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1 Summary

This chapter describes Snowy Hydro's approach to the execution phase of Snowy 2.0 (***the Project***), including managing the complexity associated with the Project's location, scale, regulatory environment, technical requirements, transmission connection and location. The chapter provides an overview of the project governance framework. The chapter also describes how Snowy Hydro's objectives, clear functional and performance requirements have been communicated to the contractors. The chapter describes the processes and controls that ensure Snowy Hydro meets its safety, social, environmental, regulatory, and commercial obligations, and appropriate systems.

Snowy Hydro is confident that this Project Execution approach will ensure the Project is delivered to high safety and environmental standards and the overall business deliverables are realised.

1.1 Outline

This chapter is one of four core chapters:

1. **Chapter One** - Health and Safety;
2. **Chapter Two** - Commercial business case;
3. **Chapter Three** - Project execution (this chapter); and
4. **Chapter Four** - Project and consolidated business operability.

This chapter has eight sections, including the summary. References within this chapter are to the other core chapters, but each section of this chapter has a corresponding supporting chapter of the same name with additional detail, available on request. The chapter numbers are given below:

1. Site and ground conditions (*Supporting Chapter Ten*);
2. Environment, permits and approvals (*Supporting Chapter Eleven*);
3. Transmission (*Supporting Chapter Sixteen*);
4. Facilities (*Supporting Chapter Twelve*);
5. Early and exploratory works (*Supporting Chapter Thirteen*);
6. Project controls (*Supporting Chapter Fourteen*); and
7. Contractors' execution approach (*Supporting Chapter Fifteen*).

1.2 Introduction

The Project is entirely within the Kosciuszko National Park (***KNP***) as is the existing Snowy Mountains Scheme (the ***Scheme***). This location brings with it a mountain range ideal for hydro generation but many challenges: constrained access, climate extremes, important natural, cultural and recreational values, regulatory complexity, and a complex geology and geotechnical context.

The Project landscape comprises undulating tablelands, steep ravines, and the Yarrangobilly River, with several major faults across the area. Geology and geotechnical conditions at depth can be reasonably inferred, but several important unknowns remain as at Final Investment Decision (FID). This uncertainty influenced the contracting strategy for the Civil component of the scope of works.

There are a number of significant natural, cultural and socio-economic values present in the Project area, with the Project likely to affect some. There is, however, significant potential to mitigate adverse impacts on KNP and the Project has been designed to avoid these where possible.

The Project requires approvals at State and Federal levels. The Scheme is governed by special-purpose NSW legislation and operating instruments, some of which require amendment. The Project also requires approval under State and Commonwealth environmental protection acts.

As at FID, a number of referrals have been granted or are in progress. The Environmental Impact Statement (***EIS***) process is central to the approvals process. The Exploratory Works EIS was lodged in mid-2018,[1] and the Main Works EIS is

[1] See https://v2.communityanalytics.com.au/snowy/ew/downloads.

planned to be lodged in early-2019. In parallel with the Snowy Hydro EIS processes, Transgrid is running separate transmission-related EIS processes as the proponent for transmission lines.

The Exploratory Works EIS lodgement was based on the Reference Design undertaken by the Owner's Engineer, SMEC Australia Pty Ltd (***SMEC***). While the Exploratory Works EIS was based on a detailed design, the Main Works EIS depends on the post-tender design work done by the Contractors. Further assessment of impacts and mitigation measures will be required for the Main Works, but Snowy Hydro expects that many of the key environmental issues and therefore approvals requirements, will be fundamentally similar to those encountered in the Exploratory Works.

The transmission network is undergoing rapid change. Since the Feasibility Study, rapid and fundamental changes to the generation mix have driven significant activity in the National Electricity Market (***NEM***) transmission space. For example, Australian Energy Market Operator (**AEMO**) released its inaugural Integrated System Plan (***ISP***) in July 2018. The ISP provides a long-term (20-year) view of strategic infrastructure development – identifying the transmission investments that can best unlock the value of existing and new resources in the NEM, at the lowest cost. The ISP also considers the transmission investment required to develop Renewable Energy Zones (***REZ***) to provide customers access to the lowest cost renewable resources.

An initial transmission network development proposal (the ***Transmission Proposal***) for the connection of the Project into the existing and future transmission network (a short span of 9 km of new lines) was developed for Feasibility. Since, the Transmission Proposal has progressed in a number of areas.[2]

A number of important developments have occurred in the deep transmission network, and the Project's shallow connection configuration has been further refined since the Feasibility Study. The Transmission Connection Agreement (***TCA***) is the key agreement/instrument under the National Electricity Rules (***NER***) where a physical connection to the NEM is authorised. The TCA cannot be signed until the Generator Performance Standards (***GPS***) are agreed and approved by AEMO and the Transmission Network Service Provider (***TNSP***).

The Project includes three locations for construction power supplies in close proximity to construction worksites and/or tunnel portals. Further planning and approvals work will be required to secure these supplies.

At Feasibility, Snowy Hydro submitted a proposed design for the Facilities. Over the course of 2018, Snowy Hydro, SMEC and Snowy Hydro's advisors (the ***Owner's Advisors***) have progressed the design (the ***Reference Design***) and developed Snowy Hydro's scope requirements (the ***Employer's Requirements***). They were refined and validated through options evaluation, site visits, specialist advice,

[2] Snowy 2.0 Feasibility Study,
Available at: http://www.snowyhydro.com.au/our-scheme/snowy20/snowy-2-0-feasibility-study/

collaboration with the Contractors and engagement with Snowy Hydro operations.

The Employer's Requirements were the basis for the Civil and Electrical/Mechanical (***E&M***) tenders. Fundamentally, these are performance and functional requirements for the constructed Facilities.

The Facilities must meet a number of basic criteria, including performance, flexibility, operating life, reliability and availability, efficiency and head loss, and NER requirements.

The key elements of the Facilities are:

1. **Power Waterways** - the various tunnels and tanks that convey water between the Tantangara and Talbingo Reservoirs to supply the Power Station;
2. **Power Station Complex** - the underground facility comprising the Machine Hall, Transformer Hall and Gas-insulated Switchgear (***GIS***) cavern;
3. **Access tunnels** - various tunnels providing efficient and safe access to permanent infrastructure; and
4. **Project-wide systems and services** - various systems and services such as security and CCTV, communications, control and measurement and protection.

Certain elements of the Facilities will be constructed early (the ***Exploratory Works***). These works include access roads and bridges, an exploratory tunnel, accommodation camp, barge access, related infrastructure and excavated rock management. The Exploratory Works will give a greater understanding of the rock conditions at the proposed location of the Power Station Complex.

These works will be let in two tranches:

1. Exploratory Works - Roads (***EWR***) as a standalone construct-only contract;
2. Balance of Exploratory Works - as an initial part of the main Civil Contract (see the *Early and exploratory works* section below).

As at FID, an Exploratory Works EIS has been lodged, the public comments period has closed and the Response to Submission (***RTS***) has been submitted. A tender has been issued for the EWR package only. A preferred tenderer has been recommended for the EWR package. The balance of the Exploratory Works scope will be undertaken within the scope of the Civil Contractor.

Several structures were considered in the context of the selected contracting strategy (Engineer- Procure-Construct (***EPC***)). The EPC Contractors are wholly responsible for the Works, but a capable and well-resourced Owner's Team is still essential to manage the Contractors.

Appropriate delegations and governance structures will be put in place for the Project (see the *Governance* section of *Core Chapter Five*).

Managing a Project of this scale requires a dedicated Project controls function. The primary focus of Project Controls is the tracking and management of the Project's cost and schedule, and the analysis and mitigation of variance.

Earned Value (***EV***) has been adopted as the preferred approach. Pre-FID work addressed fitness-for-purpose, systems, critical Business-As-Usual (***BAU***) interfaces, Exploratory Works requirements, capability, scalability and alignment.

The Project Controls function and supporting systems will be progressively implemented as information comes available from the Contractors, and the control requirements develop.

Most of the work of delivering the Project will be done by the EPC Contractors. The Employer's Requirements specify what the Contractors must build. The Contractors must execute the Project as set out in the Employer's Requirements.

The approach relies on a series of interconnected plans (collectively the Project Execution Plan (***PEP***)) reinforcing the Project's beliefs and values, with the expectation that all who work with Snowy Hydro will share the same value goals, or operate above them. These management plans address health and safety, environmental management in construction, construction, human resources (***HR***) and industrial relations, design, risk, project controls, procurement and logistics, quality, and interface management.

The Civil Contractor is responsible for management and control of the Site, is engaged by the Employer and will be the Principal Contractor for the execution of the Project (including the E&M Contractor's activities).[3] The Civil Contractor is also responsible for supply and management of services for the whole of the Project Works through to commissioning and handover of the Works.

2 Site and ground conditions

2.1 Introduction

The Project lies within the complex geology of the Lachlan Fold Belt, which comprises undulating tablelands and steep ravines around the Yarrangobilly River. Several major faults cross the area and are indicated to be present at depth. Geology and geotechnical conditions at depth can be reasonably inferred but not known. Desktop and field investigation and analysis to date provided an '80/20' level of information; however, several important unknowns remain.

Geotechnical uncertainty will be managed contractually through construction by means of classification into broad ground support classes (tunnelling classes (***TCs***)) and an agreed mechanism for determining which class should apply and associated costs and advance rates.

[3] Note that 'Principal Contractor' has a defined meaning both under the Contract and under NSW legislation (see *Chapter One*).

2.2 Activities undertaken

Desk studies were performed during Feasibility to develop a preliminary regional geotechnical model. A desktop regional fault study was performed prior to FID. Some field mapping was performed during Feasibility.

Further field mapping has been undertaken for the main tunnel alignment and the surface works (access roads) locations.

Geotechnical investigations have been carried out for the underground works, groundwater model and Exploratory Works:

1. **Underground works** - 38 boreholes have been drilled with another ten boreholes currently underway, with associated in situ and laboratory tests;
2. **Groundwater -** EIS-related hydrogeological investigations, with additional drilling and aquifer testing at specific locations with potentially high risk with respect to groundwater inflows and or environmental impacts along the alignment;
3. **Surface works** - test pits and Drop Cone Penetrometer (***DCP***) tests were performed on a subset of EWR locations. Boreholes were drilled to assess the geological conditions and bridge foundations.

Groundwater monitoring has been undertaken to provide long-term groundwater levels and thermal data. See the *Environment, permits and approvals* section below for more on groundwater monitoring.

2.3 Geological and geotechnical interpretation

The Project lies within the complex geological province of the Lachlan Fold Belt. It comprises two distinct terrains:

1. **Plateau/Kiandra Tablelands** - mature, undulating tablelands with many streams and boggy areas; and
2. **Ravine** - steep valleys and ravines around the Yarrangobilly River.

The area includes many faults, particularly the Long Plain Fault, the Boggy Plain Fault and the Kiandra Fault. Groundwater occurs within localised flow systems along the alignment profile, and early modelling suggests high construction inflows are possible. The complex geological setting has implications for the engineering geology of the Project area, with a wide range of rock types and geological structures.

The tunnelling is anticipated to encounter a hard rock mass with variably spaced bedding and joints, forming a blocky structure that may include areas of highly fractured rock with associated high groundwater inflows. The site for the surge shafts and pressure shafts lies within rock with extensive zones that are sheared and fractured in addition to potentially low in situ stress within the uppermost 250 m. The site for the power cavern complex lies within folded sedimentary rocks that include conglomerate, sandstone and siltstone. The rock condition at the power cavern complex is considered favourable. SMEC and the internationally capable Civil contractors assessed the complex geological setting

that will be encountered, and each organisation developed credible engineering plans for the required cavern and associated underground infrastructure.

2.4 Geotechnical Baseline Report

The Project will use a risk-sharing mechanism (the Geotechnical Baseline Report (***GBR***)) for the allocation of geotechnical risks between the Employer and the Contractor. The aim is to cater for the inherent variability and uncertainty associated with subsurface conditions and is based on the industry's recognised best-practice.

3 Environment, permits and approvals

3.1 Introduction

As at FID a number of State and Commonwealth referrals have been formally initiated and are in progress, with approvals and enabling legislation expected progressively through 2018, 2019 and 2020. The EIS process is central to the approvals process, with the Exploratory Works EIS lodged in 2018, and the Main Works EIS planned to be lodged in early-2019.

3.2 Status as at FID

The approvals status as at FID is as follows:

1. The Exploratory Works EIS, including piloting spoil disposal in Talbingo Reservoir, was lodged in July 2018. It followed the *Environment Protection and Biodiversity (**EPBC Act**) Act 1999 (Cth)* referral, which was submitted in June 2018 and determined not a controlled action in July 2018. Exploratory Works are expected to be approved by NSW Planning shortly after FID with acceptable conditions;
2. Legislation granting Snowy Hydro tenure to the land required for the Project was passed by the NSW Parliament on 21 November 2018;
3. The conditions of planning approval for the Exploratory Works have been taken into account in the budget, scope and program for the Main Works (with contingencies for the outcome of the more detailed assessment);
4. The Main Works planning process has formally commenced with the Main Works Scoping Report lodged in October 2018 and Secretary's Environmental Assessment Requirements (***SEARs***) are expected to be received from NSW Planning by mid December 2018;
5. The EPBC referral for Main Works was lodged in October 2018 and assessment requirements are expected to be incorporated into the SEARs;
6. The Project team and its advisors confirm that lodgement of the Main Works EIS by the end of March 2019 is achievable;
7. Agreements to Lease for construction and operations leases are expected to be achieved with Office of Environment and Heritage (***OEH***) by mid December 2018; and

8. Shallow transmission and construction power planning approval processes are well advanced by TransGrid and consistent with the Project schedule.

3.3 Scope and exclusions

As at FID, the Project comprises:

1. Exploratory works, eg construction of an exploratory adit, exploratory shaft and associated civils as further described in the *Early and exploratory works* section below; and
2. Construction and operation of the main pumped-hydro energy storage (***PHES***) project (***Main Works***) as further described in the *Facilities* section below.

As at FID, the environmental assessments undertaken for both the Exploratory Works and Main Works have been based on the Reference Design undertaken by SMEC. The assessments undertaken for the Exploratory Works have been undertaken to the level required to support a full EIS, but those assessments are necessarily at a higher level, for the Main Works. A preliminary assessment of the tender designs undertaken by the Civil Contractors has been undertaken. Further detailed assessments will continue after FID as further clarifications and design work are undertaken with the successful Contractor.

Tender designs of the Main Works will be available early-2019. Therefore, while assessment and mitigation for the Exploratory Works are comprehensive, the assessment of impacts and mitigation measures for the Main Works is high-level and subject to further detailed environmental assessment by specialist consultants. Snowy Hydro expects that many of the key environmental issues and therefore approvals requirements will be fundamentally similar to those encountered in the Exploratory Works.

Note that separate to the Project, approvals will also need to be obtained to carry out network connection and transmission augmentation works (see the *Transmission* section below for further details). These works will be carried out by a TNSP in NSW and Victoria and so the TNSP will be responsible for obtaining the approvals to construct and operate. Details of the required approvals and environmental impact assessment for the network connection and transmission augmentation works are therefore not discussed in this submission. Snowy Hydro will collaborate closely with both the TNSP and NSW, Victorian and Commonwealth approval authorities throughout this process.

3.4 Activities undertaken

Snowy Hydro undertook a broad program of work prior to FID:

1. Developed an approval strategy:
    a. Met with key stakeholders and approval bodies, including State and Federal Government Departments, prominent local community groups and associations, to discuss the needs of the Project and required approvals;
    b. Identified and assessed the options for a planning approval pathway

at both State and Federal levels with reference to relevant laws, including the Environmental Planning and Assessment (***EP&A***) Act and EPBC Act, and strategic needs of Snowy Hydro;

c. Reviewed the *Snowy Hydro Corporatisation* (***SHC***) Act and *National Parks and Wildlife (**NPW**) Act 1974* (NSW) for any required amendments to facilitate the construction and operation of the Project;
d. Developed and lodged a joint request with TransGrid to the NSW Minister for Planning to declare the Project Critical State Significant Infrastructure (***CSSI***). For more details regarding transmission, see the *Transmission* section below.

2. Reviewed the existing environmental values and risks of the Project area in the context of its location;
3. Prepared preliminary environmental assessments to identify high-level environmental aspects, impacts and mitigation strategies for the Exploratory Works and Main Project EIS;
4. Conducted field work to obtain baseline environmental data, including cultural heritage and biodiversity data in the KNP, which will feed into future EIS for the Project;
5. Undertook investigations and research activities to inform assessment and approvals identified in the Feasibility Study;
6. Undertook regular consultation activities with stakeholders in the Project area (for more details regarding community consultation, see the *Stakeholder strategy and engagement* section of *Chapter Five*);
7. Prepared two EPBC referrals for the purposes of assessing whether the Exploratory Works and Main Project were Controlled Actions under the legislation;
8. Prepared the EIS for Exploratory Works and commenced drafting of EIS for the Main Works;
9. Prepared and submitted the RTS report following Public Exhibition of the Exploratory Works EIS;
10. Provided inputs to procurement processes and tender documentation (Employer's Requirements);
11. Prepared draft Construction Environmental Management Plan (***CEMP***) and subplans for the Exploratory Works; and
12. Evaluated tender documents for E&M, Civil and EWR tenders.

EMM Consulting Pty Ltd (***EMM***) has provided environmental and planning consulting services to the Project since mid-2017. They were responsible for delivery of a Preliminary Environmental Assessment (***PEA***) and the Exploratory Works EIS. They will continue to be engaged with the Project following FID to prepare the Main Works EIS and undertake other approvals-related studies and activities.

The Feasibility Study and subsequent consultation with the various regulators identified a number of studies and investigations necessary to the EIS and approvals process. These included:

1. **Social impact assessment** - impacts to recreational uses and amenity from construction activities;
2. **Terrestrial and aquatic ecological survey** - the presence of threatened and endangered species at specific locations, existing biodiversity and existing environment, constraints, mitigation and compensatory measures, aquatic habitat and species present, fish diversity and presence of invasive fish species;
3. **Water balance model** - surface water assessment and site water balance;
4. **Groundwater assessment** - groundwater monitoring network, a groundwater model;
5. **Cost-benefit and regional economic analysis** - local and regional impacts of the Project during construction;
6. **Traffic impact assessment** - traffic impacts associated with construction;
7. **Soils capability and contamination assessment** - character and sensitivity of soil and land resources, potential areas and contaminants of concern;
8. **Geodiversity assessment** - significant geodiversity features of KNP and potential risks to them;
9. **Spoil management** - impacts of spoil management and placement on biodiversity, surface water, traffic, soil and contamination and visual amenity;
10. **Invasive fish assessments** - assessment of the potential for the spread of invasive species through the proposed main Project alignment;
11. **Bushfire risk and hazard risk** - response to the SEARs requirement to assess public safety, including an assessment of the risks to public safety;
12. **Heritage assessment** - assessment of the potential for impacts on Aboriginal artefacts and places, and places of historic heritage;
13. **Surface water assessment**;
14. **Noise and vibration assessment** - identification, modelling and assessment of construction noise impacts; and
15. **Air quality assessment** - air quality and greenhouse gas assessment.

These studies were undertaken by EMM, its subconsultants and other consultants engaged directly by Snowy Hydro.

3.5 Approvals

The Project requires approvals at both State and Commonwealth levels. The existing Scheme is governed by special-purpose NSW, VIC and Commonwealth legislation and operating instruments, some of which require amendment. The Project also requires approval under Commonwealth environmental protection legislation. The interplay of the various acts means that there were a number of possible pathways that could be followed to obtain full approval to construct and operate the Project.

The preferred and selected approval pathway involves:

1. Seeking CSSI status under the EP&A Act;
2. Requesting that the responsible Minister make minimal amendments to the *SHC Act 1997 (*NSW); and

3. Referral of the Project for Commonwealth approval under the EPBC Act.

The Project was declared State Significant Infrastructure (***SSI***) and CSSI in March 2018. Snowy Hydro requested SEARs for the Exploratory Works in March 2018 and received them in May 2018, and a revision in June 2018.

The EIS for Exploratory Works was submitted to the NSW Department of Planning and Environment (***DPE***) in July 2018 and exhibited in July and August 2018. The RTS report was submitted in October 2018.

Snowy Hydro requested SEARs for the Main Works in October 2018, and expects to receive this by mid December 2018**.**

Approval for the Exploratory Works EIS is expected to be received/advised by DPE that this would be provided shortly after FID. The Main Works EIS is being prepared for submission by March 2019.

A referral for Exploratory Works under the EPBC Act was lodged with the Federal Department of Environment and Energy (***DoEE***) in May 2018. The DoEE found the Exploratory Works to be 'not a controlled action' under the EPBC Act in July 2018. A referral for Construction of the Project was made with DoEE in October 2018.

3.6 EIS process

Certainty around planning approvals is a key factor influencing the Project's viability, and the EIS process is central to the key approvals. Various alternatives were considered for EIS lodgement. The selected plan includes two EISs - one for Exploratory Works and one for the Main Works. In parallel with the Snowy Hydro EIS processes, Transgrid is running separate transmission-related EIS processes as the proponent (see the *Transmission* section below).

3.7 Environmental values and impacts

Environmental and cultural values were initially considered when determining the construction and operation impacts of the Project during the Feasibility Study. Further investigation of these values has been undertaken as part of the environmental impact assessment process, and key environmental aspects and impacts requiring priority investigation were identified for the EIS, which will accompany any application for planning approval. These include:

1. Recreational use - and amenity of conservation areas (KNP);
2. Biodiversity - terrestrial and aquatic, including the transfer of undesirable aquatic species;
3. Heritage - Aboriginal cultural heritage and historic heritage;
4. Water - surface and groundwater;
5. Soils and contamination;
6. Spoil - excavated rock and waste management, including subaqueous disposal of spoil;
7. Transport and access;
8. Noise, vibration and blasting impacts;
9. Air quality;

10. Social and economic impacts, including local infrastructure and services; and
11. Other risks, including climate, bushfire and public safety.

There are a number of significant natural, cultural and socio-economic values present in the Project area. Snowy Hydro assessed the potential impacts on those values from construction and operation phases of the Project.

As construction methods are developed and environmental impact assessment processes proceed, the values, impacts and mitigation measures will become better understood. This, in turn, means they can be communicated effectively so timely Project approval is achieved and social licence to operate is maintained in the long term.

Some specific social, cultural and economic values are likely to be impacted, including recreational uses and amenity, Aboriginal cultural heritage values and local infrastructure and services. There is significant potential to mitigate the impacts of these, such as through strategies to provide alternate access and facilities, spreading of the workforce (in time and place), investment in infrastructure and services where the link to the Project is clear/quantified, and by locating activities so as to avoid significant Aboriginal cultural heritage.

Some specific natural values are also likely to be impacted, including biodiversity and water. There is potential to avoid location of activities in high-value areas, minimise the impacts where they are located in sensitive areas and to offset these impacts where they are unavoidable.

3.8 Mitigation and management

The Project has been designed to avoid and minimise adverse impacts on KNP where possible. All works will be carried out by the appointed contractors under the conditions of the Environment Protection Licence (***EPL***) and in accordance with the existing SMP EMP. A detailed CEMP and several CEMP subplans have been prepared by EMM for submission to DPE. These have been prepared in parallel with the tender process to allow construction works to commence as soon as possible after the Exploratory Works planning approval is received. Contractors will be required to operate under these detailed CEMPs. Specific mitigations and offsets will be implemented as required.

Snowy Hydro proposes to enter into a heads-of-agreement with National Parks and Wildlife Services (***NPWS***) that will form the basis of a voluntary planning agreement (***VPA***) or similar between the two parties. This will broadly set out the measures proposed to mitigate impacts to recreational users of KNP and nominate the monetary contributions required to fund the mitigation and management measures.

A hierarchy of avoidance, mitigation and management, and offsetting is proposed to manage impacts to terrestrial and aquatic biodiversity.

Road designs for the EWR have been designed to minimise the impact on areas of geodiversity, particularly fossiliferous beds and rock streams.

Erosion and sediment control plans (***ESCPs***) will be developed specifically for the construction works.

The formal consultation process with the Aboriginal community commenced in accordance with the requirements of the Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010. Further site-specific mitigation measures will be developed during the preparation of the Main Works EIS. Specifically, Snowy Hydro (in conjunction with the contractors) will prepare separate Cultural Heritage Management Plans (***CHMP***) to manage Aboriginal and historical heritage values.

Site-specific water impact mitigation measures will be developed during the preparation of the Main Works EIS. Appropriate process water and wastewater treatment facilities will be constructed for both the Exploratory Works and Main Works to ensure any water discharged to reservoirs, natural water courses or ground will meet the required discharge specifications. Run-off from construction areas will be treated before discharge. Sedimentation dams and basins of the appropriate type will be constructed where necessary.

A social impact assessment will be undertaken during the preparation of the EIS to assess the social impacts of the Project on the local community and KNP users.

To avoid the uncontrolled placement of Potentially Acid-Forming (***PAF***) rock, the excavated material will be geochemically characterised prior to placement, with sequestration and treatment of PAF material.

Standard construction mitigation measures will be applied to mitigate identified potential bushfire impacts.

A contaminated land management plan and a site-specific asbestos management plan will address risks posed by contaminated material.

Noise management will involve noise monitoring during the initial stages of construction to determine if noise levels are within acceptable levels. Safe working distances will be applied to manage vibration impacts within acceptable levels. A blasting management procedure or plan will outline measures to minimise public safety risks.

Site-specific spoil and waste mitigation measures will be developed during the preparation of the Main Works EIS.

The feasibility of all fish protection options will need to be considered in relation to their capability of preventing or minimising the movement of all life stages of pest species during the Main Works EIS stage. Current mitigation options to be evaluated include deterrent technologies, barriers and screens and offsetting measures including targeted species protection and supplementary stocking for recreational fishing. These mitigation measures will be focussed on taking a risk-based approach to minimising transfer and spread of pest species within and beyond Tantangara reservoir.

The final decommissioning and rehabilitation outcomes for the Works are to be determined and subject to ongoing consultation with NPWS. The final landform

and rehabilitation outcomes to be achieved following the Works will be designed to meet the land use goals of NPWS and the KNP Plan of Management.

3.9 Tenure

The Feasibility Study identified that the Project will primarily be located within the KNP, but outside Snowy Hydro's existing Snowy Park Lease areas. For this reason the Study foreshadowed that minor legislative amendments would be required to the *Snowy Corporatisation Act* 1997 to authorise Snowy Hydro's existing lease arrangement over the KNP to be expanded for the Project.

The *Snowy Hydro Corporatisation Amendment (Snowy 2.0) Act 2018* (the ***Snowy 2.0 Act***) was passed by the NSW State Parliament on 21 November 2018 and received assent on 28 November 2018.

Under the Snowy 2.0 Act, the Minister for the Environment has been authorised to grant leases, licences, easements and rights of way to facilitate Snowy 2.0. The Office of Environment and Heritage (***OEH***) as representatives of the Minister are currently working with Snowy Hydro on the grant of leases.

Agreement with OEH has been reached on the following approach to the grant of leases and licences, and draft documents are in negotiation:

1. An agreement for lease (***AfL***) will be entered into by mid-December 2018.
2. The AfL will provide for the grant of construction lease(s), licence(s) (or other relevant tenures) as well as the long term operational lease for the purposes of Snowy 2.0. Note that the long term operational lease will be on substantially the same terms as the existing Snowy Park Lease and must expire at the same time as the existing Snowy Park lease.
3. The AfL will set out high-level agreement in relation to:
    a. Approach to rent for construction lease and long term operational lease (broadly based on the current cost recovery approach);
    b. Conditions Precedent to the construction and operating leases being granted (will include planning approval for each project element);
    c. Commencement dates and terms for construction and operating leases which will need to be integrated as construction areas become operational; and
    d. Others are currently the subject of discussions with OEH.
4. It is proposed that there will be one construction lease and works access licence for Exploratory Works and one construction lease and work access licence for Main Works, but there will be provision for further staging if required. The lease and licence process for exploratory works will triggered as soon as practicable after planning approval is granted.
5. The construction leases will allow for construction of the Project in accordance with the CSSI planning approval and the Construction Environment Management Plan (***CEMP***) developed in accordance with that approval.

4 Transmission

4.1 Introduction

Since the Feasibility Study, the Transmission Proposal for the connection of the Project into the existing and future transmission network has progressed, guided by the developments from the continuation of existing activities and the commencement of new ones as required. The overall status of the Transmission Proposal has been updated to reflect the changes.

The Transmission Proposal includes five key work streams:

1. 'Shallow' connection works;
2. 'Deep' transmission network development, as reflected in the Integrated System Plan (***ISP***);
3. NER-related activities;
4. TCA-related activities; and
5. Construction supplies (a new workstream since Feasibility).

Significant activity in the external NEM transmission space resulted in changes to the initial Transmission Proposal required to maintain alignment of the Proposal with AEMO's ISP,[4] and other deep transmission network developments.

Figure 1 shows the updated version of the Transmission Proposal 'three-state network development' and includes the relevant deep transmission network developments, particularly 'Bannabylink' (the ISP version of the Snowy 2.0 NSW deep network augmentation proposal), Riverlink (ElectraNet's SA Energy Transformation RiT-T preferred option), and the ISP Group 3 'Keranglink' option.

[4] AEMO, 2018. AEMO - Integrated System Plan. Available at: https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Integrated-System-Plan [Accessed October 23, 2018]

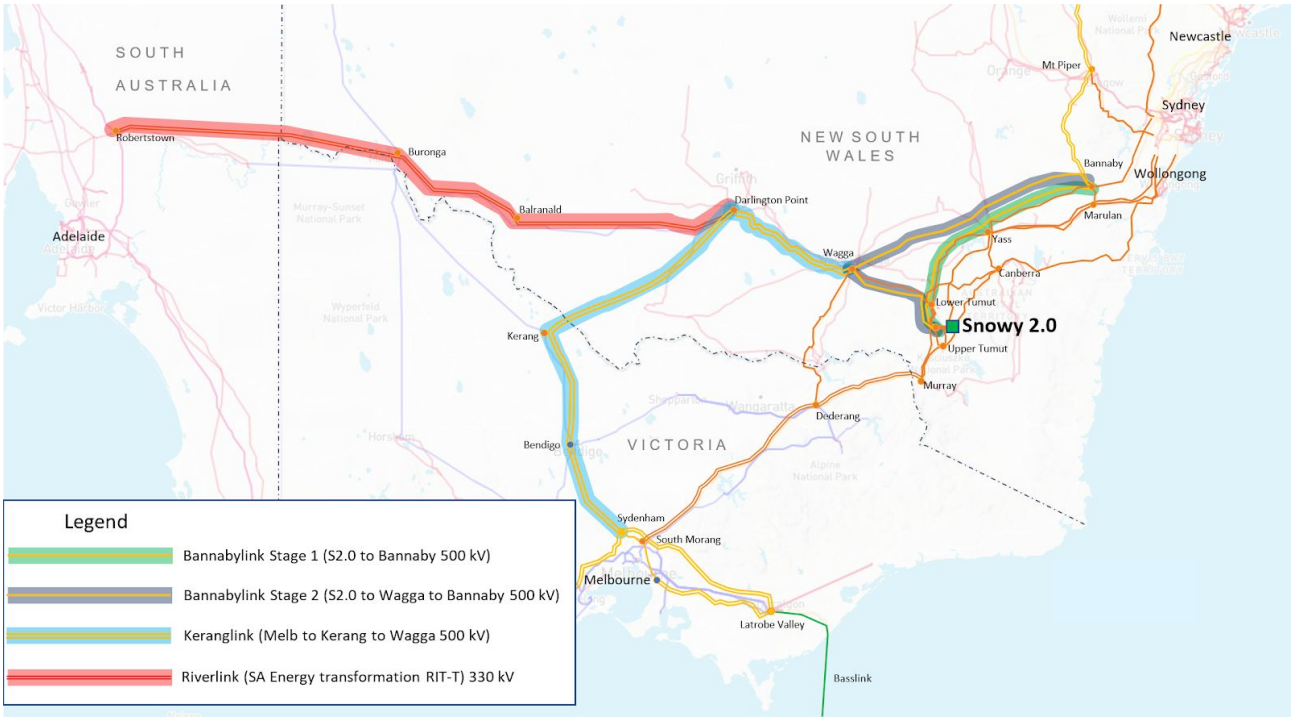

Figure 1: Preferred network development concept after ISP

Key points:

1. Energy Security Board (***ESB***) Focus Area 2 (ISP as an actionable strategic network development plan) and its basis for the fast track approval of Bannabylink and Keranglink through broader-based benefits assessments in the RiT-T, that recognises the need to facilitate an orderly transition in the context of rapid and fundamental changes to the generation mix;
2. Bringing construction of stage one of Bannabylink forward to release approximately 1,000 MW of southern NSW and VIC capacity into the major NSW load centres by the closure date of the Liddell power station in 2022;
3. Ensuring stage two of Bannabylink is completed by the Project commissioning date to meet the Project NSW connection objectives, release south-west NSW Renewable Energy Zones (***REZ***) capacity and integrate Riverlink into the NSW and SA market regions;
4. Bringing the Keranglink option forward to align with the Project commissioning date through review of the benefits test and the system security implications in Victoria under Victorian Renewable Energy Target (***VRET***) and rapid changes to the generation mix, and in NSW under the early or unplanned closure of coal-fired power stations;
5. Strong opposition to the application of Transmission Use of System (***TUOS***) charges to generator participants who provide energy firming services required to facilitate the orderly transition to renewables;
6. Timely completion of temporary construction supplies; and
7. Timely completion of the shallow connection works.

4.2 Activities undertaken

Work has progressed as follows:

1. **Shallow connection works:**
    a. **Snowy Hydro** - Reference Design development, construction coordination activities, battery limit and interface definition; and
    b. **TransGrid** - Early Works Agreement (***EWA***) to advance connection works, advancement of approvals, contractual development, engagement and coordination with Snowy Hydro.
2. **Deep transmission network development** - discussion and stakeholder engagement with applicable State and Federal departments, Transgrid, AEMO, Ausnet, operational and governance bodies, and Council of Australian Governments (***COAG***);
3. **NER-related activities** - monitoring and communication of AEMO and COAG Rule changes, communication of AEMO updates to E&M Contractors, and development of NER requirements for the E&M Contract;
4. **TCA-related activities** - submission of the Connection Enquiry, an update of the deep transmission network development concept, site visits with Transgrid and AEMO for variable-speed machine familiarisation, execution of the Connection Process Agreement (***CPA***), and supply by Transgrid of connection point data to the E&M Contractors;
5. **Construction supplies** - refinement of construction supply requirements and execution of the construction supply CPA with Transgrid and Connection Investigation and Services Agreement (***CISA***) with Essential Energy; and
6. **Risk assessment and review** - ongoing identification and management of transmission-related risks integrated with the overall Project Risk Management interaction with the independent risk advisor (see *Chapter Four*).

4.3 Transmission proposal

While the objectives of the Transmission Proposal remain the same as for the Feasibility Study, internal design changes and external developments have required some changes to the Transmission Proposal to ensure it remains relevant to the Project.

The initial Transmission Proposal dealt with deep transmission augmentations and integrated grid planning as separate topics; these are now combined as 'deep transmission network development'.

Changes have also been made to the shallow connection works to reflect the evolution of the Project design and to incorporate increased knowledge of local conditions and/or requirements since the Feasibility Study. However, these shallow works changes do not directly influence the deep transmission network concept.

A number of important recent developments occurred in the deep transmission network after the Feasibility Study:

1. **Liddell power station closure** - the planned closure of the Liddell power station in 2020 has increased focus on changing generation mix and energy security;
2. **Riverlink option** - Riverlink (a new 330 kV interconnector between mid-north South Australia and Wagga Wagga in New South Wales, via Buronga) has advanced as a preferred option in SA.
3. **AEMO Inaugural ISP** - AEMO released its inaugural ISP;
4. **Australian Energy Regulator (*AER*) review of Draft RiT-T** - AER's review essentially maintained the status quo for benefits assessment;
5. **ESB ISP Action Plan** - focus on actioning ISP Group 1 projects and progressing Group 2 projects, and treating ISP as an actionable strategic network development plan;
6. **Australian Energy Market Commission (*AEMC*) COGATI Options Paper** - the AEMC released its 'Coordination of generation and transmission investment (***COGATI***) review Options Paper';
7. **VRET 1st Reverse Auction Results** - the Victorian Government released the VRET 1st Reverse Auction Results for 930 MW new renewable energy in Victoria;[5]
8. **Multi-party NEM workshops** - the AEMC, ESB, AEMO and the AER conducted NEM workshops around the main transmission planning and associated regulatory review areas;[6]
9. **NSW Transmission Infrastructure Strategy** - funding guarantee for Bannabylink Stage 2; and
10. **Victoria to NSW Interconnector Upgrade RiT-T** - AEMO and TransGrid's Project Specification Consultation Report (***PSCR***) which includes Bannabylink Stage 1 as an option.

4.4 Shallow connection works

The Project's shallow connection configuration has been further refined through two mechanisms:

1. **Station general arrangement** - the reduction of cables and transmission lines from six to four through the introduction of a 330 kV GIS bus; and
2. **Shallow connection works layout** - the selection of a more suitable location for the TransGrid connection substation, and further optimisation of the transmission line routes from the Project cableyard to the TransGrid connection substation.

The classification of the connection assets under the NER has changed so that connection-related assets are now defined as:

[5] Victorian Government, 11 September 2018. MORE RENEWABLE ENERGY TO DRIVE DOWN POWER PRICES. Available at: https://www.premier.vic.gov.au/wp-content/uploads/2018/09/180911-More-Renewable-Energy-To-Drive-Down-Power-Prices.pdf

[6] AEMC Market Reviews, Coordination of Generation and Transmission Investment October 2018. Available at: https://www.aemc.gov.au/markets-reviews-advice/reporting-on-drivers-of-change-that-impact-transmi [Accessed October 23, 2018]

1. Shared transmission network;
2. Identified user shared assets (***IUSA***); or
3. Dedicated assets.

Under the new Rule. the Project connection assets will span a range of classifications.

There has been significant activity in the layout and design of the Lobs Hole area in preparation for Project execution. Transgrid (as the transmission asset owner) is a critical stakeholder in this area and must be consulted during both the Exploratory Works and the Main Works to ensure designs and activities around transmission assets meet Transgrid's requirements for the safety of personnel and protection of assets.

4.5 Deep transmission network development

For the Feasibility Study the Transmission Proposal adopted Transgrid's 'Option 10' (dual 500 kV single circuit lines from the Project connection substation (at that time known as 'Long Creek') to the Bannaby 500 kV substation located near Marulan) as the Snowy Hydro option for NSW that best suited the Transmission Proposal objectives.

Transgrid has since proposed, and AEMO has adopted a revised NSW deep transmission network development referred to as 'Bannabylink' in its Integrated System Plan (***ISP***).

Snowy Hydro has reviewed the technical capability of the Bannabylink topology, including dynamic stability studies and finds that it still meets the objectives of the Transmission Proposal.

At FID, there is a high degree of certainty BannabyLink will be in place before 2024. This is because in November 2018 the NSW Government published its 'Transmission Infrastructure Strategy' that included BannabyLink as one of four 'priority' transmission projects that NSW will provide TransGrid a 'funding guarantee' (that applies irrespective of whether or not the ISP is implemented) to accelerate through the existing regulatory and environmental approval processes. The identification of BannabyLink as a priority project will significantly enhance its prospects through the regulatory process.

Advancing Bannabylink Stage 1 to meet the closure date of Liddell Power Station is supported by NSW and is currently being progressed by both Transgrid and Snowy Hydro.

From the Feasibility Study, the preferred option to meet the VIC augmentation objectives was 'Option 1C'. Since then, the ISP has included KerangLink, which will meet the needs of the Project. However, the construction of KerangLink remains both uncertain in timing and problematic for the project; that is, a 2033 commissioning date.

For this reason, Snowy Hydro had requested revenue-replacement covenants and alternative methods of 'make-good' in the event that KerangLink was not constructed in time for commissioning of the Project in 2025.

The most recent financial modelling, however, has identified that:

1. The 'ISP case', which assumes the Kerang Link is never built, has an equity Internal rate of return (***IRR***) only marginally below that required by Snowy Hydro's investment processes; and
2. Other transmission risk mitigants are available to Snowy Hydro, at a cost significantly below $3.3 billion and is financeable, assuming Base Case Project outcomes, within the constraints of maintaining Snowy Hydro's investment-grade credit rating.

It is, therefore, appropriate to consider the options available to Snowy Hydro in terms of proceeding to FID, in the absence of any make-whole or revenue replacement covenants (which are no longer sought by Snowy Hydro) in relation to the timing of KerangLink. If Snowy Hydro proceeds beyond FID without certainty in relation to KerangLink, there are at least five mitigants available to resolve the southern transmission requirements of the Project.

4.6 NER-related activities

The ERC0222 Rule change (generator technical requirements (***GTR***)) has dominated NER-related activities since the Feasibility Study.[7] The Rule makes significant changes to technical performance standards for generators seeking to connect to the national electricity grid and the process for negotiating those standards. The main focus of the Project team was to ensure the E&M bidders were fully aware of the Rule change and their obligations and that the change was reflected in the Employer's Requirements.

During the Feasibility Study, details of the NER requirements for generator connections in the NEM were provided to the prospective E&M contractors/equipment suppliers, and they were also advised of the pending Rule change.

Since the Feasibility Study, AEMO has lodged its Rule change proposal and the AEMC progressed the Rule change to final determination in September 2018. As a Rule change directly relating to system security, there is a heightened emphasis on compliance with this Rule, and prospective E&M Contractors have been made fully aware of the requirements to ensure their bids and engineering designs incorporate the changes.

4.7 Transmission Connection Agreement

The TCA is the key agreement/instrument under the NER by which physical connection to the NEM is authorised. The TCA comprises terms and conditions for

[7] ([ICSL STYLE ERROR: reference with no printed form.]).

connection over the life of the TCA, the Project Agreement (for construction of the shallow connection works), and the GPS.

As at the Feasibility Study, it was too early to progress the TCA. As at FID it is theoretically possible to submit the Connection Agreement, subject to sufficient technical information being provided by the prospective E&M Contractors. As at FID, technical submissions are being evaluated for completeness.

The TCA cannot be signed until the GPS are agreed and approved by AEMO and the TNSP. The major risk associated with the TCA typically arise from time delays caused by technical verification and clarification during the normal course of negotiating the terms and conditions of a connection agreement.

As the Project is a very large connection (the largest since the commencement of the NEM) and includes new equipment never before connected to the NEM, AEMO is expected to demand a significant number of verification studies.

4.8 Construction supplies

The Project includes three locations for construction power supplies in close proximity to construction worksites and/or tunnel portals. The agreed timing for energisation of the Construction Supplies (at all three nominated locations) is 01 October 2020. The three construction supplies are:

1. **Lobs Hole (TransGrid)** - a 330 kV/33 kV 50 MVA permanent substation in the Ravine south of the Yarrangobilly River and adjacent to existing transmission line 2 (TL2). This substation will provide 33 kV power for construction and future operations;
2. **Marica (TransGrid)** - a 330 kV/33 kV 50 MVA temporary substation on the Plateau adjacent to the Marica Trail and Snowy Mountains Highway intersection. This substation will provide construction power for contractors working in the headrace area, and eventually a backup for the Lobs Hole construction supply; and
3. **Tantangara (Essential Energy)** - a 33 kV/17 MVA supply to be obtained by upgrading the existing 11 kV line that supplies the Tantangara dam auxiliary electrical equipment. The existing supply has insufficient capacity to meet Civil Contractor requirements.

Further planning and approvals work will be required to secure these supplies post-FID.

5 Facilities

5.1 Introduction

Snowy Hydro undertook a program of site visits and third-party engagement to develop the engineering design to operating requirements. Given the Project's challenging performance requirements, prospective contractors were involved early in developing and proofing design concepts and clarifying requirements, including Research & Development (***R&D***) and modelling.

The above process resulted in the Employer's Requirements, formalising Snowy Hydro requirements from a contractual perspective, and were issued to Civil and E&M contractors in a formal tender process.

The Employer's Requirements are arranged hierarchically and embody a number of key principles and drivers for operating performance.

Snowy Hydro undertook a staged design process, which, as at FID, resulted in the submission (and ongoing evaluation) of Civil and E&M tender designs.

5.2 Activities undertaken

The following ongoing activities were central to developing the engineering tender design of the Project to its FID state:

1. Site visits;
2. Engagement of specialist advisors;
3. Collaboration with contractors;
4. Development of Reference Design; and
5. Technical assurance program.

The Project began with research and collation of existing relevant worldwide experience. Sites of special interests were visited and various specialist advisors engaged. A Request for Information (***RFI***) process was undertaken with the E&M suppliers to support early development and reference checking.

Snowy Hydro engaged SMEC in 2017 to:

1. Undertake engineering design and geotechnical investigation management for the Feasibility Study; and
2. Develop the feasibility design into a Reference Design to support the tender process for the Main Works (see *Supporting Chapter Two - Procurement* for the process).

The Main Works Project contract structure is an EPC contract based on the International Federation of Consulting Engineers' (***FIDIC***) Silver Book as detailed in *Supporting Chapter Three - Contracts and legal*. A key component of this contract is the Employer's Requirements. Fundamentally these are performance and functional requirements that the Employer (Snowy Hydro) requires for the Project to meet its objectives. The Reference Design is an interpretation of the Employer's Requirements. It represents one way in which the Project could be developed and serves as a basis for tender evaluation.

A collaborative process utilising SMEC's internal expertise, review by Snowy Hydro external advisors and finally pressure testing from the Contractors, refined the Employer's Requirements to a position that reflects Snowy Hydro's performance and functional output requirements for the Facilities. The Project has been running a collaborative process, or Early Contractor Consultation (***ECC***) process with both the Civil and E&M Contractors since mid-2017 (see *Supporting Chapter Two*).

Given the proposed scale and complexity of the proposed Facilities, the Project undertook a technical assurance program. This included the following parties:

1. **SMEC (as Owner's Engineer)** - engineering design and quality assurance;
2. **Snowy Hydro's engineering, asset management and operations team** - operational advice and direction on design and construction elements;
3. **Owner's Advisors** - key organisations and individuals with experience in similar projects; and
4. **Technical Reference Group (*TRG*)** - Snowy Hydro senior leaders' group representing the interests of Snowy Hydro for high impact and critical technical issues.

The Project team undertook a program of visits to pumped-hydro projects, experts and manufacturing locations around the world.

The Project hydraulic design is challenging due to the power output, high head and long tunnels. Therefore all E&M Contractors were required to perform R&D and design works in critical areas and to make this visible to Snowy Hydro prior to submission of tenders.

Each E&M Contractor completed a pump-turbine model test of the proposed Project variable-speed pump-turbine as close to full homology as time permitted, with the performance of this model witnessed by Snowy Hydro.

5.3 Functional and performance requirements

The documents comprising the Employer's Requirements are a key input into the Main Works contract structure. These documents specify Snowy Hydro's key performance and functional requirements.

The Employer's Requirements are structured in a 'pyramid' formation, with the key overarching performance and functional requirements at the top. The key elements of the Employer's Requirements are:

1. 3.01 - Performance requirements - purpose, key principles, functional and performance requirements;
2. 3.02 - Key Project elements - key Project elements and milestones, division of responsibility;
3. Specifications:[8]
    a. 3.04 - Particular functional and performance requirements;
    b. 3.05 - Standard technical requirements;
    c. 3.06 - Construction requirements.
4. 4 - Plans and management processes - processes by which the Contractors will complete the Project.
5. A number of key principles were outlined in the Employer's Requirements:
    a. Safety management;
    b. Zero harm;
    c. Snowy Hydro values;
    d. Operability and maintainability;

[8] Note: There is no section 3.03.

    e. Quality; and
    f. Life cycle cost.
6. The Employer's Requirements included a number of design-specific key drivers:
    a. High round-trip efficiency (***RTE***) across the operating range;
    b. High availability and reliability;
    c. Fast generation and pump start-up times;
    d. Wide operational load bands;
    e. Low vibration and noise;
    f. Low arc flash energy, low electric and magnetic fields and low circulating currents;
    g. Ease of maintenance;
    h. Long asset life; and
    i. Ability to undertake all future operation and maintenance activities efficiently and safely.

The Project is required to achieve a generation and pumping capacity of 2,000 MW at a 0.9 power factor leading and lagging for the full design life.

Dynamic capability, or the ability to operate up to 10% over the rated capacity, is required for all generating units individually.

The Facilities are required to operate over the:

1. Full generation range when Tantangara is between maximum flood level conditions and minimum operating level (***MOL***) and Talbingo operating between MOL and full supply level (***FSL***);
2. Full pumping range when Talbingo is at maximum flood level conditions and MOL and with Tantangara operating between MOL and FSL; and
3. Full range of extreme climate conditions prevalent at the Site in KNP.

The Facilities must be designed to meet changing future market demands (see *Chapter Two*) and has been specified to operate in a way that allows for flexibility going forward.

Snowy Hydro has assets in its fleet close to 70 years old and still functioning as designed. The Facilities need to have a similar long design life to ensure the most commercial value can be derived from the assets. The operational life for key structural elements of the Facilities is thus 100 years, with other elements of the Facilities requiring shorter operating lives.

High reliability and availability are among Snowy Hydro's key pillars of operational success. They depend on strong maintenance and monitoring practices.

Key drivers for maintenance include:

1. Prescriptive and condition-based;
2. Non-invasive;
3. Short-duration outages;
4. Remote monitoring;
5. Low ambient noise; and

6. Minimised manual handling.

Key drivers for monitoring include:

1. Digital twin;
2. Real-time, self-monitoring; and
3. Video.

The Facilities must meet specified efficiency and head loss targets.

The E&M Contractor must meet requirements in respect of NER, including:

1. Access standards and performance requirements;
2. Information to confirm compliance; and
3. Requests for additional information.

The E&M tenders were received on 12 October 2018, and the Civil tenders on 09 November 2018. They included a number of alternative options and departures from the Employer's Requirements.

5.4 Design approach

Snowy Hydro's guiding principles for the design and the Employer's Requirements for the Project evolved from the objective of meeting the needs of the NEM, as variable intermittent generation is expected to supply a large portion of the NEM's energy.

To meet this goal, the Facilities must:

1. Provide safe and robust operation, meeting international design standards;
2. Comply with the requirements of Australian regulatory bodies;
3. Have high operational reliability and flexibility; and
4. Require low operating and maintenance costs.

The design process went through the following stages:

1. Feasibility design:
    a. Development of a Technical Requirements Document (***TRD***);
    b. Exploration of options; and
    c. Development of a base case feasibility design.
2. Reference design - basis for tender documents;
3. Geotechnical investigations - preparation of GBR (see *Chapter Two*) from outputs of geotechnical investigation campaigns;
4. Contractors' design proposals - received and being evaluated as at FID.

Further design reviews will occur following contract award and commencement of the Contractors' formal design activities.

5.5 Key project elements

5.5.1 Overview

The main features of the Facilities comprise:

1. Power Waterway;
2. Power Station Complex;
3. Access Tunnels; and
4. Project-wide services and systems.

5.5.2 Power Waterway

The Power Waterway conveys water between the two reservoirs and comprises:

1. **Tantangara Intake** - point of entry/exit to the Power Waterway for water entering/leaving Tantangara Reservoir. The Tantangara intake structure will be located towards the southern end of Tantangara Reservoir, on its western shore, about 1 km northwest of Tantangara Dam;
2. **Headrace Tunnel** - links the Tantangara Intake to the Distributor Tunnels;
3. **Distributor Tunnels** - division of the single waterway (headrace) into three waterways so that separate waterways can service a pair of machine units;
4. **Headrace Surge Tanks** - Provide free surface as close as possible to the turbine to attenuate transient pressures;
5. **Pressure Shaft Structure** - conveys the water vertically from the end of the Distributor Tunnel to the start of the Pressure Tunnels;
6. **Pressure Tunnels** - connect the bottom of the Pressure Shaft Structure to six Penstock Tunnels;
7. **Penstock Tunnels** - provide individual water supply to the six pump-turbines;
8. **Draft Tube Tunnels** - connect the draft tube elbow below the pump-turbines to the Collector Tunnels;
9. **Collector Tunnels** - combine flow from the Draft Tube Tunnels upstream of the Tailrace Surge Tank;
10. **Tailrace Surge Tank** - operates similarly to the Headrace Surge Tanks;
11. **Tailrace Tunnel** - links the Tailrace Surge Tank, to the Talbingo Intake; and
12. **Talbingo Intake** - point of entry/exit to the Power Waterway for water entering/leaving Talbingo Reservoir. The Talbingo Intake Structure is situated near the upstream end of Talbingo Reservoir on its eastern side, about 17 km south of Talbingo Dam, where the Yarrangobilly River and Middle Creek flow into the storage.

5.5.3 Power Station Complex

The Power Station Complex is a drained, underground facility comprising:

1. **Machine Hall** - a machine hall cavern housing six pump-turbine units. Each unit consists of a 340 MW Francis pump-turbine and a 375/425 MVA motor-generator and their ancillary systems. Three of the units are variable-speed (asynchronous) and three are fixed-speed (synchronous),

arranged in a way that the three pressure tunnels are connected to one variable-speed and one fixed-speed unit. The Machine Hall includes various control rooms and space for communication and power equipment, amenities and drainage and dewatering equipment;
2. **Transformer Hall** - a transformer hall cavern housing six transformers. The Transformer Hall contains the main transformers with one three-phase transformer per unit provided in the Reference Design; and
3. **GIS cavern** - a cavern for housing GIS will be incorporated into the Power Station Complex. The Reference Design has located the GIS into an extension of the Transformer Hall; however, placing the GIS directly over the main transformers has not been specifically precluded.

5.5.4 Access Tunnels

The access tunnels provide efficient and safe access to permanent infrastructure. The access tunnels comprise:

1. **Main Access Tunnel (*MAT*)** - primary access conduit to the Power Station Complex during operation;
2. **Emergency Egress, Cable and Ventilation Tunnel (*ECVT*)** - provides a conduit for power evacuation, an alternative to the MAT for egress in emergency situations, and a ventilation and dewatering conduit. A 330 kV outdoor cable yard will be provided at the ECVT portal for termination of the 330 kV cables from underground GIS and interconnection with the transmission line connecting to the Transgrid transmission system;
3. **Penstock Guard Valve (*PGV*) Chamber Access Tunnel** - provides permanent access to the PGV and Pressure Shaft Inspection Chamber;
4. **Pressure Shaft Inspection Chamber Access Tunnel** - connects the PGV Chamber Access Tunnel with the Pressure Shaft Inspection Chamber;
5. **Tailrace Surge Tank Access Tunnel** - provides construction and permanent access to the top of the Tailrace Surge Tank from the MAT; and
6. **Draft Tube Valve (*DTV*) Gallery Access Tunnel** - connects the MAT to the bottom of the transformer hall cavern to facilitate the installation, operation and maintenance of the DTVs.

5.5.5 Project-wide systems and services

Project-wide services and systems provided in the Reference Design include:

1. An integrated security system with a CCTV and access control system;
2. An overall fibre-optic cable-based communication system;
3. DC systems, lighting and small power;
4. Outlying areas Medium Voltage (***MV***) and Low Voltage (***LV***) distribution system;
5. Control and measurement system; and
6. Protection system.

5.6 Contractors' design

Contractors' submissions included key differences between the Reference Design and the proposed Civil and E&M tender designs.

Major areas of difference include:

1. **Access roads** - grade separation between light and heavy vehicles and reducing the grade of some roads by changing the alignment;
2. **Power waterway**:
    a. Headrace and tailrace - Secondary cast in situ lining, length of headrace;
    b. Surge tanks - one surge tank instead of three;
    c. Pressure shafts - differing downstream waterway layouts.
3. **Power station complex** - no significant changes; and
4. **Access tunnels** - Exploratory Tunnel alignment based on ECVT rather than MAT.

6 Early and exploratory works

6.1 Introduction

The power station cavern will be one of the largest underground caverns for a hydroelectric power project in the world, and its design and excavation will be highly dependent on the rock properties and structural geology of the cavern location. To date, the geological investigation program has only drilled down vertically from the surface and at large intervals apart. Exploratory Works involves extensive horizontal drilling in situ, and at depth, so detailed geological data can be collected about the rock types, conditions, ground temperature and stress conditions.

The Exploratory Works will provide a greater understanding of the rock conditions at the proposed location of the Power Station Complex. An exploratory tunnel is the key element proposed to gain this critical information.

Exploratory tunnels are used as a subsurface investigation method and are common in hydroelectric projects internationally. Exploratory tunnels were excavated during the 1960s for the Tumut 1 and Tumut 2 power stations in the Scheme. Exploratory Works offer material risk reduction opportunities for the design and construction of the power station cavern through improved geotechnical knowledge.

Exploratory Works will predominantly be in the Lobs Hole area of KNP and Talbingo Reservoir and are entirely within NSW. Lobs Hole is between Talbingo Reservoir to the north-west and the Snowy Mountains Highway to the east.

Lobs Hole is currently used as a remote campground (known as Ravine campground) within KNP and provides space for recreational activities. The nearest towns to Exploratory Works are Cabramurra, Adaminaby, Cooma,

Talbingo and Tumut. The area in which Exploratory Works will be undertaken is referred to as the project area. The project area is shown in Figure 2.

Note for interested parties: material for this chapter is largely derived from *Volume 1: Main report - Environmental Impact Statement - Exploratory Works for Snowy 2.0* (the ***EIS Report***) as amended by *Response to Submissions - Exploratory Works for Snowy 2.0 - October 2018 (EMM)*, and Contract 94705 - Exploratory Works Roads Part B: Scope of Work (Snowy Hydro). The EIS report is in the public domain and contains substantial additional information and graphics describing the works.[9]

[9] Available at https://v2.communityanalytics.com.au/snowy/ew/downloads.

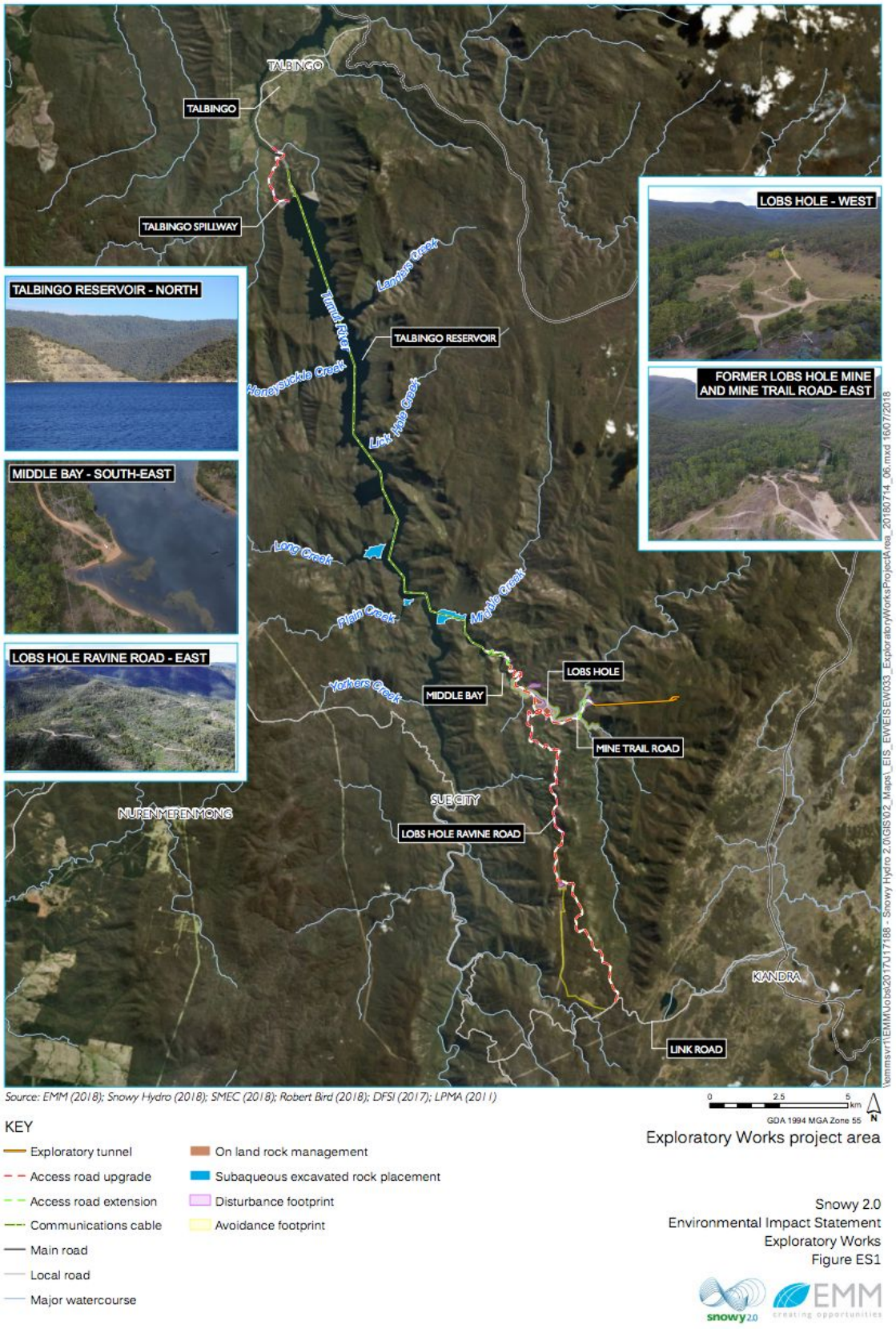

Figure 2: Project area

6.2 Scope and exclusions

The Exploratory Works comprise the scope shaded in Table 1 below.

These works will be let in two tranches:

1. EWR as a standalone construct-only contract;
2. Balance of Exploratory Works - as an initial part of the main Civil Contract (see details below).

Package	Employer (Snowy Hydro)[10]	EWR	Exploratory Works	Civil Works
Approvals	x	x	x	x
Connection agreements	x			
Engineering (access roads)	x			
Engineering (balance)			x	x
Mobilisation		x	x	x
Project management	x	x	x	x
Site establishment		x	x	x
Camps			x	x
Construction facilities		x	x	x
Construction power			x	x
Testing and commissioning				x
Demobilisation		x	x	x
Marine works			x	x
Access roads		x		

Table 1: Division of responsibility

6.3 Activities undertaken

As at FID, an EIS has been lodged, the public comments period has closed, and the RTS has been submitted. A contract to deliver the EWR has been negotiated with Leed Contractors.

The balance of the Exploratory Works scope will be undertaken within the scope of the Civil Contractor.

8 Project controls

8.1 Introduction

The Project Controls function centralises and analyses progress data from Contractors and internal departments (such as Accounts Payable) to monitor, support and report on the management of status, risk, change, deliverables, and other information affecting the Project within the Project's governance framework. Performance reports, change requests, escalated issues and risk, and information about outcomes flow up to the Project's governing body as a result of Project Controls.[11]

[10] Includes owner's contractors and consultants.
[11] See (Project Management Institute 2016).

8.2 Activities undertaken

The Project requires a dedicated Project Controls function. Pre-FID, objectives were identified and Earned Value (***EV***) adopted as the preferred approach. Pre-FID effort addressed fitness-for-purpose, systems, critical BAU interfaces, exploratory works requirements, capability, scalability and alignment.

8.3 Project controls principles

The EV management approach is based on the project management triangle of scope, time and cost and provides accurate tracking and forecasting of project performance and identifying potential variances.

Project Controls concentrates on cost and schedule management and management of variance. The Project will follow general project management principles, especially Earned Value Performance Management (***EVPM***) as defined in *AS 4817-2006 Project performance measurement using Earned Value*.[12]

Contractors are expected to operate an Earned Value Management (***EVM***) System.

The primary focus of Project Controls is the tracking and management of the Project's cost and schedule and the analysis and mitigation of variance.

The project manager directs the work of the project team while Project Controls advises the team and the project manager of possible cost and schedule risks or variances and recovery plans as identified by the Contractors.

Project controls interprets data from the Contractors and generates the Project's cost and schedule status and variances with potential impacts and mitigations or recovery plans. Project management consumes the information generated and makes decisions for the Project.

8.4 Work Breakdown Structures

The Project's scope of work is divided into deliverable-oriented elements making up the Work Breakdown Structure (***WBS***), agreed by the leadership team and assigned to the appropriate management levels via an Organisation Breakdown Structure (***OBS***) and a Responsibility Assignment Matrix (***RAM***).

The WBS established for pre-FID works will be superseded by a new structure that will address the Exploratory Works remaining at FID and Main Works.

Control accounts are defined by the intersection of the WBS and the OBS and are maintained by the project cost control function.

8.5 Schedule

The Owner's Team needs to understand and follow work progress and manage owner-controlled milestones. The baseline schedule will be developed following

[12] (Standards Australia 2016).

FID. The contractors will develop detailed schedules. The schedule will be baselined and then managed against that baseline.

8.6 Time-phased budget

The Project baseline budget will be established after FID but before the commencement of any approved works. Project activities will have assigned budgets to an appropriate level of granularity for the activity to be managed. These budgets will be time-phased by period over the duration of the activity, or over the duration of the Project where activities are not yet planned in detail.

A contingency/management reserve budget will be established that is not assigned to any activity and will be drawn down on as needed.

8.7 Performance measurement and reporting

Each activity will have an assigned metric to monitor with the performance measurement set against a formalised baseline and planning parameters. The baseline provides the reference against which progress is measured and reported. The measurement model to track individual scope elements will be selected from available methodologies suited to the Scope of Work.

For the EWR and the Main Works, quantities and job hours will be tracked along with contractor-supplied data.

Performance data is aggregated up through the WBS to allow a strategic view. Project controls will provide a regular dashboard representation and reports of the aggregated data from each discipline.

The data is to be analysed (at least) monthly against the performance metrics by contractors and Project controls and identify and verify variances. The forecast will need to be maintained for accurate EVM and effectively manage cash flow.

8.8 Management action

Through a series of potential options, Project management can take action over variances detected through Project Controls.

8.9 Change management

Management of scope and change is a critical element of project management. Scope changes detected through the trend program or Project controls tools record the effect on the project cost and schedule from the baseline.

Change control procedures will ensure proper management notification and corrective action is taken to regain the project cost, scope and schedule.

Action on all change requests carried out through Change Orders (***CO***) must be deliberate, timely, and carried out without interfering disproportionately with Project progress.

8.10 Supporting systems

The primary Project Controls suite of applications was selected from industry-standard tools and tested through 2018 on a standalone basis. The suite of systems is sufficient for current needs but may require further consideration during the evaluation and implementation of the EWR contract.

Project reporting/dashboards will be further investigated.

8.11 Commitments

Commitment tracks and covers the financial obligation documented by contracts, purchase or service orders.

New contracts or contract variations (see *Chapter Two*) must be committed based on an Executed Change (***EC***) and supported by an approved Contract Change Order (***CCO***). The full expected value of each purchase order, assignment or contract (to completion) should be carried as a commitment control.

Project Controls will forecast planned commitments in alignment with the Schedule, and track actual commitments within the Project cost management system as incurred.

8.12 Project accounting

Prior to each financial month-end closure within the Finance business unit, each Control Account Manager (***CAM***) will work with the Project accountant to compile the accruals for their responsible control accounts.

The Project is likely to fall within the scope of the NSW security of payment legislation with requirements reflected in the payment terms of the contracts and in contract administration procedures.

The Owner's Team will keep tight control over the contract and ensure that the payment cycle is managed efficiently.

The Owner's Team will be responsible for the development and maintenance of the Project cash flow forecast. The cash flow forecast will provide an estimate of the monthly commitment and expenditure forecasts for the Project and be based on the Project schedule and progress information. Snowy Hydro will use the cash flow forecasts as a basis for management reporting and to make the necessary cash calls.

8.13 Contract close-out

On notification of a contract close-out, the contract commitment must be released from the Project Controls tools with residual funds returned to the parent.

8.14 Deliverables by phase

The Project Controls function and supporting systems will be progressively implemented as information comes available from the Contractors, and the control requirements develop.

9 Contractors' execution approach

9.1 Introduction

The Employer's Requirements, as defined by the key construction and execution obligations on the Contractors, apply to the Civil and E&M contracts unless otherwise noted. They may potentially apply to the EWR contract as applicable to that contract's scope of work (see *Early and exploratory works* above).

The Employer's Requirements were issued to the Civil and E&M Contractors in the course of the tender process conducted in Q2/Q3 2018 (See *Core Chapter Two*).

The requirements as described here are as issued to the Contractors, without any consideration of possible exceptions. See *Core Chapter Two* for more details of the tender process.

9.3 Management plans

Contractors will submit a detailed PEP and associated subplans within eight weeks of award. Each Contractor submitted a pro forma or first draft of the PEP with their tender. Contractors are expected to align their execution approach with Snowy Hydro's values.

In preparing the PEP and all other management plans, the Contractors were required to address compliance with the conditions of the Approvals and the Employer's Requirements in detail.

The Civil Contractor is responsible for management and control of the Site, is engaged by the Employer and accepts the engagement as the Principal Contractor for the execution of the Project (including the E&M Contractor's activities).[13]

The Civil Contractor is also responsible for supply and management of services (as detailed below) for the whole of the Project Works through to commissioning and handover of the Works.

9.4 Health, safety and security

Contractors have given safety the highest priority by aligning their safety management systems with Snowy Hydro's principles and providing a detailed Health & Safety (***H&S***) management plan and policy. Each shortlisted contractor

[13] Note that 'Principal Contractor' has a defined meaning both under the Contract and under NSW legislation (see *Chapter One*).

provided a history of demonstrated and documented compliance with the safety objectives and a detailed and comprehensive Health and Safety Management Plan (***HSMP***) outlining the implementation of regulations and the associated governance tools to maintain them. The Contractors will submit a detailed and comprehensive HSMP prior to commencing any Works.
The HSMP will define, outline or detail as appropriate:

1. The Contractor's H&S management systems, interfaces and integration with subcontractors and other contractors on the site;
2. 'Cardinal' rules;
3. Safety culture;
4. Emergency readiness and management;
5. H&S risk management;
6. The Contractor's Workplace H&S organisation and the roles and responsibilities for Workplace H&S management;
7. Currency of the HSMP;
8. Monitoring and reporting H&S performance; and
9. Incident management.

9.5 Environment and approvals

Snowy Hydro's overall Project approach to Environment and Approvals is described in the *Environment, permits and approvals* section above. The Employer is responsible for obtaining the required Employer's Approvals as defined in the Conditions of Contract (See Core *Chapter Two*).

The Employer is responsible for obtaining a lease and/or other access rights to those areas required for construction of the Project (Lease) that are located inside the KNP. Contractors will prepare comprehensive management plans, obtain necessary permits and approvals, and prepare a comprehensive CEMP and required subplans.

The Contractor will:

1. Prepare comprehensive management plans in consultation and for review, to the requirements and conditions of the Approvals;
2. Identify and obtain all consents, permits, approvals and authorisations other than the Employer's Approvals and the Lease, and do all things required to transfer them to the Employer, to the extent legally permitted; and
3. Comply with and ensure the Works comply with all consents, permits, approvals and authorisations, including the Approvals and the Lease.

The Contractor will provide a comprehensive CEMP for each phase of the Project that is consistent with best industry practice and the conditions of the Approvals.

The Contractor will ensure that the CEMP is maintained and resubmitted as necessary to the Employer until the Date of Completion of the Works.

In addition, as a subset to the CEMP, the Contractor will produce management plans addressing:

1. Biodiversity;
2. Heritage;
3. Noise, vibration and blasting;
4. Excavated rock and its disposal;
5. Soil;
6. Geodiversity;
7. Contaminated land;
8. Waste;
9. Surface water and groundwater;
10. Public safety;
11. Community consultation and complaints; and
12. Decommissioning and site rehabilitation.

The Contractor will provide an Environmental Management Strategy for each phase of the Project that is consistent with best industry practice and the conditions of the Approvals.

9.6 Risk management

Snowy Hydro's Project approach to risk management is described in Core *Chapter Four.* The Civil Contractor will conduct a risk workshop, communicate risks and proposed mitigations,, and undertake agreed risk mitigations. The Contractors will apply *AS/NZS 31000:2009 Risk Management Principles and Guidance*.[14]

9.7 Construction

The Contractors will produce a Construction Management Plan (***CMP***) that will detail all aspects of the construction of the Works in line with the Contractor's PEP. The CMP will need to be in sufficient detail to satisfy the requirements of the relevant regulatory authorities and comply with all conditions of the Approvals.

The plan will cover:

1. Construction planning and methods in each area;
2. Inclusion of subcontractors;
3. Sourcing of materials and equipment; and
4. Quality control and schedule.

The Contractors will also provide detailed method statements for each major section of the Works giving more specific details to the construction techniques and sequencing proposed and also the interface required between the Civil and E&M contractor where appropriate.

The Contractors were also given detailed requirements, including:

1. Standards and quality;
2. Access and site coordination;
3. Construction methods and materials;

[14] (Standards Association of Australia 2009).

4. Testing of materials;
5. Use of the Site;
6. Temporary works;
7. Materials testing;
8. Control of water;
9. Surface excavation and earthworks;
10. Underground excavation;
11. Concrete production;
12. Instrumentation;
13. Building construction;
14. Structural steelwork;
15. Road and bridge construction;
16. Underwater excavation; landscaping; and
17. Explosives.

9.8 Human resources and industrial relations

Contractors must ensure their personnel are performing and complying with Snowy Hydro's expectations defined by the agreements and regulations. Planning, recruiting and mobilising the construction workforce is the Contractor's responsibility.

The Contractors' workforce will be accommodated in suitably-located construction camps, with Fly-in/Fly-out (***FIFO***)/Drive-in/Drive-Out (***DIDO***) arrangements. The workforce will work 24/7 with a variety of potential rosters. Details of the exact rosters will be determined post-tender award and upon negotiation of the Project Agreement. It is the responsibility of the Contractor to determine contractual agreements, remuneration packages and working conditions applicable to the construction workforce in accordance with Australian employment standards.

The Contractor's Personnel will be solely the responsibility of the Contractor. Industrial agreements covering the Project workforce will be established by the Contractors. Snowy Hydro will rely on the experience and knowledge of the Contractors to ensure that these agreements reflect contemporary practice. The Employer expects that the Works will be completed with no or minimal disruptions due to employment or industrial relations issues.

The Contractors will work closely with the Employer and each other to align HR/Industrial Relations (***IR***) policies and procedures across the Project. The Contractors were required to produce comprehensive HR and Workplace Relations Management Plans.

9.9 Information management

The Conditions of Contract and the Project Execution Requirements set out the Contractors' obligations in respect of documents. The Contractors were required to provide and implement an Information Management (***IM***) plan, prior to any works commencing, and subject to the Employer's review and approval.

Snowy Hydro sees value in the adoption of Building Information Management (***BIM***). As at FID, Snowy Hydro has taken its BIM planning to a conceptual level only, with the expectation that the Contractors will have clear views and recommended approaches in this space.

Snowy Hydro's requirements for BIM will apply to both Civil and E&M Contractors.

Snowy Hydro intends to achieve a number of strategic priorities and objectives through BIM, including:

1. Supporting the design, construction and operation delivery to reduce risk and improve efficiencies;
2. Ensuring both Civil and E&M Contractors have a common understanding of and compliance with Snowy Hydro's requirements;
3. Providing the models to demonstrate compliance with these requirements. Including statutory information requirements, regulations and standards;
4. Providing accurate as-built digital records that can be integrated for operations with existing Scheme assets; and
5. Creating an Asset Information Model (***AIM***) suitable to enhance and integrate with asset management and maintenance systems.

The Contractors were required to develop and implement a BIM Execution Plan (***BEP***) based on the Employer's Information Requirements (***EIR***). This will cover requirements to execute BIM efficiently through all phases of the Project, including the contractual alignment, the model uses, meetings and milestones, model collaboration and coordination, and model standards and quality assurance. This BEP will form part of the final Project IM plan developed in collaboration with the Contractors.

After the Commencement Date, but before the commencement of detailed design, the Employer and the Contractor will agree in detail the systems, tools, protocols and standards that the Contractor will apply to BIM.

9.10 Procurement and logistics

It is expected that the contractors will maintain full control over their supply chain for the term of the Project. The Contractors' approach to transport, logistics and materials control is tightly bound to their preferred construction methodology, given the significant volumes of material to be moved for the Project.

There are specific areas, though, where Snowy Hydro intends to have active involvement.

9.11 Project controls

Contractors will develop and maintain a Project Controls Management Plan, addressing cost, schedule, change, earned value, meetings, and progress reporting.

9.12 Design management

Contractors will undertake design work within a Design Management Plan they will submit to the Employer for approval. The plan will detail the Contractors' scope, resources, design processes, design procedures, quality, change control and coordination with the overall IM process.

The Contractors' design process will include a 'Safety-in-Design' process that meets the requirements of the Safe Work Australia *Safe Design of Structures Code of Practice.*[15]

The design will generally seek to:

1. Eliminate major hazard risks;
2. Minimise lifecycle cost;
3. Meet compliance obligations;
4. Have reliability, risk and safety as fundamental;
5. Consider redundancy, diversity, robustness and failure tolerance;
6. Consider maintainability and safety in operation; and
7. Be supported by appropriate studies, modelling and analysis.

The Contractors will hold regular design review meetings that the Employer will attend.

9.13 Quality management

The Contractors will be required to have comprehensive quality systems and a Quality Management Plan to provide Snowy Hydro with evidence that the Employer's Requirements have been met.

The Contractor will be required to keep current and supply to Snowy Hydro a complete set of 'as-built' records and drawings, operation and maintenance manuals.

Throughout the course of the Project, the Owner's Team will regularly inspect Works, Plant and Materials at appropriate points, and may maintain an ongoing presence for high-criticality work.

The Contractors will be required to establish and clearly follow inspection and test procedures, and deal with any nonconforming product or service.

The Contractors will appoint a Quality Manager with appropriate experience in managing the quality aspects of projects similar to the Works.

The Contractors will arrange for an external quality audit to be undertaken in accordance with the Quality Management Plan.

The Contractors will maintain records clearly identifying the source and condition of all Plant, Materials and equipment used for the construction of the Works.

[15](Safe Work Australia 2012).

9.14 Interface management

The Civil Works Contractors were required to produce an Interface Management Plan to be agreed with the Employer and the E&M Contractor Representative. Details of the requirements for the plan are included in the Interface Deed (see Core *Chapter Three*).

9.15 Role of the Civil Contractor in managing services

The Civil Contractor will provide management services. These include:

1. Security;
2. Road construction and maintenance;
3. Rehabilitation of the Site as required;
4. Traffic management; and
5. Accommodation camps.

The Civil Contractor will operate the services from as soon as practicable after the commencement date until takeover. The Contractor will provide all necessary staff, labour, services and materials to provide the services. The Contractor will operate any temporary services until they are no longer needed, or replacement permanent services are operational, as required.

9.16 Commissioning, ramp-up and handover

See the *Operations Readiness* section of Core *Chapter Four*.

10 Definitions and abbreviations

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AfL	Agreement for lease
AIM	Asset Information Model
BAU	Business-As-Usual
BEP	BIM Execution Plan
BIM	Building Information Management
CAM	Control Account Manager
CCO	Contract Change Order
CEMP	Construction Environmental Management Plan
CHMP	Cultural Heritage Management Plans
CISA	Connection Investigation and Services Agreement
CMP	Construction Management Plan
CO	Change Orders
COAG	Council of Australian Governments
COGATI	Coordination of generation and transmission investment
CPA	Connection Process Agreement

CSSI	Critical State Significant Infrastructure
DCP	Drop Cone Penetrometer
DIDO	Drive-in/Drive-Out
DoEE	Department of Environment and Energy
DPE	Department of Planning and Environment
DTV	Draft Tube Valve
E&M	Electrical/Mechanical
EC	Executed Change
ECC	Early Contractor Consultation
ECVT	Egress, Cable and Ventilation Tunnel
EIR	Employer's Information Requirements
EIS	Environmental Impact Statement
EP&A	Environmental Planning and Assessment
EPC	Engineer- Procure-Construct
EPL	Environment Protection Licence
ESB	Energy Security Board
ESCP	Erosion and sediment control plans
EV	Earned Value
EVM	Earned Value Management
EVPM	Earned Value Performance Management
EWA	Early Works Agreement
EWR	Exploratory Works - Roads
FID	Final Investment Decision
FSL	Full supply level
GBR	Geotechnical Baseline Report
GIS	Gas-insulated Switchgear
GPS	Generator Performance Standards
GTR	Generator technical requirements
H&S	Health & Safety
HR	Human resources
HSMP	Health and Safety Management Plan
IM	Information Management
IR	Industrial Relations
IRR	Internal rate of return
ISP	Integrated System Plan
IUSA	Identified user shared assets
KNP	Kosciuszko National Park
LV	Low Voltage
MAT	Main Access Tunnel
MOL	Minimum operating level
MV	Medium Voltage
NEM	National Electricity Market
NER	National Electricity Rules
NPW	National Parks and Wildlife
NPWS	National Parks and Wildlife Services
OBS	Organisation Breakdown Structure
OEH	Office of Environment and Heritage
PAF	Potentially Acid-Forming

PEA	Preliminary Environmental Assessment
PEP	Project Execution Plan
PGV	Penstock Guard Valve
PHES	Pumped-hydro energy storage
PSCR	Project Specification Consultation Report
R&D	Research & Development
RAM	Responsibility Assignment Matrix
REZ	Renewable Energy Zones
RFI	Request for Information
RTE	Round-trip efficiency
RTS	Response to Submission
SEAR	Secretary's Environmental Assessment Requirements
SHC	Snowy Hydro Corporatisation
SSI	State Significant Infrastructure
TC	Tunnelling classes
TCA	Transmission Connection Agreement
TNSP	Transmission Network Service Provider
TUOS	Transmission Use of System
VPA	Voluntary planning agreement
VRET	Victorian Renewable Energy Target
WBS	Work Breakdown Structure

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