Kidston Pumped Storage Hydro project

Coordinator-General's evaluation report on the impact assessment report

April 2019

COORDINATOR-GENERAL

Queensland Government

The Department of State Development, Manufacturing, Infrastructure and Planning

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Synopsis

This report details my evaluation of the Kidston Pumped Storage Hydro project (the project). It has been prepared pursuant to section 34L of the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act). The project is one of the projects that make up the Kidston Renewable Energy Hub (the Hub), an integrated solar, pumped storage hydroelectric and wind power generation facility, which could represent up to 20 per cent of Queensland's total peaking power generation capacity.

The pumped storage hydro project will act as natural battery storage, allowing solar energy to be stored and delivered back into the grid as baseload power during periods of high electrical demand, by generating energy through moving water between reservoirs.

This renewable energy project will reuse the Kidston Gold Mine site, 280 kilometres north-west of Townsville, which was decommissioned in 2001. The concept is a first for the State, demonstrating the beneficial reuse of a disused mining asset.

Genex Power Limited (Genex) (the proponent), proposes to construct and operate the Hub. Stage 1 of the Hub, a 50 megawatt (MW) solar power project, has been constructed and is operational. Stage 2 of the Hub includes this project and a second solar project with 270 MW capacity. This second solar project was approved by Etheridge Shire Council (ESC) on 3 April 2018 under the *Planning Act 2016*. Stage 3 is a 150 MW wind farm, which is in the feasibility stage.

Powerlink is also proposing to develop a 275-kilovolt transmission line from the project to a substation at Mount Fox near Townsville to connect all stages of the Hub to the National Energy Market.

The project's impact assessment report (IAR) (January 2019) states the project would require an estimated capital expenditure of $330 million. Key project benefits identified in the IAR include:

- up to 370 direct full time equivalent (FTE) jobs during the construction period
- up to nine ongoing direct FTE jobs during operations
- supporting the government's target of generating 50 per cent of Queensland's electricity needs from renewable energy by 2030
- adding stability and strength to the North Queensland electricity network, reducing the need to import excess electricity from neighbouring regions
- contributing to the Australian Renewable Energy target and the development of the Renewable Energy Zone in Far North Queensland.

Construction is due to commence in 2019 and is expected to take three and a half years.

In undertaking my evaluation, I have considered information including the IAR, supplementary material to the IAR and advice I have received from relevant state and local government agencies.

The following provides an overview of the main issues arising from my evaluation.

Surface water

The project proposes the release of water into the Copperfield River to allow the lowering of water levels in the two pits to facilitate construction of the project and following significant rainfall events during construction and operation. Due to historical mining activities, the reservoirs contain residual contaminants including metals and nutrients such as zinc and nitrogen that, without mitigation, could affect the aquatic ecosystems of the Copperfield River. Increased metal concentrations such as zinc can have impacts on aquatic flora or fauna and increased nutrients, such as nitrogen can cause algal blooms deteriorating water quality, also impacting aquatic ecosystems.

The proponent modelled a range of water release scenarios including the worst-case changes to surface water quality in the Copperfield River. The modelling informed the proponent's proposed release criteria which includes a flow trigger and post release flush. A water release would not occur until the Copperfield River is flowing at 400 megalitres (ML) per day (flow trigger) to limit the concentration of potential contaminants in the receiving environment. Releases would also cease when flow in the river recedes to below 400 ML per day. After each release, natural streamflow would continue down the Copperfield River at a volume of between 1,676 ML to 1,758 ML for a period of 29 to 32 days (post release flush).

In the worst-case scenario, modelling identified potential impacts to the Copperfield River due to elevated levels of dissolved zinc and total nitrogen from previous mining activities. However, the median scenario predicts that acceptable water quality levels would be met in the Copperfield River approximately 625 metres downstream of the release point. The proponent also proposes a receiving environment monitoring program (REMP) to identify any requirements to modify or cease the water releases to protect the aquatic ecosystems of the Copperfield River.

I note that the release criteria including the flow trigger and post release flush would limit the concentration of contaminants in the receiving environment to confirm that acceptable water quality is maintained within the Copperfield River. To ensure that the potential impacts can be managed I have imposed a comprehensive framework of stringent conditions to regulate the proposed water releases (at Appendix 1, Schedule 1 of this report). The framework includes: contaminant limits set at the release point and in the receiving environment; an expanded REMP to monitor, identify and respond to any adverse impacts identified in the Copperfield River; and a reporting framework. As a result, the proposed water releases should not adversely affect the water quality and aquatic ecosystems of the Copperfield River.

Groundwater

The IAR identified two potential impacts on groundwater resulting from the project: potential seepage of reservoir water into the groundwater surrounding the reservoirs; and adverse changes to groundwater quality of the Copperfield River alluvium from the proposed water releases.

During project construction the majority of water from the Eldridge Pit would be transferred into the Wises Pit to enable construction works. Additional pressure from the increase in volume of water in the Wises Pit could potentially result in seepage of water from the

Wises Pit impacting the quality of the surrounding groundwater. The proponent proposes to minimise the risk of seepage from the Wises Pit by covering the western wall of the reservoir with a liner which is predicted to significantly reduce the risk of seepage.

The surface water of the Copperfield River and groundwater of the Copperfield River alluvium are linked. As a result, the proposed water releases have the potential to impact on the water quality of the groundwater alluvium. Release criteria and a post release flush are proposed to prevent release water accumulating in the Copperfield River alluvium. The conditions that I have imposed to regulate surface water releases will ensure that the accumulation of contaminants in the Copperfield River alluvium does not occur. I have also set out requirements for the proponent's REMP to identify changes in groundwater to ensure the proponent would modify or cease the water releases if required.

Ecology

The IAR assessed the potential impacts on aquatic and terrestrial ecology surrounding and downstream of the project site.

Project construction activities have the potential to disturb aquatic habitats in the Copperfield River. The IAR identifies that a construction environmental management plan (CEMP) would be developed for the project and would contain measures to avoid, minimise and mitigate risks of impact during construction activities.

Mitigation measures implemented through the CEMP would be developed for the project and would contain measures such as the use of silt curtains to avoid, minimise and mitigate risks of impact during construction activities.

In addition to the measures set out to manage water quality, the project's REMP requires the proponent to undertake sediment sampling and biological monitoring to ensure that the aquatic values of the Copperfield River are protected. The proponent proposes to use a diffuser for the controlled releases of water into the Copperfield River which would minimise erosion of the river banks during operations.

I do not expect the project's construction and operation to adversely impact on the terrestrial and aquatic ecology.

Land use, tenure and other environmental effects

This IAR also assesses land use, tenure and other environmental effects of the project including traffic and transport and amenity. I note that the community may be affected by some of the construction aspects of the project, in particular impacts to the road network and potential impacts to amenity (i.e. noise, vibration and dust). However, the proponent is required to comply with ESC's conditions of development approval (issued 19 September 2018) relating to construction waste, road works, vegetation clearing and dam construction. I am satisfied that compliance with these conditions, along with implementation of the mitigation measures proposed, would address any adverse impacts.

I am satisfied that the conditions of ESC development approval address the other environmental effects of the project as outlined in this report.

This evaluation report, including the imposed conditions for the project, do not affect the development approval issued by ESC.

Approval pathway

The *Environmental Protection Act 1994* does not make provision for the transition from a decommissioned mine to a hydroelectricity project. As such, no existing legislative mechanism exists for the approval and regulation of the project's water release requirements.

The SDPWO Act provides the ability to impose conditions for matters where there is a regulatory gap. I have imposed a framework of conditions to regulate the project's proposed water releases to fill the regulatory gap.

Coordinator-General's conclusion

This report has evaluated the IAR documentation, agency advice, and other material relevant to the project.

I consider that the IAR requirements of the SDPWO Act for the project have been met and that sufficient information has been provided to enable an evaluation of the environmental effects of the project.

I conclude that there are significant local, regional and State benefits to be derived from the Kidston Pumped Storage Hydro project, and that environmental effects can be adequately avoided, minimised or mitigated as required through the implementation of the measures outlined in the IAR documentation. The conditions I have specified in this report have been formulated to further manage all potential impacts associated with the water releases from the project.

Accordingly, I approve the project, subject to conditions included in this report.

A copy of this report will be provided to the proponent and relevant state government agencies and will also be made publicly available at: www.dsdmip.qld.gov.au/kidstonhydro.

Barry Broe

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Barry Broe
Coordinator-General

5 April 2019

1. Introduction

This report has been prepared pursuant to section 34L of the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act) and provides an evaluation of the impact assessment report (IAR) for the Kidston Pumped Storage Hydro project (the project).

This report does not record all the matters that were identified and subsequently addressed during the assessment. Rather, it concentrates on the substantive issues identified during the IAR process. This report:

- summarises the key issues associated with the potential impacts of the project on the physical, social and economic environments at the local, regional and state levels
- presents an evaluation of the project, based on information contained in the IAR, as well as information and advice from Etheridge Shire Council (ESC) and advisory agencies
- imposes conditions under which the project may proceed.

2. About the project

2.1 The proponent

The proponent for the project is Genex Power Limited (Genex) (the proponent) (ABN 18 152 098 854). Genex is an Australian renewable energy generation and storage company listed on the Australian Stock Exchange (ASX) (ASX code: GNX). Genex has a number of subsidiary companies including Genex (Solar) Proprietary Limited.

In June 2014, Genex acquired 100 per cent of Kidston Gold Mines Limited from Barrick Gold Corporation. Genex assumed operational control of the decommissioned Kidston Gold Mine site in January 2015.

2.2 Project location

The project is located on the decommissioned Kidston Gold Mine site, approximately 280 kilometres (km) north-west of Townsville and 275 km south-west of Cairns (Figure 2.1). The closest townships to the project site are Kidston with approximately 10 permanent residents, located north-west of the project site; and Georgetown which is the nearest regional centre located approximately 90 km north-west of the project site. The township of Einasleigh, with an estimated population of 200, is located approximately 40 km to the north of the project site.

The project is located directly adjacent to the Copperfield River, which forms a tributary of the Einasleigh River (a tributary of the Gilbert River). The Gilbert River Basin covers an area of approximately 46,500 km^2 and drains into the Gulf of Carpentaria. The project site is located within the Etheridge Shire local government area (LGA).

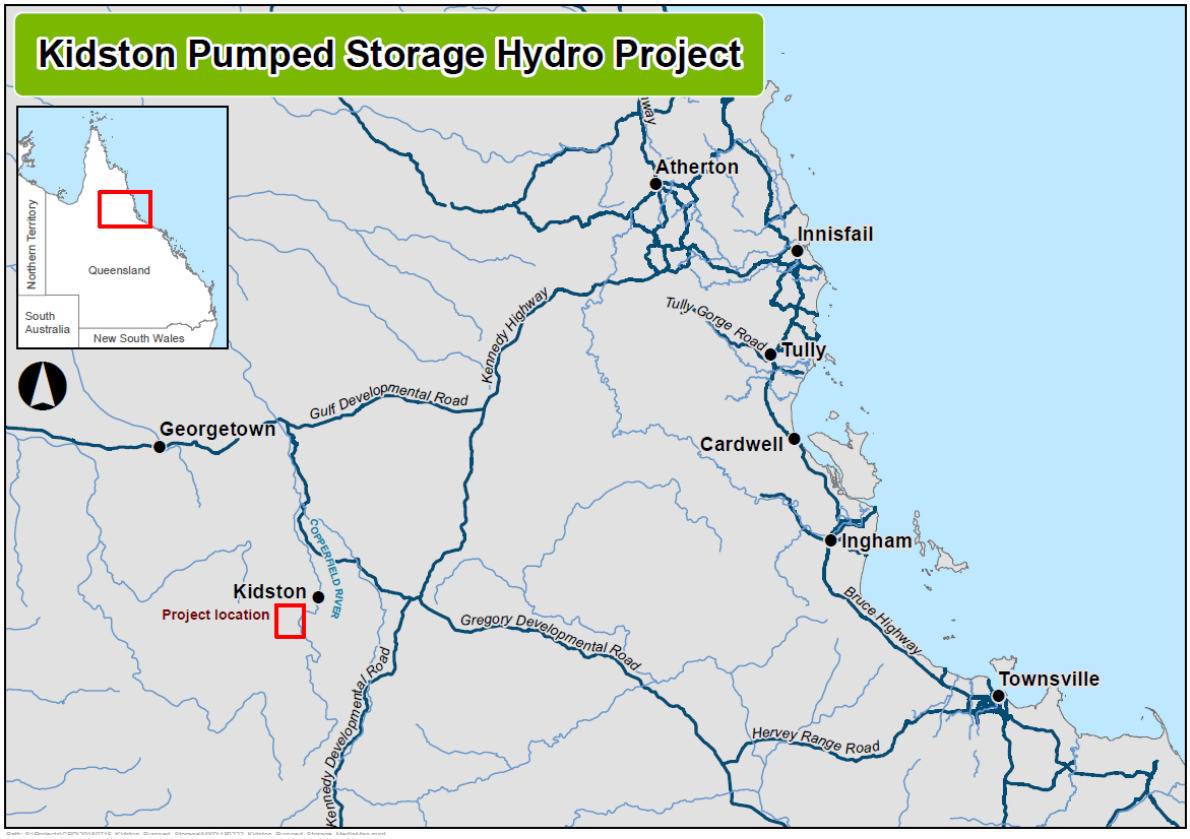

Figure 2.1 Project location

2.3 Project description

The Kidston Pumped Storage Hydro project (the project) forms part of Stage 2 of the Kidston Renewable Energy Hub, which is further described in 2.3.3. The project acts as a large-scale storage battery, allowing solar energy from the proponent's proposed adjoining solar farm to be stored as baseload power for times of peak energy demand.

During off-peak periods with low electricity demand (late at night and midday), water will be pumped from the lower reservoir to the upper reservoir using low-cost surplus/off-peak power. This is known as a pump-back cycle. Figure 2.2 is a schematic of a pumped hydro storage system (Hydro-Electric Corporation, 2018).

During periods of high energy demand (early morning and evenings), water will be transferred from the upper reservoir to the lower reservoir through a turbine generator, converting the potential stored energy to kinetic energy, producing power. This is known as a generation cycle.

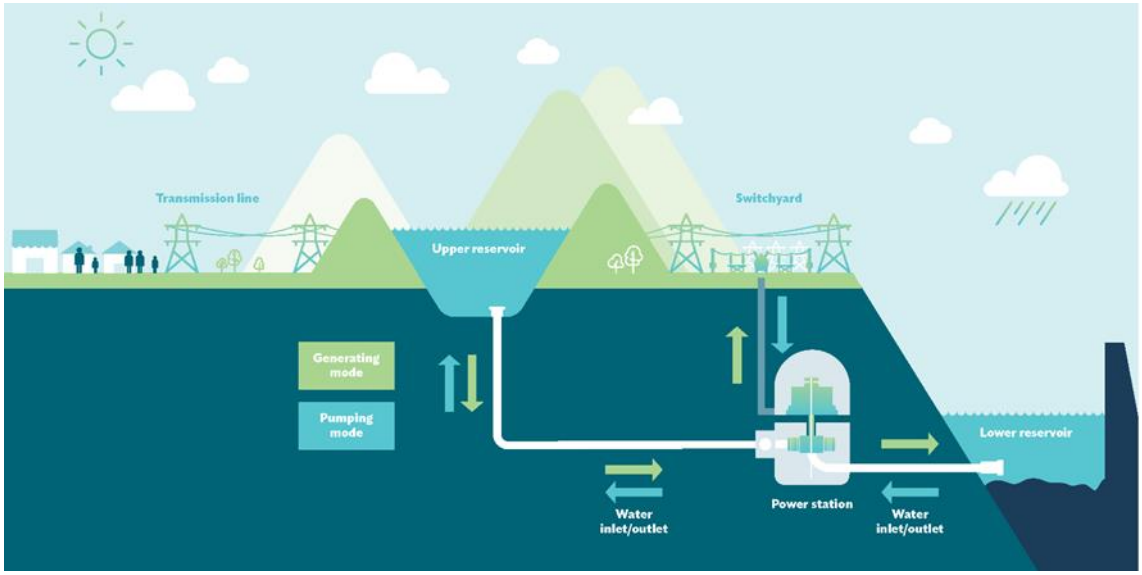

Figure 2.2 Schematic of a pumped hydro storage system

The project has been sized to 250 megawatts (MW) which is approximately 1,870 megawatt hours (MWh). According to the Intergovernmental Panel on Climate Change report on hydropower, this type of system is currently considered the most cost-effective means of storing large amounts of energy[1].

The project consists of the following components:

- an upper reservoir formed by a 20-metre-high dam around the existing Wises Pit
- a lower reservoir utilising the existing Eldridge Pit
- a constructed underground cavern between the two reservoirs to house the project's powerhouse, which has the capacity to generate 250 MW
- a tailrace allowing water to pass from the powerhouse to the reservoirs
- spillway infrastructure to release water from the upper reservoir to the Copperfield River.

2.3.2 Project stages

Construction stage

Construction is due to commence in 2019 and expected to take three and a half years. The construction activities for the Wises and Eldridge Pits are outlined below.

Wises Pit (upper reservoir):

- 1.6 million cubic meters (m^3) of existing waste rock currently stored within the Wises Pit would be excavated to create additional pit storage

[1] Kumar, A., T. Schei, A. Ahenkorah, R. Caceres Rodriguez, J.-M. Devernay, M. Freitas, D. Hall, A. Killingtveit, Z. Liu, 2011: "Hydropower". In IPCC *Special Report on Renewable Energy Sources and Climate Change Mitigation* [O. Edenhofer, R. Pichs-Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwickel, P. Eickemeier, G. Hansen, S. Schlomer, C. von Stechow (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

- 130,000 m^3 of this waste rock and a further 900,000 m^3 of waste rock material surrounding the Wises Pit would be used to construct a dam wall
- the balance of the excavated waste rock (1.5 million m^3) would be stored and managed at a site adjacent to the dam wall
- a high-density polyethylene (HDPE) liner would be installed in the pit (on top of a transition layer and a fine material layer) to reduce seepage loss
- a spillway structure would be constructed to direct excess water from the pit to the adjacent Copperfield River and will incorporate a dispersion device to facilitate mixing and minimise scouring of the river bank.

Eldridge Pit (lower reservoir):

- a permanent access tunnel will be constructed at an elevated position so as to minimise dewatering before tunnelling can start
- dewatering the pit (into the Wises Pit) before tunnelling begins
- underground excavation between the Wises Pit and the Eldridge Pit to facilitate the construction of access tunnels, the powerhouse cavern and shafts
- the installation of temporary services such as ventilation, power, water supply and gantry cranes
- constructing underground infrastructure including the powerhouse cavern, the tailrace (channel that carries water between reservoirs) and pressure piping
- installation of turbines, including supply of electrical, transformer, instrumentation and controls.

Construction water releases

To enable the construction phase, the Eldridge Pit water level needs to be decreased by pumping out approximately 28 gigalitres (GL) of water. It is proposed that 0.5 megalitre (ML) of water per day would be used for construction activities such as dust suppression, approximately 27.5 GL would be pumped into the expanded Wises Pit, while the remaining estimated 1.85-2.56 GL of excess would be released to the Copperfield River subject to the defined flow rate.

A key requirement of the project's construction phase is the need to dewater the existing Eldridge Pit to enable construction works associated with access and tailrace tunnel construction. Stage 1 dewatering of Eldridge Pit is expected to take approximately four months. Final dewatering of Eldridge Pit (Stage 2) down to relative level (RL) 305 meters Australian Height Datum (AHD) is expected to take approximately nine months.

Following construction, the Eldridge Reservoir would be refilled to RL 328.4 meters AHD with water from the Wises Reservoir, which is expected to take approximately two weeks.

Water releases from the Eldridge Pit may be required during construction as a result of heavy rainfall.

Operation stage

To enable the project to generate electricity, water would be moved between two pits as described in section 2.3.

The water levels in the reservoirs need to be managed to ensure optimal operating levels for operation of the pumped storage hydro system. The IAR states that for most years of the project's life, water would be required to top up the pits utilising the proponent's allocation from the Copperfield Dam during operations. However, in other years, water would need to be released from the Wises Reservoir to the Copperfield River subject to the defined flow rate. The IAR states that the operational water releases are required in order to:

- ensure the safe operation of the Wises Reservoir by, as far as practical, minimising the prolonged storage of water above the full supply level (FSL)
- maintain sufficient water storage capacity to temporarily contain, without uncontrolled release, significant wet season inflows
- ensure the project's power generation potential is not adversely impacted by excess water within the system.

Figure 2.3 illustrates the final project layout including the two decommissioned mine pits converted to reservoirs, the extent of the Wises Reservoir expansion and the location of the ancillary and supporting infrastructure.

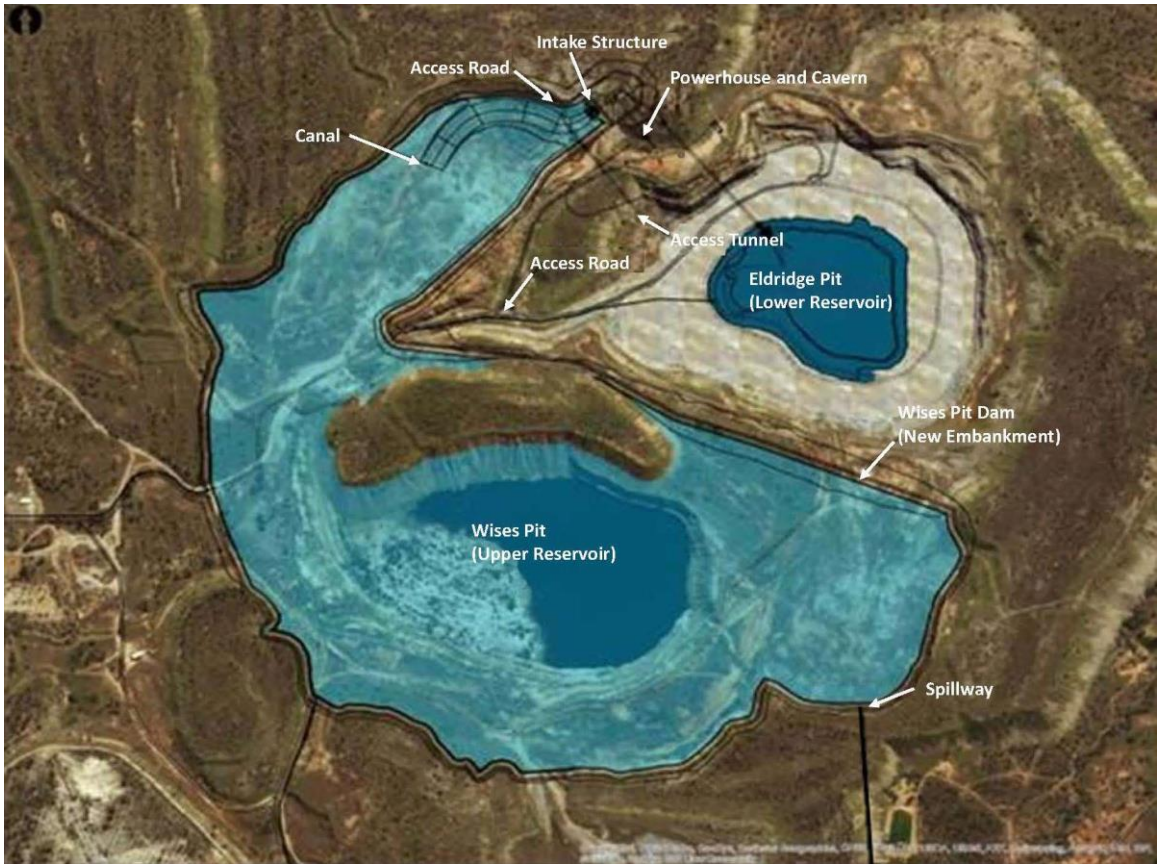

Figure 2.3 Proposed final project layout

Release location

It is proposed that during both construction and operation, water would be discharged at the same release point to the Copperfield River. However, the source and mix of water from each reservoir would vary.

The proposed water releases to the Copperfield River during construction are to occur primarily from the Eldridge Pit throughout the dewatering stage. For the remainder of the construction phase, releases would be from the Wises Pit.

Rehabilitation stage

The project is designed to have a minimum lifespan of 50 years. The IAR states that there would be several rehabilitation options available once the project nears the end of its design life including:

- upgrading the facility to extend the economic life of the project
- repurposing the facility for an alternative land use, such as tourism
- closing the facility and rehabilitating the site.

Site history

The IAR states the Wises Pit was mined to a depth of approximately 252 meters below ground level (292 meters AHD) and mining ceased in 1997. The Wises Pit was then backfilled with co-disposed tailings (27 million tonnes (mt)) and waste rock (35 mt) from the Eldridge Pit.

The Eldridge Pit was mined to a depth of approximately 270 meters below ground level (260m AHD). It was closed and rehabilitated in 2001. Rehabilitation of the pit involved accelerated flooding over a five-year period to cover any exposed potential acid forming (PAF) rock from oxygen exposure; and to prevent the risk of acid drainage contaminating land. Water was sourced from the Copperfield Dam as well as the Wises Pit and the tailings storage facility (TSF) to flood the pit to a water level of 450 meters AHD, approximately 80 meters below the pit's FSL.

Mining operations generated waste rock which was stored on site in surface engineered dumps surrounding the pit. Waste rock that was PAF was capped with an engineered cover.

Tailings deposits ceased in 1997 and the TSF was later rehabilitated with native trees, shrubs and a mixture of native and introduced pasture grasses.

2.3.3 Dependencies with other projects

The project is part of the broader 'Kidston Renewable Energy Hub' (the Hub) proposed by the proponent and comprising of the following three stages:

- Kidston Stage 1 – the 50 MW Kidston solar project (KS1) constructed on the tailings storage facility (TSF) of the closed mine. Stage 1 commenced providing electricity in December 2017
- Kidston Stage 2 – includes the proposed project (K2H), with a 250 MW capacity which would generate power through transferring water between two existing water-filled mine pits. Stage 2 also includes an approved 270 MW solar farm (K2S) to integrate with the K2H project. The K2S and K2H project are proposed to be developed together.
- Kidston Stage 3 – the proposed 150 MW Kidston wind farm, currently undergoing feasibility assessment.

Powerlink is also proposing to develop a 275 kV transmission line from the Kidston site to a substation at Mount Fox, near Townsville, to connect all stages of the Hub to the National Energy Market.

2.4 Project rationale

2.4.1 Site selection

The K2H project site was selected by the proponent in order to take advantage of the remaining infrastructure and existing permits associated with the decommissioned Kidston Gold Mine, including:

- two decommissioned mine pits at different elevations, for use as the upper and lower reservoir
- water pipeline to Copperfield Dam
- existing environmental permitting
- accommodation, road access and airstrip
- 132 kV transmission line and substation.

The K2S project site was also selected by the proponent as it is situated in the highest solar radiation zone in Australia and has large consistent flat areas, making it ideal for a large-scale solar project.

2.4.2 Project benefits

According to the IAR, the project offers a flexible solution to Queensland's growing peaking power requirements. The project would be well positioned to take advantage of the combined effects of an oversupply of baseload generation capacity and escalating peak power prices being driven by increasing gas turbine fuel costs. The project will contribute towards alleviating the growing pressure on peaking power demand and peak power prices in North Queensland, and Queensland more generally.

The IAR states that the project benefits include:

- supporting the government's target of generating 50 per cent of Queensland's electricity needs from renewable energy by 2030
- adding stability and strength to the North Queensland electricity network, reducing the need to import excess electricity from neighbouring regions
- contributing to the development of the Renewable Energy Zone (REZ) in Far North Queensland, required to support further renewable generation projects
- helping to maintain the affordability of electricity for consumers in Queensland, through supporting development of additional low-cost renewable generation
- providing local employment opportunities for over 370 people.

3. Impact assessment process

In undertaking this evaluation, I have considered information including the following:

- the initial advice statement (IAS)
- the IAR including the supplementary material
- clarification material submitted by the proponent and advisory agencies
- technical reports
- advisory agency advice from:
  - Department of Environment and Science (DES)
  - Department of Natural Resources, Mines and Energy (DNRME)
  - Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP)
  - ESC.

The steps taken in the project's IAR process are documented on the project's webpage at **www.dsdmip.qld.gov.au/kidstonhydro**

3.1 Coordinated project declaration

On 28 September 2018, I declared the project a 'coordinated project' under section 26(1)(b) of the SDPWO Act. This declaration initiated the statutory environmental impact evaluation procedure of Part 4 of the SDPWO Act, which required the proponent to prepare an IAR for the project.

3.2 Impact assessment report

3.2.1 Draft impact assessment report

On 11 January 2019, the proponent submitted a draft IAR for the project, in accordance with section 34G of the SDPWO Act.

On 25 January 2019, I decided public notification on the draft IAR was not required under section 34H of the SDPWO Act, as there are no subsequent notifiable approvals for the project and the proponent had undertaken consultation activities with relevant stakeholders.

3.2.2 Final impact assessment report

On 1 March 2019, the proponent provided supplementary information (supplementary material) to the draft IAR. On 25 March 2019, I accepted the draft IAR including the supplementary material as the final IAR under section 34I of the SDPWO Act.

4. Project approvals

4.1 Commonwealth

The proponent undertook a self-assessment to identify potential risks of the project to matters of national environmental significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The self-assessment did not identify potential risk to any MNES and the proponent advised in the IAS that the project would not be referred to the Commonwealth Department of the Environment and Energy for a controlled action decision under the EPBC Act.

4.2 Queensland

4.2.1 *Planning Act 2016*

On 19 September 2018, prior to a 'coordinated project' declaration, the proponent received development approval from ESC for a material change of use for community infrastructure (hydro storage facility and associated infrastructure). The development approval also included State Assessment Referral Agency (SARA) conditions for the following project components:

- operational works for clearing native vegetation
- operational works for a referable dam
- operational works for development within 100 meters of electricity infrastructure (Ergon substation).

Public notification was not required as part of the development assessment process.

This evaluation report, including the imposed conditions for the project, do not affect the development approval or the SARA response and conditions.

4.2.2 *Environmental Protection Act 1994*

An environmental authority (EA) (EPML00817013) was granted over the site in October 2013 to regulate the management of the mine site post closure, including rehabilitation requirements. The proponent acquired the site and EA in 2015 and has managed the site under the terms of the EA whilst seeking to beneficially reuse the site as a renewable energy generation and storage facility.

Components of the project are subject to the ongoing requirements of the EA and are managed separately to this evaluation report.

4.2.3 *Water Act 2000*

The project site is located within the Water Plan (Gulf) 2007 area. The proponent has an existing licence to access 4,650 ML of water per year from the Copperfield Dam which is available for project use.

4.2.4 SDPWO Act

On 28 June 2017, the then Minister for State Development declared Stages 1 and 2 of the Kidston Renewable Energy Hub as a prescribed project and a critical infrastructure project in accordance with Part 5 the SDPWO Act.

The Queensland legislative framework does not make provision for the transition from decommissioned mine to a hydroelectricity project. As such, no existing legislative mechanism exists for the approval and regulation of the project's water release requirements to achieve the water levels necessary for the operation of the project.

Section 54B of the SDPWO Act provides the Coordinator-General with the ability to impose conditions for matters which cannot be assessed through other legislative processes. As no process exists to regulate the proposed water releases, the coordinated project process can regulate the water releases required for the project's construction and operational phases.

I have therefore imposed a framework of conditions in Appendix 1 of this report.

4.2.5 Subsequent approvals

Following the release of this evaluation report the proponent will need to obtain approvals from state agencies and ESC before the project can proceed.

These approvals would be subject to separate applications and assessment and are detailed by the proponent in the IAR. The proponent acknowledges that further information would be required to support lodgement of applications for subsequent approvals with the relevant assessment managers.

Additional approvals that may be required for the project to proceed are identified in Table 4.1. These approvals would not require public notification.

Table 4.1 Subsequent approvals

Project component	Permit/approval	Legislation	Assessment manager/s
State Approvals			
Waterway barrier works	Development permit for operational works – works involving constructing or raising waterway barrier works	Planning Act and Planning Regulation, *Fisheries Act 1994*	DSDMIP/SARA Department of Agriculture and Fisheries
Chemical storage	Development permit – ERA 8	Planning Act and Planning Regulation, EP Act	DSDMIP/SARA DES
Extraction and screening of sand from the Copperfield River	Quarry material – allocation permit – ERA 16	*Water Act 2000* (Water Act)	DSDMIP/SARA DNRME

Project component	Permit/approval	Legislation	Assessment manager/s
Building works	Development permit – Building works	Planning Act and Planning Regulation, ESC Planning Scheme	DSDMIP/SARA Private certifier
Local Government			
Drainage works and plumbing works	Development permit – Drainage works and plumbing works	Planning Act and Planning Regulation, ESC Planning Scheme	DSDMIP/SARA ESC

5. Evaluation of environmental impacts

This section discusses the major environmental effects identified in the IAR. I consider some potential impacts of the project to have been adequately addressed in the IAR. For these matters, I have determined that the proponent's mitigation measures are appropriate. For the remaining matters evaluated below, I have included conditions to manage and mitigate adverse impacts.

5.1 Water resources

5.1.1 Baseline environment

Pit water quality

Since closure of the mine, seepage from the waste rock dumps (WRDs) has been collected in a series of seepage collection dams and evaporation ponds and is pumped back into the Eldridge and Wises Pits. The seepage pump-back system operates autonomously and is also designed to prevent the uncontrolled discharge of low-quality water into the Copperfield River and Charles Creek. A complete table of water quality statistics can be found at Table 7 of the IAR. A full list of parameters above the default water quality objectives (WQOs) can be found at Table 8 of the IAR. Table 5.1 outlines the concentration of key parameters in the Eldridge and Wises Pits.

Table 5.1 Eldridge and Wises Pit water quality

Parameter	Pit	Median	Maximum	80%ile	95%ile	Default WQO
Zinc (dissolved) (mg/L)	Eldridge	0.745*	1.75*	1.27*	1.61*	0.014[#]
	Wises	0.106*	0.327*	0.122*	0.266*	
Zinc (total) (mg/L)	Eldridge	0.22	2.28	1.238	2.09*	2
	Wises	0.092	3	0.169	0.727	
Nitrate (mg/L)	Eldridge	5.29*	5.45*	5.386*	5.434*	0.7
	Wises	0.155	0.3	0.242	0.286	
Nitrite (mg/L)	Eldridge	0.0475	0.09	0.073	0.0858	1
	Wises	0.0075	0.01	0.009	0.00975	
Nitrogen (total) (mg/L)	Eldridge	7.1*	7.2*	7.16*	7.19*	0.15
	Wises	0.95*	1*	0.98*	0.995*	
Reactive phosphorous (mg/L)	Eldridge	0.0150	0.0250	0.0210	0.0240	N/A
	Wises	0.0300	0.0400	0.0360	0.0390	
Phosphorous (total) (mg/L)	Eldridge	0.025*	0.025*	0.025*	0.025*	0.01
	Wises	0.055*	0.09*	0.076*	0.0865*	

*parameter concentrations above assigned WQO
[#]site specific WQO

Since 2003, yearly water samples have been taken from both pits for metal and nutrient concentrations.

The IAR states that Wises Pit has a relatively shallow water column to a depth of approximately 10 meters. The Eldridge Pit is filled to a depth of approximately 240 meters. The water quality in both pits is largely unstratified and homogeneous.

Catchment

The project site is located within the Copperfield River, a tributary of the Einasleigh River situated within the Gilbert River Basin, draining towards the Gulf of Carpentaria. The Copperfield River forms the eastern boundary of the project site and is the receiving environment for potential water releases associated with the project.

There are various downstream inflows into the Copperfield River including East Creek, Charles Creek, Oak River, Soda Creek and Chinaman Creek. The Copperfield River converges with the Einasleigh River approximately 48 km downstream of the proposed release location (Figure 5.1).

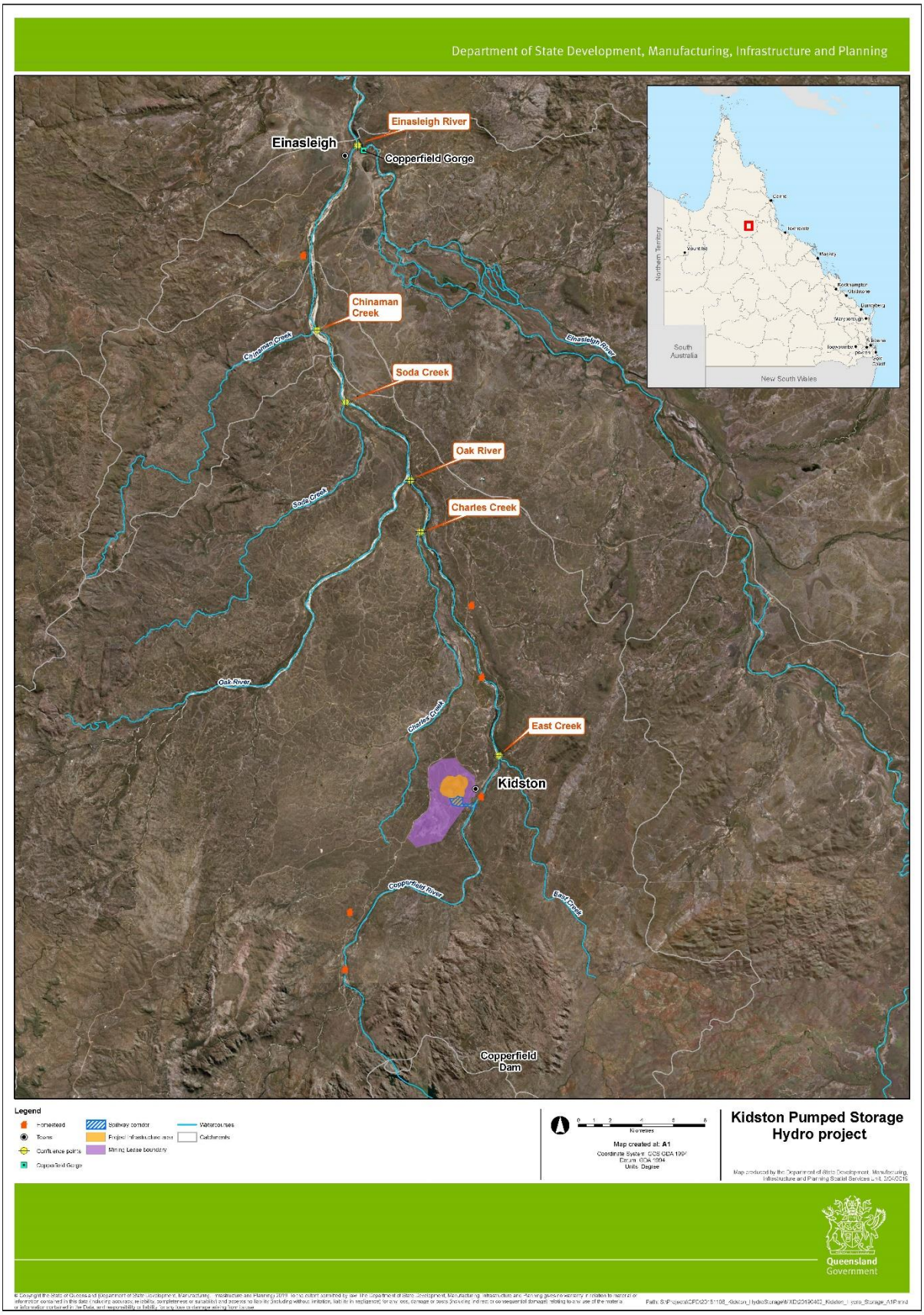

Figure 5.1 Copperfield River catchment

The catchment has a highly variable semi-arid, sub-tropical climate, with distinct wet and dry seasons. The majority of the mean annual rainfall total (705 millimetres (mm)) occurs during the wet season months of November through to March.

The catchment is situated in the highest solar radiation zone in the country having a fourfold higher pan evaporation[2] rate than other regions, which will result in the project having a negative water balance due to evaporative losses across any 12-month period.

The Copperfield River is a large ephemeral braided watercourse with no defined low flow channels. Instead, it consists of multiple small, shallow channels that divide and recombine. Braided streams typically occur where stream banks consist of highly erodible material in combination with rapid and frequent variations in water flow.

The IAR states that the Copperfield River in the vicinity of the project site, drains through alluvial sediments comprising of clay, silt, sand, and gravel which extends laterally from the river bed as floodplain alluvium. The alluvial sediments are approximately 5 to 6 meters thick. Groundwater levels vary seasonally over time; the unconfined alluvial aquifer displays low water levels during the dry season and elevated levels in the wet season.

The Copperfield River and surrounding catchment consists of varying soil types with high mineral content resulting in a baseline water quality high in metals.

During the dry season when the Copperfield River is not flowing, six semi-permanent waterholes were identified within the floodplain of the Copperfield River. These semi-permanent waterholes can be heavily impacted by cattle and feral pigs. High flow rates over the wet season limit the establishment of aquatic flora and small bodied fauna communities. The Copperfield Gorge located 44.3 km downstream from the project at Einasleigh before the Copperfield-Einasleigh River confluence, (see Figure 5.1), retains a number of environmental values. Water is used for stock and domestic water supply, recreational activities and is listed as a tourist destination. The Gorge also holds cultural and community significance.

Flows in the Copperfield River are supplemented by the Copperfield Dam, located approximately 18 km upstream from the project site. The dam was originally constructed in the 1980s to service the Kidston Gold Mine and will provide a water supply to the project site. Controlled releases from the dam typically occur in August to augment low water levels in the Copperfield Gorge. The dam is also used to service the Rycon Homestead, the Oaks Rush Resort and a number of stock watering points (see Figure 5.1).

Existing hydrology

Predicted streamflow of the Copperfield River

Streamflow in the Copperfield River at the project site is currently ungauged. Therefore, in order to determine existing flow characteristics (such as velocity, flow depth, stream

[2] International Journal of Mining, Reclamation and Environment, 2017 – 'Geochemical characteristics of rehabilitated tailings and associated seepages at Kidston gold mine, Queensland, Australia' - Mansour Edraki, Thomas Baumgartl, David Mulligan, Warwick Fegan & Ali Munawar

power and flow width) the proponent undertook hydraulic modelling of the Copperfield River.

A water resource model was developed for the purpose of simulating a long-term streamflow record for the Copperfield River at the project site. The simulation was developed to provide additional capability for conducting the water quantity and water quality assessment of proposed releases from the project.

To ensure a wider range of inflow information to the downstream Copperfield River was captured, the model included historical and recent data from additional downstream locations. The model considered stream gauges for all watercourses upstream and directly downstream of the project site along the Copperfield River and Einasleigh River.

The model estimated the annual discharge and daily flow duration for the Copperfield River and identified that:

- streamflow has a distinct seasonal distribution, with high flows occurring from December through to April (flow conditions of 391 ML per day typically occur multiple times during the wet season and persist over a number of days)
- significant variability in streamflow occurs from January through to March, for example, mean daily flow for February ranges from approximately 22 ML per day to 2,400 ML per day
- the likelihood that the Copperfield River will experience no flows on any given day throughout the dry season is 55 per cent and reduces to approximately 32 per cent during the wet season (November through to April).

Existing surface water

The water quality in the existing environment is impacted by a number of anthropogenic sources, such as cattle grazing. There are also a number of water quality parameters above default WQOs in the receiving environment due to the characteristics of the local geology and/or hydrology.

The IAR describes the condition of the aquatic ecosystem near the proposed water release point as being within the “slightly to moderately disturbed” category as outlined in the Australian and New Zealand Environment Conservation Council (ANZECC) (2000) water quality guidelines and the Queensland Water Quality Guidelines[3]. The Aquatic Conservation Assessment for the Eastern Gulf of Carpentaria[4] assessed the Copperfield River as having high value to the Gilbert River sub-catchment.

Water quality data has been collected at the monitoring points outlined in Table 5.2 and Figure 5.2. Site WB is upstream of the proposed site and is used as a baseline to determine contaminants that enter the Copperfield River upstream from the site. Site W3 is located at the Gilberton Road crossing used to gain access to the site and is the most downstream site on the Copperfield River. E1 and E2 are additional sites on the Copperfield River used to monitor the influence of flows from East Creek.

[3] Environmental Policy and Planning, Department of Environment and Heritage Protection, 2013
[4] Biodiversity Assessment, Conservation and Biodiversity Strategy, Department of Environment and Science, 2018

Table 5.2 Monitoring locations

Monitoring location	Proximity to proposed release location	Easting	Northing	Period of record	Description
WB	2 km upstream	201087	7907273	13/09/2004 – 05/06/2017	Upstream of all historic mining impacts
W1	1.2 km upstream	200799	7908133		Copperfield River below the TSF Dam Spillway
W2	1.1 km downstream	201851	7910299		Copperfield River below Butchers' Creek Dam and Manager's Creek Dam
W3	7.4 km downstream	202667	7915973		Downstream monitoring site at the Causeway
E1#	Additional upstream/control site	203774	7912124	24/03/2018	East Creek 900 meters upstream of confluence with the Copperfield River
E2#	4.3 km downstream	202887	7912197		Copperfield River immediately downstream of the confluence with the East Creek

Additional site added as part of IAR assessment

Figure 5.2 Water monitoring points

A complete table of key statistics for all receiving environment monitoring locations can be found at tables 20 to 23 of the IAR. Key statistics for zinc and total nitrogen assessed at receiving monitoring locations WB, W1, W2 and W3 are shown in Table 5.3.

Table 5.3 Summary of zinc and nitrogen

Monitoring site	Parameter	Dataset (mg/L)			
		Median	80%ile	95%ile	Maximum
WB	Zinc (T)	0.0025	0.0108	0.028	0.074
	Zinc (D)	0.0025	0.005	0.0112	0.019
W1	Zinc (T)	0.0025	0.009	0.0893	0.177
	Zinc (D)	0.0025	0.008	0.012	0.077
W2	Zinc (T)	0.0025	0.0108	0.0294	0.115
	Zinc (D)	0.0025	0.007	0.0121	0.028
	Nitrite	0.005	0.005	0.005	0.005
	Nitrate	0.06	0.06	0.06	0.06
	Nitrate + Nitrite	0.06	0.06	0.06	0.06
	Total Nitrogen	0.25	0.28	0.295	0.3
	Total Phosphorus	0.005	0.005	0.005	0.005
W3	Zinc (T)	0.0025	0.012	0.0414	0.09
	Zinc (D)	0.0025	0.0025	0.00855	0.038

T = total
D = dissolved

Due to the limited number of samples collected in 2018, the proponent undertook additional water quality sampling in February 2019 to better understand nutrient concentrations at locations upstream and downstream of the project. Nine samples were collected at WB, W1 and W2 monitoring sites and eight samples were collected from the W3 monitoring site and the Copperfield Gorge at Einasleigh. Samples were analysed for parameters including ammonia, nitrate, nitrite, total nitrogen and total phosphorous.

Table 5.4 Additional total nitrogen and total phosphorous data

Variable	Site	Minimum	Median	80%ile	Maximum
Total nitrogen (mg/L)	WB	0.24	0.41	0.648	0.82
	W1	0.2	0.35	0.402	0.44
	W2	0.16	0.32	0.348	1.1
	W2*	0.16	0.305	0.34	0.36
	W3	0.15	0.28	0.424	0.78
	Copperfield Gorge	0.19	0.235	0.296	0.35
Total phosphorous (mg/L)	WB	0.01	0.04	0.054	0.08
	W1	0.01	0.03	0.044	0.05
	W2*	0.01	0.035	0.04	0.04
	W2	0.01	0.04	0.04	0.04
	W3	0.01	0.03	0.044	0.05
	Copperfield Gorge	0.01	0.04	0.04	0.05

*values are calculated based on the removal of an outlier. See pg. 37 of IAR Supplementary Information.

Total nitrogen values from all samples for all sites were above the default WQO of 0.15 mg/L with total nitrogen values significantly higher at the WB upstream site compared to downstream sites, consistent with previous concentrations reported in the draft IAR.

A significant rainfall event occurred prior to the sampling event which commenced on 11 February 2019 (the river had a flow rate of approximately 4,000 ML per day on 10 February 2019 gradually reducing to 1,000 ML day on 19 February 2019). The IAR states that the Copperfield Dam is a key likely source for nitrogen in the Copperfield River as organic matter that accumulates and decays in the dam during the dry season is flushed into the downstream system during significant rainfall events when the dam overflows. Total nitrogen concentrations of 0.35 mg/L at the Copperfield Gorge at Einasleigh is also higher than the WQO of 0.15 mg/L.

Based on the data obtained, the proponent concluded that the WQO for total nitrogen as well as for other parameters (sourced from the ANZECC (2000) guidelines for 'upland rivers in tropical Australia') are not suitable for application to the catchment.

Existing groundwater

The baseline assessment focused on results from two registered bores in the alluvium only.

Groundwater levels obtained show that water levels for these alluvial bores range from 1.57 meters to 2.8 meters below ground level. The IAR states that water levels in the alluvial bores were found to represent an unconfined aquifer (not restricted by impermeable layers of rock) with low to no water during the dry season and higher levels in the wet season.

The IAR states that no permanent waterholes have been identified along the Copperfield River, although the presence of six semi-permanent waterholes suggests the river is fed by groundwater discharge for some parts of the year. However, because the waterholes do not persist throughout the year, the IAR suggests the storage of groundwater is limited.

Data from two bores located north and south of the project indicate relatively high alkalinity and a pH of between 7 and 8. Metals have been generally at or below the laboratory limit of reporting.

The IAR states that there is one confirmed wetland spring, Middle Spring, located 4.8 km north-west of the project site. Groundwater modelling predicts that the pits are unlikely to be hydraulically connected to Middle Spring and water quality analysis shows that Middle Spring has not experienced groundwater influx from the decommissioned pits in the years since mining operations ceased.

Currently, both the Wises and Eldridge Pits are understood to act as groundwater sinks, as the groundwater levels in the surrounds of both pits are higher than the surface water level in the pits.

5.1.2 Potential impacts and mitigation

Hydrology

The proposed water releases during construction and operation have the potential to impact on the flow characteristics of the Copperfield River which may result in adverse impacts to aquatic ecosystem values. The proponent undertook the assessment using streamflow data and a range of water release scenarios to determine changes to the baseline flow regime parameters (section 5.1.1) including timing, duration, frequency, magnitude and the rate of rise and fall of flows.

The proponent modelled the proposed release regime for construction and operation. Table 5.5 outlines the proposed median volumes, duration and frequency of the releases.

Table 5.5 Proposed construction and operational release criteria

	Construction	Operation
Median annual release volume	409 ML	294 ML
Median volume of each release	101 ML	68 ML
Number of events per year	4.2	4
Duration of releases	7.7 days	7 days

The assessment determined the change to the flow characteristics of the Copperfield River to be minor and not have an adverse impact on aquatic ecosystems or restrict fish passage down the river. As a result, the IAR determined that water releases are unlikely to have an impact on the existing flow regime in terms of the timing, duration, frequency and magnitude of flows.

5.1.3 Surface water

Assessment methodology

The proponent has largely undertaken an assessment of the potential water quality impacts in accordance with the DES *Wastewater release to Queensland waters* technical guideline (ESR/2015/1654) (technical guideline) which applies the requirements of the ANZECC and Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) Water Quality Guidelines and the intent of Environmental Protection (Water) Policy 2009 (EPP (Water)). As discussed in the baseline environment (section 5.1.1) the Copperfield River is classified as slightly-to-moderately disturbed for the purpose of water quality assessment.

The EPP (Water) does not set WQOs for the Gilbert River catchment therefore default values for 'upland rivers in tropical Australia' and values derived from baseline water quality at the upstream WB site, are appropriate for the Copperfield River over a 44 km stretch downstream from the release point to the confluence of the Einasleigh River.

As per the ANZECC and ARMCANZ (2000) guidelines, the proponent has applied a site-specific hardness modification trigger value (HMTV) to the default WQOs for dissolved metals. A median HMTV at monitoring point W2 of 56 mg/L was applied to metals, including zinc, from the release point to the confluence point with East Creek and the Copperfield River.

Table 5.6 shows the assumptions used for the modelling in the IAR to predict the changes in water quality in the receiving environment. The worst-case water quality for construction releases is from the Eldridge Pit only; while a worst-case operation release is a water ratio of one part Wises Pit and nine parts Eldridge Pit.

Table 5.6 Modelled assumptions

	Construction	Operation
Dilution ratio	200 to 1	200 to 1
Release ratio	0.5 per cent	0.5 per cent
Assimilative capacity utilisation	76.3 per cent	69 per cent
Concentrations for dissolved zinc (maximum)	1.75 mg/L	1.5874 mg/L

The proponent used the worst-case scenarios (for construction and operation) and undertook an impact assessment by comparing concentrations of metal and nutrients following a release event to the water quality in the baseline environment to identify potential impacts to environmental values.

Potential impacts

The IAR identified a number of potential impacts to surface water of the Copperfield River including:

- increased metal concentrations, including dissolved zinc, resulting in acute or chronic impacts to aquatic flora and fauna

- increased nutrient loads (such as nitrogen and phosphorous) resulting in eutrophication causing algal blooms
- accumulation of contaminants in sediments
- residual water quality changes following discharge events, pooling in the Copperfield Gorge and semi-permanent waterholes along the Copperfield River.

The proponent identified a number of key water quality changes at downstream locations in the Copperfield River as in Figure 5.1.

A complete table comparing contaminant concentrations and default WQOs can be found at Table 54 (operations) and Table 85 (construction) of the IAR.

In particular, the IAR predicts that levels of total nitrogen (nutrient) and dissolved zinc (metal) have the potential to be above default WQOs during construction and operational releases at location points downstream as seen in Figure 5.1.

Nutrients

The proponent undertook assessment to determine the levels of nutrients (in particular total nitrogen) in the Copperfield River and the potential impacts as a result of water released from the project. As discussed in baseline environment (section 5.1.1), the receiving baseline environment has high levels of total nitrogen with a median concentration of 0.23 mg/L at the Einasleigh River confluence with the Copperfield River, suggesting the default WQO of 0.15 mg/L assigned for the parameter is not suitable for this site.

The water quality during construction and operational releases was analysed to determine the concentration of total nitrogen at downstream locations.

The results in Table 5.7 (as per the IAR) show the predicted concentration of total nitrogen as the worst-case maximum concentration scenario for construction releases, which is water released from the Eldridge Pit only (scenario 3b as per Table 92 in the IAR). The table also shows the predicted concentration of nitrogen as the worst-case maximum concentration scenario for operation releases (scenario 3a as per Table 65 in the IAR). The scenario represents the maximum concentration of total nitrogen for a release of one part Wises Pit water to nine parts Eldridge Pit water. The concentrations of total nitrogen compared with the default WQO are shown at downstream locations in Table 5.7, with some concentrations above the default WQO.

Table 5.7 Total nitrogen predictions in the Copperfield River

Monitored location	Distance (km)	Construction (mg/L)	Operation (mg/L)
WQO		**0.15**	**0.15**
W2 baseline median		**0.25***	**0.25***
Proposed release point	0	0.284*	0.281*
East Creek	6.9	0.279*	0.275*
Charles Creek	19.6	0.276*	0.273*
Oak River	23.4	0.272*	0.268*
Soda Creek	30.4	0.270*	0.266*
Chinaman Creek	35.7	0.269*	0.265*
Einasleigh River confluence	48.3	0.256*	0.252*

*total nitrogen concentrations above the default WQO

During construction, total nitrogen is predicted to be above the default WQO from the release point to the Einasleigh River confluence. Concentrations decrease from 0.284 mg/L at the release point to 0.256 mg/L at the Einasleigh River confluence, just above the W2 baseline median of 0.25 mg/L.

During operation, total nitrogen is predicted to be above the default WQO from the release point to Chinaman Creek. The concentration of total nitrogen increases as a result of a release to 0.281 mg/L (compared to the W2 baseline median) and decreases at each downstream location to a concentration of 0.252 mg/L at the Einasleigh River confluence, slightly above the WQO.

Nutrients such as nitrogen and phosphorous have the potential to result in eutrophication (causing algal blooms), deteriorating water quality and impacting aquatic ecosystems. The concentration of phosphorous is predicted to increase baseline levels by approximately 0.0002 mg/L, (to the concentration of 0.0052 mg/L at maximum concentrations in the receiving environment). The proponent states that the increase in phosphorous levels are minimal and the effect is negligible.

The IAR states that total nitrogen in the receiving environment (already above default WQOs) is predicted to increase by 14 per cent (from 0.25 mg/L to 0.285 mg/L) during a worst-case water release. The IAR states that high flow conditions in the receiving environment would prevent an algal bloom. The assessment concluded that an algal bloom is unlikely due to only a minor increase in the concentration of phosphorous and nitrogen.

In February 2019, the Copperfield River experienced a high flow event due to significant rainfall. The proponent undertook additional water sampling, (presented in the supplementary information to the IAR) to obtain additional flow-based and water quality data to provide further support as to why the assigned default WQO for total nitrogen is not appropriate. The proponent has proposed to establish an alternative and site-specific WQO appropriate for the Copperfield River.

As per the supplementary material to the IAR, Table 5.8 presents the levels of total nitrogen and phosphorous at the monitoring points in proximity to the site and the at Copperfield Gorge at Einasleigh (as per Table 5.2).

Table 5.8 Additional and total phosphorous data

Monitored locations	Distance	Total nitrogen (mg/L)	Total phosphorous (mg/L)
Default WQO		**0.15**	**0.01**
WB	2 km upstream	0.82*	0.08*
W1	1.2 km upstream	0.44*	0.05*
W2	1.1 km downstream	0.36*	0.04*
W3	7.4 km downstream	0.78*	0.05*
Copperfield Gorge	44.3 km downstream	0.35*	0.05*

*total nitrogen and total phosphorous concentrations above the default WQO

Elevated levels of total nitrogen and total phosphorous at the two monitoring points upstream of the site (WB and W1) indicate that post-mining activities are not the main cause of high levels of nutrients in the system. Concentration levels of nutrients decrease from the project site to the Copperfield Gorge at Einasleigh. At each monitoring point, levels of total nitrogen and phosphorous are higher in the baseline environment and above the proposed default WQO. The project water release will contribute to total nitrogen levels in the receiving environment, however the default WQO is exceeded prior to a release.

The supplementary information to the IAR identified the Copperfield Dam (18 km south of the project site) as a potential source of high levels of total nitrogen. Nutrient levels (including nitrogen and phosphorous) would accumulate over the dry season and overflow following a period of high rainfall. The overflow event would flush the nutrients down the river system, suggesting the dam as the source of high levels of total nitrogen and phosphorous.

The proponent concluded that the default WQO assigned for total nitrogen and total phosphorous for upland rivers in tropical Australia are not appropriate for the Copperfield River catchment. The assessment undertaken in the IAR and supplementary information to the IAR identified the likelihood of eutrophication or algal bloom would be unlikely. The proponent is to continue monitoring total nitrogen and total phosphorous to set a site-specific WQO for each nutrient.

Metals

Historical water quality and sediment data collected from monitoring locations listed in Table 5.2 were used to establish the condition of the baseline environment. Additional data collected for the purpose of this assessment indicated that metal concentrations meet and are below the assigned default WQOs of the Copperfield River. The potential for high levels of contaminants in the water release may have an impact on the values of the Copperfield River if releases are unmitigated.

The assessment and modelling in the IAR show that all default WQOs for metals are met in the worst-case water release scenario except for dissolved zinc.

The proponent identified that dissolved zinc is the contaminant of most concern during construction and operation as it requires the highest dilution of release water to receiving water flows to achieve the WQO of 0.008 mg/L. The HMTV was applied to the default

WQO 0.008 mg/L for dissolved zinc. From the release point to East Creek (approximately 7 km downstream), the HMTV dissolved zinc WQO is 0.014mg/L.

Table 5.9 presents the predicted concentration of dissolved zinc at the location points downstream. The results are the worst-case maximum concentration scenario for construction releases, which is water released from the Eldridge Reservoir only (scenario 3b as per Table 95 in the IAR). The operational scenario represents the worst-case maximum concentration scenario (scenario 3a as per Table 65 in the IAR) which is the maximum concentration of dissolved zinc for a release of one part Wises to nine parts Eldridge Pit water. The IAR modelling identified that no metals were above WQOs as a result of a median water release event. It should be noted that from East Creek to Einasleigh, the HMTV does not apply, resulting in predicted concentrations of dissolved zinc above the default WQO.

Table 5.9 Predicted zinc concentrations

Monitored location	Distance (km)	Construction (mg/L)	Operation (mg/L)
WQO		**0.014 HMTV** **0.008 (default)**	**0.014 HMTV** **0.008 (default)**
W2 baseline median		**0.0025**	**0.0025**
Proposed release point[#]	0	0.11	0.010
East Creek[#]	6.9	0.010	0.010
Charles Creek	19.6	0.010*	0.010*
Oak River	23.4	0.009*	0.009*
Soda Creek	30.4	0.009*	0.009*
Chinaman Creek	35.7	0.008	0.009*
Einasleigh River confluence	48.3	0.006	0.006

*dissolved zinc above the default WQO
[#]HMTV applied to the default WQO at these locations

During construction releases, the predicted concentrations of dissolved zinc are above the default WQO of 0.008 mg/L from Charles Creek to Soda Creek. The maximum dissolved zinc concentration at Charles Creek is 0.010 mg/L. The default WQO is met at Chinaman Creek and decreases further to 0.006 mg/L at the Einasleigh River confluence.

The IAR predicted that dissolved zinc concentrations meet the WQO at all downstream locations for a median concentration release during construction.

During operation releases, the predicted concentrations of dissolved zinc are above the default WQO of 0.008 mg/L from Charles Creek to Chinaman Creek. The maximum dissolved zinc concentration at Chinaman Creek is 0.009 mg/L. The concentration decreases to 0.006 mg/L at Einasleigh, meeting the default WQO.

The IAR predicted that dissolved zinc concentrations meet the WQO at all downstream locations for a median concentration release during operation.

The proponent undertook a direct toxicity assessment (DTA) of the release water to quantify the potential for acute or chronic effects of metals to the receiving waters in

accordance with the ANZECC and ARMCANZ (2000) guidelines. If a proposed water release has the potential to cause impact to values, further risk assessment including a DTA is required to determine the extent of a mixing zone and biological effects, ensuring contaminants do not have a chronic or acute impact.

The results of the DTA in the IAR indicated that worst-case controlled releases would not result in chronic or acute impacts to aquatic ecosystems, even where default WQOs were predicted not to be met downstream between Charles Creek and Chinaman Creek. Based on the modelling and DTA results, the IAR concluded that impacts on aquatic ecosystems from dissolved zinc are negligible, despite a potential risk of minor predicted elevated levels of zinc in the Copperfield River from the confluence of Charles Creek to Chinaman Creek. As the WQO for dissolved zinc is met during a median concentration release, there are no predicted acute or chronic impacts to aquatic ecosystems.

5.1.4 Mitigation

Water release criteria

The IAR concluded that the potential impacts from the release of water from the project during construction and operation can be mitigated and managed by applying the controlled release criteria, dependent on flow in the receiving environment and appropriate rates of dilution. Modelling of scenarios demonstrated the proposed release criteria in Table 5.10 would mitigate potential impacts. The implementation of the release criteria would achieve a mixing zone of approximately 50 to 625 meters and achieve the WQO for the contaminant of most concern, dissolved zinc.

Table 5.10 Proposed release criteria

Release Aspect	Limit	Comment
Controlled release trigger	400 ML per day	Release does not occur unless Copperfield River is experiencing 400 ML per day of flow
Dilution ratio	200 to 1	
Release ratio	0.513 per cent	Operational release ratio is based on a 69 per cent utilisation of the available capacity for the contaminant of most concern, dissolved zinc which results in an effective total dilution ratio of 200 to 1. During construction, the utilisation of available assimilative capacity may increase to 76 per cent due to the higher concentration of dissolved zinc in the Eldridge Pit.
Maximum controlled release capacity	86.4 ML per day (1.0 m^3 per second)	Maximum rate at which water can be released into Copperfield River

It is predicted that between four and five water releases per year would be required and occur for an estimated duration of between seven and eight days, during construction and operation.

Water releases for the construction and operational stages will be triggered by the same flow conditions in the Copperfield River. A flow release trigger of 400 ML per day in the Copperfield River is proposed to achieve the dilution ratio. The proponent proposes to continually monitor the flow of the Copperfield River, ensuring controlled releases are followed by a post release flush and a release does not occur when less than 400 ML per day of water is moving down the river. If a greater volume of water is flowing down the system, release volumes would increase (to the maximum release rate of 86.4 ML per day).

The IAR states that any residual risk posed to downstream aquatic ecosystem values would be reduced through the implementation the minimum flow release trigger.

A post release flush event for an average duration of 29 to 32 days would follow each release (as detailed in Table 5.5) with an average volume of between 1,676 ML to 1,758 ML. The IAR states that the post release flush volumes would be seven times higher than release volumes during operation and five times higher during the construction phase. The post release flush ratio is lower as the water quality during construction is worse than during operation. Downstream of the release point, water from tributaries flows into the Copperfield River and contributes to the post release flush volume to reduce the concentration of contaminants. Inflow from creeks and rivers joining the Copperfield River would increase volumes of post-release flush to release water by 42 times during operation and 29 times during construction at the Einasleigh River confluence.

A number of semi-permanent waterholes have been identified within the Copperfield River and were included in the impact assessment due to the potential for accumulation of water from the release. The IAR indicates that accumulation of nutrients and metals within the semi-permanent waterholes located downstream would not occur due to significant flushing volumes. The post release flush would ensure algal blooms do not occur at locations downstream, semi-permanent waterholes or the Copperfield Gorge at Einasleigh. The implementation of a REMP would ensure that changes could be made to release volumes if monitoring results identified an increase in contaminants, including total nitrogen and dissolved zinc.

The IAR identifies that the use of the post release flush would further reduce the potential impacts to aquatic ecosystems minimising the likelihood of a worst-case scenario event. If required, the proponent also has access to an annual water allocation of 4,650 ML per annum from the upstream Copperfield Dam for additional post release flush volumes.

Receiving environment monitoring plan

The proponent prepared a draft REMP (Appendix C of supplementary information to the IAR) in accordance with the DES *Receiving environment monitoring program* (2014) guideline. The scope of a REMP considers the release characteristics, the receiving environment, spatial extent (location) and temporal context (timing and frequency).

A monitoring framework outlined in the draft REMP requires regular monitoring of water quality, sediment, biological, flow and groundwater features at downstream locations (Figure 5.1) and points referenced in Table 5.2. Monitoring would consist of water and sediment sampling to determine changes in a wide range of water quality indicators including metals and nutrients. This would ensure that any changes in the receiving environment are identified and the proponent can respond to ensure WQOs are met to protect environmental values. The REMP nominates monitoring points at the confluence of Sandy Creek and Copperfield River and the Copperfield Gorge at Einasleigh. If unacceptable concentration levels and potential impacts are identified, the proponent would change the release criteria (release volume, post-release flush volume) or stop the release.

5.1.5 Coordinator-General's conclusion: surface water

I am satisfied that the proponent has established the baseline water quality of the Copperfield River and assessed the potential impacts as a result of the water releases from the project.

The proponent modelled a range of water release scenarios including the worst-case changes to surface water quality in the Copperfield River. The modelling informed the proponent's proposed release criteria which includes a flow trigger and post release flush. A water release would not occur until the Copperfield River is flowing at 400 ML per day (flow trigger) to limit the concentration of potential contaminants in the receiving environment. Releases would also cease when flow in the river recedes to below 400 ML per day. After each release, natural streamflow would continue down the Copperfield River at a volume of between 1,676 ML to 1,758 ML for a period of 29 to 32 days (post release flush).

In the worst-case scenario, modelling identified potential impacts to the Copperfield River due to elevated levels of dissolved zinc and total nitrogen in the water releases from previous mining activities. However, the median scenario predicts that acceptable water quality levels would be met in the Copperfield River approximately 625 metres downstream of the release point. The DTA further demonstrated that no chronic or acute effects to aquatic ecosystems would occur as a result of the predicted elevated levels of dissolved zinc. In addition, the proponent undertook additional data sampling to confirm that total nitrogen is already elevated in the receiving environment and above the proposed release levels.

I note that the release criteria including the flow trigger and post release flush would limit the concentration of contaminants in the receiving environment to confirm that acceptable water quality is maintained within the Copperfield River.

To ensure that the environmental values of the Copperfield River are protected, I have imposed a strict framework of conditions that the proponent must meet. Contaminants that would, or have the potential to cause environmental harm must not be released directly or indirectly to any waters, except as permitted under my conditions in Appendix 1.

I have set the flow trigger at the release point of 4.63 m^3 per second. I consider this streamflow to be the most appropriate to ensure that water releases are managed as proposed by the proponent.

I have set water quality release limits for contaminants at the end of pipe and in the receiving environment to ensure that water quality of the Copperfield River is not adversely affected, as predicted.

To ensure compliance with the conditions, I have nominated locations for monitoring water quality downstream along the Copperfield River and the frequency at which the monitoring points must be sampled.

To provide further assurance that potential water quality impacts are identified, I have set trigger values in the receiving environment and identified appropriate monitoring points for these trigger values. If a water quality indicator is triggered, I require the proponent to investigate the event by undertaking an investigation in accordance with ANZECC (2000) guidelines and take appropriate action.

In addition, I require the proponent to ensure that the release of water to surface waters do not cause erosion of the stream bed and banks of the receiving waters, or a material build-up of sediments in such waters.

I have also set a reporting framework to ensure that the proponent notifies of the timing and performance of each release event.

While the proponent has proposed a draft REMP in the IAR and supplementary information to the IAR, I require the proponent to ensure the REMP meets the requirements of the conditions in this evaluation report.

I note that the proponent has proposed a number of additional mitigation measures that can be applied to further manage water quality. These measures include:

- increasing the post release flush by ceasing releases at a higher flow trigger than specified in the conditions
- using the water allocation from the Copperfield River to provide an additional volume for post release flush
- not releasing during dry season conditions.

I expect the proponent to implement these measures should the project's monitoring indicate a deterioration of water quality in the Copperfield River due to the release of water from the project.

In accordance with section 54B(3) of the SDPWO Act, I have nominated DES (the administering authority for the EP Act) as the entity with jurisdiction for the conditions listed in Appendix 1, Schedule 1 of this evaluation report.

5.1.6 Groundwater

Introduction

The project proposes to store and release water from the two pits during construction and operation which has the potential to impact on surrounding groundwater.

The IAR identified a number of potential impacts to groundwater including:

- the risk of seepage of water from the pits into surrounding groundwater
- changes in the water quality of the alluvial groundwater associated with the Copperfield River from water releases.

The IAR states that there is no intention to extract groundwater during construction or operation of the project.

5.1.7 Potential impacts and mitigation

The IAR states that during construction the majority of water from the Eldridge Pit would be transferred into the Wises Pit to enable construction works. Without adequate management, additional pressure from the increase in the volume of water in the Wises Pit could potentially result in seepage of water through the pit walls. This could impact the water quality of the surrounding groundwater.

To determine the potential impacts from seepage, the proponent undertook groundwater modelling to determine hydraulic connections between the project site and surrounding wetland springs. The groundwater modelling identified that a hydraulic connection between the project site and Middle Spring, located 4.8 km north-west of the project site, is unlikely and project activities are not likely to cause a significant impact to water quality at Middle Spring.

The project has been issued a referable dam approval under the *Water Supply (Safety and Reliability) Act 2008* (WSSR Act) as part of the development approval issued by ESC. To obtain the approval, the Wises Pit has been designed to minimise the risk of water from the pits seeping into the surrounding groundwater by covering the western wall with a HDPE plastic liner.

During construction and operation, the Eldridge Pit would continue to act as a groundwater sink, meaning that potential seepage is expected to flow from the Wises Pit toward the Eldridge Pit. As the water would flow towards the Eldridge Pit, the risk of seepage of water from the Wises Pit is minimised, reducing the likelihood of potential impacts to water quality of the surrounding groundwater.

The project has the potential to impact on the water quality of the groundwater alluvium in the Copperfield River during construction and operation, from water releases into the Copperfield River, which could potentially impact groundwater quality.

As the alluvial groundwater and surface water of the Copperfield River are connected, measures implemented to mitigate surface water impacts (section 5.1.3) would also mitigate the potential impacts to groundwater. The proponent proposes release criteria and a post release flush to prevent concentrations of contaminates accumulating in the Copperfield River alluvium.

The two registered bores located adjacent to the pits would be monitored as part of the proposed REMP to monitor groundwater levels and water quality to ensure impacts do not occur from the proposed water releases. The monitoring of these bores will ensure seepage from the pits do not result in impacts to the Copperfield River.

5.1.8 Coordinator-General conclusion: groundwater

I am satisfied that the information presented in the IAR has sufficiently identified the groundwater regime at the project site.

The IAR identified that the projects proposed water releases have the potential to change the water quality of alluvium in the Copperfield River which could, if unmitigated, affect groundwater quality. The proponent has proposed a number of mitigation measures to reduce the risk of potential impacts from the water releases. The proponent's proposed implementation of a set of release criteria including a flow trigger and post release flush was designed to limit the release of contaminants to protect downstream environmental values. These mitigation measures are consistent with those proposed to manage potential impacts to surface water and would mitigate the impacts from seepage to groundwater, and changes to water quality in the alluvium.

I have imposed monitoring conditions to detect any water quality changes in groundwater from the project in the project's REMP. If changes in groundwater quality are identified, the release criteria would be modified, or the release event would be ceased. Monitoring is required for groundwater at the locations specified in these conditions to quantify any linkages between the Eldridge Pit, Wises Pit and the Copperfield River.

I consider the proposed design of the reservoirs adequate to prevent seepage from the pits into the surrounding groundwater. This is supported by the project's referable dam approval under the WSSR Act.

I agree with the proponent's conclusion that Middle Spring is unlikely to be hydraulically connected to the project site. Impacts to groundwater from construction and operation of the project is likely to be negligible.

I am satisfied that potential impacts to groundwater have been adequately identified by the proponent and that the mitigation measures proposed are sufficient to prevent adverse effects to groundwater users and ecosystems.

5.2 Ecology

5.2.1 Baseline environment

Ecosystem description

The project is located within the Einasleigh Uplands Bioregion, on a heavily disturbed, decommissioned mine site under progressive rehabilitation. As such, there are limited ecological values on the project site.

The southern-most extent of Newcastle Range-The Oaks Nature Refuge adjoins the northern boundary of project site.

Further, the habitat condition assessment undertaken for the aquatic ecology assessment in April 2018 indicates that the majority of surveyed sites were mostly rated as being in good condition, with water quality results displaying a relatively well mixed

system with stable electrical conductivity, pH and dissolved oxygen across all sample sites.

Aquatic ecology

Surveys of aquatic macroinvertebrates have been undertaken within the Copperfield River between 2009 and 2013 in accordance with Australian River Assessment System[5] (AUSRIVAS) and the Queensland Sampling Manual. This sampling has not previously indicated impacts on aquatic ecology associated with the decommissioned mine.

The IAR identified:

- The relatively high percentage of sensitive macroinvertebrates found during surveys suggests that both the Copperfield River and East Creek (which joins the Copperfield River approximately 6.9 km downstream of the project water release point) are in relatively good condition. No species listed under EPBC Act or *Nature Conservation Act 1992* (NC Act) were recorded.
- Seven species of freshwater fish were identified in the Copperfield River surveys. No species listed under EPBC Act or NC Act were recorded. The Copperfield Gorge, approximately 44.3 km downstream of the proposed water release point at Einasleigh, is the location of an annual recreational fishing tournament held around Easter.
- Two macrophyte species were recorded in the Copperfield River and East Creek, Rice Sedge (*Cyperus difformis*) and *Cyperus species*. The reduced species assemblage is possibly a response to the ephemeral nature of the watercourses combined with high flow rates.
- No aquatic Weeds of National or State Significance were observed. Further, none of the aquatic flora species identified within the project site are listed under the EPBC Act or the NC Act.
- No freshwater turtles were caught or observed within the Copperfield River or East Creek during the field studies. However, there is some anecdotal evidence that the common Krefft's turtle (*Emydura Macquari Krefftii*) could inhabit farm dams and more permanent waterholes within the area.
- Database searches identified the potential for the freshwater crocodile (*Crocodylus johnstoni*) to inhabit the area. While not found during field surveys of the Copperfield River or East Creek, the species was observed inhabiting the Einasleigh River upstream of the confluence with the Copperfield River. Therefore, it is highly likely that the species utilises the lower reaches of the Copperfield River with the potential to push further upstream during flow events. There has been anecdotal evidence of freshwater crocodiles inhabiting the Copperfield River and Copperfield Dam in the past. This species is listed as 'least concern' under the NC Act.

[5] AUSRIVAS (Australian River Assessment System) is a prediction system used to assess the biological health of Australian rivers. AUSRIVAS was developed under the National River Health Program in 1994, in response to growing concern in Australia for maintaining the ecological values of our rivers.

Terrestrial ecology

A desktop review identified twelve threatened animal species and two threatened flora species as potentially occurring at the project site. Because the project is located on a decommissioned mine site it is heavily disturbed and there is limited habitat at the project site for use by the potentially occurring threatened species.

There are areas of Category B, 'least concern' vegetation mapped between the mining lease boundary and the water release point on the Copperfield River. This vegetation appears, from inspection of aerial imagery, to also be heavily disturbed due to historical mining and grazing activities.

Vegetation occurring along the banks of the Copperfield River at the site of the proposed spillway and release point is mapped as regional ecosystem (RE) 9.3.20 (*Eucalyptus microneura +/- Corymbia spp. +/- E. leptophleba* woodland on alluvial plains) ('least concern') and RE 9.3.3a (*Corymbia spp. and Eucalyptus spp.* dominated mixed woodland on alluvial flats, levees and plains) ('least concern'). This riparian vegetation along the Copperfield River provides connectivity values for terrestrial species to move through a disturbed rural landscape.

The southern-most boundary of the Newcastle Range-The Oaks Nature Refuge extends to just north of the project site. This Nature Refuge adjoins the western bank of the Copperfield River approximately 635 meters downstream of the confluence with East Creek, then extends alongside the river for approximately 8 km downstream.

The proponent proposes to release water from the project to the Copperfield River. The water releases are required to enable construction of infrastructure between the pits and ensure water levels are suitable for operation. The IAR stated that operational releases are primarily driven by high rainfall weather events resulting in water levels reaching capacity in the reservoirs. A diffuser outfall structure is also proposed at the release point.

As discussed in section 5.1.1, water quality data results from the Eldridge and Wises Pits identified that the quality of the water currently held in the pits can be attributed to previous mining activities. If water released from the project to the Copperfield River is not managed, a deterioration of water quality in the Copperfield River (the receiving environment) has the potential to impact on the environmental values of the catchment.

The proponent undertook modelling to determine the potential impact of water releases to the Copperfield River. The proponent proposes the following release criteria to protect the downstream environmental values:

- minimum flow release trigger in the Copperfield River of 400 ML per day (4.63 m^3/s)
- dilution ratio of 200 to 1
- maximum release rate of 86.4 ML per day (1.00 m^3/s).

At a minimum receiving flow rate of 400 ML per day, the water released from the project would be 2 ML per day. The proposed maximum release of 86.4 ML per day would occur if approximately 17,000 ML per day was flowing in the Copperfield River.

5.2.2 Assessment methodology

Aquatic ecology

An aquatic ecology assessment for the project was undertaken in April 2018, comprising of:

- a review of existing data from desktop sources and previous assessments
- field surveys to identify the potential for presence of listed threatened species, and to characterise aquatic habitat near the project.

The aquatic ecology field survey was undertaken approximately six weeks after significant rainfall and after the major flows had receded, in line with industry guidelines. The surveys were undertaken to assess ecosystem health. Sampling sites were selected based on historic monitoring locations, with two additional sites downstream of the proposed water release point to collect further information to determine the influence of East Creek, approximately 6.9 km downstream of the proposed water release point (Figure 5.1).

Water quality modelling outputs as discussed in section 5.1.3 were assessed against the existing environment values and WQOs to predict potential impacts to aquatic ecology values.

Terrestrial ecology

A review of existing data from desktop sources and previous assessments for terrestrial ecology values was undertaken to inform the project IAS and development applications made to ESC (as approved 19 September 2018 (section 4.2)). This assessment considered regulated vegetation, protected areas, historic land uses, and rehabilitation efforts on the decommissioned mine site.

5.2.3 Potential impacts and mitigation

Aquatic ecology

Water releases associated with construction and operation of the project may have the potential to impact on the Copperfield River's water quality, hydrology and erosion and sedimentation values, which may as a result affect aquatic ecology values.

Additionally, project construction activities have the potential to directly disturb aquatic habitats in the Copperfield River in the immediate vicinity of the proposed water release point.

The proposed water release regime for construction and operation has been developed to minimise the risk of potential water quality impacts. The IAR identifies that a construction environmental management plan (CEMP) would be developed for the project and would contain measures such as the use of silt curtains to avoid, minimise and mitigate risks of impact during construction activities. Implementation of the REMP would ensure any operational impacts identified in the receiving environment are identified, and timely corrective action undertaken.

Water quality

The fish species found within the Copperfield River display relatively broad tolerance to a wide range of water quality characteristics. However, the macroinvertebrate community is likely to be sensitive to environmental change. The proponent proposes ongoing monitoring of potential impacts to aquatic ecology in the project's REMP which would monitor:

- aquatic habitat characteristics and condition - using Queensland AUSRIVAS procedures
- water quality – physicochemical parameters and a suite of analytes
- aquatic flora communities – including macrophytes and algae
- fish communities – using backpack electrofishing, baited traps, seine nets, tangle nets, dip nets
- data analysis including species richness, total abundance, abundance of listed aquatic species, abundance of exotic species, and abundance of each life history stage present (e.g. juvenile, intermediate or adult)
- turtles – visual surveys and baited cathedral traps
- other aquatic vertebrates – via database searches
- aquatic macroinvertebrate communities – using Queensland AUSRIVAS procedures and analysis of multiple indices to categorise stream health.

Adaptive management strategies are proposed in the IAR where any impacts are detected through implementation of the REMP. Strategies include:

- The use of the release criteria – this has the potential to increase the duration and volume of the post release flushing. By increasing the flow rate trigger at which releases stop, release events are curtailed at an earlier point in the receding flow period extending the post-release flush.
- A controlled release of water from the Copperfield Dam – this could provide a means of diluting, flushing and assisting in the downstream movement of water contained within the pools and waterholes downstream of the proposed release point.
- Complete cessation of releases during the dry season or a defined period within the dry season – this could be utilised as a measure to exclude the potential for stranding of released water in downstream pools and waterholes. This mitigation measure would only be required if the monitoring undertaken as part of the proposed release program identifies that the flushing that is currently proposed is shown to be insufficient to flush construction water releases during the dry season.

As discussed in section 5.1.3, the implementation of the release criteria would allow water released from the project to mix with water in the receiving environment in approximately 50 to 625 metres and achieve the WQO for the contaminant of most concern, dissolved zinc.

Hydrology

While some minor increases to the rates of rise and fall of flow in the river are expected (see section 5.1.2), they are not considered to be of sufficient magnitude to result in any adverse impacts to the aquatic ecology values of the system. Further, the IAR notes that

the small extension of flows and/or the increased permanence of water in the system associated with water releases may allow aquatic flora and fauna to use more of the watercourse for longer each year.

Erosion and sedimentation

The water releases required for the construction and operation of the project have the potential to impact on erosion and sedimentation processes within the Copperfield River. There is also the potential for erosion and sedimentation impacts associated with earthworks to construct the spillway and water release structures.

Construction activities and water releases during construction may cause localised erosion resulting in increased sedimentation. The main construction mitigation measures proposed in the IAR include:

- spillway infrastructure construction works being undertaken during the dry season when flows have subsided
- the use of silt curtains (or other similar measure) for any remnant pools
- immediate clean-up of any spills with any contaminated sediment removed
- rehabilitation of the riparian zone through stabilisation once construction has been completed.

Potential impacts from spillway construction activities are expected to be negligible and restricted to the immediate area surrounding the working area. Appropriately applied best practice environmental management practices, as described above, would reduce risks to aquatic ecology values.

Long term water release structures would be designed and managed to reduce residual risk to downstream aquatic ecology values. The use of a diffuser for water releases during construction and operation would ensure mixing of release water is maximised and would also reduce the potential for erosion associated with water releases.

Construction of water release structures would be strictly limited to the dry season, which would minimise erosion and sedimentation risks to the Copperfield River.

The REMP identifies that photographic monitoring of the release point over time would document any erosion and deposition downstream of the release point. Adaptive management strategies are proposed in the IAR where any impacts are detected through implementation of the REMP, as presented above in relation to water quality monitoring (insert cross reference).

Terrestrial ecology

Due to historic mining activities, there is limited suitable habitat on the project site for use by potentially occurring threatened species. As such, no direct impacts to listed threatened terrestrial fauna species are predicted as a result of the construction and operation of this project.

The clearing of a small extent of riparian vegetation (including RE 9.3.3a listed as ‘least concern’) required to construct water release infrastructure for the project was considered and approved in development applications through Etheridge Shire Council in September 2018. The project footprint avoids or minimises impacts on native

vegetation and complies with the requirements of the *State Development Assessment Provisions code 16: Native vegetation*[6].

The IAR identifies that mitigation measures in the project CEMP to protect terrestrial fauna, flora and connectivity values would include:

- pre-clearing surveys
- fauna spotter catcher
- delineation of clearing areas
- supplementary planting and revegetation where required following construction.

The desktop assessment of terrestrial ecology values did not identify any groundwater dependent REs along the Copperfield River between project water release point and the confluence with the Oak River (approximately 20 km downstream). Even if groundwater dependent REs were identified downstream, no potential adverse impacts on alluvial groundwater quality are predicted, as discussed in section 5.1.6. Project water releases during construction and operation are only proposed during high flow periods when alluvial groundwater would be saturated before water releases enter the system.

5.2.4 Coordinator-General's conclusion: ecology

I consider the proponent to have completed an evaluation of potential impacts to aquatic and terrestrial ecology that is appropriate for the risk profile of the project, particularly considering that there are no listed species or protected vegetation to be impacted by the water releases.

While the proponent has proposed a REMP in the IAR and supplementary material, I require the proponent to ensure the REMP incorporates all stages of the project's activity to monitor, identify and describe any adverse impacts to receiving water environmental values, water and sediment quality and flows due to the project as set out in my conditions (Appendix 1).

To confirm that the project is not having an adverse impact on the aquatic and terrestrial ecology in the receiving environment, I require biological monitoring to be undertaken in accordance with the conditions set for the REMP. The monitoring of macroinvertebrates should be undertaken in accordance with AUSRIVAS methodology as outlined in Appendix 1.

Should the results of the REMP identify a deterioration of water quality and environmental values I expect the proponent to change or cease the water release as per measures outlined in section 5.1.4.

I am satisfied that the proposed mitigation measures and imposed conditions would manage impacts to aquatic and terrestrial ecology associated with the water release from the project to the Copperfield River.

[6] State Development Assessment Provisions code 16: Native vegetation
https://dsdmipprd.blob.core.windows.net/general/sdap-v2-2-state-code-16.pdf

5.3 Land use and tenure

5.3.1 Existing land use

Surrounding land use

The main land use within the region is cattle grazing which occupies almost all land between the project site and Einasleigh in the north. The project site itself is largely bounded by pastoral leases. The project site and surrounding land is zoned as rural under the *Etheridge Shire Planning Scheme 2005*.

The project is located within the decommissioned Kidston Gold Mine site. Adjoining the mine is the Kidston township and the Copperfield River to the east.

Approximately 18 km upstream on the Copperfield River is the Copperfield Dam, which was constructed in 1984 to supply water to the mine. The lease of the dam ended in 2005 when mining ceased, and it is now owned and managed by DNRME.

Land use - project site

Prior to closure of the gold mine in 2001 and during the decommissioning stage, a number of rehabilitation works were undertaken including: grading and vegetation of the waste rock dumps and tailings storage facility; implementation of a water management plan, removal of all mining related buildings and revegetation of these areas.

In October 2013 an EA (EPML00817013) was granted over the site to regulate the management of the mine site post closure including rehabilitation requirements. The proponent manages the site under the terms of the EA whilst seeking to beneficially reuse the site as a renewable energy generation storage facility. To date, the proponent has repurposed the tailings storage facility with the development of the Kidston Stage 1 solar project and seeks to reuse other associated mine infrastructure for the development of the Kidston Renewable Energy Hub.

5.3.2 Proposed land use

The project proposes to beneficially reuse the project site as a productive industrial use being a renewable energy generation and storage facility. A development application for a community infrastructure (hydro storage facility) and associated ancillary infrastructure was assessed against the following components of the ESC planning scheme:

- rural zone
- general development code
- community infrastructure zone code
- good quality agricultural land overlay code
- bushfire management overlay code (medium bushfire hazard).

As the application was deemed code assessable under the ESC planning scheme, public notification was not required. The project complied with the requirements of the ESC planning scheme and the application for the proposed land uses was subsequently approved on 19 September 2018. The proponent is be required to provide a

decommissioning and rehabilitation plan for ESC approval prior to any decommissioning activities commencing.

5.3.3 Tenure

The project site is largely located on freehold land (Lot 1 SP289310) which is owned by Kidston Gold Mines Limited, a subsidiary of the proponent. The project's spillway infrastructure is proposed to cross leasehold land (Lot 66 SP287774) and unallocated state land, being the Copperfield River. The proponent proposes to lease the necessary part of the land for the spillway infrastructure from a local landowner.

Lot 1 SP289310 is subject to mining lease ML 3347 and contains all remaining mining infrastructure and landforms of the decommissioned Kidston Gold Mine.

5.3.4 Native Title

The Ewamian People #2 and Ewamian People #3 have been determined as holding Native Title over parcels of land that abut the southern extent of the proposed spillway. The area over which Native Title has been determined includes the Copperfield River and its northern banks and the IAR identifies that this area may be impacted from works intended for the spillway. However, the proponent has stated that the spillway infrastructure would be designed to avoid impacts to Native Title.

The IAR states that the proponent conducted a search of the National Native Title Tribunal database was on 8 May 2018 to confirm that there are no current claims or determinations over the balance of the project site.

5.4 Other environmental effects

5.4.1 Traffic and transport

The project related traffic impacts on the road network within and surrounding the project site were assessed as part of a development application which was subsequently approved by ESC on 19 September 2018.

During construction and operation, access to the site is proposed to be via Gilberton Road, which is currently the main access point to the decommissioned Kidston Gold Mine site.

The Gregory Development Road is the closest State controlled road, but it is not expected to be impacted by the project.

Construction traffic

During construction, there is expected to be an increase in heavy vehicles along the Kidston-Gilberton Road network. A traffic impact assessment undertaken by the proponent identified that the construction traffic will overlap with the construction traffic for the proposed KS2 solar project and will peak at 68 vehicles per day. The assessment further identified that there is adequate capacity in the existing road network to accommodate an increase in traffic. However, road improvement works including the

upgrade of Copperfield River Bridge, would be required due to an increase in heavy vehicle traffic volumes during this phase of the project.

The ESC development approval conditions require the proponent to undertake a road impact assessment for approval prior to construction. Any improvement works identified by the proponent must be approved by ESC.

Operation traffic

During project operation, minimal traffic is expected to be generated with an estimated 20 light vehicles per day for staff movements and a maximum of eight trucks per day for deliveries. The IAR states that there will be sufficient road capacity during the operations phase of the project.

Informal access to the project site from the Kidston township is currently via Old Kidston Road, which continues into the mining lease where it becomes an access track through the site. The proposed spillway infrastructure will sever Old Kidston Road. ESC requires the proponent to design and construct an alternate route, minimising cut and fill, to provide adequate drainage and minimise impacts to soil erosion. The proponent is required to obtain ESC approval for the location of an alternative access site to the project.

5.4.2 Amenity

Dust

Project construction activities that would generate dust include earthworks during dam wall construction, rock bolt stabilisation works, underground excavation for access tunnels and powerhouse cavern building works.

The nearest sensitive receptors to the project are the approximately 10 residents of the Kidston township approximately 600 meters to the east of the site. Given the predominant easterly wind directions in the region, any potential dust is unlikely to affect these receptors. The IAR notes that the implementation of standard management and mitigation measures (such as on-site watering to minimise dust) through a CEMP, would mitigate air quality issues. It is expected that the project construction and operation activities will meet the air quality objectives under the Environmental Protection (Air) Policy 2008.

Noise and vibration

Existing noise levels in the surrounding project area are generated by farm activities, road usage and the natural environment. Project noise has the potential to impact on the immediate and surrounding area, particularly the Kidston township, during construction and operation. Construction activities that are likely to contribute to noise emissions include: earthworks, blasting, drilling, concrete batching and underground excavation works.

Although a noise and vibration impact assessment has not been undertaken for the project, potential noise and vibration impacts during project construction are expected to be minimal due to the project's distance from the Kidston township. Mitigation measures would be implemented through a CEMP and would include noise management

procedures, such as selecting low noise generating equipment and maintaining equipment to reduce noise, in line with legislative requirements and site-specific triggers.

Potential noise and vibration impacts are likely to be less during project operations when equipment that generates less noise will be used. The operational equipment that may contribute to noise and vibration include the operation of pumps and general operational activities.

5.4.3 Waste management

The management of waste generated during the construction and operation of the project was assessed by ESC as part of the development application. The project will generate high volumes of commercial waste during construction which will be transported to Townsville or an alternative site outside of the Etheridge Shire LGA for disposal, due to the limited capacity at the local waste facility.

Minimal waste is proposed to be generated during project operations, consisting primarily of general rubbish including putrescible waste and recyclable material. Operational waste will be disposed at the waste facility in Einasleigh.

5.4.4 Hazard and risk

Bush fire management

The project site is mapped as medium bushfire hazard under the ESC planning scheme. Accordingly, ESC has conditioned the proponent to develop and implement a bushfire management plan to reduce the risk to the project and the community. ESC has also required the proponent to ensure that the hydro storage facility infrastructure is designed and constructed to ensure that it is not susceptible to damage from bushfire. Additionally, ESC requires the proponent to ensure that the development can be accessed by the rural fire and emergency services personnel in the event of a bushfire. These measures would ensure that the risk of bushfire resulting from the development would be minimised.

Wises Dam assessment

The proposed Wises Dam is considered a 'referable dam' under the WSSR Act and subsequently required approval under the *Planning Act 2016.* A failure impact assessment undertaken for the proposed Wises Dam was used to determine the risk to population in the event of dam failure. The Wises Dam is considered a 'category one dam' for assessment purposes under the WSSR Act.

The failure impact assessment was accepted by the Chief Executive administering the WSSR Act. The proponent was granted operational works approval through SARA for the referable dam on 19 September 2018 because the proposal:

- complies with the applicable performance outcomes of the *State Development Assessment Provisions: State code 20: Referable dams*[7]

[7] State Development Assessment Provisions: State code 20: Referable dams https://dsdmipprd.blob.core.windows.net/general/sdap-v2-4.pdf

- will be designed and constructed in accordance with appropriate dam engineering practices and standards
- is appropriate for the site conditions where the dam is located.

The failure impact assessment ensures that any flooding risk to nearby people and property from the dam is minimised.

Subsequent to the application being approved, the proponent has since modified the dam design (by increasing its capacity) as well as increasing the height of water to be stored (to a level higher than the design FSL) for a temporary period during construction. The dam safety regulator has advised that the proposed changes are considered acceptable subject to the proponent demonstrating that the risks associated with operating the storage at this level are properly considered during the design stage as well as preparing and implementing an Emergency Action Plan (EAP) prior to construction commencing.

5.4.5 Cultural heritage

Indigenous cultural heritage

The IAR states that a search of the Department of Aboriginal and Torres Strait Islander Partnerships (DATSIP) cultural heritage database indicates there are no recorded Indigenous cultural heritage places within 5 km of the proposed works. However, given the proximity to the Copperfield River, there is potential for previously unrecorded cultural heritage sites in the area of the proposed spillway works. For this reason, the proponent is undertaking an Aboriginal cultural heritage survey to identify any previously unrecorded heritage values near this location.

In May 2018, the proponent and the Ewamian People signed a Cultural Heritage Management Agreement for the Kidston project. The agreement identifies roles and responsibilities and outlines clear processes for the identification of unexpected heritage items and dispute resolution. The project's CEMP will incorporate these protocols to manage risk to Indigenous cultural heritage.

The IAR states that the proponent will continue to consult the Ewamian People regarding the requirement for any additional management measures.

Non-Indigenous cultural heritage

The project is adjacent to the State Heritage Listed, Kidston State Battery and Township. The former township and isolated miners' homestead leases extend into the area of the proposed spillway and there is potential for historical archaeological and built remains of State heritage significance.

The proponent is committed to using management measures such as monitoring of ground disturbing works, avoiding areas of high value and salvaging archaeological remains as required.

The project's CEMP will include protocols for any unexpected cultural heritage finds, ensuring that impacts to items of State cultural heritage are appropriately managed.

5.4.6 Socio-economic costs and benefits

Socio-economic environment

Kidston

The Kidston township was created to service the gold field in 1907 and had a peak population of 1700 in 1908. By the 1920s open cut mining commenced and continued until 1945 when mining operations ceased.

Mining recommenced from 1985 and continued up until 2001. Mine workers were housed in a construction camp on site. Since the mine's closure, the residential population of the town has significantly decreased, leaving a small permanent population in the township estimated at ten residents.

Etheridge LGA

In 2016, the percentage of workers aged 25-54 years employed full-time in Etheridge was 71.6 per cent. The primary industry in the Etheridge LGA is agriculture, which employs about 40 per cent of the population, and is approximately 20 times the state level of 2.8 per cent. Public administration and safety is the second largest industry in Etheridge LGA employing around 17 per cent of the population.

Unemployment in the Etheridge LGA was an estimated 4.8 per cent at June 2018, while Queensland had an unemployment rate of six per cent[8]; and the median total personal income in the LGA was $41,990 per year, lower than the state median of $50,901.

According to Queensland Government Statisticians Office (QGSO), the population of Etheridge LGA has continued to decline since 2012 and this decline is projected to continue into 2030. Due to population decline, there is little demand for new housing, with one building approval in the whole of the Etheridge LGA since 2016. In the year leading up to June 2018 four residential dwellings were sold.

In 2016, the population of Aboriginal and/or Torres Strait Islanders in the LGA was 5.5 per cent (44 people) and the unemployment rate was 57.1 per cent. The IAR notes that the project would provide opportunity for Aboriginal and Torres Strait Islander participation in the regional workforce through the creation of employment.

Economic benefits

The IAR notes that the project represents a large investment in the construction of renewable energy infrastructure in North Queensland. Stated economic benefits include:

- $330 million capital investment
- creation of an estimated 370 construction jobs
- creation of up to nine full-time equivalent operations jobs
- direct and indirect local, regional and Indigenous employment opportunities
- local and regional contractor and supply opportunities for individuals and businesses.

[8] QGSO – https://statistics.qgso.qld.gov.au/qld-regional-profiles

Construction accommodation

Genex has utilised the existing mining accommodation camp (Oak's Rush Resort) for on-site employees for KS1. The proponent paid to upgrade the accommodation camp to house up to 160 personnel during the peak employment period in November 2017.

For the Stage 2 projects (KS2 and K2H), the proponent would further upgrade the facilities to allow the camp to house the higher number of employees. This would mitigate negative impacts to the local housing market by avoiding a temporary increase in housing demand. In addition, the proponent notes that allowing the employees to stay on-site mitigates travel and transport logistics and promotes employee safety (i.e. not driving large distances in the early-morning or late-evening).

Community and stakeholder consultation

The proponent has undertaken consultation and stakeholder engagement with directly affected land owners (including presentations and a series of community consultation sessions); local, state and Commonwealth government regulators; and relevant infrastructure providers throughout the development of the Hub project. Consultation activities have occurred since 2016.

The proponent advises that the local landholders, community and ESC support the project. The North Queensland Conservation Council and one local landholder has recently raised concerns about the proposed water releases; these are the only known concerns raised by stakeholders about the water releases. The evaluation report imposes strict conditions limiting the release of contaminated water to ensure potential impacts on aquatic ecosystems can be effectively managed.

A number of engagement activities have also been undertaken with the Traditional Owners of the area, the Ewamian people. The Ewamian people and Genex have signed a cultural heritage management agreement for the project.

Community benefits

In addition to construction and operation employment opportunities, use of Oak's Rush Resort for workers accommodation would create further job opportunities, with the need for permanent camp staff, cleaners, electricians, plumbers, and maintenance workers.

In addition to economic benefits from the additional spending in the local area, the IAR states that the proponent currently supplies water at no cost to the Kidston township and surrounding cattle stations. Genex also provides the funding to maintain the Copperfield Dam. The IAR states that the proponent would ensure that residents receive this social benefit of continued use the dam.

5.4.7 Coordinator-General's conclusion: other environmental effects

I note that the community may be affected by some of the construction aspects of the project, in particular impacts to the road network and potential impacts to amenity (i.e. noise, vibration and dust). However, the proponent is required to comply with ESC's conditions of development approval relating to construction waste, road works, vegetation clearing and dam construction and I am satisfied that compliance with these

conditions, along with implementation of the mitigation measures proposed, would address any adverse impacts.

I am satisfied that the assessment and conditions provided by ESC and SARA address the other environmental effects of the project as outlined in this report.

I consider the project would provide a number of positive economic development opportunities for Kidston and the Etheridge LGA by introducing a new industry to the region and associated jobs, and I encourage the proponent to work with ESC and the community to maximise project benefits.

Accommodating construction workers will mitigate any negative impacts to the local housing market as well as offering opportunities for supplies and services to the camp.

To ensure that the proponent continues to consult with the downstream landholders, residents of Einasleigh and ESC about potential project impacts, I have imposed a condition requiring the proponent to prepare a stakeholder and community engagement plan. This will ensure appropriate engagement activities are undertaken before any controlled water release events occur. This will support the framework of conditions that I have set to manage the water release to the Copperfield River required for the project.

Similar to the EAP prepared for the Copperfield Dam, the proponent would also be required to prepare an EAP for the new Wises Dam, which would include WSSR Act requirements around notifying potentially affected persons downstream in the event of dam hazard events.

6. Conclusion

In undertaking my evaluation, I have considered the IAR including the supplementary material and advice I have received from relevant state and local government agencies.

I am satisfied that the requirements of the SDPWO Act have been met and that sufficient information has been provided to enable the evaluation of potential impacts, and development of mitigation strategies and conditions of approval.

The impact assessment report process commenced with the declaration of this project as a coordinated project in September 2018. I have assessed and considered the potential impacts identified in the IAR and supplementary material and I consider that the mitigation measures together with the conditions imposed in this report, would result in overall acceptable outcomes.

Based on the information provided by the proponent, I conclude that the project would support the government's target of generating 50 per cent of Queensland's electricity needs from renewable energy by 2030 and add stability and strength to the North Queensland network and reduce the need to import excess electricity from neighbouring regions. The project would also contribute to the Australian Renewable Energy target and the development of a REZ in Far North Queensland.

The project has the potential to create employment opportunities of up to 370 direct FTE jobs during the construction period and the project would require up to nine direct FTE jobs during the operations phase.

Accordingly, I recommend the Kidston Pumped Storage Hydro project proceed, subject to the conditions in Appendix 1. In order to verify the proponent's compliance, I require the proponent to arrange periodic third-party audits (Appendix 1, Schedule 3) to confirm compliance. To proceed further, the proponent will be required to obtain relevant state and local government permits and approvals under the *Planning Act 2016* and *Environmental Protection Act 1994* in relation to water and spillway construction and operations, infrastructure works across waterways, associated quarry and dredging works.

If there are any inconsistencies between the project (as described in the IAR documentation) and the conditions in this report, the conditions shall prevail. The proponent must implement all the conditions of this report.

Copies of this report will be issued to:

- DES
- DSDMIP
- ESC.

A copy of this report will also be available on the DSDMIP's website at **www.dsdmip.qld.gov.au/kidstonhydro.**

In accordance with section 35A of the SDPWO Act, this report will lapse on 5 April 2022.

Appendix 1. Imposed conditions

This appendix includes conditions imposed by the Coordinator-General under section 54B of the SDPWO Act.

All of the conditions imposed in this appendix take effect from the date of this Coordinator-General's report.

These conditions do not relieve the proponent of the obligation to obtain all approvals and licences from all relevant authorities required under any other Act.

In accordance with section 54B(3) of the SDPWO Act, I have nominated DES (the administering authority for the EP Act) as the entity with jurisdiction for the conditions listed in Appendix 1, Schedule 1 – Water Releases of this evaluation report.

Pursuant to section 54D of the SDPWO Act, these conditions apply to anyone who undertakes the project, such as the proponent and an agent, contractor, subcontractor or licensee of the proponent, and any public utility providers undertaking public utility works as a result of the project.

The conditions are as follows:

Schedule 1 – Water Releases

General

Condition 1. General

A1 This **evaluation report** authorises environmental harm referred to in the conditions. Where there is no condition, or this **evaluation report** is silent on a matter, the lack of a condition or silence does not authorise environmental harm.

A2 The holder of this **evaluation report** must:

(a) install all measures, plant and equipment necessary to ensure compliance with the conditions of this environmental authority

(b) maintain such measures, plant and equipment in a proper and efficient condition;

(c) operate such measures, plant and equipment in a proper and efficient manner; and

(d) ensure all instruments and devices used for the measurement or monitoring of any parameter under any condition of this **evaluation report** are properly calibrated.

A3 All monitoring records or reports required by this **evaluation report** must be kept for a period of not less than five years.

A4 The holder of this **evaluation report** must develop and implement a risk management system for the activity which meets the content requirement of the Standard for Risk Management (ISO 31000:2009), or the latest edition of an Australian standard for risk management, by 1 May 2019.

A5 The holder of this **evaluation report** must notify the **entity with jurisdiction** and the Coordinator-General by written notification within 24 hours, after becoming aware of any emergency or incident which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with, the conditions of this **evaluation report**.

A6 Within 10 business days following the initial notification of an emergency or incident, or receipt of monitoring results, whichever is the latter, further written advice must be provided to the **entity with jurisdiction** and the Coordinator-General, including the following:

(a) results and interpretation of any samples taken and analysed;

(b) outcomes of actions taken at the time to prevent or minimise unlawful environmental harm; and

(c) proposed actions to prevent a recurrence of the emergency or incident.

A7 The holder of this **evaluation report** must record all environmental complaints received about the authorised activities including:

(a) name, address and contact number for of the complainant
(b) time and date of complaint
(c) reasons for the complaint
(d) investigations undertaken
(e) conclusions formed
(f) actions taken to resolve the complaint
(g) any abatement measures implemented
(h) person responsible for resolving the complaint.

A8 The holder of this **evaluation report** must, when requested by the **entity with jurisdiction** or the Coordinator-General, undertake relevant specified monitoring within a reasonable timeframe nominated or agreed to by the **entity with jurisdiction** or the Coordinator-General to investigate any complaint of environmental harm. The results of the investigation (including an analysis and interpretation of the monitoring results) and abatement measures, where implemented, must be provided to the **entity with jurisdiction** or the Coordinator-General within 10 business days of completion of the investigation, or no later than 10 business days after the end of the timeframe nominated by the **entity with jurisdiction** or the Coordinator-General to undertake the investigation.

A9 All determinations of water and sediment quality, and biological monitoring must be performed by an appropriately qualified person.

Water

Condition 2. Contaminant Release

B1 Contaminants that will, or have the potential to cause environmental harm, must not be released directly or indirectly to any waters, except as permitted under conditions of this **evaluation report**.

B2 The release of **contaminated water** must only occur in accordance with **Table 1 – Contaminated water release criteria.**

B3 The release of **contaminated water** must only occur from the release point specified in **Table 1 – Contaminated water release criteria**

B4 During the release of **contaminated water** from the specified release point, the holder of this **evaluation report** must measure and record the receiving waters **streamflow** rate and the contaminant release discharge rate at the gauging station location specified in Table 1 – **Contaminated water** release criteria.

B5 During the release of **contaminated water** from the specified release point, the holder of this **evaluation report** must measure and record the receiving waters **streamflow** rate and the contaminant release discharge rate at the recording frequency specified in **Table 1 – Contaminated water release criteria.**

B6 **Contaminated water** released to surface waters must be monitored for each contaminant specified in **Table 2 – Contaminant release limits (End of Pipe)**.

B7 **Contaminated water** released to surface waters must be monitored at the frequency specified in **Table 2 – Contaminant release limits (End of Pipe).**

B8 **Contaminated water** released to surface waters must not exceed a release limit specified in **Table 2 – Contaminant release limits (End of Pipe).**

B9 The release of **contaminated water** to surface waters must not cause erosion of the bed and banks of the receiving waters, or a material build-up of sediment in waters.

Table 1 – Contaminated water release criteria

Monitoring Point	Gauging station (GDA94 MGA z55)		Recording Frequency	Criteria for release	
	Latitude	Longitude		Streamflow rate	Release Discharge
Receiving waters stream discharge					
WB Copperfield River (Upstream of release point)	-18.9051	144.1625	Hourly during release events (m^3/sec)	Contaminated water may only be released when the streamflow rate at WB is greater than (>) 4.63 m^3/sec. Once the streamflow rate is less than (<) 4.63 m^3/sec, the release must cease.	N/A
Contaminated water release					
KPH1 Release point (in pipe)	TBA[1]	TBA[1]	Hourly during release events (m^3/sec)	N/A	Contaminated water may only be released at KPH1 when streamflow rate in the Copperfield River measured at WB is 200 times greater than the release discharge rate at KPH1 (m^3/sec). When the release occurs during minimum streamflow in the Copperfield River (5 m^3/sec), the maximum release discharge rate is 0.025 m^3/sec. Release discharge rate must be calculated in real time.

[1] Coordinates must be provided to the **entity with jurisdiction** by 30 September 2019.

Table 2 – Contaminant release limits (End of Pipe)[1]

Contaminant	Release Limit (for metals (µg/L) based on filtered[7] samples)	Release Limit (for metals (µg/L) based on total samples)	Monitoring Frequency
Electrical conductivity (µS/cm)	5,320[2]		Every fifteen (15) minutes during release
pH (pH Unit)	6 - 7.5[2]		
Dissolved oxygen (% sat)	>85[1]		
Sulfate (SO_4^{2-}) (mg/L)	2690[2]		Daily during release (the first sample must be taken within 2 hours of commencement of release).
Turbidity (NTU)	15[3]		
Fluoride (mg/L)	3[2]		
Major ions	No limit - For interpretation purposes		
Hardness			
Ammonia as N (mg/L)	0.5[4]		
Nitrate as N (mg/L)	5.5[2]		
Total N (mg/L)	7[2]		
Total P (mg/L)	0.03[2]		
Cyanide as unionized HCN	7[4]		
Aluminum	55[4]	240[2]	
Arsenic	170[2]	370[2]	
Cadmium	30[2]	46[2]	
Chromium	1[4]	50[5]	
Cobalt	30[2]	3840[2]	
Copper	5[2]	200[6]	
Iron	300[4]	310[2]	
Lead	3.4[4]	190[2]	
Manganese	2860[2]	3770[2]	
Mercury	0.06[4]	1[5]	
Molybdenum	63[2]	125[2]	
Nickel	38[2]	51[2]	
Selenium	5[4]	10[5]	
Uranium	0.5[4]	17[5]	
Vanadium	6[4]	10[2]	
Zinc	1750[2]	2350[2]	

Notes:
1. Notwithstanding the release limits stated in this table, receiving waters compliance limits stated in Table 4 must be met at the downstream compliance monitoring site.
2. Maximum of historical data used in the risk assessment process (Genex Impact Assessment Report; Table 13)
3. ANZECC (2000) Aquatic Ecosystem Guidelines for Lowland Rivers for Tropical Australia – Table 3.3.4
4. ANZECC (2000) Table 3.4.1 Trigger values for aquatic ecosystem protection, applicable to slightly–moderately disturbed systems.
5. NWQMS (2011) Australian Drinking Water Guidelines
6. ANZECC (2000) Long term irrigation
7. Samples that have been filtered through a 0.45µm filter.

Condition 3. Receiving waters compliance

B10 Receiving waters must be monitored at the location specified in **Table 3 - Downstream compliance monitoring site and frequency**.

B11 Receiving waters must be monitored at the frequency specified in **Table 3 - Downstream compliance monitoring site and frequency.**

B12 Receiving waters must be monitored for the contaminants listed in **Table 4 - Receiving waters compliance limits.**

B13 Receiving waters compliance limits specified in **Table 4 - Receiving waters compliance limits** must not be exceeded at the location specified in **Table 3 - Downstream compliance point and monitoring frequency**.

Table 3 - Downstream compliance monitoring site and frequency

Monitoring sites	Receiving waters description	Location[1] (GDA94 MGA z55)		Monitoring frequency
		Latitude	Longitude	
KPH2	Copperfield River, (approx.)1.9 km downstream of KPH1	-18.8719	144.1740	• Daily during release (the first sample must be taken within 2 hours of commencement of each release); and • Daily for one week following cessation of each release.

1. Coordinates must be provided to the **entity with jurisdiction** prior to activities commencing at the Kidston Pumped Storage Hydro Project.

Table 4 - Receiving waters compliance limits

Contaminant	Receiving Waters Compliance Limit	
	for metals (µg/L), based on filtered[9] samples	for metals (µg/L), based on total samples
Electrical conductivity (µS/cm)	300[1]	
pH (pH Unit)	6.5 - 8.75[2]	
Sulfate (SO_4^{2-}) (mg/L)	250[5]	
Fluoride (mg/L)	1[5]	
Chlorophyll a (cells/100ml)	5[2]	
Major ions	No limit - For interpretation purposes	
Hardness		
Turbidity (NTU)		
Dissolved Oxygen		
Total Ammonia N (mg/L)	0.5[6]	
Nitrate as N (mg/L)	0.7[3]	
Total N (mg/L)	0.35[10]	
Total P (mg/L)	0.04[10]	
Cyanide as unionized HCN (µg/L)	7[3]	
Aluminium (µg/L)	2870[1]	3950[1]
Arsenic (µg/L)	13[3]	13[8]
Cadmium (µg/L)	0.2[3,4]	2[6]
Chromium (µg/L)	1[3]	50[6]
Cobalt (µg/L)	2.8[5]	50[7]
Copper (µg/L)	5[1]	200[7]
Iron (µg/L)	300[3]	750[1]
Lead (µg/L)	3.4[3,4]	10[7]
Manganese (µg/L)	1900[3]	1900[8]
Mercury (µg/L)	0.05[3]	1[3]
Molybdenum (µg/L)	34[5]	34[8]
Nickel (µg/L)	11[3,4]	25[1]
Selenium (µg/L)	5[3]	10[6]
Uranium (µg/L)	0.5[3]	17[6]
Vanadium (µg/L)	6[3]	100[7]
Zinc (µg/L)	8[3,4]	2000[7]

Notes:
1. Site specific value – 95th percentile of WB full dataset (Genex Impact Assessment Report; Table 20)
2. ANZECC (2000) Aquatic Ecosystem Guidelines for Lowland Rivers for Tropical Australia – Table 3.3.4
3. ANZECC (2000) Table 3.4.1 Trigger values for aquatic ecosystem protection, applicable to slightly–moderately disturbed systems.
4. Hardness modification may be applied to the Compliance Limit for this toxicant based on analytical results of the collected sample.
5. Low reliability freshwater trigger (Section 8.3.7 Detailed description of chemicals, ANZECC guidelines 2000)
6. Australian drinking water guideline.
7. Long term irrigation.
8. Where the filtered compliance limit is higher than the lowest applicable Receiving Waters Limit for total metals, the filtered number is applied.
9. Samples that have been filtered through a 0.45µm filter.
10. Interim value – 80th percentile of W2 full data set (Genex Supplementary Material; Table 8, 1 March 2019). A site-specific value must be provided to the **entity with jurisdiction** by 1 September 2020.

Condition 4 Receiving environment monitoring – Surface waters

B14 Receiving waters must be monitored at the locations specified in **Table 5 - Receiving waters monitoring sites**.

B15 Receiving waters must be monitored for each contaminant specified in **Table 6 - Receiving waters trigger values.**

B16 Receiving waters must be monitored at the frequency specified in **Table 5 - Receiving waters monitoring sites.**

B17 If a contaminant concentration measured at a downstream site specified in **Table 5 - Receiving waters monitoring sites** exceeds any of the trigger values listed in **Table 6 - Receiving waters trigger values,** the holder of this **evaluation report** must compare this result to monitoring results collected from the relevant upstream control site; and

(a) If the contaminant concentration measured at the receiving waters monitoring site is equal to or less than the contaminant concentration measured at the relevant control sites, no further action is required; or

(b) If the contaminant concentration measured at the receiving waters monitoring site is greater than the contaminant concentration measured at the relevant control sites:

(i) Notify the **entity with jurisdiction** and the Coordinator-General within 24 hours of becoming aware of the exceedance; and

(ii) Undertake further sampling of potentially impacted receiving waters for all contaminants specified in **Table 6 - Receiving waters trigger values**; and

(iii) Complete an investigation into the potential for environmental harm to occur in accordance with ANZECC (2000) methodology, within three months of identifying this exceedance or the alternative timeframe specified by the **entity with jurisdiction** or the Coordinator-General; and

(iv) Within one week of completing the investigation, provide a written report to the **entity with jurisdiction** and the Coordinator-General detailing all pertinent aspects of the investigation (such as objectives, applied methodology, investigation outcomes, assumptions relied upon and justification for any assertions made) and any actions undertaken and/or proposed to prevent or minimise environmental harm.

Note: Where a Trigger Value exceedance has occurred and is under investigation in accordance with B17(b)(iii) and B17(b)(iv), no further reporting is required for subsequent exceedance events of that contaminant during the course of the investigation required under B17(b)(iii).

Table 5 - Receiving waters monitoring sites

Monitoring sites	Receiving waters description	Location (GDA94 MGA z55)		Monitoring frequency Receiving waters
		Latitude	Longitude	
Control sites				
WB	Copperfield River, upstream of KPH1	-18.9051	144.1625	Once within 24 hours prior to commencement of release; and Daily during release; and Once every two days for 6 days following cessation of release; and Once per month thereafter.
KPH3	Copperfield River, upstream of East Creek confluence	-18.8614	144.1885	
Interpretation site				
W2	Copperfield River, downstream of KPH1	-18.8779	144.1702	Once within 24 hours prior to commencement of release; and Daily during release; and Once every two days for 6 days following cessation of release; and Once per month thereafter.
Downstream site				
KPH4	Copperfield River, downstream of KPH1	-18.8549	144.1808	Once within 24 hours prior to commencement of release; and Daily during release; and Once every two days for 6 days following cessation of release; and Once per month thereafter.
W3	Copperfield River, downstream of KPH1	-18.8268	144.1788	
Pond 5	Copperfield River, downstream of KPH1	-18.8383	144.1770	
Copperfield Gorge (at Einasleigh)	Copperfield River, downstream of KPH1	-18.5082	144.1009	

Table 6 - Receiving waters trigger values

Contaminant	Trigger values	
	for metals (µg/L), based on filtered samples	for metals (µg/L), based on total samples
Electrical conductivity (µS/cm)	200[1]	
pH (pH Unit)	6.5 - 8.75[1]	
Sulfate (SO_4^{2-}) (mg/L)	4[1]	
Fluoride (mg/L)	1[2]	
Chlorophyll a (cells/100ml)	5[3]	
Major ions	No trigger value - for interpretation purposes	
Hardness		
Turbidity (NTU)		
Dissolved Oxygen		
Total Ammonia N (mg/L)	0.5[4]	
Nitrate as N (mg/L)	0.7[5]	
Total N (mg/L)	0.30[3]	
Total P (mg/L)	0.04[3]	
Cyanide as unionized HCN (µg/L)	7[5]	
Aluminium (µg/L)	570[1]	1530[1]
Arsenic (µg/L)	1[1]	2[1]
Cadmium (µg/L)	0.1[1]	0.1[1]
Chromium (µg/L)	1[1]	1[1]
Cobalt (µg/L)	1[1]	2.5[1]
Copper (µg/L)	3[1]	5[1]
Iron (µg/L)	210[1]	435[1]
Lead (µg/L)	1[1]	1[1]
Manganese (µg/L)	48	83[1]
Mercury (µg/L)	0.05[5]	1[4]
Molybdenum (µg/L)	1[7]	2.5[1]
Nickel (µg/L)	1[7]	3[1]
Selenium (µg/L)	5[1]	5[1]
Uranium (µg/L)	1[7]	17[4]
Vanadium (µg/L)	6[5]	100[2]
Zinc (µg/L)	6[1]	13[1]

Notes:

1. Site specific value – 80th percentile of WB full dataset (Genex Impact Assessment Report; Table 20); or the laboratory limit of detection where the calculated 80th percentile is less than the limit of detection.
2. ANZECC (2000) Long term irrigation
3. Site-specific value – 50th percentile of W2 – full dataset
4. Australian drinking water guideline.
5. ANZECC (2000) Table 3.4.1 Trigger values for aquatic ecosystem protection, applicable to slightly–moderately disturbed systems.
6. Samples that have been filtered through a 0.45µm filter
7. The laboratory limit of detection where the calculated 80th percentile is less than the limit of detection.

Condition 5 Receiving environment monitoring – sediments

B18 Sediment must be monitored at the locations specified in **Table 7 - Sediment monitoring sites.**

B19 Sediment must be monitored for each contaminant specified in **Table 8 - Sediment contaminant default guideline values**.

B20 Sediment must be monitored at the frequency specified in **Table 7 - Sediment monitoring sites.**

B21 If a contaminant concentration measured at a downstream site specified in **Table 7 - Sediment monitoring sites** exceeds any of the default guideline values listed in **Table 8 - Sediment contaminant default guideline values**, the holder of this **evaluation report** must compare this result to monitoring results collected from a relevant control site; and

(a) If the contaminant concentration measured at the downstream sediment monitoring site is equal to or less than the contaminant concentration measured at the relevant control sites, no further action is required; or

(b) If the contaminant concentration measured at the downstream sediment monitoring site is greater than the contaminant concentration measured at the relevant control sites:

(i) Notify the **entity with jurisdiction** and the Coordinator-General within 24 hours of becoming aware of the exceedance; and

(ii) Undertake further sampling of potentially impacted sediment for all contaminants specified in **Table 8 - Sediment contaminant default guideline values**; and

(iii) Complete an investigation into the potential for environmental harm to occur in accordance with ANZECC (2000) methodology, within three months of identifying this exceedance or the alternative timeframe specified by the **entity with jurisdiction**; and

(iv) Within one week of completing the investigation, provide a written report to the **entity with jurisdiction** and the Coordinator-General detailing all pertinent aspects of the investigation (such as objectives, applied methodology, investigation outcomes, assumptions relied upon and justification for any assertions made) and any actions undertaken and/or proposed to prevent or minimise environmental harm.

Note: Where a contaminant trigger level exceedance has occurred and is under investigation in accordance with B21(b)(iii) and B21(b)(iv), no further reporting is required for subsequent exceedance events of that contaminant during the course of the investigation required under B21(b)(iii).

Table 7 - Sediment monitoring sites

Monitoring sites	Receiving waters description	Location (GDA94 MGA z55)		Monitoring frequency
		Latitude	Longitude	
Control sites				
WB	Copperfield River, upstream of KPH1	-18.9051	144.1625	Once every three months
KPH3	Copperfield River, upstream of East Creek confluence	-18.8614	144.1885	
Downstream sites				
KPH2	Copperfield River, downstream of KPH1	-18.8719	144.1740	Once every three months
W2	Copperfield River, downstream of KPH1	-18.8779	144.1702	
KPH4	Copperfield River, downstream of KPH1	-18.8549	144.1808	
W3	Copperfield River, downstream of KPH1	-18.8268	144.1788	
Pond 5	Copperfield River, downstream of KPH1	-18.8383	144.1770	
Copperfield Gorge (at Einasleigh)	Copperfield River, downstream of KPH1	-18.5082	144.1009	

Table 8 - Sediment contaminant default guideline values

Contaminant (mg/kg dry weight)	Default Guideline Values (DGV)
Arsenic	20[1]
Cadmium	1.5[1]
Chromium	80[1]
Copper	65[1]
Lead	50[1]
Mercury	0.15[1]
Nickel	21[1]
Zinc	200[1]

1. ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine o. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines
2. Measured data for toxicants in sediment should be normalised to the silt fraction (< 63 µm) for comparison with the DGV.

Condition 6 – Receiving Environment Monitoring Program

B22 The holder if this **evaluation report** must develop, maintain, and implement a Receiving Environment Monitoring Program (REMP) for all stages of the activity to monitor, identify and describe any adverse impacts to receiving water environmental values, water and sediment quality and flows due to the Project. This must include monitoring the effects of the Project on the receiving environment periodically (under natural flow conditions) and while contaminants are being discharged from the site. For the purposes of the REMP, the receiving environment is the waters, including underlying groundwaters in alluvial and

colluvium deposits, of the Copperfield River, East Creek, semi-permanent pools and the Copperfield Gorge at Einasleigh. The REMP should encompass any sensitive receiving waters or environmental values downstream of the authorised activity that will potentially be directly affected by an authorised release of contaminants.

B23 The REMP must include at a minimum:

- Monthly monitoring for all sites listed in **Table 5 - Receiving waters monitoring sites**:
  - (a) Water quality for contaminants listed in **Table 4 - Receiving waters compliance limits**; and,
  - (b) Stream flow and *in situ* parameters including temperature, pH, EC and DO continuously (15 min intervals) at the locations listed in **Table 1 – Contaminated water release criteria**
- Quarterly monitoring for all sites listed in **Table 5 - Receiving waters monitoring sites**:
  - (c) Sediment quality for contaminants listed in Table 8 - Sediment contaminant default guideline values; and,
  - **(d)** Groundwater monitoring at the locations specified in **Table 9 – Groundwater bore locations** to quantify any linkages between the Eldridge Pit, Wises Pit and the Copperfield River; and,
- Biological monitoring for the following parameters in **spring** and **autumn** each year:
  - (e) Habitat assessment undertaken in accordance with the AUSRIVAS methodology (DNRM, 2001);
  - (f) Macroinvertebrates, including taxonomic richness, PET Taxa richness and SIGNAL 2 Index.

Note: timing of the macroinvertebrates in accordance with accepted methodologies for ephemeral streams.

B24 A document that details the content of the REMP that addresses the requirements of conditions this **evaluation report** must be prepared and provided to the **entity with jurisdiction** and the Coordinator-General by 30 May 2019.

B25 A report outlining the findings of the REMP, including all monitoring results and interpretations must be prepared annually and made available on request to the **entity with jurisdiction**. This must identify:

- (g) Potential impacts of the releases on the receiving environment, including downstream environmental values;
- (h) The suitability of existing release limits to protect downstream environmental values; and,
- (i) Any groundwater linkages and potential impacts on downstream environmental values.

Table 9 – Groundwater bore locations

Groundwater Bore	Location (GDA94 MGA z55)	
	Latitude	Longitude
BA06	-18.8880	144.1625
BA07	-18.8781	144.1677

Condition 7. Water Monitoring reporting

B26 The following information must be recorded in relation to all water monitoring required under the conditions of this **evaluation report** and submitted to the **entity with jurisdiction** or the Coordinator-General on request:

- (a) The date on which the sample was taken;
- (b) The time at which the sample was taken;

(c) The monitoring point at which the sample was taken;

(d) The measured or estimated daily quantity of **contaminated water** released from the release point;

(e) The release volume at the time of sampling for the release point; and

(f) The results of all monitoring and details of any exceedances of the conditions of this **evaluation report.**

Notification of release event

B27 The **entity with jurisdiction** or the Coordinator-General must be notified by telephone and email of the expected date and time of any proposed release from the release point specified in **Table 1 – Contaminated water release criteria** at least 48 hours prior to a release commencing.

B28 The **entity with jurisdiction** or the Coordinator-General must be notified by telephone and email of any release from the release point specified **Table 1 – Contaminated water release criteria** within 2 hours after the release has ceased.

B29 The **entity with jurisdiction** must be notified by telephone and email no later than 24 hours after commencing a release from the release point specified in **Table 1 – Contaminated water release criteria.** Notification must include the submission of written advice to the **entity with jurisdiction** and the Coordinator-General of the following information, collected in accordance with the conditions of this **evaluation report**:

(a) Release commencement date/time;

(b) Details regarding the compliance of the release with the conditions of this **evaluation report**;

(c) Release volume and receiving water flow volume measured in accordance with **Table 1 – Contaminated water release criteria.**

(d) Release electrical conductivity, DO, temperature and pH.

B30 Following cessation of the release from the release point specified in **Table 1 – Contaminated water release criteria** and within 20 business days provide the following information, collected in accordance with the conditions of this **evaluation report**, to the **entity with jurisdiction** and the Coordinator-General in writing:

(a) Release cessation date/time;

(b) Flow rates in receiving water;

(c) Release rates;

(d) Volume of water released (total and per day);

(e) Details regarding the compliance of the release with the conditions of this **evaluation report** (i.e. contaminant limits, natural flow, discharge volume);

(f) All in-situ water quality monitoring results, including pH, EC, DO and temperature; and

(g) Any other matters pertinent to the water release event.

Definitions: Schedule 1 – Water releases

'Autumn' means the late wet season, when flow has declined to a level able to be sampled, without significant flood peaks

'contaminated water' is water sourced from Eldridge Pit (during construction phase) or mixed water from both Eldridge and Wises Pit sourced from Wise Pit (during construction and operations).

'evaluation report' the report evaluating the impact assessment report for the Kidston Pumped Storage Hydro project in accordance with section 34L of the *State Development and Public Works Organisation Act 1971* (SDPWO Act)

'entity with jurisdiction' is the entity nominated to have jurisdiction for the conditions in the evaluation report in accordance with section 54B of the SDPWO Act which is the Department of Environment and Science (the administering authority for the EP Act).

'Spring' means the early wet season, when flow has been established for at least four weeks

'streamflow' is the water flowing in the Copperfield River, arising from precipitation in the catchment of the Copperfield River, or from a release from the Copperfield Dam.

'appropriately qualified person' means a person who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis on performance relating to the subject matter using the relevant protocols, standards, methods or literature.

'EC' means electrical conductivity

'µS/cm' means micro siemens per centimetre.

Schedule 2. Community and stakeholder engagement

Condition 1. Community and stakeholder engagement

The proponent must prepare and implement a community and stakeholder engagement plan six months prior to the first water release for construction that provides for:

(a) notifying Etheridge Shire Council and all directly-affected landholders by telephone and email about the expected date and time of any proposed water release events at least 48 hours prior to a release commencing

(b) consulting with Etheridge Shire Council and all directly-affected landholders about mitigation measures relating to water release events.

Definitions: Schedule 2: Community and stakeholder engagement

'directly-affected landholders' means all landholders located downstream of the project and upstream of Einasleigh in Etheridge Shire Council, who own or inhabit the properties listed in *Table 27 Mapped potential water users for the Copperfield River between the proposed release zone and the confluence with the Einasleigh River* in the Kidston Pumped Storage Hydro Project – Impact Assessment Report (2019).

'water release events' means any releases from the release point specified in *Appendix 1 Schedule 1 Table 1 – Contaminated water release criteria*.

Schedule 3. Third Party Audit

Condition 1. Third Party Audit

(a) The proponent must notify the Coordinator-General and the Department of Environment and Science, the date at which construction works commenced, within 30 days.

(b) The proponent must notify the Coordinator-General and the Department of Environment and Science within 30 days of the date at which operation of the project has commenced.

(c) In order to verify the proponent's compliance with all conditions imposed by the Coordinator-General, the following third-party auditing requirements must be applied for the Kidston Pumped Storage Hydro project, particularly water releases:

  (i) The Audit Period will:

    (A) commence once construction activities start

    (B) end once all imposed conditions have been satisfied

  (ii) The first audit must be undertaken within one (1) year of the commencement of construction (Audit Period) and then yearly thereafter during the project construction phase (Construction Audit).

  (iii) The first audit must be undertaken within one (1) year of the commencement of operation and audits must be undertaken throughout the Audit Period every three (3) years during the project operations phase (Operation Audit).

(iv) Audits must be undertaken generally in accordance with *AS/NZS ISO 19011:2014 Guidelines for auditing management systems*, by an appropriately qualified person engaged by and at the expense of the proponent.

(v) The proponent must provide the Audit Report to the Coordinator-General and the Department of Environment and Science within 30 business days of receipt of the relevant Construction Audit or Operations Audit from the third party.

(vi) The Coordinator-General may determine that an imposed condition is no longer required to be audited where:

  (A) the condition (or its intent) has subsequently become a requirement of or has been addressed through new or amended legislation or another; regulatory approval; and

  (B) it is no longer appropriate that the matter be addressed by the Coordinator-General, as it is managed pursuant to other regulatory requirements; or

  (C) the Coordinator-General is satisfied that the condition (or its intent) has been completed

Acronyms and abbreviations

Acronym	Definition
AUSRIVAS	Australian River Assessment System
ACH Act	*Aboriginal Cultural Heritage Act 2003* (Qld)
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment Conservation Council
ARENA	Australian Renewable Energy Agency
ARMCANZ	Agricultural and Resource Management Council of Australia and New Zealand
ASX	Australian Stock Exchange
BoM	Bureau of Meteorology
CEMP	construction environment management plan
CHMP	cultural heritage management plan
CLR	Contaminated Land Register
DAF	Department of Agriculture and Fisheries
DATSIP	Department of Aboriginal and Torres Strait Islander Partnerships
DEE	Australian Government Department of the Environment and Energy
DES	Department of Environment and Science
DLGRMA	Department of Local Government, Racing and Multicultural Affairs
DNRME	Department of Natural Resources, Mines and Energy
DSDMIP	Department of State Development, Manufacturing, Infrastructure and Planning
DTA	direct toxicity assessment
DTMR	Department of Transport and Main Roads (Qld)
EA	environmental authority
EAP	emergency action plan
EC	electrical conductivity
EIS	environmental impact statement
EMP	environmental management plan
EMR	Environmental Management Register
EOP	end of pipe
EP	equivalent persons
EP Act	*Environmental Protection Act 1994* (Qld)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
EPC	engineering, procurement and construction
EPP (Water)	Environmental Protection (Water) Policy 2009
ERA	environmentally relevant activity
ESA	environmentally sensitive area
ESC	Etheridge Shire Council
EV	environmental value
FID	financial investment decision

Acronym	Definition
FIFO	fly-in fly-out
FSL	full supply level
FTE	full-time equivalent
Genex	Genex Power Limited
GL	gigalitre
HDPE	High-density Polyethylene
HEV	highest ecological value
HMTV	hardness modified trigger values
IAR	impact assessment report
IAS	initial advice statement
IQQM	Integrated Quantity and Quality Model
K2H	Kidston Pumped Storage Hydro project
K2S	Kidston Solar Farm Stage Two project
KGML	Kidston Gold Mines Limited
km	kilometre
KS1	Kidston Solar Farm Stage One project
kV	kilovolt
LGA	local government area
LNG	liquid natural gas
LOR	limit of reporting
m^3	cubic meters
MCU	material change of use
mg/L	milligrams per litre of liquid/gaseous liquid
ML	megalitres
MOL	minimum operating level
MNES	matters of national environmental significance
MSES	matters of state environmental significance
mt	million tonnes
MW	megawatts
MWh	megawatt hours
NC Act	*Nature Conservation Act 1992* (Qld)
NDRRA	Natural Disaster Relief and Recovery Arrangements
NEM	National Electricity Market
NT agreement	native title agreement
OCG	Office of the Coordinator-General
PAF	potential acid forming
QGSO	Queensland Government Statisticians Office
QWQG	*Queensland Water Quality Guidelines*
RAP	river analysis package
RE	regional ecosystem

Acronym	Definition
REMP	receiving environment management program
RET	renewable energy target
REZ	renewable energy zone
RIA	road impact assessment
RL	relative level
RMP	road-use management plan
SCL	strategic cropping land
SDPWO Act	*State Development and Public Works Organisation Act 1971* (Qld)
SARA	State Assessment Referral Agency
SIA	social impact assessment
SIAU	social impact assessment unit
SIMP	social impact management plan
SPP	state planning policy
TDS	total dissolved solids
TMP	traffic management plan
TSF	tailings storage facility
TSP	total suspended particles
VM Act	*Vegetation Management Act 1999* (Qld)
WBM	water balance model
WMP	waste management plan
WQO	water quality objectives
WRD	waste rock dumps
WRP	water resource plan
WSSR Act	*Water Supply (Safety and Reliability) Act 2008*

Glossary

Term	Definition
analyte	A substance whose chemical constituents are being identified and measured.
anthropogenic	Impacts or changes originated by human activity.
assessment manager	For an application for a development approval, means the assessment manager under *the Planning Act 2016* (Qld).
bilateral agreement	The agreement between the Australian and Queensland governments that accredits the State of Queensland's IAR process. It allows the Commonwealth Minister for the Environment to rely on specified environmental impact assessment processes of the state of Queensland in assessing actions under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth).
confluence	A point along a river system where one river or stream joins and flows into another
construction areas	The construction worksites, construction car parks, and any areas licensed for construction or on which construction works are carried out.
controlled action	A proposed action that is likely to have a significant impact on a matter of national environmental significance; the environment of Commonwealth land (even if taken outside Commonwealth land); or the environment anywhere in the world (if the action is undertaken by the Commonwealth). Controlled actions must be approved under the controlling provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth).
controlling provision	The matters of national environmental significance, under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth), that the proposed action may have a significant impact on.
coordinated project	A project declared as a ' coordinated project' under section 26 of the *State Development and Public Works Organisation Act 1971 Act* (SDPWO Act). Formerly referred to as a 'significant project'.
Coordinator-General	The corporation sole constituted under section 8A of the SDPWO Act and preserved, continued in existence and constituted under section 8 of the SDPWO Act.
dilution ratio	The ratio of volumes of the water release to the volume of water in the receiving environment.
Eldridge Pit	The decommissioned mine pit on the project site to be constructed as the lower reservoir.
Eldridge reservoir	The lower reservoir for the pumped storage hydro project.
end of pipe	The point of water release from the project site at the Copperfield River. End of pipe concentrations for metals and nutrients are conditioned.
environment	As defined in Schedule 2 of the SDPWO Act, includes: a) ecosystems and their constituent parts, including people and communities b) all natural and physical resources c) the qualities and characteristics of locations, places and areas, however large or small, that contribute to their biological diversity and integrity, intrinsic or attributed

	scientific value or interest, amenity, harmony and sense of community d) the social, economic, aesthetic and cultural conditions that affect, or are affected by, things mentioned in paragraphs (a) to (c).
environmental value	Define the uses of the water by aquatic ecosystems and for human uses (e.g. drinking water, irrigation, aquaculture, recreation). For the project, environmental values are the semi-permanent waterholes, the Copperfield Gorge at Einasleigh and the catchment used by aquatic ecosystems and human use.
environmentally relevant activity (ERA)	An activity that has the potential to release contaminants into the environment. Environmentally relevant activities are defined in Part 3, section 18 of the *Environmental Protection Act 1994* (Qld).
ephemeral	A stream or river, flowing for a short time, transitory, existing only briefly.
eutrophication	Excessive loads of nutrients in a lake or other body of water, frequently due to run-off from the land, which causes a dense growth of aquatic vegetation (e.g. algae).
full supply level	The quantity of water held in the dams at a volume level as department authorised.
imposed condition	A condition imposed by the Queensland Coordinator-General under section 54B of the SDPWO Act. The Coordinator-General may nominate an entity that is to have jurisdiction for the condition.
initial advice statement (IAS)	A scoping document, prepared by a proponent, that the Coordinator-General considers in declaring a coordinated project under Part 4 of the SDPWO Act. An IAS provides information about: • the proposed development • the current environment in the vicinity of the proposed project location • the anticipated effects of the proposed development on the existing environment • possible measures to mitigate adverse effects.
limit of reporting	Minimum level of detection under laboratory conditions.
macroinvertebrate	An animal without a backbone (invertebrate), including an aquatic organism, that can be seen with the naked eye.
macrophyte	An aquatic plant large enough to be seen by the naked eye.
matters of national environmental significance	The matters of national environmental significance protected under the *Environment Protection and Biodiversity Conservation Act 1999*. The eight matters are: a) world heritage properties b) national heritage places c) wetlands of international importance (listed under the Ramsar Convention) d) listed threatened species and ecological communities e) migratory species protected under international agreements f) Commonwealth marine areas g) the Great Barrier Reef Marine Park h) nuclear actions (including uranium mines).

nominated entity (for an imposed condition for undertaking a project)	An entity nominated for the condition, under section 54B(3) of the SDPWO Act.
post release flush	As a water release would occur during a flow in the receiving environment, water from the release would be flushed by volumes of water in the receiving environment. This is one of the proposed mitigation measures.
potentially acid forming	Material in rock that, when exposed to oxygen, may form acidic chemicals.
properly made submission (for an IAR or a proposed change to a project)	Defined under Schedule 2 of the SDPWO Act as a submission that: a) is made to the Coordinator-General in writing b) is received on or before the last day of the submission period c) is signed by each person who made the submission d) states the name and address of each person who made the submission e) states the grounds of the submission and the facts and circumstances relied on in support of the grounds.
proponent	The entity or person who proposes a coordinated project. It includes a person who, under an agreement or other arrangement with the person who is the existing proponent of the project, later proposes the project.
putrescible	Something that is liable to decay and subject to putrefaction.
release ratio	The ratio the contaminant of most concern in the release water to water in the receiving environment.
riparian	Vegetation habitats and communities along the river margins and banks.
Significant project	A project declared (prior to 21 December 2012) as a 'significant project' under section 26 of the SDPWO Act. Projects declared after 21 December 2012 are referred to as ‘coordinated projects’.
stated condition	Conditions stated (but not enforced by) the Coordinator-General under sections 39, 45, 47C, 49, 49B and 49E of the SDPWO Act. The Coordinator-General may state conditions that must be attached to a: • development approval under *the Planning Act 2016* • proposed mining lease under *the Mineral Resources Act 1989* • draft environmental authority (mining lease) under Chapter 5 of the *Environmental Protection Act 1994* (EPA) • proposed petroleum lease, pipeline licence or petroleum facility licence under the Petroleum and Gas (Production and Safety) Act 2004 • non-code compliant environmental authority (petroleum activities) under Chapter 4A of the EPA.
vertebrate	A large classification of animals that are distinguished by the possession of a backbone or spinal column including birds, reptiles, amphibians and fish.
waste rock dump	A post-mining landform engineered to store rock and prevent environmental harm.

water quality objectives (WQO)	Define objectives of metals and nutrients for the physical, chemical and biological characteristics of the water.
Wises Pit	The decommissioned mine pit on the project site to be constructed as the upper reservoir.
Wises reservoir	The upper reservoir of the pumped storage hydro project.
works	Defined under the SDPWO Act as the whole and every part of any work, project, service, utility, undertaking or function that: the Crown, the Coordinator-General or other person or body who represents the Crown, or any local body is or may be authorised under any Act to undertake, or is or has been (before or after the date of commencement of this Act) undertaken by the Crown, the Coordinator-General or other person or body who represents the Crown, or any local body under any Act, or is included or is proposed to be included by the Coordinator-General as works in a program of works, or that is classified by the holder of the office of Coordinator-General as works.

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