Nathan Dam and Pipelines project

Coordinator-General's evaluation report on the environmental impact statement

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Queensland Government

The Department of State Development

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Synopsis

This report provides an evaluation of the environmental impact statement (EIS) for the Nathan Dam and Pipelines project (the project). This report has been prepared in accordance with section 35(3) of the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act).

SunWater Limited, the project proponent, proposes to construct and operate a dam on the upper Dawson River in Central Queensland, 75 km downstream of Taroom.

The dam would become a key component of the State's Dawson Valley Water Supply Scheme which manages supply for the area's industrial and irrigation users, and urban areas including the towns of Theodore, Moura, Baralaba and Duaringa. The dam would replace the existing Glebe Weir.

The project includes a 149.3 km water supply pipeline and pump stations, and associated infrastructure such as new and upgraded roads. The dam would take around 3.5 years to construct.

The EIS stated that Nathan Dam would have a storage capacity of 888,312 megalitres (ML). By comparison, Brisbane's Wivenhoe Dam has a total storage capacity of around 3 million ML.

SunWater confirms that the dam would supply up to 66,011 ML of water per annum (ML/a) to existing and new mining and power customers in the Surat Basin and urban communities along the Dawson River. While existing agricultural users whose supply would be affected by the dam would be supplied by the project, water would not be made available to new irrigation customers, to avoid potential impacts on the Great Barrier Reef due to additional run-off.

As well as the provision of a secure water supply for mining, urban and existing agricultural uses, key project benefits also include:

- $1.2 billion investment in regional Queensland (based on 2012 values)
- improved infrastructure for the region, including upgrades to roads and the establishment of two new community recreation areas
- the creation of 525 peak construction jobs and up to 5 operational jobs
- increased opportunities for local and regional businesses for towns such as Wandoan, Miles and Warra through higher demand for goods and services.

At full supply level (FSL) the dam would inundate an area of up to 13,824 hectares (ha) affecting around 74 parcels of land. SunWater has confirmed voluntary acquisition of affected land would be sought.

The pipeline's easement would affect around 137 parcels of land, with easement agreements to be sought by SunWater.

Compensation arrangements would also be made with water users whose supply would be affected by the dam, which may include SunWater ensuring continuity of supply.

SunWater has confirmed that the project's delivery timeframes are contingent upon demand from new mining customers as the Surat Basin expands.

Matters of national environmental significance

The project is a controlled action and triggers six controlling provisions under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). These are World Heritage properties, National Heritage places, wetlands of international importance, listed threatened species and communities, listed migratory species, and Commonwealth marine areas. A summary of the project's potential impacts on these matters follows.

World Heritage properties and National Heritage Place—Great Barrier Reef World Heritage Area

Impacts on water quality and supply

The dam is located around 620 km upstream of marine waters. As no water is proposed to be allocated to new agricultural users, the dam is not expected to result in any substantial increase in land-based run-off from agricultural activities on the Great Barrier Reef. Mining and industrial projects and urban operators supplied by the dam would be subject to separate approvals for activities which may impact on water quality.

The proponent has committed to manage the project's potential water quality impacts by undertaking construction works during the dry season, implementing sediment and erosion control measures and ensuring that hazardous chemicals and substances are stored and handled correctly.

To reduce water quality impacts from decaying vegetation during the filling of the dam, the proponent has committed to mechanically clear woody vegetation from the dam's water storage area before it fills. While woody vegetation would be removed, around 8,125 ha of grazing land would be inundated which would be expected to contribute to some temporary water quality impacts as a result of the decomposing organic matter (e.g. grass and soils).

This would include an increase in nutrients and turbidity and subsequently lower levels of dissolved oxygen. As most of the woody vegetation would be removed from the water storage area prior to filling, these increases are expected to be small. The proponent would be required to undertake water quality monitoring during the operation of the dam as part of its obligations under the Queensland *Water Act 2000*. I have recommended a condition to the Commonwealth Environment Minister requiring that the results of this monitoring are given to the Australian Government Department of the Environment and Energy (DEE) for consideration in terms of potential water quality impacts on the Great Barrier Reef (GBR).

The proponent has also committed to implement strategies to manage water quality during the operation of the dam, including use of an operational water release strategy and provision of a 10,603 ha buffer area above the FSL and surrounding the dam.

The water release strategy would allow for water releases from the dam to be of better quality by enabling water to be taken from different levels in the dam. For the buffer, vegetation in the buffer area would contribute to better water quality in the dam by filtering any sediments or contaminants from surface water run-off.

I consider that, given the proponent's commitments to manage impacts, the project is unlikely to contribute to any substantial increase of sediments and nutrients entering the GBR system.

Accordingly, the project would be unlikely to affect the State's progress towards meeting the Reef 2050 Plan targets for water quality.

Loss of riparian vegetation

Riparian vegetation plays a key part in protecting water quality values both locally and downstream. The project could result in the loss of 1,676.1 ha of watercourse vegetation (including riparian vegetation) as a result of construction of the dam and the pipeline.

I have stated conditions in this report requiring the proponent to provide offsets to compensate for the loss of State regulated vegetation including watercourse vegetation. The proponent has also committed to rehabilitate and revegetate a 10,603 ha flood buffer area around the dam which would assist in enhancing and increasing the area of riparian vegetation. I support this commitment, and require it to be undertaken.

Given the proponent's commitments and conditions in this report, I consider the project would work to support the State's progress towards meeting the Reef 2050 Plan targets for increasing riparian vegetation in the Great Barrier Reef catchments.

Wetlands of international importance

The project is nearly 700 km from the nearest wetlands of international importance, the Shoalwater and Corio Bays site.

Given the controls on the project's water quality impacts and State legislation which requires the dam to release water for the environment, the project is not expected to result in significant impacts on the wetland's ecological values.

Therefore, I consider the project is unlikely to impact on the habitat or lifecycle of any species of fauna which are dependent on this site, or on its ecological character.

Threatened species and communities

Great Artesian Basin spring ecological community

Approximately 5.6 ha of wetland associated with 23 springs that meet the Commonwealth's definition for the Great Artesian Basin (GAB) spring ecological community (EC) would be inundated by the dam.

To offset this loss, the proponent has committed to secure tenure as a nature refuge for 24 springs located outside of the project area. The condition of these springs would be improved through rehabilitation, exclusion of livestock, weed and pest management

and fire management measures. I support this commitment. I also consider the application of weed and pest management measures within the buffer area surrounding the dam would benefit this EC, and I require this to be undertaken.

In addition, the EIS confirms around 49 springs that meet the definition of the GAB spring EC could be affected by increased groundwater pressure resulting from the dam.

As it is unclear whether increased groundwater pressures and the subsequent increase in groundwater flows may be beneficial or detrimental for the springs, I have recommended a condition requiring the proponent to develop a groundwater dependent ecosystem spring monitoring management program which requires the proponent to monitor any impacts on the springs and to address any such impacts.

I note that a number of the springs that may be affected by groundwater pressures have been identified as potentially suitable offsets. The proponent is required to demonstrate that the offsets are providing a conservation gain. Otherwise an alternative offset will need to be provided by the proponent.

Brigalow threatened ecological community (EC)

The project is expected to impact on a total of 173.3 ha of brigalow EC. This includes 128.9 ha of remnant brigalow EC (including 128.5 ha from the water storage area and 0.4 ha from the pipeline and associated infrastructure footprint), and 44.4 ha of regrowth brigalow EC. The actual amount to be cleared would be confirmed during pre-clearance surveys.

I have recommended a condition to the Commonwealth Environment Minister requiring the proponent to provide offsets for the loss of brigalow EC. The final offset obligation is to be confirmed through pre-clearance surveys which would be used to determine the actual area of the brigalow EC that would be impacted. The recommended condition confirms that prior to construction, the proponent will need to provide an offsets management plan for approval by DEE.

Threatened flora

To address potential impacts on threatened flora, including hairy joint grass and curly bark wattle, I have recommended a condition to the Commonwealth Environment Minister requiring the proponent to undertake a pre-clearance survey for threatened plants in impact areas prior to works starting.

The proponent has committed to translocate any EPBC Act-listed plants identified during pre-clearance surveys to a site outside of the inundation area before the dam is filled. I support this commitment. I have recommended a condition requiring offsets for residual significant impact for threatened flora to be provided if translocation of the plants is unsuccessful.

Boggomoss snail

The project could result in the permanent inundation and subsequent loss of 2.4 ha of suitable boggomoss snail habitat and the loss of the Mount Rose population, which is

one of the six known boggomoss snail populations in the area. The proponent has identified a number of properties within the project area which may be suitable offset sites.

I have recommended a condition to the Commonwealth Environment Minister requiring the proponent to provide an offset to compensate for the loss of 2.4 ha of habitat. Further, my condition requires the offset sites to be lawfully secured via a conservation agreement and managed to ensure viable populations are maintained.

In addition to providing offsets for the loss of habitat, the proponent has committed to translocate the impacted snail population to a suitable location outside the impact area.

I have recommended a condition in this report requiring the proponent to undertake a trial translocation project at a suitable site outside the inundation footprint. The trial must demonstrate that the receiving translocation site can support a self-sustaining population of the snails. The trial should be used to confirm success criteria and appropriate ongoing management actions.

If the trial demonstrates that the receiving translocation site can support a self-sustaining population, the Mount Rose population of boggomoss snails should be translocated to the receiving site which should be secured under a conservation agreement and managed to maintain a viable population.

My recommended conditions include that the proponent is required to undertake long-term monitoring of the translocated population and take corrective actions, if required, to ensure a successful outcome for the population. During the trial, the proponent would be required to provide regular reports to the Commonwealth Environment Minister on the results of monitoring.

Further, I have recommended a condition requiring the proponent to manage water releases from the dam to ensure water supply is maintained at the five known boggomoss snail habitat areas downstream.

The proponent is also required to undertake long-term monitoring of flow regimes during the operation of the dam to ensure the boggomoss snail habitats are not adversely affected. Further, corrective actions are to be undertaken if monitoring shows that habitat areas are adversely affected.

Squatter pigeon (southern)

The project could result in a loss of 3,306 ha of remnant habitat. The loss of this vegetation is unlikely to adversely impact the squatter pigeon, as the species is known to readily traverse open and disturbed areas and would continue to use existing habitat surrounding the water storage area and pipeline.

The EIS indicates that around 10,000 ha of habitat would be improved for the squatter pigeon as result of revegetation and rehabilitation works within the water storage buffer zone, a proposed wildlife corridor, and for offsets. This would compensate for any loss of squatter pigeon habitat, and so I have not recommended that specific offsets be provided for this species.

Fitzroy River turtle

The Fitzroy River turtle and the state-listed white-throated snapping turtle share very similar habitat requirements and biological characteristics. The EIS shows that the project would have similar impacts on both species, including loss of potential nesting and foraging habitat in the inundation area and by presenting a barrier to passage in the Dawson River.

I have imposed a number of conditions to address the project's impacts on the white-throated snapping turtle and as the project would be expected to have similar impacts, I have recommended similar conditions to the Commonwealth Environment Minister for addressing impacts on the Fitzroy River turtle.

I also note that the proponent has proposed a number of commitments to address the project's impacts on both species of turtle and I consider these measures to be appropriate.

Listed migratory species

The white-throated needle-tail, fork-tailed swift, rufous fantail, satin flycatcher and Latham's snipe migratory bird species are known to occur or likely to occur in the project area.

My recommended conditions require compensatory measures to address the loss of habitat, including provision of a 10,603 ha buffer area around the dam's FSL and a wildlife corridor proposed to the north of the dam to benefit migratory bird species.

Revegetation and regenerative works that will be undertaken for the dam's buffer area, the wildlife corridor and offset areas would involve the enhancement of similar habitat to that which would be inundated by the dam. I have set requirements in this report requiring these actions to be undertaken.

Commonwealth marine areas

The closest Commonwealth Marine Area (CMA) to the project is the Commonwealth Coral Sea Marine Reserve which is more than 850 km from the project site. The Coral Sea Marine Reserve is adjacent to, but does not include, the Great Barrier Reef Marine Park. It covers Australian waters from the east of Cape York Peninsula to the north-east of Bundaberg.

Considerations discussed in this section about the project's potential impacts on the Great Barrier Reef World Heritage Area and National Heritage place would also apply to potential impacts on CMAs.

I therefore consider that the project is unlikely to have an impact on any key conservation values relevant to the Coral Sea Commonwealth Marine Reserve and therefore the overall integrity of the CMA.

Matters of state environmental significance

Vegetation connectivity

The EIS has adequately identified the potential impacts on 2,503.7 ha of connected vegetation areas.

To ensure the project does not have any unacceptable impacts on connectivity, I have stated conditions in this report requiring the proponent to limit disturbances to existing vegetation, to provide environmental offsets for the significant residual impacts on vegetation connectivity, and to develop and implement a wildlife corridor revegetation plan.

The condition requires the proponent to prepare an offset strategy which outlines how the loss of connectivity will be addressed. This strategy would be required to be submitted to DNRM for approval, prior to construction of the project.

Regulated vegetation

The project would potentially impact on 1,879.2 ha of regulated vegetation, including 1,750.3 ha of 'of concern' and 128.9 ha of 'endangered' regional ecosystems.

To ensure the project does not present an unacceptable impact on regulated vegetation, I have stated conditions that limit the disturbance of regulated vegetation, and require the proponent to provide offsets to compensate for any significant residual impacts.

The proponent may co-locate offsets for regulated vegetation with offsets for threatened ecological communities and connectivity areas if it can be justified that the management activities for the offset areas can adequately meet offset requirements for all of these matters.

White-throated snapping turtle

The project's inundation area would impact on foraging and nesting habitat for the white-throated snapping turtle. As the proponent has not quantified the area of impact, I have imposed a condition requiring the proponent to undertake further work to quantify the impact and to determine whether this impact would be considered a significant residual impact.

In addition, I have made recommendations for the proponent to ensure that flows downstream are maintained to support nesting and foraging habitat downstream of the dam.

Unmitigated, the dam could create a barrier to turtle passage in the Dawson River. To ensure turtle passage is maintained in the Dawson River I have imposed a condition requiring the proponent to construct turtle passage infrastructure (a turtle way) at the dam. The turtle way is to be designed to facilitate safe passage of turtles around the dam wall.

Waterways providing for fish passage

Without mitigation, the dam is expected to create a barrier to fish passage in the Dawson River and result in the modification and fragmentation of 1,358.85 ha of fish habitat.

To mitigate any adverse impacts on fish passage and habitat I have recommended conditions requiring the proponent to construct a fish passage at the dam wall. In addition, conditions require the proponent to provide financial or direct offsets for the significant residual impact on fish habitat.

Land use

Landholders

The dam's 13,508 ha footprint would impact around 74 parcels of land, while the 149.3 km pipeline will require a 15-metre-wide easement on around 137 parcels of land.

Agricultural land

The project is located in a Strategic Cropping Area designated under the *Regional Planning Interests Act 2014* (RPI Act), which regulates the impacts on matters such as strategic cropping and agricultural areas.

The project would result in a loss of around 4,777 ha of strategic cropping land in the Banana Local Government Area (LGA) and approximately 321 ha of land in the Western Downs LGA, equating to around 0.5 per cent of the Banana LGA of 911,581 ha and around 0.016 per cent of the 1,936,273.4 ha Western Downs LGA.

As the project is not a resource activity as defined in the RPI Act it is exempt from assessment under that Act. However, while cropping land will be affected by the dam, I accept the EIS finding that agricultural activities could continue on properties traversed by the pipeline as it will be located underground.

Further, the proponent has committed to avoid or minimise disruption of land associated with construction of the pipeline by negotiating individually with directly impacted landholders.

To address the land impacts of the project, I expect the proponent to implement its commitments to:

- finalise detailed design for the proposed dam, update flood modelling and provide a copy to Banana Shire Council (BSC)
- negotiate individually with directly impacted landholders and, prior to construction, develop and implement a project land access strategy, land acquisition strategy and compensation strategy
- undertake a recreation facilities options study and enter into a dam community recreational facilities agreement with BSC that will ensure the Glebe Weir recreation area inundated by the dam is replaced with new facilities.

I am satisfied that implementation of these management measures and commitments would reduce land impacts as much as practicable. I expect that potential impacts

would be further reduced through field planning and project refinements that would inform the project's detailed design.

Surface water

Dam wall

Construction of the dam wall would interrupt natural river flows and reduce downstream environmental flows and water access for existing water licence holders.

I am satisfied that these impacts can be managed by the proponent's commitment to establish a diversion channel to allow flows to continue, to not construct during wet seasons and by continuing the operation of the upstream Glebe Weir throughout the 3.5-year construction period. I require these commitments to be undertaken.

Water storage—initial filling period

The volume and frequency of river flows within the Dawson River, and cumulatively within the Fitzroy Basin, will be reduced during the initial filling period of the water storage. I note that the significance of these impacts on water users and the environment is dependent on the time it will take to fill the water storage.

While there is a low risk of environmental flows and water access being restricted during this time, an operational release strategy will be implemented to ensure that environmental flows and supply for water entitlement holders is maintained.

To undertake the project, the proponent will need to obtain a Resource Operations Licence (ROL) under the *Water Act 2000*. To secure the ROL, the proponent is required to obtain DNRM's approval for a final operational strategy for the dam and develop a compensation strategy to ensure that affected water licence holders are fairly compensated and environmental flows are adequate, including during the dam's filling period.

I expect the proponent to consult with DNRM when developing the final operational strategy and to agree on measures that could avoid potential reductions in water access or environmental flows during unanticipated prolonged filling periods. These measures could include:

- emptying of Glebe Weir before dam closure
- maintaining water levels within downstream water storages at higher levels than usual
- drawdown of downstream water storages to a lower level than normal
- increasing water access to existing water entitlement holders prior to dam closure.

In the event that water access is reduced, the proponent has committed to provide financial compensation to affected water entitlement holders, and I require this to be undertaken.

Water storage—operation

Operation of the dam would provide 100 per cent reliable water supply for industrial and urban water customers (known as high priority supplemented water entitlements).

While irrigators (known as medium priority supplemented water entitlements) would experience a reduction in the volume of water supply, they would be provided with a more reliable water supply during the dry season.

Water harvesters (unsupplemented water allocations) are predicted to experience a reduction in water supply by 6,040 ML/a due to operation of the dam. As part of obtaining the ROL, the proponent will be required to consult with affected water harvesters and agree on compensation prior to commencing construction. The final compensation strategy for water harvesters would be subject to approval by DNRM.

I have imposed a condition requiring the proponent to consult with stakeholders and provide a report which demonstrates that stakeholder concerns have been considered in any decisions to avoid, mitigate and manage impacts.

Surface water quality

The existing surface water quality within the Dawson River is as expected of a slightly to moderately disturbed ecosystem, affected by existing water extraction and surrounding vegetation clearing and grazing land uses.

The project has the potential to further degrade the quality of water in the Dawson River due to a range of activities associated with construction, and initial filling period of the water storage and operation of the dam. I am satisfied that construction-related water quality impacts can be adequately managed by the proponent's commitments to limit construction to during the dry season and to implement erosion and sediment control measures.

During operation, poor water quality could result from development of toxic algal blooms, increase in nutrient and sediments from inflow of poor quality water from the catchment, and stagnant water during extended dry periods. If poor quality water is released downstream, this could potentially affect the health of downstream ecosystems and quality of water supplied to existing and new water entitlement holders.

Outbreaks of algal blooms would be avoided by reducing nutrient input by mechanically clearing terrestrial vegetation within the water storage prior to inundation, regular flushing of the water storage during operation, undertaking routine water quality monitoring and ensuring that water is not released in the event of an algal bloom that is classified as a high-risk hazard.

Other impacts include release of cold water downstream, affecting aquatic fauna which have specific water temperature requirements. I am satisfied that this can be adequately managed by using the multi-level off-take structure which would enable selective delivery of water. The multi-level off-take structure would also enable higher quality water to be released downstream. I note that the proponent is required to finalise the operational release strategy, including the first release strategy which would include specific water storage releases needed to minimise water quality impacts during prolonged filling periods.

I am satisfied that the construction and operation of the pipeline would not result in detrimental impacts on surface water quality within watercourses crossed by the

pipeline. I expect the proponent to realign the pipeline to avoid watercourse crossings where possible and to implement standard erosion and sediment controls.

Groundwater

Dam construction

Construction of the dam wall will require dewatering of groundwater over a 50-day period. The groundwater drawdown would be limited to a 1.5 km radius of the dam wall.

The drawdown is unlikely to result in impacts on groundwater bores as there are no groundwater bores within the impact area.

To avoid the dam wall's potential impacts on groundwater–surface water connectivity, a grout curtain would not be installed as part of the wall's foundations.

I have recommended that the proponent prepare and implement a Groundwater Monitoring and Management Plan, including a Bore Monitoring and Management Plan. These plans will detail monitoring of groundwater quality and levels during construction and operation of the project and identify corrective actions. The Groundwater Monitoring and Management Plan will need to be approved by DNRM and the Department of Environment and Heritage Protection (EHP).

Dam operation

The dam's water storage is expected to increase the groundwater levels of underlying aquifers. This is predicted to occur when the water storage is at or above a FSL of 181.7 m Australian Height Datum (AHD), and was modelled, at a maximum impact scenario, as likely to occur around 60 times over a 107-year period.

Increase in groundwater pressure could result in collapse or failure of 157 registered groundwater bores known to be present within the project area.

The proponent has committed to undertake a bore survey to confirm the presence of bores and to undertake a risk assessment of the likely impacts. The proponent has further committed to consult with affected groundwater users and agree on rehabilitation or replacement of high-risk bores. I support this commitment, and require it to undertaken.

Seven groundwater bores located within the water storage area could be inundated. I require the proponent to fulfil its commitment to undertake negotiations with affected groundwater users about compensation and make good agreements.

Groundwater quality could be also impacted as a result of seepage of saline surface water from the water storage into the underlying fresh groundwater; however as the water within the water storage would be of better or comparable quality, impacts are not expected to be detrimental.

To ensure that impacts on groundwater quality, groundwater bores and groundwater–surface water connectivity are avoided or managed, I require the proponent to:

- prepare a detailed groundwater monitoring and management plan and a bore monitoring and management plan, at least 12 months prior to construction
- conduct a bore survey to confirm the presence and condition of groundwater bores that may be affected by the predicted increase in groundwater pressure
- consult with affected groundwater users and finalise make-good agreements
- monitor groundwater levels during dewatering, construction and operation of the project and submit results to DNRM and EHP for their review and comment.

To ensure that make-good agreements are in place for affected groundwater users, I require the proponent to submit a bore mitigation strategy for DNRM's review and approval prior to construction.

Flooding

The proponent has undertaken a preliminary flood study, which found that changes in the catchment's hydrodynamics would occur when the water storage is at FSL of 183.5 m AHD.

An increase in peak flood level of 0.6 m is predicted to occur upstream of the dam at Taroom. However, the overall peak level would still be below the town's minimum development level of 190.1 m AHD, the level that new residences must be constructed above.

The dam would reduce flood peaks downstream, for example the 1-in-100 Annual Exceedance Probability (AEP) peak flood level would reduce by up to 0.5 m, however the peak water level post-dam would be reached slightly later and would recede over a longer period (2–3 weeks) compared with approximately 10 days pre-dam.

I consider the information provided by the proponent in the EIS and AEIS with regard to potential flooding impacts is suitable for the preliminary design stage of the project. I require the proponent to update this flood modelling to increase its accuracy and incorporate the latest flood data, including climate variability scenarios. I also expect the proponent to provide the revised flood modelling to Banana Shire Council prior to construction.

I note the proponent proposes to acquire flood affected properties and easements on a voluntary basis. The proponent has advised that the processes and procedures required by the *Acquisition of Land Act 1967* would be undertaken if a voluntary agreement cannot be reached.

To ensure proper engagement with affected landholders, I have imposed a condition requiring the proponent to submit a stakeholder engagement plan six months before construction commences. I consider that this condition will provide assurance to landholders that negotiations will be transparent and that there will be opportunities for stakeholder review and comment.

With regard to ensuring safe releases of any flood waters, I note that safety requirements for the dam during operations will be based on the proponent's existing safety procedures and in line with legislative requirements of the *Water Supply (Safety and Reliability) Act 2008,* Queensland Dam Safety Management Guidelines (DNRM,

2002) and the Australian National Committee on Large Dams Incorporated *Guidelines on Dam Safety Management 2003*.

I note that submissions were made during the EIS process about potential flooding north of Taroom and on the Leichhardt Bridge and surrounds as a result of the project. I expect the proponent to fulfil its commitment to update flood modelling upon finalisation of the detailed design, and I require this modelling data to be provided to the Banana Shire Council.

Social and economic impacts

The project would deliver social and economic benefits to the region and State through increased local employment, opportunities for local suppliers, capital expenditure in the region, and the provision of a secure water supply for mining, urban and existing agricultural uses.

The proponent undertook an economic impact assessment using an input-output methodology. Economic impacts of the project include reduced agricultural production due to water storage and inundation and reduced access to existing surface water and groundwater for some existing harvesters. To manage these impacts, the proponent has committed to:

- voluntary acquisition as a first step and following the requirements of the *Acquisition of Land Act 1967* if voluntary agreement cannot be reached
- develop a program of financial compensation to offset negative impacts on existing water harvesters in accordance with the Water Act
- manage potential impacts on water users through replacement, rehabilitation or make-good agreements.

The proponent's social impact assessment (SIA) considered the following in relation to the project:

- community and stakeholder consultation
- workforce and housing
- community health, safety and wellbeing
- local business and industry content.

I have imposed a condition requiring the proponent to update the SIA and associated social impact action plans prior to commencement of construction. The purpose of this condition is to ensure that the SIA reflects the current social context and informs effective social impact action plans.

The proponent has committed to a number of strategies to mitigate and manage potential social impacts and to maximise social benefits of the project including:

- ongoing liaison and communication with landholders, residential communities, local and regional government, and industry
- the development of a workforce accommodation and housing strategy
- strategies to address weed management, traffic and road conditions, dust and noise

- opportunities for local business and suppliers to tender in line with the Queensland Procurement Policy (2013).

To ensure that stakeholder interests in the project are clearly identified and effectively managed, I have imposed a condition that requires the proponent to develop a detailed project-wide stakeholder engagement plan, to be submitted for review and approval six months prior to any land acquisition.

To ensure effective delivery of social benefits and adherence to social commitments, I have imposed a condition for the proponent to provide an annual Social Impact Management Report for five years from the commencement of construction.

The report will require the proponent to demonstrate how they have addressed any stakeholder and community issues such as land access, land acquisition and compensation, local and regional training and employment, any impacts on local and regional housing markets, and community health, safety and wellbeing.

Traffic and transport

The project is expected to impact the local and state-controlled road network and the local stock route network during construction and operation.

Impacts will be both temporary and permanent. A number of roads within the dam FSL will require closure or diversion or experience decreased flood immunity as a result of the dam, and upgrades to support construction traffic will be required.

The proponent will further define impacts on local and state roads and the stock route network at the detailed design stage.

I support the proponent's commitments to manage traffic and transport impacts, including ongoing consultation with councils, the Department of Transport and Main Roads (TMR) and stakeholders, and further refinement of the transport impact assessment at the detailed design stage, and I require these to be undertaken by the proponent.

I have set recommendations in this report requiring preparation of a road impact assessment and road-use management plan which will be subject to approval by councils and TMR. Agreements on the undertaking of road works or contributions required to be made to these authorities towards the works will also need to be in place before construction commences.

I am satisfied that the proponent's commitments, and my recommendations, would appropriately manage the project's traffic and transport impacts.

Air quality and noise

I am satisfied that the air and noise emissions generated by construction works required for the project would be within acceptable levels provided that the proposed buffer distances between emitting activities and sensitive receivers such as residences are maintained.

Where maintaining buffer distances is not possible, the proponent proposes to implement mitigation measures identified in the EMP including using water sprays to

control dust, stabilising and rehabilitating exposed soils and minimising vehicle speeds on unsealed access routes.

For the operation of the project, the proponent has committed to ensure that noise from the pipeline's pump station would not exceed 28 decibels A-weighted (dB(A)) at nearest sensitive receivers from the pumping station. This is the equivalent of noise experienced during a quiet rural night time.

Non-Indigenous cultural heritage

The dam and pipeline construction works would temporarily affect access to a number of non-Indigenous cultural heritage sites. The proponent proposes a range of mitigation measures including temporary fencing and delineation of buffer zones, as well as the development of site-specific archaeological management plans.

In addition, the dam would permanently inundate the Glebe Homestead, which is listed on the Queensland Heritage Register.

Under the provisions of the *Queensland Heritage Act 1992* (QH Act), the proponent is required to undertake an analysis to determine the most appropriate actions to conserve the character of the Glebe Homestead, the outbuildings and the garden setting before a decision can be made on a proposal to affect the heritage item.

I require the proponent to further consider the options of relocating, or recording and abandoning the homestead.

I have also recommended that the proponent engage with EHP as soon as practicable about possible options to retain the heritage characteristics of Glebe Homestead.

Indigenous cultural heritage

The project would impact on sites of Indigenous cultural heritage during construction and operation, resulting in the partial inundation of the former Taroom Aboriginal Settlement and the full inundation of a former Aboriginal Camp at Glebe Weir.

To ensure the impacts on parts of the former Taroom Aboriginal Settlement are managed, I have recommended that, prior to construction, the proponent engage with EHP about a heritage agreement under the QH Act and the scope of a management plan that should cover the matters of historic heritage and archaeology.

I am satisfied with the extent of consultation activities undertaken to date and that the proponent has either entered into agreements with affected Indigenous parties or has committed to do so. Furthermore, I note that consultation with affected Aboriginal parties will continue as part of negotiating cultural heritage management plans.

Coordinator-General's conclusion

In undertaking my evaluation, I have considered information including the initial advice statement, EIS, additional information to the EIS (AEIS), technical reports, submissions on the EIS and AEIS, technical advice and clarifications from the proponent, and advice received from Commonwealth and State advisory agencies.

I consider that the environmental impact assessment requirements of the SDPWO Act for the Nathan Dam and Pipelines project have been met and that sufficient information has been provided to enable a thorough evaluation of the potential impacts of the project.

I conclude that the project would deliver a more secure water supply that would help meet the future water demands of existing and new mining and power customers in the Surat Basin and urban communities along the Dawson River.

The project has the potential to generate significant economic benefits throughout the region, including 525 peak construction jobs, up to 5 operational jobs and capital expenditure of $1.2 billion (based on 2012 values).

Accordingly, I recommend that that the project proceed, subject to conditions and recommendations included in this report. In addition, I expect that the proponent's commitments will be fully implemented as presented in the EIS documentation and summarised in Appendix 5 of this report.

My report will be provided to the Commonwealth Environment Minister, pursuant to section 36(2) of the State Development and Public Works Organisation Regulation 2010. My report will inform the assessment decision by the Minister on the controlled actions for the project in accordance with section 133 of the EPBC Act.

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.statedevelopment.qld.gov.au**

Barry Broe

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Barry Broe
Coordinator-General

30 May 2017

1. Introduction

This report provides an evaluation of the environmental impact statement (EIS) for the Nathan Dam and Pipelines project (the project). This report has been prepared pursuant to section 35(3) of the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act).[1]

It is not intended to address in this report all the matters that were identified and subsequently addressed; rather, it concentrates on the substantive issues identified during the EIS process and the measures and conditions required to address the impacts. This report:

- summarises the key issues associated with the potential impacts of the project on the natural, physical, social and economic environments at the local, regional, state and national levels
- presents an evaluation of the project, based on information contained in the EIS, additional information to the EIS (AEIS), submissions made on the EIS and AEIS during public consultation periods and information and advice from advisory agencies and other parties
- imposes conditions and makes recommendations under which the project may proceed
- documents the proponent's commitments.

2. About the project

2.1 The proponent

The proponent for the project is SunWater Limited (the proponent), a statutory Government Owned Corporation under the *Government Owned Corporations Act 1993* (Qld). The proponent is a bulk water infrastructure developer and manager which owns and manages around $10 billion in water infrastructure assets and supplies approximately 40 per cent of all commercially used water in Queensland.

The proponent's network of water supply infrastructure supports mining, power generation, industry, urban development and irrigated agriculture throughout Queensland.

[1] Pursuant to section 197 of the SDPWO Act, the version of the Act in force at the time the project was declared (Reprint No. 5B, November 2007) applies for the evaluation of the project.

2.2 Project description

The proponent proposes to construct and operate a dam on the Dawson River and connecting water distribution infrastructure in Central Queensland. The project would service existing and new mining and power customers in the Surat Basin and urban communities along the Dawson River, as well as existing agricultural users whose supply would be affected by the dam.

The project was identified in the Queensland Government's Central Queensland Regional Water Supply Study (2005) as the preferred option for providing water security for the region. It would expand the volume of water available within the Dawson Valley Water Supply Scheme (DVWSS) however due to the proposed pricing of water and anticipated demand from industry, water supply is not proposed for new agricultural purposes.

2.2.1 Location

The project would be located in Central Queensland within the Banana Shire Council (BSC) and Western Downs Regional Council (WDRC) local government areas (LGAs). The water storage area is within the bounds of the BSC and the pipeline traverses both LGAs.

The dam wall would be located on the upper Dawson River, 75 km downstream of the township of Taroom along the river (35 km directly north-east), 11 km downstream of the Glebe Weir and 8 km upstream of Nathan Gorge (Figure 2.1).

It would be located at adopted middle thread distance (AMTD) 315.3 km from the confluence of the Dawson and Fitzroy Rivers and 620 km from the mouth of the Fitzroy River where it meets the sea. The water storage area would extend from the dam wall to just north of Taroom. The dam wall is proposed to be located in a steep-sided valley in a relatively straight section of the Dawson River.

The pipeline would extend south from the dam wall and terminate north of Warra and would include the construction of 149.3 km of new pipeline as well as the use of the existing 69.4 km Woleebee Creek to Glebe Weir pipeline (W2G pipeline).

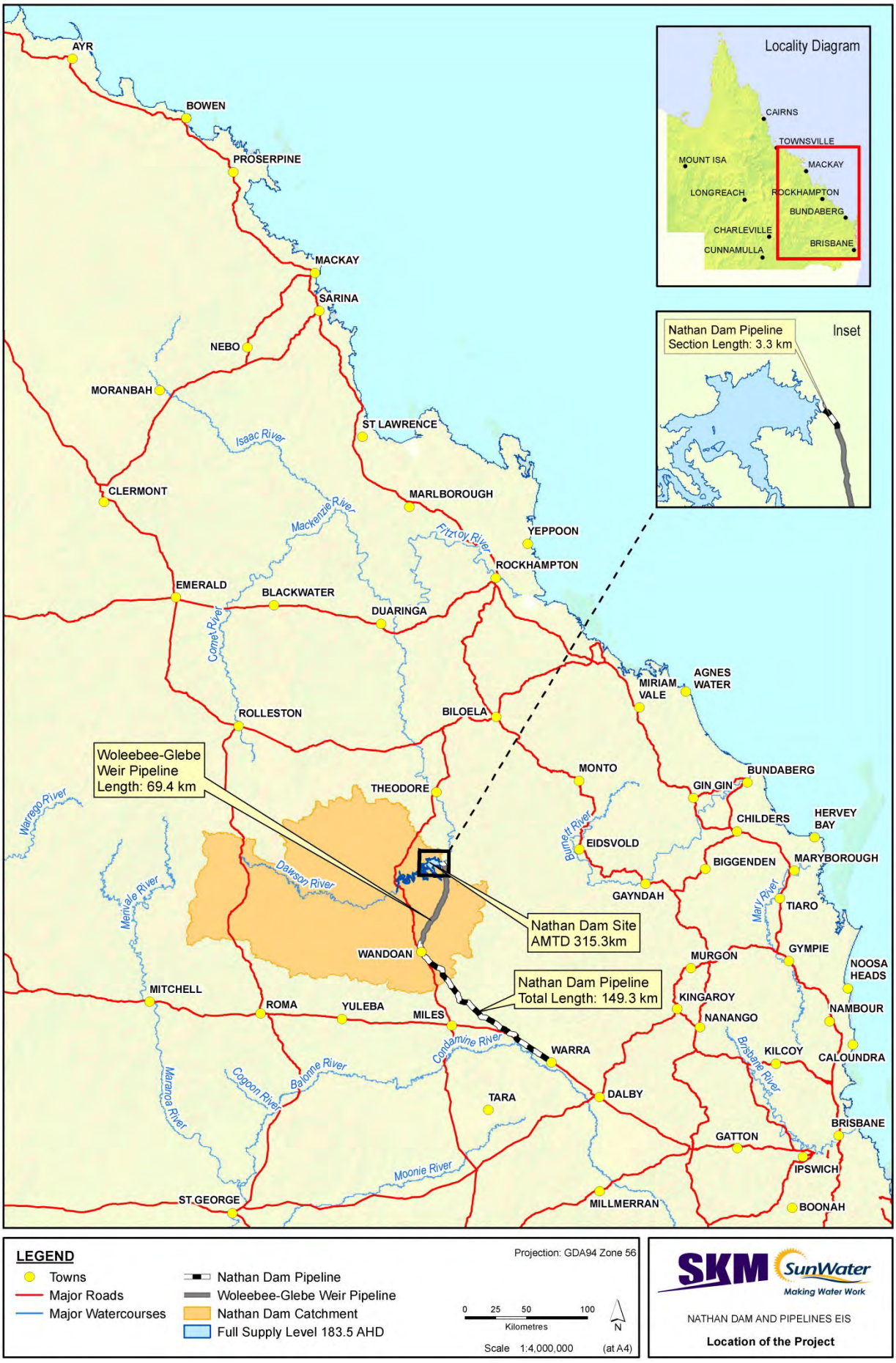

Figure 2.1 Project location

2.2.2 Components

My evaluation considers the project in three parts—the dam and surrounds; the pipeline; and associated infrastructure including roads, water, power and telecommunications infrastructure and recreation facilities.

Dam and surrounds

The dam and surrounds include the following components:

- **dam wall**—an earth and rockfill embankment built to an elevation of 183.5 m Australian height datum (AHD). The dam wall would measure 1,240 m wide, 38 m high from the stream bed and have a maximum base thickness of approximately 280 m tapering upwards to an 8-metre-wide crest
- **spillway**—a 200-metre-wide ungated mass control crest situated on the right abutment and built 23.5 m above the streambed. The spillway has been designed without gates to minimise flood impacts both upstream and downstream of the proposed dam
- **saddle dam**—an embankment built to an elevation of 201 m AHD, located 1,150 m south-east of the spillway measuring 730 m long and up to 8 m high
- **water storage area**—includes the full supply level (FSL) and flood buffer. At the FSL the dam would have a storage capacity of 888,312 megalitres (ML) and a surface area of 13,508 hectares (ha). The flood buffer would be established as an easement which would extend over land between the FSL and the 1-in-100 annual exceedance probability (AEP) flood level. The easement, requiring 10,603 ha of land, would be designed and located in consultation with landholders and would have regard to specific site characteristics such as slope, vegetation and existing infrastructure
- **intake structure with multi-level offtake and outlet works**—a selective withdrawal system to enable the best quality water to be extracted and outlet conduits with facilities to regulate and control water flow
- **aquatic fauna transfer devices**—a fishway (bidirectional fish lift) and turtle way (constructed channel between dam pondage and the downstream river) accommodating upstream and downstream aquatic fauna movement
- **dam chimney filter**—a sand drain which extends through the foundation of the dam to prevent the risk of erosion beneath the embankment
- **dewatering bores**—dewatering bores located around the excavation with some drilled to depths above the sandstone and foundation and others below it—groundwater discharge from the bores would be pumped via pipeline to a sedimentation pond on the left bank of the river.

Pipeline

The pipeline component of the project includes:

- **a pipeline from the dam wall to the existing W2G pipeline**—3.3 km of buried 1,200 mm pipeline connecting the dam to the existing W2G pipeline

- **a pipeline from Woleebee Creek to north of Warra**—146 km of buried pipeline following existing easements (notably road reserves)
- **water supply infrastructure**—including pumps at the dam site, three pump stations and associated balancing storages along the route, air release valves (at alignment high points), and scour valves (at alignment low points), surge tanks and standpipes.

As shown in Figure 2.1, the project would connect with the existing W2G pipeline which is owned and operated by the proponent and commenced operation in 2015. It currently transports treated coal seam gas (CSG) water from the Surat Basin gas fields south-west of Wandoan to the Glebe Weir for use within the DVWSS.

The W2G pipeline was designed to include fittings where it would meet the project at chainage 3.3 km and 72.7 km to allow the linking of the project's pipeline with minimum disturbance.

Demand for water from this project is expected to occur once the volume of CSG water available is too low to fulfil the pipeline demands, in which case the W2G pipeline would cease transporting CSG water and the flow of water would be reversed to enable the pipeline to be used for delivering river water to pipeline customers.

Associated infrastructure

Associated infrastructure that would be constructed, relocated or decommissioned includes:

- a new 6.5 km dam site access road linking into the local road network
- the upgrade, closure and/or realignment of local roads and property access tracks
- a new two-lane road for access to a new recreation area on the southern side of the dam
- new gauging stations at the headwater and tailwater of the dam and at major tributaries upstream of the dam
- the upgrade, removal or relocation of affected power and telecommunication infrastructure
- the decommissioning of the existing Glebe Weir infrastructure
- the decommissioning of a 10.3 km section of the W2G pipeline between the Glebe Weir and chainage 3.3 km of the project and the associated 3.1 km of maintenance track
- construction of new recreational facilities—featuring two picnic areas and boat ramps located on the southern side of The Bend and on the northern side of the termination of Glebe Weir Road at Boggomoss Creek; and a viewing platform provided at the dam wall.

It is anticipated that the project would also require the use of new and temporary construction camps and resource extraction areas. The impacts relating to these developments would be assessed as part of separate approval processes.

2.2.3 Project change

The proponent advised in the AEIS that the pipeline would terminate north of Warra instead of extending a further 44.6 km to supply water the town of Dalby as proposed in the EIS.

This refinement was made to the project as a result of advice from WDRC that the council would not potentially require water from the project for approximately 30 years and also on the basis that there were no potential customers north of Dalby until around Warra.

It should be noted that any future pipeline to Dalby would be treated as a lateral pipeline and relevant approvals would be sought at the appropriate time.

2.2.4 Water supply

Once the dam is operational, it would supply 66,011 ML of water per annum (ML/a) to existing and new mining and power customers in the Surat Basin and urban communities along the Dawson River, as well as existing agricultural users whose supply would be affected by the dam.

It is proposed that 47,700 ML/a of this volume of water from the dam would be distributed by the project's pipeline to the Surat Basin mines, urban areas, power stations and other industries. The remaining 18,311 ML/a would be released downstream along the Dawson River to supply the DVWSS, Bowen Basin mining and industrial areas and the Lower Fitzroy Water Supply Scheme.

New high-priority water products supplied to downstream customers would be extracted via the following existing water infrastructure:

- 750 ML/a supplied from Gyranda Weir
- 400 ML/a supplied from Theodore Weir
- 7,092 ML/a supplied from Moura Weir
- 2,269 ML/a supplied from Neville Hewitt Weir
- 7,800 ML/a extracted at Duaringa (from the Boolburra Waterhole) and supplied from Neville Hewitt Weir.

The proponent is committed to continue supplying water to existing irrigation water licence holders in these schemes, however as discussed, no water would be supplied to new customers for agricultural purposes.

2.2.5 Project development stages

Pre-construction

The proponent would undertake pre-construction activities including land acquisition, obtaining all necessary permits, vegetation clearing and fauna relocation, establishment of material laydown areas and site decontamination.

Within the dam site, trees and shrubs would generally be cleared to the FSL with grasses left undisturbed, with the exception of the riparian zone of the Dawson River

and any tributaries, where vegetation would be cleared to within 1.5 m of the FSL. Other physical works would include upgrading and constructing access roads, the extension of power and communications facilities to the water storage construction site, establishment of site offices, workers accommodation and resource extraction sites and the transportation of construction materials.

Construction

Construction activities are proposed to be undertaken seven days a week, 12 hours per day from 6 am to 6 pm over a 3.5-year period.

Construction of the dam components—including the diversion channel and coffer dams, earth and rockfill embankment, the spillway, saddle dam, intake structure and outlet works, turtle way and fishway—would take place over 36 months with the construction of the dam wall to be carried out over two dry seasons and the placement of the dam wall ceasing over the wet season (November to March).

During construction, river flows would be diverted around the construction site via a diversion channel. Groundwater dewatering would occur for approximately 50 days to facilitate the construction of the dam chimney filter.

The pipeline is proposed to be laid simultaneously on four work fronts over a 33-month period with up to 1 km of pipe laid each day on each work front. Key construction activities include: excavation of trenches, pipe laying, construction of each of the three pump stations and associated balancing storages, vegetation clearing, river/creek crossings, general pipeline fittings and electrical and mechanical fit-out.

Initial dam filling phase

The dam construction is expected to be completed prior to the start of a wet season. Although the time needed to fill the water storage is dependent on rainfall conditions and the volume of inflows, it is expected that with average rainfall conditions the minimum operating volume (MOV) of 34,502 ML would be reached within 6 months and that full supply volume of 888,312 ML would be reached within 2.6 years.

Until the MOV is reached, environmental flows of the Dawson River would be maintained through water releases via the diversion channel.

Operation

The dam would be commissioned once the MOV is achieved and the proper and effective operation of the intake structure, outlet works and fishway and turtle way had been confirmed.

The engineering design life of the project is expected to be 100 years, although the dam is likely to be maintained after that period providing it continues to meet safety requirements and remains an integral part of the regional water supply strategy. The design life of the pipeline is 80 years. Pumps, valves and motors would have a design lives ranging from 20 to 40 years.

2.2.6 Infrastructure requirements

Roads

The project would require the construction of a new 6.5 km, two-lane sealed access road to the dam extending from Glebe Weir Road to the left (northern) bank of the Dawson River. This road would be owned and operated by BSC.

Upgrades or realignments would be required for local roads in the region including the:

- upgrade of 25 km of Glebe Weir Road
- upgrade of the intersection of Glebe Weir Road and the Leichhardt Highway
- construction of a two-lane rural road bridge on Cracow Road at Cockatoo Creek
- construction of a two-lane rural road causeway with culverts on Cracow Road at Bentley Creek
- closure of the Bundulla Road crossing of the Dawson River and construction of turning circles at the terminus on each side of the river
- realignment of The Bend Road where the storage cuts across the existing road
- realignment of Brodies Road where the storage cuts across the existing road.

Further information on traffic and transport impacts of the project can be found in Section 5.8.

Power supply and telecommunications

The project would require power and telecommunication infrastructure to service the dam site during construction and operation. This infrastructure would be installed adjacent to the dam access road as far as possible. Existing overhead powerlines and telecommunications cables situated with the proposed water storage area would be relocated by the asset owners prior to commencement of the project construction.

New infrastructure would be required to supply power to the pump stations and it is anticipated that this power supply would be sourced from the proposed Powerlink substation located south-west of Wandoan and the existing Ergon Energy infrastructure in the area.

Power required along the pipeline route would be provided by a portable generator or solar panels.

Water and sewerage

Dam

As there is no water and sewerage network in the dam construction area, the proponent has identified that:

- water supply for the dam construction would be drawn from the Dawson River under permit or from sedimentation ponds
- potable water sources would include rainwater and town water delivered to the site by tanker and stored in holding tanks

- relocatable toilet facilities would be provided and serviced by a contractor during construction and septic tanks would be constructed for the permanent dam site office located within the dam construction area
- dry composting toilets would be constructed at new recreational facilities.

Pipeline

Potable water supply for project offices and accommodation camps associated with the pipeline would be drawn directly from the town water supplies in consultation with the relevant local council and trucked to the work fronts. Relocatable toilet facilities would be provided and serviced by a contractor during pipeline construction.

Water for construction of the pipeline would be drawn from the Dawson River and the Condamine River and tributaries, under permit and in consultation with DNRM.

Resource extraction areas

The project would require quarried raw materials (coarse aggregate, sand, pavement material and clay) for the construction of the earth and rockfill dam embankment, concrete, access and haul roads, pipeline bedding sand, erosion protection and landscape rehabilitation. These are proposed to be mainly sourced from licensed quarries and extraction areas located off site and it is expected that several sources of the material would be required to satisfy the project's demand, with up to two of the rock quarries and three of the earth and sand borrow areas expected to be operating at the same time.

Nine potential clay borrow areas have been identified on site within the water storage area. The deposits are expected to be small to medium volume and although one area has been identified as the most likely source, each of the possible clay borrow areas are undeveloped and would require appropriate investigation and permitting prior to use.

2.2.7 Project rationale

Project benefits

Benefits of the project include:

- capital expenditure of A$1.2 billion (based on 2012 values)
- development of a secure water supply for future industry
- improved infrastructure into the region including upgrades to local and state-controlled roads
- the creation of approximately 525 peak construction jobs and up to five local jobs during operations in a mixed workforce including on-site construction workers and professional support personnel including engineers, clerical staff, supervisors, foremen, soil technicians, and environmental officers
- direct and indirect local, regional and Indigenous employment opportunities
- increased opportunity and viability for local and regional businesses through demand for goods and services arising from project-related expenditure.

Regional demand for water

The project was identified in the Queensland Government's Central Queensland Regional Water Supply Study (2005) as the preferred option for providing water security for the region. The strategy informed the Central Queensland Regional Water Supply Strategy (CQRWSS) (2006) which identified the projected demand, the adequacy of existing supplies and potential shortfalls of water in the Upper Dawson Region and indicated that the project would be necessary to meet the future urban, industrial and coal mining requirements and to avoid supply shortfalls throughout the region.

Commencement of the project is contingent upon demand from mining customers and their development timeframes. Currently the region is experiencing a slow-down in the mining industry, however the proponent has indicated there is a strong likelihood that the minimum demand required to make the project economically viable would exist when funding is sought from mining customers to begin significant works.

Furthermore, the availability of treated CSG water would delay the need to construct Nathan Dam until such time as the volume of available CSG water could not fulfil pipeline demands and the demand for Nathan Dam water increased.

2.2.8 Dependencies and relationships with other projects

Woleebee Creek to Glebe Weir pipeline

As previously discussed, the project's pipeline can readily link with the required sections of the W2G pipeline with minimal disturbance.

Coal mining

The project is contingent upon the viability of potential coal mining customers and on their development timeframes and would advance once sufficient foundation customers have committed to financially supporting the project through its developmental stages.

The Surat Basin has large thermal coal reserves suitable for open-cut mining and export to international markets. Mines established within the region include New Acland, Wilkie Creek and Cameby Downs mines. There are several other coal projects within the region at various stages of planning and/or assessment.

Glencore's approved Wandoan Coal Project, comprising a number of open-cut coal mines with an estimated mine life in excess of 30 years, is expected to produce approximately 30 million tonnes per annum of run-of-mine thermal coal. The Wandoan Coal Project has been on hold pending market considerations since 2013.

It is expected that if and when individual mines develop, the mine proponents would be required to analyse and advise of the extent of water needs and supply options available to satisfy the mine requirements. Stored water in Nathan Dam and the availability of the pipeline would form part of each project's assessment of this aspect. If Nathan Dam were to be constructed it would be necessary to construct supply delivery infrastructure—e.g. lateral pipelines—linking the specific demand node to the pipeline.

2.2.9 Project alternatives

Project alternatives are presented in the CQRWSS, including the taking of groundwater from the Great Artesian Basin (GAB) and the beneficial use of CSG water, however the EIS found that:

- groundwater supply is currently considered to be over-allocated in the Surat Basin and therefore not a viable source for supplying the mining industry
- CSG water has a lack of long-term certainty of its supply and so the project would still be necessary to meet long-term water security requirements of the mining industry.

The EIS also evaluated other sources of water that were not considered to be viable alternatives to the project due to insufficient volume, high cost or excessive distance from the region including:

- improved recycling, system management and water-use efficiency of rural and urban water usage in the Mackay, Rockhampton and Gladstone regions
- desalination and pumping of water from a coastal desalination plant
- accessing alternative proposed surface water supplies from the Connors River Dam, the raised Eden Bann Weir and the Rookwood Weir.

3. Environmental impact statement assessment process

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

- the initial advice statement
- the EIS and technical reports
- issues raised in submissions on the EIS
- other correspondence received after the submission period of the EIS
- the AEIS and technical reports
- issues raised in submissions on the AEIS
- advice from the proponent
- advice from the following Australian Government agencies:
  - Department of Sustainability, the Environment, Water and Energy (DSEWPaC) (now the Department of Environment and Energy [DEE])
  - Great Barrier Reef Marine Park Authority.
- advice from the following state agencies:[2]
  - Department of Aboriginal, Torres Strait Islander and Multicultural Affairs (DATSIMA)
  - Department of Agriculture, Forestry and Fisheries (DAFF)

[2] The names of some government agencies have changed since the EIS was made publicly available.

  - Department of Communities, Child Safety and Disability Services (DCCSDS)
  - Department of Education, Training and Employment (DETE)
  - Department of Environment and Heritage and Protection (EHP)
  - Department of Housing and Public Works (DHPW)
  - Department of Natural Resources and Mines (DNRM)
  - Department of State Development, Infrastructure and Planning (DSDIP)
  - Department of Transport and Main Roads (TMR)
  - Queensland Health
  - Queensland Police Service (QPS).
- advice from the following Councils:
  - Banana Shire Council (BSC)
  - Western Downs Regional Council (WDRC).

The steps taken in the EIS process for the project are documented on the project's webpage at **www.statedevelopment.qld.gov.au/nathan-dam**

3.1 State environmental impact assessment process

3.1.1 Coordinated project declaration

On 2 May 2008, the then Coordinator-General declared the Nathan Dam and Pipelines project to be a 'significant project'[3] under section 26(1)(a) of the SDPWO Act. This declaration initiated the statutory environmental impact evaluation procedure of Part 4 of the Act, which required the proponent to prepare an EIS for the project.

3.1.2 Terms of reference

The draft terms of reference (TOR) for the EIS for the project were released for public and advisory agency comment from 13 September 2008 to 17 October 2008. Submissions were received from advisory agencies, non-government organisations and the general public.

The draft TOR was amended having regard to comments received and issued to the proponent as the final TOR on 13 February 2009.

3.1.3 Review of the EIS

The draft EIS prepared by the proponent was released for public and agency comment from 23 April 2012 to 5 June 2012.

Comments were received from 58 submitters, including 20 submissions from local, state and Commonwealth agencies, 9 submissions from non-government organisations

[3] Amendments to the SDPWO Act in December 2012 resulted in the replacement of the term 'significant project' with 'coordinated project'.

and 29 from individual submitters. The most prominent issues raised in submissions from advisory agencies, non-government organisations and the public related to:

- potential impacts on:
  - the Great Artesian Basin (GAB) springs
  - the boggomoss snail
  - the white-throated snapping turtle and the Fitzroy River turtle
  - water users
  - agricultural land
- compensation for affected water users and landowners
- impacts from flooding as a result of the development
- surface water
- groundwater.

3.1.4 Additional information to the draft EIS

On 26 July 2012, I requested the proponent submit additional information regarding:

- impacts on the boggomoss snail population and the GAB springs
- revised surface water modelling
- pipeline alignment options
- mitigation measures for potential impacts on strategic cropping land
- design of aquatic fauna transfer devices
- an updated social impact management plan
- a draft offsets strategy.

On 20 September 2016, the proponent submitted the AEIS and I approved its release for public and agency comment between 8 October 2016 and 7 November 2016. Twenty-two submissions were received, including 13 submissions from state and Commonwealth advisory agencies, 1 from a local government, 5 from non-government organisations and 3 from private submitters. Copies of the submissions were forwarded to the proponent and to DEE.

I have reviewed the AEIS, submissions and other material relevant to the project and I consider that all submissions made on the draft EIS and AEIS have been satisfactorily considered.

I note that the EIS material has been developed over a nine-year period and some information has become outdated. Where I consider this has occurred I have provided conditions and recommendations requiring the proponent to update relevant information prior to the commencement of construction.

3.2 Commonwealth assessment

3.2.1 Matters of national environmental significance

On 30 July 2008 the then Commonwealth Environment Minister's delegate determined that the project is a 'controlled action' under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) (EPBC ref. 2008/4313).

The relevant controlling provisions under the EPBC Act are:

- World Heritage properties, sections 12 and 15A
- National Heritage places, sections 15B and 15C
- wetlands of international importance, sections 16 and 17B
- listed threatened species and communities, sections 18 and 18A
- listed migratory species, sections 20 and 20A
- Commonwealth marine areas, sections 23 and 24A.

The Commonwealth has accredited the State of Queensland's EIS process conducted under the SDPWO Act under a bilateral agreement between the Commonwealth and the Queensland Government. Under the bilateral agreement, if a controlled action is a 'coordinated project for which an EIS is required' under the SDPWO Act, certain types of projects do not require assessment under Part 8 of the EPBC Act. The agreement enables the EIS to meet the impact assessment requirements of both Commonwealth and Queensland legislation.

Under Part 4 of the SDPWO Act and section 36 of the State Development and Public Works Organisation Regulation 2010, the Coordinator-General must ensure the assessment report evaluates all relevant impacts that the action has, will have, or is likely to have, and provide enough information about the action and its relevant impacts to allow the Commonwealth Environment Minister to make an informed decision whether or not to approve the action under the EPBC Act.

The controlled action may be considered for approval under section 133 of the EPBC Act, once the Commonwealth Environment Minister has received the Coordinator-General's EIS evaluation report (prepared under section 34D of the SDPWO Act).

Section 6 of this report (Matters of national environmental significance [MNES]) explains the extent to which the Queensland Government EIS process addresses the actual or likely impacts of the project on the MNES covered by each controlling provision.

3.2.2 Historical assessment of the Nathan Dam project

A dam on the Dawson River was originally proposed in 1922. The project gained impetus during the 1990s due to ongoing drought and increasing water demands in the region. An impact assessment study was completed by Hyder Consulting Pty Ltd for the Department of Natural Resources in September 1997. The study found that, with appropriate management, no significant adverse impacts existed that would prevent

the development from being progressed. Expressions of interest to build the dam were then sought from the private sector. SUDAW Developments Ltd (SUDAW) was chosen as the preferred developer on a fully commercial basis.

On 16 December 2002, the Australian Government determined that the Nathan Dam project was a controlled action under the EPBC Act (EPBC reference 2002/770). The project was subject to one controlling provision—listed threatened species and communities (sections 18 and 18A).

In December 2003, the Queensland Conservation Council and World Wide Fund for Nature successfully challenged, in the Federal Court of Australia, the scope of the investigations required by the Australian Government. The Court ruled that the assessment should have considered the potential impacts of run-off from cotton crops on the Great Barrier Reef World Heritage Area. The then Commonwealth Environment Minister appealed the decision but that appeal was dismissed on 24 July 2004.

In April 2005 the Commonwealth Environment Minister remade the decision under section 75 of the EPBC Act, requiring an investigation into the impact of the construction and operation of the dam on World Heritage areas, listed threatened species and listed threatened birds.

On 14 October 2011, SUDAW Development's project was declared a lapsed proposal under section 155 of the EPBC Act. The State of Queensland's assessment process was not progressed.

The proponent for the Nathan Dam and Pipelines project, SunWater, does not propose to supply water for new agricultural use, unlike the SUDAW proposal for Nathan Dam. This is discussed in Section 2 of this report (About the project) and in subsequent sections evaluating potential impacts. The Australian Government took this into account when identifying the relevant controlling provisions and making its referral decision for SunWater's Nathan Dam and Pipelines project in 2008.

4. Project approvals

Following the release of this evaluation report, the project will require approvals from the Australian, state and local government agencies before it can lawfully proceed. Table 4.1 provides a list of approvals that are likely to be required. The proponent acknowledges that further information will be required to support lodgement of applications for these subsequent approvals.

It should be noted that the order of the list below does not necessarily reflect the sequence in which the proponent would apply to the relevant authority.

Table 4.1 Approvals likely to be required for the project to proceed

Project component/activity	Relevant approval	Legislation	Authority
Whole of project	EPBC Act approval of controlled decision	*Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)	Department of the Environment and Energy
Dam wall and inundation area	Material Change of Use (MCU) under the Taroom Shire Planning Scheme*	*Sustainable Planning Act 2009* (SPA)	Banana Shire Council
Dam wall and inundation area	Reconfiguration of a lot*	*Land Act 1994* (Land Act), SPA and Sustainable Planning Regulation (SPR)	Banana Shire Council
Pipeline	MCU under the Taroom Shire, Chinchilla Shire, Wambo Shire and Murilla Shire Planning Schemes for the Nathan Dam Pipeline*	SPA	Banana Shire Council (pipeline chainage 0 to 40 km) Western Downs Regional Council (pipeline chainage 40 km to 218 km)
Pipeline	Reconfiguration of a lot*	Land Act, SPA and SPR	BSC (pipeline chainage 0 to 40 km) WDRC (pipeline chainage 40 km to 218 km)
Whole of project	Building works	*Building Act 1975*, SPA and SPR	Council/private certifier
Disturbing Aboriginal cultural heritage (dam inundation area)	Cultural heritage management plan approval	*Aboriginal Cultural Heritage Act 2003* (ACH Act)	Department of Aboriginal and Torres Strait Islander Partnerships
Dam inundation area	Development permit for development on a Queensland Heritage Place or a local Heritage Place	SPA, SPR, *Queensland Heritage Act 1992*	EHP, Department of Local Government, Infrastructure and Planning (DILGP)

Project component/activity	Relevant approval	Legislation	Authority
Construction on State-owned land	Evidence of a resource entitlement	SPA, Land Act, *Water Act 2000* (Water Act) and *Transport Infrastructure Act 1994* (TI Act)	Relevant government department
Operation of dam and pipeline infrastructure	Amendment to Fitzroy Basin Resource Operations Plan (Fitzroy Basin ROP) 2014	Water Act	DNRM
Operation of dam and pipeline infrastructure	Resource Operations Licence (ROL)	Water Act	DNRM
Construction of the dam wall and taking water for construction activities	Operational works permit for taking or interfering with water from a watercourse	Water Act, Water (Fitzroy Basin) Plan 2011, Water (Great Artesian Basin) Plan 2006	DNRM, State Assessment and Referral Agency (SARA)
Taking of water during project operation	Water licence	Water Act, Fitzroy Basin ROP	DNRM, SARA
Dam wall construction and pipeline—placing fill or excavating fill in a watercourse	Riverine protection permit (exemptions may apply for the holder of a Resource Operations Licence granted under the Water Act)	Water Act	DNRM, SARA
Dam wall and pipeline waterway crossings during construction	Operational works for construction waterway barrier works	*Fisheries Act 1994* (Fisheries Act), SPA and SPR	Department of Agricultur and Fisheries (DAF), SARA
Dam wall and inundation area	Operational works for taking or interfering with water from a watercourse	Water Act, SPA and SPR	DNRM, SARA
Whole of project	Operational works permit for vegetation clearing	*Vegetation Management Act 1999* (VM Act)	DNRM, SARA
Inundation area, pipeline and access road	Clearing permit for the taking of a protected plant	*Nature Conservation Act 1992* (NC Act)	EHP
Whole of project	MCU for environmentally relevant activities (ERAs)	*Environmental Protection Act 1994* (EP Act)	SARA

Project component/activity	Relevant approval	Legislation	Authority
Whole of project—removal of native fauna	Damage mitigation permit	Nature Conservation (Wildlife Management) Regulation 2006	EHP
Tampering with a protected animal breeding place	Species Management Program	Nature Conservation (Wildlife Management) Regulation 2006	EHP
Dam	Operational works that is the construction of a referable dam	SPA and SPR, *Water Supply (Safety and Reliability) Act 2008* (WSSR Act)	Department of Energy and Water Supply (DEWS), SARA
Dam safety	Certificate of failure impact assessment (required to be undertaken prior to the submission of the referable dam operational works application)	WSSR Act	DEWS
Water service provider registration	The supply of a water service for a charge unless an exemption applies	WSSR Act	DEWS
Contaminated land or materials (whole of project)	Disposal permit to remove and treat or dispose of contaminated soil from land on the Environmental Management Register or Contaminated Land Register	EP Act	EHP
Use of heavy vehicles exceeding national standards during construction (whole of project)	Permit to use heavy vehicles exceeding national standards in respect of specific roads	Heavy Vehicle National Law 2012	TMR, National Heavy Vehicle Regulator
Development on or adjacent to a railway (pipeline alignment south of Wandoan)	S255 - Approval from the railway management for interference with a railway	*Transport Infrastructure Act 1994* (TI Act)	The accredited rail infrastructure manager
Whole of project - locating a public utility in a state controlled road corridor	S50 (ancillary works and encroachments) structures or activities to be located or carried out in a state controlled road—Road Corridor Permit	TI Act	TMR
Temporary road closures	Approval to close roads for works	TI Act	TMR, SARA

Project component/activity	Relevant approval	Legislation	Authority
Permanent road closures	Approval for permanent road closure	Land Act	DNRM, BSC, WDRC
Access (state controlled road network)	S62 location of vehicular access to state controlled roads approval	TI Act	TMR
Roadworks (state controlled road network)	S33 road works approval (state controlled road network)	TI Act	TMR, SARA
Roadworks—local roads	Approval for carrying out works on a road or interfering with a road or its operation	*Local Government Act 2009*	BSC, WDRC
Traffic impacts	Oversize load permit	TI Act	Queensland Police Service (QPS)
Whole of project (where applicable)	Flammable and combustible liquids licence	*Workplace Health and Safety Act 2001* (WHS Act)	Department of Justice and Attorney-General (JAG)
Whole of project (where applicable)	Notification of hazardous chemicals in excess of manifest quantities or Major Hazard Facility	WHS Act	JAG
Importation, transportation and storage of explosives	Permit to import, transport and store explosives	*Explosives Act 1999*	DNRM
Quarrying and sand extraction from state land outside a watercourse	Sales permit	*Forestry Act 1959* (Forestry Act)	DAF
Quarrying in a waterway (which is the property of the state)	Quarry material allocation notice	Water Act, SPA and SPR	DNRM
Whole of project (where applicable)	Forestry Act permit—Interfering with quarry or forestry material in a State Forest, Timber Reserve, or other Crown Land holding and on certain freehold lands where the state owns the native forest log timber and/or where there is a reservation of quarry material on title	Forestry Act	DAF
Destruction of trees within road reserves	Permit for destruction of trees within road reserves	Forestry Act	DAF

Project component/activity	Relevant approval	Legislation	Authority
Locating infrastructure in unallocated state land (including watercourses), reserves and roads	Permit to occupy	Land Act	DNRM
Coordination of utility relocations	Approval of public utilities plan	*Electricity Act 1994*, *Telecommunications Act 1997* (Cwlth), *Gas Supply Act 2004*, WSSR Act, *Petroleum and Gas (Production and Safety) Act 2004*.	Various utility providers: Telstra, Ergon etc.

* If a community infrastructure designation is granted, these approvals may not be required. Refer to Section 4.3.1 for more information

4.2 Australian government approvals

A decision on the controlled action (EPBC reference 2008/4313) will be made by the Commonwealth Environment Minister under section 133 of the EPBC Act. The Minister will use the information in this report to determine whether or not to approve the controlled action under the EPBC Act and, if so, apply conditions to the approval necessary to limit the impact on MNES.

I have recommended conditions related to MNES for the Minister's consideration in determination of whether or not to approve the controlled action.

4.3 State government approvals

4.3.1 Community infrastructure designation

The proponent has stated its intention to seek a community infrastructure designation (CID) under SPA for the project. A CID may exempt the proponent from obtaining some development approvals for assessable development under the local government planning scheme and for reconfiguring lots. In the event of a CID for the project, conditions stated, imposed or recommended in appendixes 1–2 of this report should be treated as recommended requirements under section 43 of the SDPWO Act.

4.3.2 Approvals process under the Water Act

The capture and retention of river flows for the project is provided for in the existing Water Plan (Fitzroy Basin) 2011 (Water Plan) which governs the management,

allocation and sustainable management of water to meet environmental protection requirements and the future water supply needs of the region.

The Water Plan identifies 90,000 ML of unallocated water for water infrastructure on the Dawson River. The proponent has proposed to use the project to extract 66,011 ML/a of high priority water to service coal mines and power stations and associated urban communities in the Surat Basin.

Prior to construction of the project, the proponent will require an operational works development approval for interfering with water under the SP Regulation. Once this approval is received, the proponent will require a ROL to interfere with water and a water entitlement to take water under the Water Act.

Consequently, the current ROP will need to be amended to detail how the water reserved for the project would be allocated and what the operating and reporting requirements for the new infrastructure would be. These processes would apply to the water entitlement of 66,011 ML/a for water infrastructure, should it be granted. It is noted that the Water Act also provides for interim ROLs and interim water entitlements, which can be used to operate water infrastructure while the ROP is being amended or approved.

The proponent must confirm with the Chief Executive of the Water Act, prior to commencing construction, the following matters:

- the means by which it intends to allocate water to third parties (tender, auction)
- the approvals pathway most appropriate for the project (interim ROL or ROL).

Following changes to the Water Act, which commenced on 6 December 2016, water allocation and management requirements for the project will be incorporated into a new statutory Water Plan under that Act.

For the purposes of this report, all references to and obligations under the Water Plan (Fitzroy Basin) 2011[4] or the Fitzroy Basin ROP should be read as applicable under the relevant provisions of the Water Act at the time.

4.3.3 Environmentally relevant activities

Under the EP Act, an environmental authority (EA) must be issued by EHP to carry out an environmentally relevant activity (ERA). A range of ERAs are likely to be relevant to this project. EHP has not provided conditions for any ERAs for this project as further information is required to allow assessment and development of applicable site-specific conditions. The proponent acknowledges that further information is required to support lodgement of applications for ERAs.

[4] Prior to December 2016, this document was entitled Water Resource (Fitzroy Basin) Plan 2011.

4.3.4 Conditions in this report under the SDPWO Act

Under section 39 of the SDPWO Act, the Coordinator-General may state conditions for the assessment manager for matters subject to a material change of use approval under SPA. Stated conditions are provided in Appendix 2 of this report.

I have the power under section 54B of the SDPWO Act to impose conditions for matters where conditions cannot be applied through approvals under other legislation. Imposed conditions are provided in Appendix 1 of this report.

I consider that there are some matters for the management of potential impacts of this project for which no head of power exists. As these cannot be implemented as either stated or imposed conditions, I have made recommendations in Appendix 4 of this report to address those matters. While those recommendations have no statutory authority, the relevant stakeholders, including agencies and the proponent, have agreed to the implementation of these recommendations.

5. Evaluation of environmental impacts

This section discusses the major environmental effects identified in the EIS. For each matter, I have included a detailed evaluation and stated or imposed conditions or made recommendations to manage adverse impacts.

5.1 Land

5.1.1 Background

The project is located in a rural area, with the major land uses comprising grazing with some irrigation (primarily fodder) adjacent to the Dawson River. The pipeline extends from the dam wall south, adjacent to the towns of Wandoan and Chinchilla before terminating at the town of Warra on the Warrego Highway around 44 km north-west of Dalby.

At FSL the dam will inundate an area of approximately 13,508 ha of land over 74 parcels of land and the 149.3 km pipeline will intersect 137 parcels of land with approximately 366 ha in the easement area.

The proponent has advised it will acquire land tenure which is inundated by the FSL and an easement will be registered over land within the flood buffer area. Upon finalisation of detailed design the proponent has committed to undertake a more detailed assessment of the extent of the project's impact on each property and consult with landholders.

At the completion of construction, approximately 10,603 ha of flood buffer will be established above the FSL as an easement to be owned and managed by the proponent.

The number of intersected land parcels has been reduced from 225 in the original proposal (where the pipeline proposed was 263.3 km) to 137 land parcels. Land within

the proposed water storage area and underground pipeline comprises a mixture of freehold, leasehold and reserves. The proponent will need to secure agreements with each affected landholder.

Relevant planning legislation, statutory instruments and guidelines

State Planning Policy

Agriculture is one of the key state interests within the State Planning Policy (SPP). The SPP seeks to protect agricultural resources from incompatible activities that would compromise existing or potential productivity. The EIS reported that the project will impact mapped strategic cropping areas and Class A and Class B agricultural land (under the agricultural land classification [ALC]) on the SPP interactive mapping system. (Refer to page 30 for further discussion regarding agricultural land.)

The SPP provides clarity to local governments when making and amending local planning instruments (schemes) and assessing development applications. The SPP has been relied upon when considering the impacts of the project on agriculture, however, the proponent will need to formally address the SPP when seeking a development approval under the applicable planning legislation.

Community infrastructure

The proponent intends to seek a community infrastructure designation (CID) for the project under SPA. If approved, a CID may exempt the proponent from obtaining development approvals. Where land forms part of a CID, the conditions stated in Appendix 2 of this report should be treated as recommended requirements under section 43 of the SDPWO Act.

The *Planning Act 2016* was passed in May 2016 by the Queensland Parliament and will establish a new planning system for the state. Commencing on 3 July 2017, the new Act will replace the current SPA. The new planning system will be performance-based, which allows for innovation and flexibility in how the development can be achieved. The draft Planning Regulation identifies water cycle management infrastructure as infrastructure for which a designation can be made by the Minister or a local government.

State Development Area

Approximately 500 m of the pipeline crosses the Surat Basin Infrastructure Corridor State Development Area (SBICSDA), which is an area of land established by the Coordinator-General to promote economic development in Queensland. The SBICSDA was declared in 2011. An approval under the SBICSDA Development Scheme for this section of the pipeline would be required.

Regional planning

The project is located within the Central Queensland Regional Plan[5] and the Darling Downs Regional Plan[6] areas. Both regional plans were prepared with a strong focus on resolving land-use competition between the agricultural and resources sectors, and driving economic development.

The plans both note that the regions encompass a variety of regional landscapes, including urban and rural holdings, agricultural production, resources and mine sites, and protected areas. They also contain features of both national and state environmental significance. However, despite both regions' ecological values, historical clearing for residential development and major industries including the agriculture and resources sectors has resulted in vegetation loss across the regions.

The Central Queensland Regional Plan and the Darling Downs Regional Plan both identify priority agricultural areas (PAA) which are strategic areas of the most regionally significant agricultural production. Within these areas, agriculture is to be the priority land use. Other land uses are not prohibited within the PAA, however any other land uses, particularly resource activities, must co-exist with the priority land use. The *Regional Planning Interests Act 2014* (RPI Act) defines a resource activity as:

(a) an activity for which a resource authority is required to lawfully carry out; or

(b) for a provision about a resource authority or proposed resource authority—an authorised activity for the authority or proposed authority (if granted) under the relevant resource Act.

Based on this definition the proposed dam and pipeline is not a resource activity under the RPI Act and therefore a regional interests development approval, which would consider impacts on the PAA, is not required under the RPI Act.

Local Government planning schemes

The project is located within the Banana Shire and Western Downs Regional Council areas. The relevant planning schemes within the council areas are:

Taroom Shire Planning Scheme 2006 (BSC)

The proposed dam water storage area and approximately 40km of the pipeline are located within the rural zone of the Taroom Shire Planning Scheme 2006. The intent of the rural zone is 'for rural uses and associated activities'. The project is considered to be exempt development in accordance with section 1.4 (2)(a)(v) of the planning scheme. Exempt development is development that may not be made assessable or self-assessable development under a planning scheme.

[5] Department of State Development, Infrastructure and Planning, October 2013, The State of Queensland, *Central Queensland Regional Plan*

[6] Department of State Development, Infrastructure and Planning, October 2013, The State of Queensland, *Darling Downs Regional Plan*

Western Downs Planning Scheme 2017

WDRC adopted a new planning scheme[7] on 15 March 2017. Around 143km of the pipeline is located within a range of zones including rural, recreation and open space, low density residential and community facilities.

The pipeline is predominantly located within the rural zone which provides:

> opportunities for non-rural uses that are compatible with agriculture, the environmental features and landscape character of the rural area where the uses do not compromise the long term use of the land for rural purposes.

Within the rural zone of the planning scheme the pipeline would be defined as a utility installation and require development approval from WDRC.

5.1.2 Submissions received

The key issues regarding land impacts raised in submissions on the EIS and AEIS included the following:

- loss of agricultural land
- impacts on agricultural activities including cropping and livestock
- potential compensation for impacted landholders
- flooding impacts
- construction impacts.

I have considered each submission and the responses provided by the proponent in my evaluation of the project and my assessment is provided in the relevant sections below.

5.1.3 Impacts and mitigation

Landowner engagement

A range of management plans have been proposed as mitigation measures to reduce potential impacts on landholders. A stakeholder engagement plan will guide adequate, timely and regular communication with stakeholders including information on project status, water allocations and management of key project impacts.

A project land access and acquisition strategy will manage land access, loss of land, compensation and potential impacts on existing and future water allocations. The strategy includes the development and implementation of a weed management plan to prevent the introduction of new weed species and the spread of declared weeds. With regard to acquisition, the emphasis of the strategy would be a preference to secure land by agreement.

[7] Western Downs Regional Council, March 2017, *Western Downs Planning Scheme*

Coordinator-General's conclusion—landowner engagement

Clear and transparent engagement with landholders will be critical to the success of this project. I am satisfied with the commitments made in the EIS about engagement with landholders and I require the proponent to deliver on all of their commitments.

To ensure that the proponent appropriately undertakes all engagement and negotiation strategies I have imposed a condition at Appendix 1 requiring the proponent to report on community engagement annually for five years from the commencement of construction. Refer to Section 5.5 (social and economic impacts) for more detail.

The EIS included a draft environmental management plan (EMP) outline that demonstrates how potential impacts may be addressed during the construction and operational phases of the project. Upon finalisation of detailed design and consultation with landholders, the proponent has committed to prepare a construction EMP (CEMP) and operational environmental management plan (OEMP) that will discuss in detail the environmental objectives, performance criteria, mitigation measures, monitoring, reporting, responsibility and corrective actions for all of the issues discussed below.

Flood risk

Flooding within the Fitzroy Basin typically occurs in summer or early autumn in association with tropical cyclones or intense monsoonal depressions, with these weather systems producing high rainfall over short periods of time. Due to the size of the catchment and its major tributaries, the Fitzroy Basin frequently experiences flooding following high rainfall events, particularly in the lower catchment. Flood flows and levels were estimated using the MIKE11, 1D hydraulic modelling software package.

The EIS and AEIS reported that the dam would reduce flood peaks downstream, for example the 1-in-100 AEP peak flood level would reduce by up to 0.5 m, however the peak water level post-dam would be reached slightly later and would recede over a longer period (2-3 weeks) compared with approximately 10 days pre-dam.

Several submissions raised concerns about projected flood levels in Taroom, upstream of the proposed dam. The EIS and AEIS reported that the peak flood level once the dam is constructed and at FSL (which is estimated at 7 per cent of the time), would result in a peak flood level in Taroom 0.6 m higher than if the dam were not present. The peak level would still be below the town's minimum development level of EL190.1m AHD, the level that new residences must be constructed above.

Land acquisition and easements

The EIS states that land affected by the dam, would be acquired by DNRM on behalf of the proponent prior to construction of the project. It is proposed to acquire, via purchase or easement:

- land to be inundated at FSL
- land occupied by the water storage construction footprint
- land occupied by significant above-ground infrastructure along the pipeline route such as balancing storages, pump stations and possibly surge tanks.

DNRM would negotiate easements for the 1-in-100 AEP flood buffer around the storage area and the proponent will attempt to develop easement conditions that place minimum (if any) restrictions on current land use to ensure minimal impact to landholder activities. The exact location of land included in the flood buffer will have regard to specific on-site characteristics such as slope, vegetation, and the location of existing infrastructure. It will be finalised in consultation with individual landholders.

The EIS noted that elements of the acquisition strategy include:

- ensuring that landholders are paid fair market value for land acquired
- ensuring that landholders are paid fair value for interests in or access to land based on permanent or temporary loss of productivity and disruption to ongoing farm operations
- meeting costs of surveys necessary to delineate the areas required for purchase or areas where interest or access is required
- meeting costs of independent valuations of the land or interest in or access to land required
- meeting reasonable costs, including legal costs, stamp duty, disturbance costs, general expenses incurred by landholders in arranging sale of land or interests in or rights of access to land, reasonable personal relocation expenses if required, expenses related to relocation of houses or infrastructure if this is the chosen option and relocation of services and access roads to any such new house location
- finalising land acquisitions as expeditiously as possible to give landholders certainty of their position
- ensuring security and preventing public access to land which the landholder retains, or retains an interest in.

Coordinator-General's conclusion—flood risk

I am satisfied that the proponent has committed to update flood modelling upon finalisation of the detailed design, and engage with all affected property owners to mitigate the flood impacts of the project. This would include negotiating easements with affected landholders and purchasing properties.

BSC, in its submission on the EIS, requested it be provided with Q100 flood information for the project. I require the proponent to provide updated flood modelling data to Banana Shire Council upon finalisation of detailed design.

I consider the information provided by the proponent in the EIS and AEIS with regards to potential flooding impacts is suitable for the preliminary design stage of the project. I expect the proponent to update this modelling to increase its accuracy and incorporate the latest flood data, including climate variability scenarios.

I note that safety requirements for the dam during operations will be based on the proponent's existing safety procedures and in line with Australian National Committee on Large Dams (ANCOLD) Guidelines (2003). DEWS will be required to assess the dam design prior to construction which will ensure that the design of the dam is appropriate from a safety perspective.

The proponent is proposing to acquire affected properties and easements through the DNRM. Because DNRM will be using the processes and procedures required by the *Acquisition of Land Act 1967*, I am confident that the acquisition of properties and easements will be transparent and fair.

I have also imposed a condition for the proponent to properly engage with the community and report to me on the outcomes of this engagement. I consider that this will provide further assurance to landholders that negotiations will be appropriate.

Recreation areas

The EIS reported that the water storage area will inundate the existing Glebe Weir recreation area, which currently has 24 camping sites and a range of facilities including a boat ramp, toilets and showers. The proponent has committed to establishing two new recreation areas and a viewing platform as part of the project.

One of the recreation areas is proposed on the southern side of the 'Bend' and the other is on the northern side at the termination of Glebe Weir Road at Boggomoss Creek. In addition, a viewing platform is proposed at the dam wall (refer to Figure 5.1). Other than the boat ramp, these facilities will be located above the 1:100 AEP flood level. The locations of the proposed recreation facilities are shown in Figure 5.1.

I have set a recommendation in this report that the exact nature, extent and location of the dam community recreation facilities is to be informed by a facilities options study to be carried out by the proponent at its cost in consultation with BSC. The proponent will be responsible for constructing the recreational facilities and will seek to establish a Dam Community Recreational Facilities Agreement with BSC that will see the local government maintain and manage the facilities post-construction.

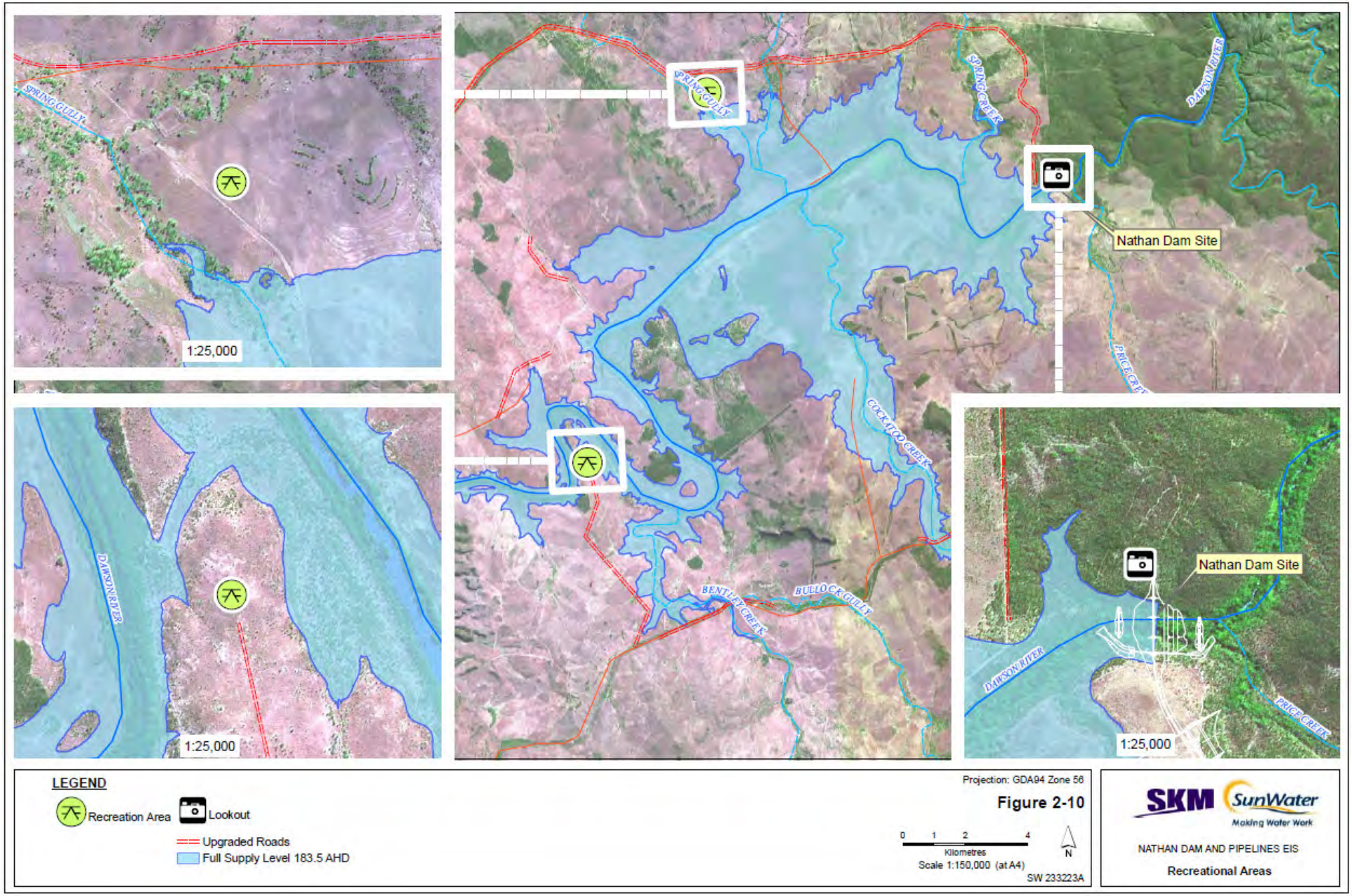

Figure 5.1 Proposed recreation areas

Coordinator-General's conclusion—recreation areas

I consider the loss of the Glebe Weir recreation area will be offset by the two new recreation areas and viewing platform to be constructed by the proponent. The final location and specific details of the facilities will be informed by a facilities options study and the proponent has committed to establish a dam community recreational facilities agreement with BSC. I have made a recommendation at Appendix 4 to ensure this occurs.

Agricultural land

The EIS reported that the project would impact on good quality agricultural land (GQAL) along the Dawson River. GQAL anticipated to be impacted by the project is:

- water storage area: 5,981 ha of Class A, 1,589 of Class B and 6,254 ha of Class C
- pipeline: 76 ha of Class A, 44ha of Class B and 105ha of Class C.

The EIS did not include a total GQAL figure as overlap can occur between the agricultural land classes (A, B & C). I note that the legislation relevant to the regulation and protection of agricultural land has changed since the EIS was prepared and that GQAL has since been superseded by strategic cropping land and strategic cropping areas in Queensland.

The EIS reported that the project meets the 'overriding need' definition in accordance with the *Planning Guidelines: The Identification of Good Quality Agricultural Land* (January 1993). These guidelines have been superseded by the State Planning Policy (SPP) which commenced on 29 April 2016.

The State's interest in agriculture identified in the SPP which is reflected in local government planning schemes is that 'planning protects the resources on which agriculture depends and supports the long-term viability and growth of the agricultural sector'. The project may require assessment against the local planning scheme prior to construction.

Given the changes to legislation and the fact that the EIS only included an analysis of the project's impact on GQAL, I evaluated the project's impact on strategic cropping land which indicated a loss of approximately 0.5 per cent (4,777 ha) of strategic cropping land in the Banana LGA (a total area of 911,581 ha) and approximately 0.016 per cent (321 ha) in the Western Downs LGA (a total area of 1,936,273.4 ha).

Strategic cropping land is currently known as strategic cropping areas due to the introduction of the RPI Act. As the project is not a resource activity as defined in the RPI Act, it is exempt from assessment under this Act.

The AEIS reported that the proposed pipeline will be buried with the use of appropriate machinery or controlled blasting if necessary. Locating the pipeline underground will generally allow for activities above ground (including agriculture) to continue with only minor disruptions expected during construction, which the proponent has committed to resolving through consultation with individual landholders. I support this commitment, and require it to be undertaken.

Coordinator-General's conclusion—agricultural land

I note that the project's 13,508 water storage area is the key reason the project would result in the loss of 5,098 ha of mapped strategic cropping land/areas.

While the dam is not intended to supply new agriculture, the proponent has committed to ensuring continued supply for existing agricultural users whose supply would be affected by the dam. I support this commitment.

I have evaluated the EIS and AEIS and consider that the project would not result in significant loss, severance or alienation of agricultural land. I am of the view that the estimated loss of 0.5 per cent of land available in the Banana LGA and 0.016 per cent of land available in the Western Downs LGA for agricultural purposes would be a relatively minor loss of land.

I accept the EIS finding that agricultural activities will be able to continue on around 137 parcels of land impacted by the pipeline, as it will be located underground. The proponent has committed to develop a CEMP outlining how disruption associated with the pipeline will minimised, and where it cannot be avoided, measures to minimise impacts. I expect this to occur, and as committed, with full consultation with affected landholders.

Geology and soils

The proponent proposes to undertake further geotechnical investigations to build on the desktop assessment undertaken as part of the EIS to support the detailed design phase and will be required to obtain a development approval (operational works) for a referable dam in accordance with the *Water Supply (Safety Reliability) Act 2008.* This application will assess the proposed dam against current engineering standards and practices.

The EIS reported that there is a wide range of soil types in the area of the proposed dam and pipeline and that the potential for soil erosion impacts resulting from construction and operation of the project is considered to be minor. However, the proponent will be required to employ mitigation measures around all construction activities to minimise erosion and sediment transport.

Pipeline construction will be completed by restoring the land surface to pre-disturbance conditions after the completion of construction. As stated above, the proponent provided a draft EMP outline as part of its EIS and has committed to develop a detailed CEMP and OEMP prior to construction and operation.

Proposed erosion and sediment mitigation measures identified in the draft EMP include:

- undertake an erosion risk assessment to identify flow paths, suitable stockpiles locations, soil cover type, and soil stability
- implement erosion and sedimentation control techniques in accordance with guidelines such as the IECA 2008
- undertake construction during periods of low average monthly rainfall to minimise the potential for high intensity rainfall and flooding.

- rehabilitate disturbed areas as soon as practicable after completion of works by backfilling, covering with topsoil and revegetating, hydroseeding or hydromulching
- undertake rehabilitation and revegetation of the flood buffer area around the water storage to minimise sediment and nutrient run-off from the adjacent catchment.

Coordinator-General's conclusion—geology and soils

I am satisfied that the geology and soils of the project area would not be unacceptably impacted by the project. I note that project activities could potentially cause erosion and land instability and I require the proponent to fulfil its commitments to address potential impacts by:

- undertaking physical model studies prior to construction to inform erosion protection works downstream
- undertaking a geomorphological assessment prior to inundation to refine predictions in relation to potential impacts such as sedimentation, erosion-prone soils and bank slump
- implementing the soil management program described in the draft EMP.

I also require the proponent to undertake rehabilitation and remediation works as detailed in the draft EMP.

Land contamination

The EIS identified potential contamination sites based on historical and desktop information. The EIS also reported that potential land contamination impacts associated with the project site may result from the disturbance and inundation of existing contaminated land. Contamination may also result from project activities as a result of unintended spillages or accidents.

Effective management of potential contaminants is required to prevent impacts to land, water and human health. Potential sensitive receptors within the project area include the Dawson River, Palm Tree Creek, and Cockatoo Creek.

There are no sites recorded on EHP's Contaminated Land Register within the dam footprint and pipeline however the EIS investigations identified one site on EHP's Environmental Management Register and a number of possible contamination sites of interest, including:

- a livestock dip or spraying infrastructure located approximately 950 m east of the FSL within the flood buffer area
- four possible contamination sites and areas of interest within the FSL
- one possible contamination site or area of interest outside the FSL but within the flood buffer area
- eleven possible contamination sites and areas of interest outside the FSL and between 20 to 480 m outside the flood buffer area.

The proponent proposes to undertake site investigations for potential contamination sites prior to construction to prevent the release of existing contaminants to the environment and protect the quality of water in the reservoirs. If site investigations

indicate potential or actual contamination, a site management plan, remediation action plan and a contaminated sites construction management plan would be prepared and implemented.

Potential contamination sites for the dam footprint and pipeline include stockyards, farm houses and buildings that may hold hydrocarbons, herbicides and pesticides and livestock dips or spray races. Historically, these livestock dips contained chemicals such as arsenic, dichlorodiphenyltrichloroethane (DDT) and other hazardous chemicals.

Coordinator-General's conclusion—contaminated land

I have evaluated the EIS and AEIS and comments made in submissions and am satisfied that the commitments proposed by the proponent would address potential land contamination impacts. This includes the contaminated land management program described in the draft EMP.

In the unlikely event that project activities require notification on the Contaminated Land Register, the EP Act specifies how the proponent would be required to investigate, manage and remediate any contaminated land, including the removal, treatment or disposal of contaminated soil.

5.1.4 Coordinator-General's conclusion—land

The EIS and AEIS identified the potential land impacts associated with the project. I accept the proposed management measures and I require the proponent to fulfil its commitments which include:

- finalising detailed design for the proposed dam, updating flood modelling and providing a copy to BSC
- negotiating individually with directly impacted stakeholders (including landholders) and developing and implementing a project land access strategy, land acquisition strategy and compensation strategy upon finalisation of detailed design
- obtaining relevant land tenure in accordance with the applicable legislation
- undertaking a recreation facilities options study and enter into a dam community recreational facilities agreement with BSC.

I am satisfied these management measures and commitments would reduce land impacts as much as practicable. I expect that potential land impacts would be further reduced through field planning, project refinements during detailed design and implementation of the avoidance and mitigation measures proposed in the EIS and AEIS. I have included recommendations regarding the contents of an application that will be required to be made within the State Development Area (refer to Appendix 2).

5.2 Surface water

5.2.1 Existing environment

Dam and surrounds

The Nathan Dam is proposed to be located on the Upper Dawson River at AMTD of 315.3 km. Dawson River is part of the Fitzroy Basin, which is regulated through the *Water Act 2000* and subordinate legislation, the Water Plan (Fitzroy Basin) 2011 (Water Plan) (previously known as the Water Resource (Fitzroy Basin) Plan 2011) and the Fitzroy Basin Resource Operations Plan (ROP) 2015.

The Water Plan nominates 90,000 ML of unallocated water held as strategic water infrastructure reserve for water infrastructure on the Dawson River. Subject to approval by DNRM, supply of 66,011 ML/a of high-priority water from this strategic water infrastructure reserve would be granted to the proponent.

The dam would form part of the existing Dawson Valley Water Supply Scheme (DVWSS), which is currently operated by the proponent under a ROL issued by DNRM. The DVWSS extends for 338 km along the Dawson River from the upstream limit of Glebe Weir to the downstream limit of the Boolburra waterhole, approximately 18 km upstream of the Fitzroy River junction. The DVWSS includes seven existing water storages consisting of Glebe Weir (upstream of the dam) and Gyranda Weir, Orange Creek Weir, Theodore Weir, Moura off-stream storage, Moura Weir and Neville Hewitt Weir downstream of the dam.

Hydrology and water use

The DVWSS currently supplies town water to Theodore, Moura, Baralaba and Duaringa. Water is also supplied for industrial purposes (coal mines, ammonium nitrate plant and gold mine) and for irrigation of crops such as cotton, fodder and cereal. Town water and industrial water are provided as supplemented water allocations, which are supplied from existing water storages and are assigned a level of supply reliability of high or medium.

Unsupplemented water within the DVWSS is accessed by users on an opportunistic basis during high-flow events. Unsupplemented water users include water harvesters who use the water for irrigation of crops such cotton, fodder, cereal and other crops. These water harvesters are located downstream and upstream of the dam wall and have high pumping thresholds (1,296 ML/d or 2,592 ML/d) during the wet season from November to February.

The Water Plan sets up a framework for sustainably managing the taking of water for urban, industrial, agricultural and other uses. The ROP implements the Water Plan by specifying rules by which water infrastructure is to be operated. Environmental flow objectives (EFOs) and water allocation security objectives (WASOs) are the key assessment parameters.

Environmental flow objectives aim to protect the health of natural ecosystems and attempt to minimise changes to natural flow conditions. Environmental flow objectives are set for specific locations or nodes along the river and flow conditions for seasonal

base flow (SBF), first post-winter flow (FPWF) events and medium to high-flow events. Seventeen nodes are identified in the Water Plan, however only five are located downstream of the dam wall. Of these only Node 0 (Fitzroy River Barrage) and Node 2 (Dawson River at Beckers) have nominated EFOs. These EFOs include objectives for seasonal baseflow, first post-winter flow and medium to high flow objectives.

WASOs are set for the purposes of protecting the probability of water users being able to obtain water under a water allocation. WASOs are set for high and medium supplemented water allocations, which are supplied water from existing water storages within the DVWSS. WASOs are also set for unsupplemented water allocations that are located within the DVWSS but are managed within the Dawson Valley Water Management Area (DVWMA).

As noted previously, unsupplemented water allocations access water on an opportunistic basis during high-flow conditions. The Water Plan outlines annual volumetric probability (AVP) percentage for unsupplemented water allocation groups which are specific for locations and passflow conditions. The AVP is defined as the percentage of years, during which the water allocation group would be able to divert at least the determined mean annual diversion (MAD).

A number of creeks and rivers flow into the Dawson River, with key catchments directly draining into the water storage area including Spring Creek, Spring Gully/Boggomoss Creek, Bentley Creek, Palm Tree Creek, Blackboy Creek, Cockatoo Creek and Juandah Creek. The Dawson River experiences periods of very high and very low flows. These creeks and rivers contain a number of wetlands and ecological corridors which provide habitat for a number of threatened species. For further information on ecological values of these creeks and rivers refer to Section 6 (MNES) and Section 5.4 (MSES) of this report. The EIS presented stream flow data recorded 14 km upstream of the proposed dam wall at the Glebe gauge from 1919 to 2002. The data showed considerable climatic variability with low annual flows occurring in the 1960s and high flow periods occurring in mid 1950s and late 1980s. Significant droughts have occurred in the region, with three significant droughts occurring from 1963–71, 1983–88 and 2000–07.

Flooding

Flooding in the Fitzroy region typically occurs in summer or early autumn due to tropical cyclones or intense monsoonal depressions which produce very high rainfall in a very short period of time. The EIS noted that due to the size of the catchment and each of its major tributaries, the Fitzroy Basin frequently experiences flooding following high rainfall events, particularly in the lower catchment near the dam.

Bureau of Meteorology data from 2011 showed that around 18 major flood events (above 7m) have been recorded within Dawson River at the Taroom gauge, from 1860 to 2011. The AEIS reported that the 2010/2011 flood event peaked at 10.43m at the Taroom gauge and is considered to be an extremely rare event with a very low probability of occurrence (approximately 0.2 per cent of any given year). This flood event was caused by heavy sustained rainfall occurring over a large area and over a whole month, rather than a single extreme rainfall event.

Surface water quality

The Dawson River has been classified as a slightly to moderately disturbed ecosystem. Due to existing water extraction and the extent of clearing and grazing, the water quality within the river is currently degraded. Turbidity, nutrient concentrations and dissolved metals exceed the water quality objectives nominated under the *Queensland Water Quality Guidelines 2009* (QWQG).

Water quality data obtained from existing water storages within the Fitzroy Basin, including Bingengang Weir and Tartrus Weir on Mackenzie River, Eden Bann Weir on Fitzroy River and Fairbairn Dam on Nogoa River, indicated the following:

- water storages tend to be unstratified for most of the year, or slightly stratified during warmer months
- total nitrogen and phosphorus levels tend to exceed guidelines, in both inflow and the storages
- electrical conductivity is generally below guidelines
- cyanobacterial species occur, but in low numbers.

The environmental values of the Dawson River include aquatic ecosystems, primary recreation, secondary recreation, drinking water, visual recreation, farm supply, irrigation, cultural heritage, industrial use, stock water and aquaculture. A range of water quality objectives (WQOs) are relevant to protection of these environmental values and are detailed in the EPP (Water) - *Dawson River Sub-Basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Dawson River Sub-basin except the Callide Creek Catchment (2011)* (the Dawson River guidelines).

The legislative framework for water quality is regulated by EHP and DNRM and includes:

- construction water quality impacts regulated under the *Environmental Protection Act 1994* - EPP Water and the Dawson River guidelines, QWQG and the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council [ANZECC] 2000)
- operational water quality impacts regulated under the *Water Act 2000* and the ROP (Fitzroy Basin).

Pipeline and associated infrastructure

The AEIS reported that approximately 10 significant watercourses could be crossed by the pipeline, with five watercourses likely to contain water during the construction (dry season).

These creeks are part of the Condamine Catchment and include Bottle Tree Creek, Little Tree Creek, Bottle Tree Creek, Dogwood Creek and Charleys Creek. Based on 2012 information, the EIS noted that small volumes of unsupplemented water from some of the significant watercourses are used for irrigation, stock and domestic purposes. The pipeline would cross other minor creeks, however these are likely to be dry during the dry season.

Water quality data was recorded in 2007 at watercourses that would be crossed by the proposed pipeline. It showed that water quality varies across the watercourses, and nearly all sample sites exceeded the QWQG limits for dissolved oxygen and turbidity. Generally similar water quality results for the dam and surrounds apply to proposed sites of associated infrastructure, particularly roadworks.

5.2.2 Submissions received

Submissions received on the EIS and AEIS identified the following key issues related to surface water matters:

- agency request for a revised surface water model in accordance with the updated Water Resource (Fitzroy Basin) Plan (2011)
- need for the dam to be a reliable source of water during prolonged droughts
- inadequate information on compensation measures for affected water users
- information on the impacts of water restrictions on medium priority irrigators
- impacts on water users during the initial dam filling period and need for compensation
- agency request for detail on dam operation, release requirements for operation of the fishway and turtle way and how the proposed environmental release strategy would achieve EFOs and WASOs
- need for a detailed monitoring program to address changes in the flow regime downstream of the dam
- inadequate assessment of potential water quality impacts associated with construction of the pipeline and need for a water quality monitoring plan to adequately monitor and manage impacts
- impacts on water quality within the water storage during extended dry periods
- need for assessment of the impacts of changed Dawson River flow regime on flow trigger requirements of downstream mines
- release of untreated CSG upstream of the dam and potential impacts of these releases on drinking water supplied by the dam
- need for identification of watercourse crossings along the pipeline route and assessment against the Water Plan (Fitzroy Plan)
- cumulative impacts on water quality, considering upstream and downstream coal mines and surrounding land uses
- impacts of pipeline scouring and pigging on water quality and aquatic ecosystems
- need for inclusion of flood gates to manage flooding and protection of downstream areas
- additional predictions of greater flood possibilities in regards to predicted climate variability
- future flooding impacts of the dam on Taroom and surrounding area
- need for compensation measures in the event of flooding caused by the dam
- concern in regards to water backing up for longer periods during flooding events which will extend periods of landholder isolation and damage grass vegetation

- modelling data should include the most recent major floods that occurred in 2010/2011.

I have considered all submissions on the EIS and AEIS in my evaluation of the project.

5.2.3 Methodology

Hydrology

The proponent assessed potential impacts to stream flows and water entitlements within the DVWSS using the Integrated Quantity and Quality Model (IQQM). The IQQM is a standard hydrologic model developed by DNRM and supports the assessment of EFOs and WASOs outlined in the Water Plan. For an assessment on water quality impacts refer to Section 5.2.4.

The IQQM used a historic simulation period of 107 years (1900 to 2007) as defined by the Water Plan. The model has been used to consider natural climate variability and climate change predictions based on 2050 projections. Climate change predictions were obtained from reputable organisations.

The IQQM simulations assessed potential impacts to the surface water flows and consequent impacts on downstream ecological values and existing water entitlements by comparing the 'full entitlement' and 'with dam' scenarios. The 'full entitlement' scenario is representative of the current environment and is based on all water resource development and approved levels of water entitlements in the catchment. Full utilisation of current water entitlements is included in the scenario, regardless of the actual level of water use. The EIS noted that actual utilisation of entitlements cannot be included in the full entitlement scenario as these vary from year to year and from user to user. As a result the 'full entitlement' scenario is representative of an ecologically conservative modelling approach for assessment of project impacts.

The 'with dam' scenario was modelled on the basis of the full entitlement, considering the dam operation and preliminary operational strategy described in sections below. While the modelling is based on an operational strategy rather than a final operational strategy, the project is compliant with the provisions of the Water Plan. The operation of the dam would be compliant with EFOs and WASOs, as discussed throughout this section.

The revised IQQM included river flow data obtained at five streamflow gauges downstream of the dam:

- Node 5A—Dawson River at Nathan Gorge, downstream of the dam
- Node 4—Dawson River at Theodore, downstream of Theodore
- Node 2—Dawson River at Beckers, upstream of Don River confluence with Dawson River and downstream of Neville Hewitt Weir
- Node 1—Fitzroy River at Eden Bann Weir
- Node 0—Fitzroy River Barrage.

As noted in Section 5.2.1, the Water Plan only nominates EFOs for Node 0 and Node 2, however the proponent has presented environmental flow statistics for the other

defined Water Plan nodes to demonstrate project impacts that may occur at other locations within the catchment.

The EIS presented a range of water quality data obtained from the water storage, downstream of the dam wall and other water storages in the Fitzroy Basin. This data was collected by EHP and the proponent from 1963 to 2013. Water quality samples were taken at water courses crossed by the proposed pipeline in 2009.

Flooding

Preliminary flood studies were undertaken in 2008 and 2010, including hydrologic and hydraulic modelling. The study reviewed historical DNRM flood data for Dawson River recorded at Taroom, Glebe and Theodore gauging stations from 1912 to 2004. One of the key objectives of the dam design was to maximise the water storage volume while limiting the backwater effects upstream to avoid increased flood levels at Taroom during major flood events. Assessment of potential flooding impacts resulting from operation of the dam's water storage was based on two scenarios: the existing environment with no dam and the developed case with the dam.

Modelling undertaken for the developed case assumed that the water storage was at FSL and at the beginning of a 1-in-100-AEP flood event, therefore providing a conservative assessment of flood impacts. Surface water modelling undertaken for the project indicated that the dam would be at or above FSL for seven per cent of the modelling period, which is equivalent to 60 exceedance events over the modelling period from 1900 to 2007. The actual flood levels would be less than predicted once the dam is operational.

The EIS noted that the results of the preliminary flood study are likely to be affected by errors and inaccuracies of the input data, such as local topographic data. As a result the predicted impacts of the dam's water storage on properties surrounding the water storage are likely to have an accuracy of +/- of 0.25 m. I consider this level of accuracy as acceptable for the purpose of my evaluation and note that revised modelling of flood levels will be undertaken following detailed design of the dam. I require the revised flood modelling to be provided to BSC for review prior to construction of the dam.

Environmental release strategy

Modelling of the dam operations and hydrologic impacts on the Dawson River and further downstream on the Fitzroy River incorporated a preliminary operational strategy for the dam, comprising:

- provision of 66,011 ML/a of high-priority supplemented water allocations
- existing medium priority supplemented water allocations currently supplied by Glebe Weir would be supplied by the dam
- other existing high, medium and medium-A priority supplemented water allocations and downstream storages in the DVWSS would be supplied as per their current arrangements
- environmental flow releases consisting of:

  - first post-winter flow (FPWF) releases from Gyranda, Theodore, Moura and Neville Hewitt Weirs and the dam
  - maintenance of low flows directly downstream of the dam
- operation of a turtle way and fishway.

For further detail on new high priority water allocations that would be supplied by the dam refer to Section 2 of this report (About the project).

The proponent has committed to releasing water from the dam to mimic natural downstream river conditions through each season as far as practical. The proponent has based the FPWF release strategy according to ROP requirements, which require the first high-flow event to occur between 1 October and 10 April. This release would be triggered by an inflow of more than 35 ML/d into the proposed water storage, with maximum release from the dam capped at 3,888 ML/d. Inflows to the water storage would be released for 21 days. Refer to Section 5.4 (MSES) and Section 6 (MNES) for assessment of impacts on aquatic fauna.

The low-flow release strategy was adopted mirroring the dam inflows up to a maximum release of 50 ML/d. The AEIS reported that the low-flow release strategy would enable adequate operation of the fishway and has removed the need for a seasonal baseflow release. Modelling of the turtle way was based on a release of up to 2 ML/d and would occur in addition to fishway releases. The AEIS noted that the turtle way release would occur during the natural movement periods for turtles—January to February (inclusive) and August to November (inclusive).

These environmental releases are based on achieving ecological outcomes consistent with maintaining a healthy riverine environment, floodplains and wetlands. Refer to Section 5.4 (MSES) and Section 6 (MNES) for assessment of impacts on aquatic fauna.

The proponent has committed to finalise the preliminary operational strategy during the detailed design stage of the project. The proponent would be required to submit the final operational strategy to DNRM for review and approval under the Water Act, prior to construction of the dam.

The final strategy would target specific environmental releases required to maintain the water security of existing water entitlements and EFOs during the initial dam filling period and operational stage of the project.

5.2.4 Impacts and mitigation (dam and surrounds)

Construction

Impacts on downstream ecological values and water entitlements

Construction of the dam wall would interrupt natural river flows, reduce downstream environmental flows and water access for existing water entitlements.

To reduce potential impacts, the proponent has committed to construct the dam wall over two dry seasons, therefore avoiding high river flows that would typically occur during the wet season (October to April). The AEIS reported that construction of the

dam would be undertaken during periods of low average monthly rainfall, which have previously occurred between May and November.

Regular weather monitoring would be undertaken to ensure that weather conditions are appropriate for construction and that the environmental management strategies remain effective. A diversion channel would be established to enable the natural river flows to by-pass the construction works. Two coffer dams, one at either end of the diversion channel, would be constructed to: store water upstream and divert flows through the channel; catch site run-off downstream for treatment or use; and prevent backflow of diverted water from downstream.

These mitigation measures are standard dam safety and design requirements of the *Queensland Dam Safety Management Guidelines* (2002) and the Australian National Committee on Large Dams (ANCOLD) Guidelines (2003).

During the 3.5-year construction period, the proponent would continue operation of the Glebe Weir, which is the uppermost storage of the DVWSS. This would provide water for existing water entitlements and maintain environmental flows. The draft EMP provided in the AEIS (refer to Section 29 of Appendix B29) reported that the proponent would monitor river flows to ensure that water access is not affected and that the river flows are compliant with the Water Plan.

If monitoring identifies unacceptable flow conditions that are non-compliant with WASOs and/or environmental flow objectives, the works would cease until the river flows are reinstated and rehabilitation works (if necessary) are completed (refer to Appendix B29, EMP). The draft EMP would be further developed during the detailed design stage of the project and in consultation with DAFF, DNRM and EHP.

Impacts on surface water quality

An increase in turbidity and hydrocarbon concentrations could occur during the 3.5-year dam wall construction period, due to run-off from earthworks, site clearing, road construction, concrete batching plants and vehicle wash-downs. While the risk of increased turbidity is greatest during high rainfall events, turbidity levels during high rainfall events are currently naturally high within Dawson River, and construction works are unlikely to result in a significant contribution.

Water quality impacts during construction would be managed by constructing the dam during the dry season (April to November) or during low rainfall conditions, when river flows are low. The proponent would implement erosion and sediment control mitigation measures, including:

- establishment of a diversion channel to enable natural river flows to bypass the construction site
- installation of floating booms downstream of the diversion channel and supporting silt curtains weighted to the river to reduce downstream turbidity plumes
- directing dewatered wastewater to sedimentation ponds prior to re-use or discharge in accordance with an approved project water quality management plan (WQMP)
- clearing vegetation within the water storage as late as possible in the construction process to reduce potential for surface run-off.

- The proponent would prepare and implement an Erosion and Sediment Control Management Plan (ESCMP) in accordance with the International Erosion Control Association (IECA), Best Practice Erosion and Sediment Control Sediment Guidelines (2008). A WQMP would be prepared and implemented for construction and operation of the dam. It would be informed by baseline water quality data collected upstream and downstream of the dam prior to commencement of construction.

I note that the proponent would be required to obtain a development permit for dredging of material from the river bed (Environmentally Relevant Activity 16), which includes preparation of a WQMP in accordance with the EPP (Water) and Dawson River Sub-basin Guidelines and EHP review and approval prior to dam construction.

Flooding during construction

Changes to upstream and downstream flooding are expected to be negligible during the construction of the project. Coffer dams and a diversion channel will be used to safely divert natural river flows during construction. The construction of the dam wall would be undertaken during the dry season when the risk of a major flood occurring is low. In the event that a flood event occurs and the coffer dams and the diversion channel fail to safely pass the river flows, overtopping of the partially constructed dam wall could occur. The EIS noted that the dam would allow for safe overtopping by major floods during construction as roller compacted concrete would be placed on the downstream face of the wall, therefore protecting from overtopping.

Further, a flood management plan would be prepared, which would include management strategies including pumping to clear flood water, implementation of a (small) flood diversion conduit, and risk monitoring. With these mitigation measures in place, I consider that the proponent can adequately manage the risk of dam wall overtopping during construction.

Operation

Without mitigation, the dam could reduce the volume and frequency of river flows within the Dawson River and cumulatively within the Fitzroy Basin. This could occur during the initial filling period of the water storage and once the water storage attains the minimum operating volume (MOV) of 34,502 ML. Changes to natural river flow could result in a reduction in environmental flows which are essential for maintaining a healthy riverine environment and reduced water access for existing water entitlement holders. The EFOs defined in the Water Plan will be used to assess the construction, initial filling period and ongoing operations of the dam to ensure any impacts are mitigated to an allowable level.

Initial filling period––river flow impacts

The time needed to fill up the water storage is dependent on rainfall conditions and the volume of inflows at the time of the dam closure.

Modelling results included in the EIS showed that there is a 50 per cent probability of the water storage filling up to MOV within 6 months and up to full supply volume (888,312 ML) within 2.6 years. It is anticipated that the dam closure would occur prior

to the start of a wet season. This would allow the filling of the water storage to commence during the wet season, when inflows to the storage are likely to be high.

If filling of the dam is delayed due to low rainfall, the proponent has reported that there would be a low risk of unacceptable impacts occurring on EFOs and WASOs. The proponent has advised that, subject to further consultation with DNRM, the following measures could be in place to further reduce risk of impacts during this stage:

- emptying of Glebe Weir (uppermost storage) during dry periods which would enable supply of water downstream for environmental flows and water access
- maintenance of water levels within downstream water storages at higher levels than usual to minimise the risk of shortfall by the dam
- drawdown of downstream water storages lower than normal to compensate for the slower filling period of the dam
- increasing water access to existing water entitlement holders prior to dam closure.

In the event that water access is reduced, the proponent has committed to compensate the affected water entitlement holders, and I require this to be undertaken. These measures would be further refined as part of the final operational strategy.

As part of the amendment of the existing ROL under the Water Act, the proponent would be required to obtain DNRM's approval of the following:

- final operational strategy, that would be implemented during the initial filling and operation of the dam
- compensation strategy to ensure that affected water entitlements have been fairly compensated in accordance with the Water Act.

I note that existing water harvesters would be most affected by the dam operation and I have imposed a condition at Appendix 1 requiring the proponent to prepare a stakeholder engagement plan that demonstrates how the proponent will engage with water entitlement holders. This plan must be submitted six months before construction. The proponent is also required to report on stakeholder engagement processes annually for five years after construction commences.

Initial filling period—surface water quality impacts

Water quality during the initial filling period of the water storage is anticipated to be poor. As the soils within the water storage are first inundated and terrestrial vegetation starts to decompose, nutrient levels and turbidity are predicted to increase and dissolved oxygen concentrations are predicted to reduce. Changes in water quality could impact on downstream ecological values and quality of water supplied to existing and new water entitlement holders.

The extent of water quality impacts are dependent on the time taken for the water storage to fill, the volume of water and the amount of remaining vegetation within the water storage. If filling of the dam is delayed due to low rainfall and triggers for water releases are not met for extended periods of time, a first release strategy would be implemented which is designed to minimise water quality impacts during slow filling periods. Further, use of the multi-level offtake structure would assist in managing water

quality impacts by enabling selective delivery of water and allow for higher quality water to be released downstream.

To reduce potential increases in nutrients and turbidity, the proponent has committed to implement a vegetation clearing strategy which would mechanically clear trees and shrubs within the water storage to FSL. In the riparian zone of tributaries and the main channel, clearing would occur to within 1.5m (vertical) of FSL.

I am advised by EHP that any adverse water quality impacts occurring as a result of decaying vegetation would be low due to the majority of the vegetation being mechanically removed. Water quality impacts would be further reduced through establishment of a vegetated buffer around the water storage, which would filter sediments or contaminants in run-off.

I note that the proponent is required to amend its current ROL to include operation of the project which would water quality monitoring and reporting to ensure that water quality is suitable for downstream ecological values and supply of water for existing and new water users.

Operations—surface water quality impacts

Main water quality impacts associated with operation of the water storage include:

- potential toxic algal blooms and impact on environmental values of recreation and aesthetics, primary industries, aquatic ecosystems and cultural and spiritual values could occur as a result of continued poor water quality inflows
- moderate risk of thermal stratification and turnover events, potentially resulting in release of water that is of poor quality and colder temperature than the ambient environment, therefore affecting downstream aquatic flora and fauna and resulting in potential algal blooms
- potential for wind-driven resuspension of sediments and nutrients from the bottom of the water storage if it dries out.

Blue-green algae

With regard to the risk of algae, while not common in the Fitzroy Basin, an outbreak of blue-green algal blooms could affect the consumptive and aesthetic values of the water resource. To avoid or reduce the likelihood of an outbreak, the proponent has committed to:

- clear vegetation within the water storage to minimise input of nutrients into the water storage
- undertake routine water quality monitoring, and monitoring of blue-green algal levels
- not release water from the dam in the event of a ‘high hazard’ algal bloom, unless it is safe to do so.

Thermal stratification

- In responding to the likelihood of these risks, the proponent has advised prolonged and strong thermal stratification is unlikely to occur within the water storage as the key cause for this issue is drought, which the region does not often experience.

- The surface area of the water storage is large and the dam is expected to receive run-off from the surrounding catchment, which could accumulate over time and result in an increase in nutrients and sediments within the water storage. This accumulation is not expected to be substantial as water would be flushed regularly due to releases.

Limited inflows

A submission received on the EIS raised issues regarding water quality within the water storage during prolonged dry periods. Dry periods could result in low inflows into the water storage, which could affect water quality.

These impacts would be managed through implementation of a low flow release strategy, which would maintain water quality in the downstream receiving environment. These releases would reduce the occurrence of low dissolved oxygen concentrations and increases in electrical conductivity that typically occur in standing water.

In addition, as discussed the multi-level offtake structure would enable selective delivery of water from different depths of the storage and allow for higher quality water to be released downstream.

Facilitated impacts

Submissions on the EIS and AEIS have raised queries regarding the potential for the dam to facilitate agricultural development, resulting in potential water quality impacts on the Great Barrier Reef World Heritage Area (GBRWHA) downstream. An assessment of these impacts is provided in Section 6 (MNES).

ROL water quality requirements

I note that as part of the conditions of the amended ROL for the project, the proponent would be required to finalise the operational strategy and obtain approval from DNRM. Under the ROP, the holder of a ROL is required to undertake routine water quality monitoring, including assessment of:

- thermal and chemical stratification in the storage
- quality of the water being released from the storage and its management
- cyano-bacterial population changes in response to stratification in the storage
- any proposed changes to the monitoring program as a result of the evaluation of the data.

Operations—mine releases

Project effects on mine releases

A submission received on the EIS and AEIS raised the need for assessment of how the operation of the dam may reduce the ability of downstream mines to discharge mine-affected water.

Four mines are located downstream of the dam, with the nearest mines being Dawson South (100 km downstream) and Baralaba Central (240 km downstream). Impacts would be greatest during the initial filing stage of the dam, which would reduce the volume and frequency of low and moderate flows being received by downstream

mines. This may reduce opportunities for the downstream mines to release during extended dry periods and low rainfall.

Discharge of mine-affected water under the existing mine Environmental Authority (EA) conditions are set to coincide with periods of high-flow stream conditions and it is usually during high rainfall and flood events that mines are required to make releases, therefore mine water discharges during extended dry periods are unlikely.

The proponent has advised that the likelihood of dam releases affecting releases undertaken by downstream mines during the initial filling period is anticipated to be low.

The proponent would be required to obtain DNRM's approval of the dam's final operational strategy, which would be implemented during the initial filling and operational stages. I note that DNRM will consider potential impacts on downstream mines to release mine-affected water consistent with existing EA requirements as part of its assessment.

Mine effects on the project

Submissions on the EIS also raised the need for assessment of existing and proposed mining and CSG projects and surrounding land uses on the environmental values and water quality of the proposed water storage.

Based on 2012 data, the AEIS reported that no mines are operating upstream of the dam. In the event that future projects proceed upstream of the dam, water quality impacts, including on a cumulative scale, would be regulated through EAs issued by EHP under the EP Act.

Potable water quality

Submissions received on the EIS raised the need for further information on the management of drinking water within the Dawson River. The EIS noted that the dam would primarily supply water for industrial users, with small volumes of water being provided for drinking purposes.

The nearest downstream offtake for drinking water is located at Theodore, 65 km downstream of the dam wall. The water quality supplied by this offtake is compliant with the water quality objectives for drinking water. The operation of the dam may influence water quality at Theodore, due to increased capture and retention of first flush flows and by longer low flow duration. Alterations to flows can potentially increase turbidity and increase concentrations of dissolved oxygen due to extended low flows.

The multi-level offtake structure during operations would reduce these risks. The dam could potentially deliver improved quality of water to Theodore and all drinking water supplies would be treated by the entity purchasing water from the proponent prior to distribution to its customers.

Submissions received on the EIS also raised issues regarding the release of CSG water upstream of the dam and potential impacts on drinking water supplied by the dam. Upstream CSG operations are regulated under EAs issued by EHP and are required to undertake stringent treatment of water prior to releases.

I note that DEWS and Queensland Health regulate the quality of drinking water supplied by dams through the *Water Supply (Safety and Reliability) Act 2008* and the

Public Health Act 2005. This includes routine water quality monitoring and assessment against water quality parameters nominated under the *Public Health Act 2005.* Accordingly, I am satisfied that the operation of the dam can be adequately managed to avoid any detrimental impacts on drinking water quality and public health.

Operational impacts on downstream ecological values

Modelling results show that the operation of the dam would meet all mandatory EFOs set under the Water Plan. The mandatory EFOs include medium to high-flow objectives and first post-winter flow events.

A submission on the EIS raised the need for further information on the monitoring of the flow regime downstream of the dam wall. The AEIS provided a draft operational EMP for the dam which would be finalised as part of the detailed design stage. The AEIS stated that monitoring of dam inflows may be undertaken at the Taroom gauge, while a new streamflow gauge would be installed downstream of the dam wall between the dam wall and Gyranda Weir. Due to the construction of the dam wall and presence of nearby Boggomoss Springs, increase in pressure on local groundwater may lead to increased baseflows (groundwater outflow) in the watercourse downstream of the dam wall. While this increase in stream flow may reduce the need for dam releases, the AEIS noted that the environmental flow release strategy would need to be monitored to ensure releases needed for operation of the fishway and turtle way are still made. The proponent has committed to undertake regular assessment of the effectiveness of the environmental flow releases and operation of the fishway and turtle way. Ecological monitoring and surveys would also be undertaken downstream of the dam (refer to Section 5.4.8 for further information).

In accordance with the regulatory requirements of the Water Act, the proponent would obtain DNRM's approval for an Operation and Maintenance Manual. The manual would include specific operating procedures to maintain fauna passage through a fishway and turtle way.

As part of ROL conditions, the proponent would be required to develop a water quantity and water quality monitoring program for the dam. The aim of the monitoring programs would be to measure a variety of streamflows (low, medium and high flow) necessary for maintenance of EFOs within the DVWSS. The proponent would develop these programs in consultation with EHP, DNRM and DAFF. For an assessment of reduced stream flow impacts on MNES refer to Section 6 of this report and for impacts on MSES refer to Section 5.4 of this report.

Operational impacts on water entitlements

Supplemented water entitlements

Modelling results indicate that operation of the dam would be compliant with WASOs for all high and medium priority supplemented water entitlements under the Water Plan. The operation of the dam and joining of the upper and lower sub-schemes of the DVWSS would benefit these water entitlements by increasing the reliability of water supply.

Reliability of water would be increased by 2 per cent annually for high priority users, and by 6 per cent monthly for medium priority entitlements. No changes are predicted to occur for WASOs set for the Lower Fitzroy Water Supply Scheme (LFWSS) and the Fitzroy Barrage Water Supply Scheme (FBWSS).

The AEIS identified that supplemented medium priority users (irrigators) would experience a reduction in mean annual diversion (MAD) by 3 ML/a. The largest reduction in MAD would be experienced within Zone Dawson I to Med A priority allocations (refer to Figure 5.2), with a maximum reduction of 2.8 per cent in MAD. The modelling showed that whilst this zone would also experience a reduction in MAD, the dam would provide more reliable water supply during the dry season when water is needed the most.

Unsupplemented water entitlements (water harvesters)

Modelling results indicate that operation of the dam would have a significant impact on unsupplemented water allocations (water harvesters). The establishment of the dam and dam operations reduce the peak and duration of high flow events downstream of the dam wall resulting in less opportunity for water harvesting diversions to occur. The AEIS reported that water harvesters would experience a total reduction in MAD by 6,040 ML/a. The largest reduction in MAD would occur within zones located closest to the dam wall including:

- Zone M (from Glebe Weir to upstream limit of Glebe Weir), reduction of 56 per cent
- Zone K (from Orange Creek Weir to effective upstream limit of Gyranda Weir), reduction of 27 per cent
- Zone F (from Mimosa Creek junction to Moura Weir), reduction of 25 per cent
- Zone G (from Moura Weir to upstream limit of Moura Weir), reduction of 21 per cent.

Other zones within DVWSS would experience reductions of less than 15 per cent in MAD as they are further away from the dam wall and would receive an increase of water through natural river flow from downstream tributaries.

A number of submissions on the EIS and AEIS noted that the dam should supply water for new agricultural schemes.

The EIS included that the proponent has conducted a study to predict future demand for water, which found that the price of water from the dam is likely to be several times the irrigated agriculture viability limit, even for high-value crops. As a result, the current scope of the project is limited to the supply of water for new urban and industrial customers and the maintenance of supply to existing irrigators.

Some submissions also raised the need for interim release of water currently held for the project, prior to dam construction. Release of water under the ROP is subject to a tendering process run by DNRM and is therefore outside the scope of this project.

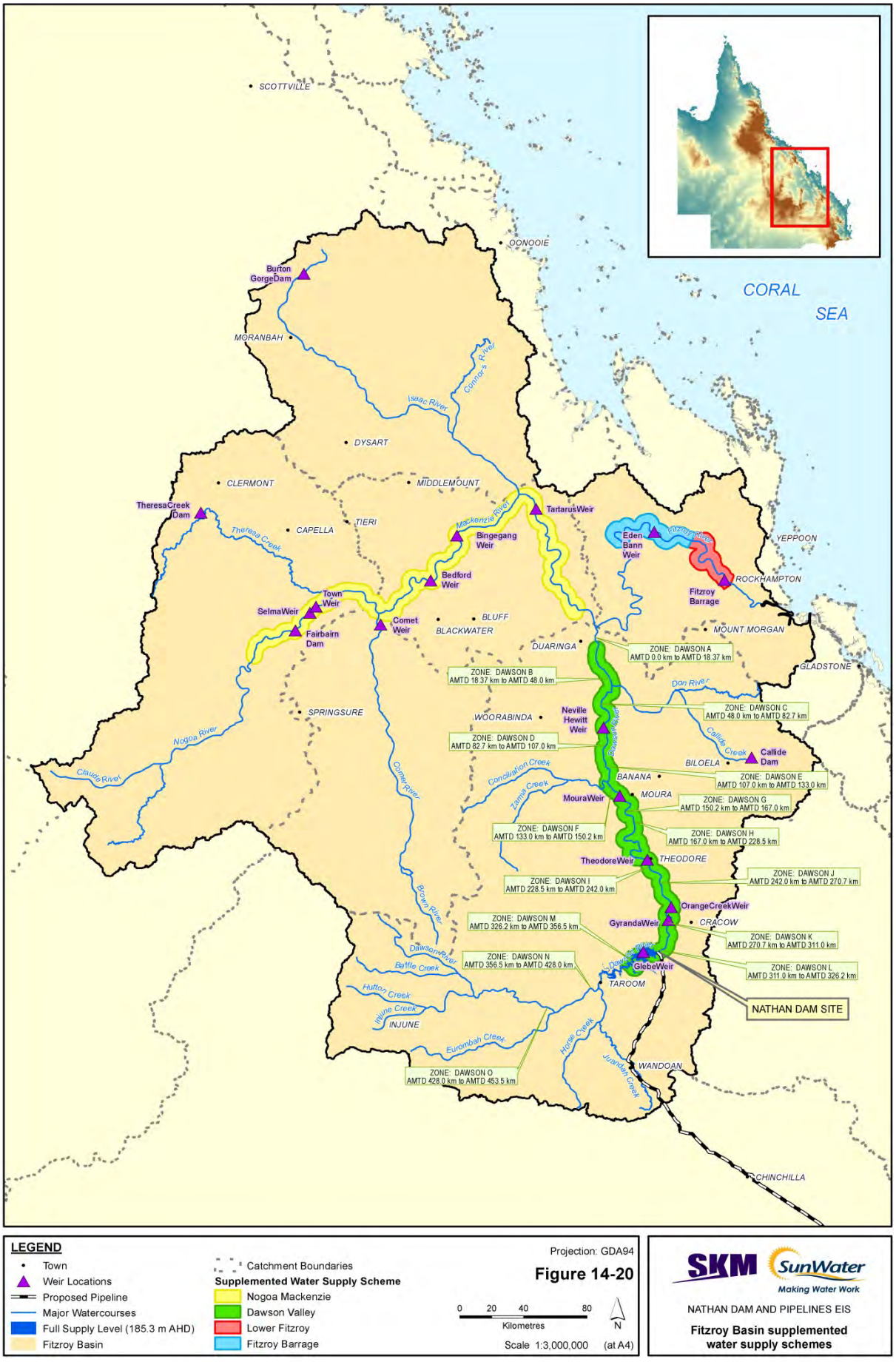

Figure 5.2 Fitzroy Basin supplemented water supply schemes

Compensation

A submission on the EIS requested further information on the types of compensation options considered by the proponent. On the basis of preliminary consultation with affected water users, the proponent has investigated four compensation options. The AEIS reported that two options have been identified as the most effective:

- provision of new medium priority licence to supplement a part of water allocations lost due to operation of the dam
- provision of new medium priority licence to supplement the whole water allocation lost due to operation of the dam, with this option requiring surrender of complete unsupplemented water allocations by existing water harvesters.

Financial compensation could also form part of the above options. The proponent has committed to undertake further consultation with affected water users and DNRM during the detailed design stage of the project. As part of the regulatory process under the Water Act, the proponent would be required to obtain DNRM's approval for the following:

- completed assessment of impacts on all existing water entitlements
- finalised compensation strategy to ensure that all water users have been fairly compensated.

I note that existing water harvesters would be most affected by the dam operation and I have imposed a condition requiring the proponent to undertake one-on-one consultation with relevant stakeholders, including affected water users prior to project construction (refer to Appendix 1).

Submissions received on the EIS reported that impacts on Class 13A and Class 13C Water Allocation Groups (WAGs) have not been considered in the EIS. The proponent has clarified that these two WAGs are located upstream of the dam wall and would be within the water storage area. While water access under current licences held by these WAGs would not reduce with the dam operation, some properties would be partially flooded. Further consultation with these water users would be undertaken prior to dam construction to agree on suitable compensation for these impacts.

Cumulative impacts

The proponent has undertaken a cumulative impact assessment of proposed water infrastructure projects in the Fitzroy Basin to existing water entitlements and environmental flows. The assessment was based on operation of Nathan Dam, Connors River Dam and the Lower Fitzroy River Infrastructure Project (LFRIP) while also considering the take of all unallocated reserves within the Fitzroy Basin.

I have approved the Connors River Dam and the LFRIP projects, and both projects have been approved by the Commonwealth Environment Minister under the *Environment Protection and Biodiversity Conservation Act 1999.* While a business case for LFRIP (Rookwood Weir) is currently being prepared by the proponent, the Connors River Dam business case has not been prepared.

The cumulative modelling was based on preliminary operational strategies for all projects and did not include compensation strategies for affected water users or low-

flow environmental release strategies important for maintenance of healthy riverine environment, floodplains and wetlands.

The cumulative modelling showed that with operation of all three dam projects, all mandatory EFOs would be met with the exception of one indicator for the FPWF objective. The AEIS noted that this non-compliance could be addressed through further refinement of the operational rules for Eden Bann and Rookwood Weir.

Assessment of impacts on WASOs identified annual reliability of high-priority water is predicted to fall below compliance level, while the medium-priority reliability would be increased. The unsupplemented irrigator groups on the Fitzroy River would experience a significant reduction in MAD.

The AEIS reported that these impacts would be managed through a combination of environmental flow releases, management rules and compensation strategies. To ensure no unacceptable impacts occur on environmental flows and water users, detailed operational strategies for each project would be subject to review and approval by DNRM in accordance with the Water Act.

Climate change impacts on dam yield

Climate change is likely to result in an increase in annual average temperature, decrease in rainfall and changes to seasonal rainfall. Modelling showed that during a dry climate change scenario, the levels of water within the water storage would drop for a maximum of 4.9 per cent of time and the periods of no inflows into the dam would increase by a maximum of 37 per cent of time.

The reliability of water supply for high priority water users (urban supply) would also drop to 96 per cent during this time. The AEIS reported that these impacts are low risk and that the operational yield of the dam has been assessed conservatively and it provides additional storage capacity and yield within the Dawson catchment.

The dam would provide a high level of reliability, therefore safeguarding the potential climate change impacts on the regional water supply during droughts.

The proponent has committed to develop a contingency plan prior to construction in consultation with DNRM and DEWS. The contingency plan would ensure that urban communities retain sufficient water supply required for essential human needs in line with the level of service parameters adopted by the community.

Operational flooding impacts

Upstream flooding impacts—Taroom and surrounds

Based on preliminary flood modelling, the EIS identified that with the dam in place, the 1-in-100-AEP flood level would increase by 0.6 m. However the peak flood level within Taroom would still be below the town's minimum development level of EL 190.1 m AHD, below which new residences may not be constructed.

Two residences located between FSL and the 1-in-100-AEP flood level in Taroom are unlikely to be habitable as they are unlikely to meet housing safety criteria. These properties are proposed to be acquired by the proponent.

The EIS identified other flooding impacts including:

- four properties are predicted to be located between FSL and the 1-in-100-AEP flood level within the proposed flood buffer
- 20 properties would experience flooding by 1 ha or more
- flooding of Glebe Weir and the associated reserve for recreation and camping adjacent to Glebe Weir.
- Measures to manage and mitigate the impacts of the increased flood levels in Taroom and surrounds include the acquisition of easements and land within the flood buffer and mitigation measures such as increasing flood resilience, movement of residence and acquisition of the property.

The proponent has committed to revise the flood modelling to confirm the extent of flooding impacts. I require the proponent to provide this information to Banana Shire Council for review. I have also imposed a condition requiring the proponent to engage with the community prior to construction of the dam.

While the project does not include construction of a levee for management of flooding impacts on Taroom, the proponent noted that easements would be established in consultation with property owners to restrict future development in areas that are subject to increased flooding.

A flood management plan for operations would be developed to manage impacts during extreme flood events. The EIS noted that the FMP may also consider inclusion of dam outlets which could release additional water during flood events and manage flooding impacts on Taroom. Section 2.3.1.6 of the EIS noted that two outlets could be used for supplementary releases, with combined capacity to release 23,760 ML/day.

Downstream impacts

The flood retention effect of the dam will significantly reduce flood peaks downstream, particularly for smaller flood events. Although the dam will not have a significant flood protection role for downstream areas, the 1-in-100-AEP peak flood level will reduce as a result of the dam construction.

The EIS identified the following impacts on areas located downstream of the dam wall:

- reduction in flood peak downstream particularly for small flood events
- the 1-in-100-AEP flood event at Theodore would reduce by 0.5 m
- several farm buildings which are currently impacted by floods will benefit from the reduced flood levels
- floods taking 22 hours longer to peak (where current average time to peak is approximately 7 days)
- floods taking longer to recede—approximately 2–3 weeks instead of ten days.

Dam safety

For the purpose of the preliminary design presented in the EIS the dam would be assessed as an Extreme Hazard category dam in accordance with provisions of the *Water Supply and Reliability Act 2008*, Queensland Dam Safety Management

Guidelines 2002 and the definitions given by the Australian National Committee on Large Dams (ANCOLD) 2003. The preliminary design of the dam allows for sufficient discharge capacity to safely pass the probable maximum flood (PMF), therefore if an event of this magnitude occurs, the downstream community will not be subject to additional risk due to the dam being in place.

The proponent will be required to obtain a development permit for a referrable dam under the WSR Act from DEWS prior to construction of the project. Refer to Appendix 1 for list of recommended information to be provided to DEWS as part of this application.

The EIS reported that the following measures will be adopted to account for climate variability or weather related extremes:

- design of the spillway to pass the PMF
- provision for rapid draw-down of the storage in the event of a dam safety emergency
- preparation of a flood management plan for operation of the project
- preparation of a storm management plan.

Flood gates are typically included in a spillway in order to control the volume of water being released downstream during a flood and to manage downstream flood levels, so that impacts to downstream communities can be reduced. This may cause an increase in floodwater backing up behind the dam wall, which could potentially impact on any upstream communities discussed above. The current design configuration without gates is considered to provide the best outcome in terms of minimising the flood impacts both upstream and downstream of the dam.

The preliminary engineering design for the dam spillway is considered to be of sufficient width to release water to safely pass the PMF so that if such an event occurs, the downstream community will not be subject to additional risk due to the dam.

Climate variation

The EIS reported that climate variability considerations are inherently included in any design flood hydrology analysis which is based on long term flow data. Climate variability is therefore already incorporated in the predictions of flood magnitude and frequency.

I require that updated hydrological modelling undertaken during the detailed design phase of the project will incorporate recent flood data and include allowances for increased flood activity due to climate change.

5.2.5 Impacts and mitigation (pipeline)

Construction

As discussed in Section 2 (About the project), the pipeline requirements for the project have been reduced to 149.3 km. The AEIS reported that the project would utilise the existing Woleebee to Glebe Weir pipeline (69.4 km) and terminate the pipeline at Warra, instead of Dalby. This change in the pipeline has resulted in a reduction from 13 to 10 significant watercourse crossings.

Overland flows

A submission on the AEIS raised concerns that construction of the pipeline would result in diversion of overland flows.

The AEIS confirmed that the pipeline would be buried and overland flow is unlikely to be affected. If any section of the pipeline is required to remain above ground, it would be supported by concrete piers which would suspend the pipeline approximately 300 mm above the natural surface level and therefore not impede overland flows.

Surface water quality impacts—creek crossings

Key water quality impacts associated with construction of the pipeline include increased sedimentation and turbidity caused by earthworks, site clearing and other associated activities.

Construction of the pipeline would be undertaken during the dry season when most of the creeks would have no water. Some larger watercourses are likely to contain water during this period and the proponent would implement the following measures to avoid impacts on surface water quality within these courses:

- standard erosion and sediment control measures in line with the IECA, *Best Practice Erosion and Sediment Control Sediment Guidelines (2008)*
- isolation of the trench area by coffer dams and use of a secondary low level coffer dam to act as a sediment basin depending on the environment downstream and the suspended sediment concentration of the discharge water
- dewatering of the trench using pumps and discharging into the water downstream
- on completion of the works, the coffer dams will be removed slowly and the stream bed and banks reinstated to their original profile.

Submissions received on the EIS and AEIS raised issues regarding inadequate monitoring and management of potential impacts to water quality (particularly for sediments) in existing streams due to the construction of the pipeline.

I note that prior to commencing construction of the pipeline, the proponent would be required to obtain a permit for environmentally relevant activity 16 (extractive and screening activities) under the EP Act.

This permit may condition the need for a water quality monitoring plan to be provided to EHP and DNRM. The WQMP would include assessment of background water quality conditions and allow for comparison with water quality objectives for relevant environmental values that need to be protected.

I have included recommendations in this report that the proponent designs, constructs and rehabilitates the pipeline water course crossings so that they do not cause unacceptable sedimentation, turbidity and erosion of the stream bank in the disturbed area of the pipeline crossing.

I have also recommended that the WQMP includes monitoring of turbidity of waters in watercourses upstream and downstream of the pipeline excavation, presence of any downstream sedimentation of stream beds and any erosion in the stream bank. With

these measures in place, I am satisfied that water quality impacts associated with pipeline construction can be adequately managed.

Operation

As noted in Section 5.2.1, the pipeline would be buried and therefore no pipeline sections would be above ground. As a result, no operational impacts on surface water flow or water quality are anticipated to occur. Infrastructure such as pump stations, balancing storages and other items of ancillary infrastructure would be above ground. This infrastructure is unlikely to interfere with surface water flow within watercourses as they are unlikely to be located within watercourses.

The EIS noted that in the event of a pipeline rupture or leak, an automated shut-down procedure would be implemented to reduce potential impacts on water quality within water courses and bed scouring within small ephemeral creeks. The risk of water quality impacts occurring as a result of a pipeline rupture or leak are considered to be negligible as the pipeline would contain good quality water.

In the event that the pipeline is not flowing efficiently, sections of the pipeline may require scouring by release of water from dedicated scour valves, located at low points along the pipeline to remove sediment accumulations, or pigging of the pipeline to remove pipe wall accumulations.

A submission on the EIS raised issues regarding the potential for water quality and aquatic ecosystems associated with the release of water from the pipeline. The AEIS noted major pipelines are typically scoured once a year and a small volume of water is discharged. The water is discharged into a constructed scoured pit, where it slowly gets absorbed into the surrounding soils or evaporates. Impacts on surface water quality and aquatic ecosystems within nearby creeks are likely to be negligible.

5.2.6 Impacts and mitigation (associated infrastructure)

The project would require the construction of new roads and closures, upgrades, realignments and reinstatements of existing roads. The project would also require the construction of bridges and culverts to facilitate the project. All road works would maintain existing drainage patterns and would be constructed in accordance with standard construction methods required by TMR, BSC and WDRC.

For further information on road impacts refer to Section 5.7 (Traffic and transport).

Construction of the associated infrastructure is not expected to result in significant impacts on surface water quality. These activities would be regulated under permits for relevant environmentally relevant activities, waterway barrier works and other development approvals.

5.2.7 Coordinator-General's conclusion

I consider that the proponent has provided adequate information to demonstrate that the project is unlikely to adversely impact on river flows, Dawson River water quality and watercourse crossings.

I consider that the preliminary environmental release strategy adequately addresses the EFOs and WASOs of the *Water Plan (Fitzroy Basin) 2011*. I note that the final operational strategy would require further refinement and approval by DNRM prior to project construction to ensure that the impacts that could occur during the initial filling of the dam and during the operation of the dam do not result in unacceptable impacts on downstream water users and aquatic ecology.

I note that prior to construction of the dam, the proponent would be required to complete an assessment of all impacts on existing water entitlements and submit a final assessment for DNRM's review and approval. I note that existing water harvesters would be most affected by the dam operation and I have imposed a condition requiring the proponent to undertake one-on-one consultation with the community prior to project construction. Subject to further review, I note that DNRM would approve the final compensation strategy to ensure that water harvesters are compensated fairly and in accordance with the Water Act.

I acknowledge that cumulative impacts on aquatic ecology and water users could occur as a result of operation of proposed water infrastructure projects in the Fitzroy Basin (Nathan Dam, Connors River Dam, Eden Bann Weir State 3 and the Rookwood Weir Stage 2). I consider that cumulative impacts can be managed through a combination of strategic environmental flow releases, management rules and compensation strategies for each project. Prior to operation, detailed operational strategies for each dam project would require an approval under the Water Act.

I note that the project would be required to obtain an approval for environmentally relevant activity (dredging) under the *Environmental Protection Act 1994* prior to construction of the dam wall and the pipeline. Management of water quality would be undertaken in accordance with the *Queensland Water Quality Guidelines 2009*, the *Environmental Protection (Water) Policy 2009* and the *Dawson River Sub-Basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Dawson River Sub-basin except the Callide Creek Catchment (2011)* (the Dawson River guidelines).

The proponent is required to undertake routine water quality monitoring throughout the operation of the dam in accordance with the ROL and to report monitoring results to DNRM.

I consider that the project would improve water reliability, safeguarding potential climate change impacts on regional water supply. I note that the proponent would prepare a contingency plan for the project to manage and prioritise urban water supply during periods of drought.

5.3 Groundwater

5.3.1 Existing environment

Dam and surrounds

Construction and operation of the project may have impacts on groundwater systems, particularly on groundwater bores, groundwater dependent ecosystems, groundwater–surface water connectivity and flow, and groundwater quality.

Aquifers underlying the dam wall and water storage (including the buffer) include:

- the regionally significant consolidated sandstone aquifers of the Precipice Sandstone and Hutton Sandstone aquifers of the Surat Basin, which are major aquifers of the Great Artesian Basin (GAB)
- minor to significant unconsolidated sedimentary aquifers associated with the alluvium of the Dawson River and its major tributaries.
- Depth to groundwater varies significantly across the area of the proposed dam wall, water storage and the buffer. A drilling program undertaken as part of the AEIS recorded sub-artesian water within the Hutton Sandstone approximately 10 km north-east from Taroom at a depth of 187 m AHD. Artesian water of the Precipice Sandstone was recorded approximately 10 km north-west of the dam wall at 206 m AHD.

Groundwater is regulated through the *Water Act 2000.* Groundwater in the aquifers of the GAB is regulated through the *Water Plan (Great Artesian Basin) 2006* (WP (GAB)) and the *Great Artesian Basin Resource Operations Plan 2007.*

Other groundwater is regulated through the *Water Plan (Fitzroy Basin) 2011* (Water Plan) and the *Fitzroy Basin Resource Operations Plan (ROP) 2015.*

Prior to construction of the project, the proponent would be required to obtain permits for take of groundwater (artesian and/or subartesian) from DNRM.

Groundwater quality is regulated by EHP in accordance with the Environmental Protection (Water) Policy 2009 (EPP Water).

Groundwater bores

A review of the DNRM groundwater bore database identified 204 registered groundwater bores within the immediate surrounds of the dam wall and the water storage at FSL. Of these bores:

- 50 per cent intersect the Precipice Sandstone aquifer
- 25 per cent intersect the Hutton Sandstone aquifer
- 25 per cent intersect the Alluvium, Birkhead, Eurombah and Evergreen Formations.

The AEIS reported that since 2010, no additional bores have been recorded in the DNRM groundwater bore database in the immediate surrounds of the dam wall and the water storage at FSL.

A review of the DERM Water Entitlement System in 2010 identified the Taroom Town Water Supply (900 ML/year), irrigation (248 ML/year), and stock and domestic

purposes as the key authorisations for take of groundwater within the immediate surrounds of the dam wall and water storage at FSL.

Most bores which are located in the vicinity of the proposed dam wall access groundwater for stock and domestic purposes. The EIS identified seven known groundwater bores within the proposed water storage area, consisting of:

- four bores used for stock and domestic purposes
- one bore used for urban water supply (amenities)
- two bores have no known water use, however are likely to be used for stock.

Groundwater–surface water connectivity and flow

Groundwater flow patterns indicate that recharge to the Precipice and Hutton Sandstones occurs in the outcrop areas located to the west and north of the dam site and that groundwater flows largely to the south-east before discharging along the Dawson River and Boggomoss springs. Groundwater discharged from some of the springs situated within the river bed support the permanent surface water flow of the Dawson River.

The EIS noted that there are limited records of groundwater levels in the project area. Based on Department of Environment and Resource Management (now DNRM) records from 2003, the groundwater levels remain relatively stable in the vicinity of the dam site, with levels fluctuating by less than 0.5 m over the nine-year monitoring period from 1994 to 2003. The AEIS stated that the 2010–11 floods caused an increase in groundwater elevation up to 10 m and returned to pre-flood levels quickly.

Groundwater quality

Groundwater quality within the underlying aquifers is considered to be fresh to slightly brackish. Groundwater within the Precipice Sandstone aquifer is considered to be typically fresh, suitable for livestock use and all crop types and is considered to be suitable for human consumption.

Groundwater within the Hutton Sandstone aquifer has been reported as fresh to slightly brackish and generally suitable for livestock use and moderately tolerant crop types. Some Hutton Sandstone aquifer groundwater is considered not suitable for human consumption, as the mean salinity is above Australian Drinking Water Guidelines

Pipeline and associated infrastructure

The pipeline would commence in the Dawson River bed and traverse the right bank before crossing over the location of the Precipice Sandstone aquifer in the immediate vicinity of the proposed dam wall. As it continues along the alignment to Warra, the pipeline crosses over the Evergreen Formation, Hutton Sandstone and other Jurassic sedimentary units.

5.3.2 Methodology

The EIS confirmed that assessment of impacts on the groundwater system were identified using available information on groundwater occurrence and through development of a groundwater model.

The groundwater model was developed through use of a finite element modelling code (Feflow) and information from the then DERM groundwater database, Water Entitlements System, Springs of Queensland – Distribution and Assessment (Version 5.0) and a number of geological and hydrogeological reports for the area.

The EIS presented the results of groundwater impact assessment on the basis of a modelling period from 1900 to 2007, and considered the following scenarios:

- Scenario 1: the dam at FSL (183.5 m AHD) for the duration of the modelling period
- Scenario 2: the dam at median FSL (181.7 m AHD) for the duration of the modelling period
- Scenario 3: simulation of dewatering impacts during the construction of the dam wall
- Base case: no dam.

Scenario 1 with the dam at FSL is representative of a maximum impact on the groundwater system, with the water storage being at FSL for an extended period of time.

Surface water modelling undertaken for the project indicated that the dam would be at or above FSL for seven per cent of the modelling period, which is equivalent to 60 events over the 107-year modelling period.

To understand the aquifer recharge and associated springs, the proponent conducted a groundwater field program from October 2012 to August 2013 to supplement the groundwater model. This drilling program included installation of five new monitoring bores and refurbishment of two pre-existing monitoring bores. The monitoring was targeted to Boggomoss springs (north-west of dam wall), Cockatoo Creek springs (south of dam wall) and Dawson River 8 springs (at the western extent of the water storage, near Taroom).

5.3.3 Submissions received

Key issues raised in submissions on the EIS and AEIS regarding groundwater included:

- impacts of dewatering activities on existing groundwater users
- need for a detailed groundwater monitoring and management plan
- lack of information on existing groundwater bores and need for a bore survey prior to construction of the dam to confirm presence of all bores and to determine their condition and water use

I have considered each submission and the responses provided by the proponent in my evaluation of the project.

5.3.4 Impacts and mitigation (dam and surrounds)

Construction

Groundwater bores

The construction of the dam chimney filter would require groundwater dewatering for approximately 50 days. Dewatering could result in temporary groundwater drawdown of sub-artesian and artesian groundwater found in the underlying alluvium and Precipice Sandstone aquifer.

The extent of groundwater drawdown is predicted to be limited to a 1.5 km radius of the dam wall. The maximum level of groundwater reduction is predicted to be 19 m, occurring within approximately 100 m of the dam wall. Other areas located within the 1.5 km radius of the dam wall would experience less than 1 m reduction in groundwater levels.

The EIS states that the nearest groundwater bore is located 2.7 km from the dam wall, over 1 km from the predicted drawdown area. While impacts on groundwater bores are not likely to occur during dewatering, the proponent has committed to undertake weekly monitoring of groundwater levels during dewatering activities. In the event that reductions in groundwater levels are detected at any bores, the proponent would provide an alternative water supply to affected groundwater users.

Prior to commencement of dewatering activities for the project, the proponent would be required to obtain a permit for construction of new groundwater bores and for taking or interfering with artesian water and/or sub-artesian water from DNRM.

After dewatering activities are completed, the proponent would be required to decommission bores in accordance with standard requirements specified by the *Minimum Construction Requirements for Water Bores in Australia 2012* (National Uniform Drillers Licensing Committee).

Groundwater-dependent ecosystems

The EIS identified 20 State protected springs that would be affected by groundwater drawdown during construction. Four of these springs are located near the proposed dam wall and are predicted to experience a reduction in groundwater levels of 1–2 m, while the remaining 16 are predicted to experience a reduction of less than 1 m. Reduction in groundwater levels is not predicted to occur at EPBC Act protected springs located upstream of the dam wall (MNES). Groundwater drawdown would be a temporary short term impact, with water levels expected to return to normal once dewatering of 50 days is completed.

To conserve the ecosystem, the proponent has committed to monitor springs on a weekly basis during the 50 day dewatering period and to water any dried springs with suitable water.

To ensure dewatering impacts are managed adequately, I have recommended preparation and implementation of a groundwater-dependent ecosystem management plan (GDEMP). The GDEMP would include but not be limited to monitoring of groundwater levels, margins of spring or wetland areas and native vegetation cover. I

note that DNRM is responsible for review and approval of the GDEMP in relation to springs protected under the VM Act.

For further assessment of impacts and proposed corrective actions on VM Act protected springs affected by groundwater drawdown refer to Section 5.4 (MSES) of this report.

Groundwater–surface water connectivity

The EIS reported that the groundwater–surface water connectivity downstream of the dam wall is unlikely to be affected during construction. The dam wall would be designed to allow the continuation of groundwater flow beneath the dam embankment. There are 20 springs located downstream of the dam wall which would experience localised impacts causing a reduction in groundwater discharge. However, the impacts on the groundwater-surface water connectivity and Dawson River baseflow downstream of the dam wall are predicted to be negligible as these springs provide a minor contribution to the Dawson River baseflows. As noted in Section 5.2 (Surface water) the proponent has committed to undertake surface water monitoring during the construction of the project to ensure that river flows are compliant with the EFOs nominated under the Water Plan (Fitzroy Basin).

Groundwater quality

Without mitigation, improper storage and use of chemicals, fuels and waste products required for construction of the dam wall could contaminate groundwater.

The EMP includes the commitment to store chemicals and hazardous materials in compliance with standard Material Safety Data Sheets (MSDS) requirements. The proponent has also committed to prepare a detailed groundwater monitoring and management plan (GMMP) in consultation with DNRM and EHP.

Baseline groundwater data would be collected 12 months prior to construction of the dam and allow for assessment of groundwater quality impacts to be determined. In the event of an unplanned spill, targeted monitoring of groundwater quality would be carried out to determine potential impacts from contamination. Site-specific remediation options will be developed based on findings from the environmental investigation. Any non-compliances with the water quality objectives of the EPP (Water) would be reported to EHP.

Operations

The EIS reported that seepage loss and transfer of pressure from the weight of the water storage would result in an increase in groundwater levels of underlying aquifers.

The AEIS noted that the increase in pressure would occur primarily within the Precipice Sandstone aquifer and overlying sediments. The increase in groundwater levels could have both negative and beneficial effects on the environment and these are discussed in Section 6 (MNES) and Section 5.4 (MSES).

To identify potential impacts on the groundwater system, the groundwater model identified potential impacts of the dam at FSL of 183.5 m AHD and at median supply level of 181.7 m AHD. Surface water modelling undertaken for the project indicated that

the dam would be at or above FSL for seven per cent of the modelling period, which is equivalent to 60 events over the 107-year modelling period. As this is a maximum impact scenario, actual impacts are likely to be less than predicted.

Groundwater bores

Depending on the weight of the water storage and condition of bores, the increase in groundwater pressure could result in collapse or failure of around 157 registered groundwater bores out of 204 known to be present within the immediate surrounds of the dam wall and water storage at FSL. The significance of impact on these bores is dependent on the condition of the bores and their presence within the predicted extent of increase in groundwater pressure. The EMP reports that a bore survey would be undertaken 12 months prior to construction of the project to:

- confirm the presence and condition of groundwater bores that could be affected by increases in groundwater pressure
- enable a risk assessment to be undertaken, ranking bores at high risk of collapse or failure based on casing type, bore age and depth, groundwater quality and pressure.

The proponent has committed to consult with relevant groundwater users to agree on replacement or rehabilitation of bores that are at high risk of collapse or failure (refer to Recommendation 40(c). I support this commitment and require the proponent to undertake this.

I note that make-good agreements for groundwater users affected during the operation of the project are not regulated under the *Water Act 2000*. I have recommended that the proponent submits a bore mitigation strategy to DNRM for review prior to commencement of project construction.

Submissions on the EIS and AEIS have raised the need for a detailed GMMP. The proponent has provided a preliminary GMMP in the AEIS, which will be further developed in consultation with DNRM and EHP prior to project construction.

The GMMP would include a Bore Monitoring and Management Plan (BMMP) which would be informed by the bore survey. In addition to ranking bores that are at high risk of collapse or failure, the BMMP would include:

- detection of heavy corrosion and potential for failure of high-risk bores
- review of class strength or collapse strength of medium-risk bores
- ongoing monitoring of high value irrigation bores, including assessment of physical characteristics to alert to potential for bore failure.

The proponent has committed to undertake groundwater monitoring 12 months prior to construction to establish baseline groundwater conditions and allow for detection of impacts on groundwater bores and water quality during construction and operation of the project.

An agency submission has noted that groundwater monitoring should be undertaken 2 km from the proposed dam wall to identify long term increases in pressure as the water storage starts to fill and in locations in the area to the south of the dam wall where

hydraulic pressures in surrounding bores are predicted to change from sub-artesian to artesian.

The proponent has committed to finalise monitoring locations following completion of the bore survey and in consultation with DNRM. I support this commitment and require it to be undertaken.

The AEIS reported that the bore survey and risk assessment would establish baseline groundwater bore conditions and allow for detection of impacts during operation. While no monitoring of groundwater bores would be undertaken during operation, the AEIS notes that any issues reported by groundwater users would be investigated. Impacts that are confirmed to be attributed to the increase in groundwater pressure would be managed through rehabilitation or replacement of bores in accordance with the final BMMP.

Once the water storage starts to fill, seven bores located within the water storage would become inundated. The proponent has committed to negotiate with affected groundwater users to agree on an offset strategy for these bores. Once an agreement is in place and prior to construction of the dam, the proponent would decommission these bores in accordance with the *Minimum Construction Requirements for Water Bores in Australia (Land and Water Biodiversity Committee, 2003).*

Groundwater–surface water connectivity

Due to predicted changes in groundwater levels, an additional 14 ML/day of groundwater is predicted to be discharged into the Dawson River and other streams. The EIS reported that the increase in flow is representative of a small proportion of the total flow in the river. I have been advised by DNRM that the increase in groundwater discharge to the Dawson River would positively contribute to the environmental flows of this river.

For an assessment of impacts of increased groundwater discharge to the Dawson River on flora and fauna, refer to Section 6 (MNES) and Section 5.4 (MSES) of this report.

Groundwater quality

Changes in groundwater salinity of the underlying aquifers of the Precipice and Hutton Sandstones may occur due to the weight of the water storage and predicted increase in groundwater levels.

Seepage of saline surface water from the water storage into the underlying fresh groundwater of the Precipice Sandstone and fresh to slightly brackish groundwater of the Hutton Sandstone could occur. Surface water within the water storage is likely to be of comparable or better quality than the underlying groundwater of both aquifers. As a result, seepage of surface water into the groundwater is unlikely to result in detrimental impacts.

Any rises in the water table associated with increased groundwater pressures from the dam may bring salt to the surface. This could lead to a gradual build-up of salt on surface soils when the water level fluctuates. This risk is considered to be low as the soil in the project area is not saline and the groundwater is typically fresh to brackish.

In addition, without mitigation, improper storage and use of chemicals, fuels and waste products required for operation of the dam wall and water storage could contaminate groundwater. As discussed previously, the proponent would store chemicals and hazardous materials in compliance with standard MSDS requirements.

The proponent has committed to prepare a detailed GMMP in consultation with DNRM and EHP 12 months prior to construction of the project. Baseline groundwater quality conditions would be established prior to construction and would allow for detection of groundwater quality changes during operation of the project. The proponent would monitor groundwater quality during operation of the dam every 6 months. If any contamination of groundwater quality is detected, the proponent would:

- undertake targeted groundwater quality monitoring to determine potential impacts from contamination
- develop site-specific remediation options based on findings from the environmental investigation
- report any incidents, complaints or environmental harm to EHP.

I support this commitment, and find that the measures would provide a comprehensive approach to managing groundwater quality.

5.3.5 Impacts and mitigation (pipeline and associated infrastructure)

Construction

Groundwater–surface water connectivity

Pipeline construction activities associated with creek crossings may necessitate dewatering if shallow groundwater is encountered. Dewatering of groundwater at creek crossings could cause a short-term, temporary impact on the groundwater–surface water connectivity by reducing the ground levels in underlying groundwater system.

The EIS noted that the need for groundwater dewatering would be confirmed during the geotechnical investigations of the pipeline route. In the event that dewatering is required, the proponent would return the groundwater to the creek to facilitate its return to the groundwater system.

The EIS states that returning groundwater to the creeks is unlikely to result in an unacceptable impact on groundwater quality in the underlying aquifer and the creek surface water quality, as it is likely to be of comparable quality.

Groundwater quality

The EIS confirmed that during pipeline construction, chemicals, fuels and waste products would be managed and stored in accordance with MSDS, which stipulate safe storage procedures. In the event of a chemical spill, the proponent would undertake a site-specific environmental investigation to determine the extent of impact and to identify appropriate corrective actions. With these measures in place, the risk of unacceptable impacts on groundwater quality is low.

The EIS reported that road works and clay areas required for the project are unlikely to require deep excavations. As a result, groundwater impacts are unlikely to occur.

Operations

The EIS noted that if there is a pipeline rupture during operation of the project, there could be a temporary and localised rise in groundwater levels in the water table aquifer, causing a localised impact to natural groundwater flow patterns.

The proponent has committed to undertake regular maintenance and monitoring of the pipeline to reduce the likelihood of pipeline rupture. If the pipeline is ruptured, sufficient shut-down or cut-off mechanisms would be in place to prevent continued spillage of water. With these measures in place, the risk of impact on the groundwater system is considered to be low.

Without mitigation, improper storage and use of chemicals, fuels and waste products required for operation of the pipeline and associated infrastructure could contaminate groundwater. As noted previously, the proponent would store chemicals and hazardous materials in compliance with standard MSDS requirements. Any incidents would be managed in accordance with the GMMP and any non-compliances with water quality objectives of the Environmental Protection (Water) Policy 2009 would be reported to EHP.

5.3.6 Coordinator-General's conclusion

I consider that the proponent has undertaken an adequate groundwater impact assessment consistent with the Australian Groundwater Modelling Guidelines (NWC 2012) and that the groundwater investigation and spring assessment generally followed the assessment approach outlined in the Queensland Water Commission Underground Water Impact report, Spring Impact Management Strategy (NWR 2012).

To confirm the actual impacts on groundwater users and groundwater quality and manage and mitigate impacts, I have made a recommendation included in this report requiring the proponent to undertake the following:

- collect baseline groundwater data 12 months prior to construction
- conduct a bore survey within the areas predicted to be affected by increased groundwater pressure confirming the presence and condition of groundwater bores
- consult with affected groundwater users to agree on replacement or rehabilitation of affected bores
- undertake monitoring of groundwater levels weekly during dewatering, monthly during construction and six-monthly during operation of the project
- prepare a detailed GMMP (including a BMMP) in consultation with DNRM and EHP that includes the bore survey results and groundwater baseline data discussed above
- during the detailed design stage of the project, ensure that the dam wall is designed to allow the continuation of groundwater flow beneath the dam embankment.

To ensure that impacts on groundwater bores are adequately managed, I require the proponent to submit a bore mitigation strategy to DNRM for review and approval prior to commencement of project construction.

With the above measures in place, I am satisfied that project impacts on the groundwater system, including groundwater quality and groundwater bores can be adequately managed.

5.4 Matters of state environmental significance

This section addresses the potential impacts of the project on matters of state environmental significance (MSES). Impacts on MSES that are also listed as matters of national environmental significance (MNES) under the EPBC Act are addressed in Section 6.

The MSES found within the project area or in the vicinity are:

- regulated vegetation ('endangered' and 'of concern' regional ecosystems [REs] and essential habitat for threatened flora and fauna), wetlands and watercourses
- vegetation connectivity areas
- protected habitat (protected plants and animals)
- protected areas (nature refuges)
- waterways providing for fish passage.

5.4.1 Submissions received

Key issues raised in the submissions on the EIS and AEIS regarding MSES include:

- loss of regulated vegetation and threatened species habitat in terrestrial environments
- loss of threatened species habitat in aquatic environments
- potential impacts on the boggomoss snail, Fitzroy River turtle and white-throated snapping turtle, and environmental offsets proposed for potential impacts
- requirements for infrastructure to maintain turtle passage
- potential impacts on waterways providing for fish passage and associated environmental offset requirements
- preliminary design intent and level of design detail for fish passage infrastructure.

I have considered each submission and the responses provided by the proponent in my evaluation of the project provided in relevant sections below.

5.4.2 Regulated vegetation

Background

Under the *Queensland Environmental Offsets Policy Significant Residual Impact Guideline*, regulated vegetation is defined as:

A prescribed RE that:

- is an ‘endangered’ or ‘of concern’ RE, as defined under the VM Act
- is mapped as essential habitat for wildlife declared endangered or vulnerable under the NC Act, as defined by the Environmental Offsets Regulation 2014
- intersects with an area shown on the vegetation management wetland map, as defined under the VM Act
- is located within the defined distance from the defining banks of a watercourse identified on the vegetation management watercourse map, as defined under the VM Act.

The definition of a prescribed RE in the Environmental Offsets Regulation 2014 does not include regrowth vegetation.

Regional ecosystems

The REs identified in the EIS within the project footprint that meet the regulated vegetation definition are provided in Table 5.1.

Table 5.1 Regulated vegetation REs within the project footprint

RE type	VM Act class	Definition	Location
11.3.1	Endangered	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	Dam and surrounds, pipeline
11.3.2	Of concern	*Eucalyptus populnea* woodland on alluvial plains	Dam and surrounds, pipeline
11.3.3	Of concern	*Eucalyptus coolabah* woodland on alluvial plains	Dam and surrounds
11.3.4	Of concern	*Eucalyptus tereticornis* and/or *Eucalyptus spp*. tall woodland on alluvial plains	Dam and surrounds, pipeline
11.3.22	Of concern	Springs associated with recent alluvia, but also including those on fine-grained sedimentary rocks, basalt, ancient alluvia and metamorphic rocks	Dam and surrounds
11.4.3	Endangered	*Acacia harpophylla* and/or *Casuarina cristata* shrubby open forest on Cainozoic clay plains	Pipeline
11.9.1	Endangered	*Acacia harpophylla-Eucalyptus cambageana* open forest to woodland on fine-grained sedimentary rocks	Dam and surrounds
11.9.5	Endangered	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	Dam and surrounds, pipeline
11.9.5a	Endangered	*Acacia harpophylla* predominates and forms a fairly continuous canopy (10-18m high). Other tree species such as *Eucalyptus populnea, Casuarina cristata, Cadellia pentastylis* and *Brachychiton spp.* may also be present in some areas and form part of the canopy or emerge above it.	Dam and surrounds

RE type	VM Act class	Definition	Location
11.9.6	Endangered	*Acacia melvillei* ± *A. harpophylla* open forest on fine-grained sedimentary rocks	Pipeline
11.9.7	Of concern	*Eucalyptus populnea, Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks	Dam and surrounds, pipeline
11.9.10	Of concern	*Acacia harpophylla, Eucalyptus populnea* open forest on fine-grained sedimentary rocks	Dam and surrounds, pipeline

Essential habitat

The EIS documentation identified 134.7 ha of mapped essential habitat for four threatened flora species within the dam's water storage and surrounds including:

- *Ericaulon carsonii* (listed as Endangered under EPBC Act and NC Act)
- *Arthraxon hispidus* (listed as Vulnerable under EPBC Act and NC Act)
- *Rutidosis crispata* (listed as Vulnerable under NC Act)
- *Thelypteris confluens* (listed as Vulnerable under NC Act).

The EIS also identified essential habitat for the brigalow scaly-foot (*Paradelma orientalis)* in the project area. Listing status for this species under the NC Act has been reclassified to 'least concern' since the EIS was released, so essential habitat for this species is therefore not discussed further in this report.

There is no mapped essential habitat in the vicinity of the pipeline route or associated infrastructure.

Wetlands

From existing RE mapping, the EIS identified seven REs associated with wetland vegetation present in the vicinity of the dam and surrounds. One of these REs was also identified in the pipeline study area.

One mapped wetland protection area (WPA) is located approximately 500 m beyond FSL of the dam, with the trigger area for this WPA intersected by FSL. This area is associated with the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin (GAB spring EC), and is considered in Section 6.6.1 of this report (MNES).

No high impact earthworks (as defined in the Sustainable Planning Regulation 2009) (SPR) are proposed in the vicinity of the WPA, so a permit for disturbance would not be required.

No high ecological value wetlands are identified within, near or potentially affected by the dam and surrounds or pipeline and associated infrastructure. The closest high ecological value wetland is in Precipice National Park, the south-eastern most boundary of which is located over 6km north-east of the dam wall.

Lake Murphy Conservation Area, Boggomoss Springs and Palm Tree Creek are in the vicinity of the project and are listed in the Directory of Important Wetlands[8]. These listed wetlands are not predicted to be impacted by the project as they are located outside the area of predicted groundwater drawdown during construction, beyond the inundation area of the dam, and are not dependent on water releases from the dam. Groundwater impacts are discussed further in Section 5.3 of this report.

No wetlands of international significance are present in the vicinity of the project or predicted to be impacted by the project.

Watercourse vegetation

Based on existing RE mapping, 1,669.3 ha of watercourse vegetation is present within the proposed dam water storage area and surrounds, and 6.8ha of watercourse vegetation is identified in the vicinity of the pipeline and associated infrastructure.

Impacts and mitigation

Using RE mapping and database records, the EIS predicted impacts to regulated vegetation. The proposed pipeline alignment was subsequently amended and the AEIS identified a reduction to predicted impacts on some regulated vegetation.

The total area of remnant vegetation loss due to construction of the dam or via inundation is estimated at 3,554.5 ha. At the completion of construction, approximately 10,603 ha of flood buffer would be established between FSL and the 1:100 year flood level.

Approximately 136.7 ha of remnant vegetation would be cleared for construction of the pipeline and associated infrastructure.

Regional ecosystems

The EIS predicted impacts on REs totalling 1,879.20 ha across the project. Of this amount, 128.9 ha of 'endangered' REs (128.5 ha for the dam and 0.4 ha for the pipeline and associated infrastructure) and 1750.3 ha of 'of concern' REs (1746.4 ha for the dam and 3.9 ha for the pipeline and associated infrastructure) would be impacted, as shown in 5.2.

One additional RE (11.4.3) was also identified in the EIS as impacted by the pipeline corridor. As the refined pipeline alignment avoids this RE, it is not considered further in my evaluation.

Table 5.2 Predicted RE impact areas

	Impact area (ha)—dam and surrounds	Impact area (ha)—pipeline and associated infrastructure
Endangered REs		
11.3.1	61.9	0
11.9.1	36.8	0
11.9.5	25.2	0.3

[8] http://www.environment.gov.au/water/wetlands/australian-wetlands-database/directory-important-wetlands

	Impact area (ha)—dam and surrounds	Impact area (ha)—pipeline and associated infrastructure
11.9.5a	4.6	0
11.9.6	0	0.1
Total	**128.5**	**0.4**
Of concern REs		
11.3.2	441.3	1.2
11.3.3	1026.2	0.4
11.3.4	169.1	0.9
11.3.22	17.0	0
11.9.7	33.7	0
11.9.10	59.1	1.4
Total	**1,746.4**	**3.9**

The REs predicted to be impacted form part of a riparian corridor that provides ecological connectivity along the Dawson River and are likely to provide habitat for listed threatened species. Watercourse (i.e. riparian) vegetation is discussed further below.

All endangered REs identified in the above table overlap with the EPBC-listed endangered brigalow ecological community (brigalow EC). Evaluation of impacts on the brigalow EC is further discussed in Section 6.6.2 of this report.

I have concluded that the project would not be expected to have an adverse net impact on the brigalow EC, provided that the proponent undertakes the proposed mitigation measures documented in its EMP and commitments register. I have also recommended a condition to the Commonwealth Environment Minister which requires the proponent to provide environmental offsets to compensate for the loss of this EC.

To mitigate potential impacts on regulated vegetation, the proponent has committed to develop and implement rehabilitation and revegetation plans for connecting a northern wildlife corridor and environmentally important areas within the water storage area buffer with areas of remnant vegetation and the southern extent of Precipice National Park. I have made a recommendation that these plans be provided as a wildlife corridor revegetation plan to EHP for approval prior to construction.

Essential habitat

To address impacts on essential habitat, the proponent has committed to:

- undertake pre-clearance surveys to confirm impacts to mapped essential habitat
- avoid or further reduce impacts where possible via implementation of a vegetation clearing strategy
- develop and implement a rehabilitation and revegetation plan to improve habitat quality by:
  - connecting areas of remaining vegetation and aiding regeneration

– weed and feral animal control, fire management and exclusion of cattle grazing in critical areas.

In addition, any residual impacts on mapped areas of 'essential habitat' would be compensated by offsets for regulated vegetation matters, listed threatened species and the EPBC-listed brigalow EC.

Wetlands

The EIS documents identified 19.1 ha of mapped wetland vegetation potentially impacted within the dam water storage area and surrounds, and 0.1 ha of mapped wetland vegetation potentially impacted by the pipeline and associated infrastructure.

Some wetland impact areas physically overlap with impacted 'of concern' REs, and both are partially co-located with impacts to EPBC-listed GAB spring EC. The proponent has committed to offsetting impacts to mapped wetlands which result from the project.

The AEIS provided further discussion of potential impacts to wetlands outside the immediate project impact area (dam and surrounds and pipeline and associated infrastructure). Flows in Precipice Creek, from within the National Park into the Gyranda Weir pool, are not expected to be impacted by the project. The AEIS concludes that there are no predicted impacts associated with changes to groundwater or surface water flows to state-listed wetlands in the vicinity of the project.

The proponent has committed to:

- undertake pre-clearance surveys to confirm impacts to mapped wetlands
- avoid or further reduce impacts where possible via implementation of a vegetation clearing strategy
- develop and implement a rehabilitation and revegetation plan to connect areas of remaining vegetation, aid regeneration and improve habitat quality through weed and feral animal control, fire management and exclusion of cattle grazing in critical areas.

Any residual impacts on mapped wetlands would be compensated by environmental offsets required for regulated vegetation matters and the EPBC-listed GAB spring EC.

Potential impacts on non-listed GAB discharge springs

Groundwater dewatering activities necessary for construction of the dam wall are predicted to reduce groundwater levels at approximately 20 springs located downstream of the dam wall. This impact would be temporary, occurring over a 50-day period and returning to normal groundwater levels quickly once dewatering activities are completed. The EIS noted that during the construction of the project, no impacts are predicted to occur on springs upstream of the dam wall.

To manage potential impacts on springs, the proponent would undertake groundwater monitoring 12 months prior to commencement and during construction of the project. The preliminary GMMP provided in the AEIS indicates that the proponent would monitor groundwater discharge and saturation at targeted springs.

If a reduction in groundwater discharge from springs or drying out of surrounding vegetation is observed, the proponent would inject water into the springs. The proponent would irrigate affected springs (if any) in accordance with an approved WQMP to ensure that water used for irrigation is of appropriate quality. Watering would continue until groundwater levels in the area recover. These springs are protected under the VM Act within REs associated with the presence of wetlands.

As discussed above, the proponent has committed to avoid impacts where possible via implementation of a vegetation clearing strategy and through development and implementation of a rehabilitation and revegetation plan. Any residual impacts on springs would be compensated by offsets required for regulated vegetation matters and the EPBC-listed GAB springs (refer to Section 6, MNES).

During operation of the dam, groundwater pressure and groundwater levels are expected to increase at a number of non-listed GAB discharge springs located outside FSL. The EIS reported that seepage loss and transfer of pressure from the weight of the dam water would increase groundwater levels of underlying aquifers. The EIS groundwater model identified potential impacts of the dam at FSL and at median supply level. A number of springs would experience an increase in groundwater discharge, which could impact on vegetation and habitat values surrounding these springs.

The proponent has committed to management measures in areas where groundwater discharge is increased, including monitoring for pressure related impacts on springs and a program of fieldwork to identify any new springs. Where possible, areas of increased discharge or saturation would be managed via appropriate land management strategies, which may include fencing areas of increased discharge to exclude stock and allow natural establishment of flora. I have recommended development of a GDEMP within the GMMP for approval by EHP and DNRM. Management measures would be detailed in the GDEMP.

Watercourse vegetation

The project would impact on 1,669.3 ha of watercourse vegetation within the dam water storage area and surrounds, and 6.8ha of watercourse vegetation in the vicinity of the pipeline.

While clearing of vegetation would be limited to within 1.5 m below FSL, the area of watercourse vegetation located within the dam would be lost due to inundation as the dam fills. The proponent would provide offsets for this impact, and would seek to co-locate offset obligations with other regulated vegetation values as discussed above.

Significant residual impacts and offsets

The project is expected to have a significant residual impact on regulated vegetation as summarised in Table 5.3.

Table 5.3 Residual impacts on regulated vegetation matters

Regulated vegetation matter	Residual impact (ha): Dam and surrounds	Residual impact (ha): Pipeline
Endangered REs	128.5	0.4
Of concern REs	1,746.4	3.9
Essential habitat	134.7	0
Wetland vegetation	19.1	0.1
Defined distance watercourse vegetation	1,669.3	6.8

Some impacted areas which are mapped as essential habitat, wetlands and watercourse vegetation physically overlap with impacted 'of concern' REs. Impact areas for 'of concern' REs and wetlands are partially co-located with impacts to EPBC-listed GAB spring EC. The proponent's offset approach identifies the intention to co-locate offsets for different values and link offsets with protected or remnant habitat where possible.

The proponent has identified properties in the vicinity of the project that would have sufficient remnant vegetation to acquit most of the project's offset requirements for MNES and MSES values.

I have stated a condition in this report which requires the proponent to provide offsets to compensate for significant residual impacts on regulated vegetation. In addition, I have recommended conditions to the Commonwealth Environment Minister requiring offsets for residual impacts on the EPBC-listed brigalow EC, GAB spring EC and habitat for the protected squatter pigeon.

The proponent may co-locate offsets required for regulated vegetation, the brigalow EC, protected wildlife habitat and connectivity areas. I have also recommended the proponent develop and implement a biodiversity offset strategy and a wildlife corridor revegetation plan.

Coordinator-General's conclusion

I consider that the project is unlikely to have an unacceptable impact on regulated vegetation with the implementation of mitigation measures, the proponent's commitments and stated conditions requiring the proponent to provide offsets for residual impacts and to develop and implement a wildlife corridor revegetation plan.

I note that the proponent may co-locate offsets for regulated vegetation, protected wildlife habitat and connectivity areas to consolidate offset obligations.

5.4.3 Connectivity areas

Background

Under the *Queensland Environmental Offsets Policy Significant Residual Impact Guideline*, 'connectivity areas' are defined as areas of remnant vegetation outside urban areas containing prescribed REs that are required for ecosystem functioning.

The EIS indicated that the landscape surrounding the project is characterised by highly fragmented vegetation, resulting from historic vegetation clearing for grazing and agricultural uses. The inundation of the dam would result however in loss of the wildlife corridor within FSL represented by the riparian zone of the Dawson River. Other areas of high-value corridor vegetation exist in the vicinity of the project, including Nathan Gorge and Precipice National Park.

Impacts and mitigation

The Queensland Government's Landscape Fragmentation and Connectivity tool was used to quantify project impacts on connectivity areas, identifying an impact area of 2,503.7 ha associated with the dam and surrounds. There is no predicted loss of connectivity values associated with the pipeline and associated infrastructure.

The proponent's vegetation clearing strategy would aim to minimise fragmentation by not clearing riparian vegetation along the Dawson River within 1.5m (vertical) below FSL. While it is assumed that remaining vegetation would eventually die due to inundation, this clearing strategy is proposed to maintain some existing habitat links until the dam fills.

To mitigate impacts, the connectivity values of the inundated riparian corridor would be enhanced via rehabilitation and management of non-remnant habitat on land surrounding the water storage. This rehabilitation would connect areas of remaining vegetation, aid regeneration and improve habitat quality through weed and feral animal control, fire management and exclusion of cattle grazing in critical areas.

The proponent has also committed to develop and implement rehabilitation and revegetation plans for connecting a northern wildlife corridor and environmentally important areas within the water storage area buffer with areas of remnant vegetation and the southern extent of Precipice National Park. I have set a recommendation in this report that these plans be provided as a wildlife corridor revegetation plan to EHP for approval prior to construction.

Significant residual impacts and offsets

The loss of 2,503.7 ha of connectivity values associated with the dam and surrounds is considered to be significant as it would be expected to fragment an important wildlife corridor. The proponent proposes to offset this area as part of a biodiversity offset strategy for the project, based on the approach presented in the EIS documentation.

I have stated a condition which requires the proponent to provide offsets to compensate for significant residual impacts on connectivity areas.

In addition, I have recommended conditions to the Commonwealth Environment Minister requiring offsets for residual impacts on the EPBC-listed brigalow EC, GAB spring EC and habitat for the protected squatter pigeon. The proponent may co-locate offsets required for connectivity areas, the brigalow EC, protected wildlife habitat and regulated vegetation. I have also recommended to EHP that the proponent develop and implement a biodiversity offset strategy and a wildlife corridor revegetation plan.

Coordinator-General's conclusion

I consider that the project is unlikely to have an adverse impact on connectivity areas, provided that the proponent's commitments and proposed avoidance and mitigation measures are undertaken, in addition to the conditions I have stated and recommended in this report. I note that the proponent may co-locate offsets for regulated vegetation, protected wildlife habitat and connectivity areas where possible to consolidate offset obligations.

I have also made a recommendation requiring the proponent to develop and implement a biodiversity offset strategy and a wildlife corridor revegetation plan.

5.4.4 Protected wildlife habitat—protected plants (terrestrial)

Background

Under the Queensland Environmental Offsets Regulation 2014 'protected wildlife habitat' is defined as 'an area of essential habitat on an essential habitat map for an animal or plant that is endangered or vulnerable wildlife'.

The EIS presented the results of desktop searches for protected terrestrial plant species, and species identified during field surveys undertaken throughout 2008. Additional pipeline survey work was conducted in June 2010 between Wandoan and Chinchilla.

A 'likelihood of occurrence' assessment for species potentially occurring within the project area was undertaken, and the significance of impacts on protected terrestrial plant species identified as 'known' or 'considered likely' to be present in the project impact area was evaluated.

The listing status under the Nature Conservation (Wildlife) Regulation 2006 (NC (Wildlife) Regulation) for *Acacia tenuinervis* and *Gonocarpus urceolatus* has been reclassified to 'least concern' since the EIS was released, accordingly these species are not discussed further in this report. The listed species which are relevant to this evaluation are provided in Table 5.4.

Table 5.4 Protected flora species known or likely to occur in the project area

Common name	*Scientific name*	NC (Wildlife) Regulation listing status	EPBC Act listing status
EPBC Act-listed species (some also state-listed)			
Salt pipewort	*Eriocaulon carsonii*	Endangered	Endangered
Curly-bark wattle	*Acacia curranii*	Vulnerable	Vulnerable
Hairy-joint grass	*Arthraxon hispidus*	Vulnerable	Vulnerable
-	*Bertya opponens*	-	Vulnerable
Ooline	*Cadellia pentastylis*	Vulnerable	Vulnerable
Bluegrass	*Dichanthium setosum*	-	Vulnerable
State-listed species			
-	*Rutidosis crispata*	Vulnerable	-
-	*Rutidosis lanata*	Vulnerable	-
-	*Thelypteris confluens*	Vulnerable	-

Evaluation of potential impacts on threatened plant species listed under the EPBC Act (*Acacia curranii, Arthraxon hispidus, Bertya opponens, Cadellia pentastylis, Dichanthium setosum, Eriocaulon carsonii)* are discussed in Section 6.6.2 of this report. I concluded that the project is unlikely to impact on any threatened flora species with the exception of the hairy-joint grass which was found on four of the springs which would be inundated by the dam.

Impacts on hairy-joint grass would be addressed through the offsets required for the EPBC-listed GAB spring EC. The offsets for the GAB spring EC would involve the rehabilitation and secured protection of springs (through a conservation agreement) which are known to support this species. The curly-bark wattle was also identified in the MNES chapter as being potentially affected by the project however the proponent has minimised impacts on this species through altering the pipeline alignment.

I have recommended a condition to the Commonwealth Minister requiring the proponent to undertake a pre-clearance survey to identify any threatened flora and to provide offsets for any flora where there is likely to be a significant residual impact. The proponent has committed to translocate (via propagation) threatened flora which is identified during pre-clearance surveys, which may reduce the potential for significant residual impacts. The evaluation provided below is for impacts on threatened plant species that are state-listed only.

Consideration of impacts on essential habitat for *Rutidosis crispata*, *Thylypteris confluens*, *Ericaulon carsonii* and *Arthraxon hispidus* are discussed in Section 5.4.2.

Impacts and mitigation

Threatened plant species that may be potentially impacted by the dam and surrounds component of the project area include:

- *Rutidosis crispata* is known to occur. Recorded on the north and south sides of the Dawson River within the inundation area, on south facing sandstone slopes to the immediate west of Blackboy Creek and in areas directly north of this and the Dawson River
- *Thelypteris confluens* is considered likely to occur. No survey records from field surveys for the EIS, but previously recorded GAB spring communities both within and outside FSL

Predicted impacts to threatened plant species associated with the dam and surrounds include loss of individuals or populations through direct clearing for construction, loss of habitat within the inundation area, and changes to habitat quality and structure in areas in the vicinity of FSL due to changes in surface water flows, water level fluctuations and groundwater level changes.

One threatened species may be impacted by the pipeline and associated infrastructure, being *Rutidosis lanata.* This species is known to occur, being recorded at one location along pipeline corridor between Wandoan and Chinchilla.

Predicted impacts to threatened plant species in the pipeline project area include loss of individuals or populations through direct clearing for construction, and encroachment of weeds and invasive species along the pipeline easement.

For identified threatened species, the proponent has committed to undertake pre-construction surveys in accordance with EHP guidelines. Results of these surveys would inform implementation of mitigation and management measures, determine whether a significant residual impact is predicted for threatened plants, and would inform finalisation of the offsets strategy for the project. I have recommended to EHP that the pre-clearance surveys be undertaken, and results reported to EHP prior to commencement of clearing.

Coordinator-General's conclusion

I am satisfied that the EIS has identified and assessed the project's potential impacts on protected plants. I note the proponent's commitment to undertake pre-clearance surveys and mitigation measures to protect any identified protected plants. I consider the project is unlikely to have an unacceptable impact on protected plants, provided the proposed avoidance and mitigation measures and commitments are implemented by the proponents.

5.4.5 Protected wildlife habitat—protected animals (terrestrial)

Under the Queensland Environmental Offsets Regulation 2014 'protected wildlife habitat' is defined as:

- an area of essential habitat on an essential habitat map for an animal or plant that is endangered or vulnerable wildlife
- an area of habitat (e.g. foraging, roosting, breeding habitat) for an animal that is an endangered, vulnerable or special least concern animal.

Under the NC Act, special least concern includes least concern birds which are listed under international agreements such as the Japan–Australia Migratory Bird Agreement (JAMBA), China–Australia Migratory Bird Agreement (CAMBA), Republic of Korea–Australia Migratory Bird Agreement (ROKAMBA) and the Bonn Convention[9].

Desktop analysis, field surveys and habitat assessment presented in the EIS identified threatened terrestrial fauna species which are potentially present in the Taroom region where the dam, pipeline and associated infrastructure are proposed.

A likelihood of occurrence for threatened species was then undertaken. Potentially occurring species were identified as known, likely, possible or unlikely to occur according to species presence, database records for species within or in proximity to the study area, and presence or absence of suitable habitat.

The AEIS then considered the significance of potential impacts to twenty-one listed threatened terrestrial fauna species identified as 'known' or 'likely to be present' within or in the vicinity of the project area. The AEIS identified mitigation measures and proposed offsets commensurate with potential significant residual impact.

Terrestrial reptiles

Background

The EIS identified six threatened terrestrial reptile species as potentially occurring in the project area. These species are listed in Table 5.5.

The rough-collared frog (*Cyclorana verrucosa*) and brigalow scalyfoot (*Paradelma orientalis*) also potentially occur in the project area. Listing status for these species under the NC Act has been reclassified to 'least concern' since the EIS was released and these species are not discussed further in this report. Least concern species are afforded the protections of the NC Act that exist for all native species.

Table 5.5 NC Act-listed reptile species potentially occurring in the project area

Common name *Species name*	NC (Wildlife) Regulation listing status	EPBC Act listing status
Collared delma *Delma torquata*	Vulnerable	Vulnerable
Dunmall's snake *Furina dunmalli*	Vulnerable	Vulnerable
Ornamental snake *Denisonia maculata*	Vulnerable	Vulnerable
Yakka skink *Egernia rugosa*	Vulnerable	Vulnerable
Common death adder *Acanthophis antarcticus*	Vulnerable	-

[9] These conventions are accessible on the DEE website: www.environment.gov.au/biodiversity/migratory-species/migratory-birds

Common name *Species name*	NC (Wildlife) Regulation listing status	EPBC Act listing status
Grey snake *Hemiaspis damelii*	Endangered	-

Potential impacts on the EPBC-listed reptile species in the above table are discussed in Section 6.6.5 of this report. I concluded that the project is unlikely to impact on EPBC-listed threated reptile species. The evaluation provided below is for impacts on threatened terrestrial reptile species that are state-listed only.

Impacts and mitigation

Dam and surrounds

Threatened terrestrial reptile species potentially impacted by the dam and surrounds include:

- Common death adder—considered likely to occur in the project area. Not recorded during field surveys, but suitable habitat exists within dam area and historic records exist for the species in the study area. The EIS identifies that the project could result in the loss of 3,284 ha of potential habitat for this species (based on RE mapping) within the dam construction footprint and water storage.
- Grey snake—considered likely to occur in the project area. The EIS reported one grey snake within the project area based on a road kill specimen. However, the AEIS provided a correction, identifying that the specimen in question was not a grey snake. The AEIS therefore considered the grey snake as likely to occur rather than known in the project area. The EIS identifies that the project could result in the loss of 3,284 ha of potential habitat for this species (based on RE mapping) within the dam construction footprint and water storage.

Impacts to threatened terrestrial reptile species in the dam and surrounding area include loss of individuals or habitat through vegetation clearing, construction disturbances (noise, dust, lighting and traffic), loss of habitat within the inundation area, and changes to habitat quality and structure in areas in the vicinity of FSL due to changes in surface water flows, water level fluctuations and groundwater level changes.

Pipeline and associated infrastructure

Threatened terrestrial reptile species that may be impacted by the pipeline and associated infrastructure include:

- Common death adder—considered likely to occur in the project area. While not recorded during field surveys, historic database records exist that show its proximity to the project area. Suitable habitat exists within large habitat patches in the mid-section of the pipeline corridor.

Potential impacts to threatened terrestrial reptile species in the pipeline project area include loss of individuals and habitat through vegetation clearing and site preparation for construction, and encroachment of invasive species along the pipeline easement

which may result in direct mortality due to predation or changes to habitat available for reptiles.

The EIS identified mitigation and management measures for impacts to threatened reptiles including:

- identification of key habitat features (tree hollows, rocks, logs and woody debris) to be retained prior to clearing
- progressive clearing to allow for fauna movement away from disturbance
- use of a fauna spotter catcher for safe handling and possible relocation away from disturbance during clearing and construction.

For identified threatened species, the proponent has committed to undertake pre-clearance surveys prior to commencing construction. Results of these surveys would inform implementation of mitigation and management measures, determine the potential for a significant residual impact, and would inform finalisation of the offsets strategy for the project.

I have recommended the proponent undertake pre-clearance surveys, report findings to EHP and finalise a project offset strategy with findings. Conditions I have recommended to the Commonwealth Environment Minister support this approach.

Coordinator-General's conclusion

I am satisfied that the EIS has identified potential impacts that the project could have on threatened terrestrial reptile species. Subject to the mitigation measures, the proponent's commitments and conditions stated and recommended in this report I consider that the project is unlikely to have an unacceptable impact on these species.

Birds

Background

The EIS identified threatened bird species potentially occurring in the project area. Species determined by the likelihood of occurrence assessment as 'known' or 'likely to occur' in the project area are listed in Table 5.6.

The black-necked stork (*Ephippiorhynchus asiaticus*), square-tailed kite (*Lophoictinia isura*), cotton pygmy-goose (*Nettapus coromandelianus*) also potentially occur in the project area. Listing status for these species under the NC Act has been reclassified to 'least concern' since the EIS was released and these species are therefore not discussed further in this report. Least concern species are afforded the protections of the NC Act that exist for all native species.

Table 5.6 NC Act-listed bird species potentially occurring in the project area

Common name *Species name*	NC (Wildlife) Regulation listing status	EPBC Act listing status
Star finch (eastern subspecies) *Neochmia ruficauda ruficauda*	Endangered	Endangered

Common name *Species name*	NC (Wildlife) Regulation listing status	EPBC Act listing status
Australian painted snipe *Rostratula australis*	Vulnerable	Endangered
Red goshawk *Erythrotriorchis radiatus*	Endangered	Vulnerable
Painted honeyeater *Grantiella picta*	Vulnerable	Vulnerable
Squatter pigeon (southern) *Geophaps scripta scripta*	Vulnerable	Vulnerable
Grey falcon *Falco hypoleucos*	Vulnerable	-
Powerful owl *Ninox strenua*	Vulnerable	-

Potential impacts on the EPBC Act-listed bird species in the above table are discussed in Section 6.6.5 of this report. I concluded that the project is not expected to impact on any EPBC-listed threatened bird species, with the exception of the squatter pigeon.

The project is expected to result in the loss of 3,306 ha of potential squatter pigeon habitat comprising 3,282.5 ha as a result of the dam and 23.5 ha as a result of constructing the pipeline and other associated infrastructure.

I have recommended a condition to the Commonwealth Environment Minister requiring the proponent to provide an offset to compensate for this loss. The EIS indicates that offsets are likely to include revegetation and rehabilitation of the water storage buffer and provision of a wildlife corridor which would connect to existing nature refuges and be secured under a conservation agreement.

In addition to compensating for the loss of squatter pigeon habitat, this offset would be expected to provide a benefit to other species which may occur around the offset sites.

The painted honeyeater and Australian painted snipe were each listed as a 'threatened species' under the EPBC Act after the controlled action decision for this project. As such, no evaluation for this species is not required in Section 6 of this report and the evaluation for these species is provided below.

Impacts and mitigation

Predicted impacts to threatened bird species in the dam and surrounds component of the project area include loss of individuals or populations through direct clearing for construction, loss of habitat within the inundation area, changes to habitat quality and structure in the vicinity of FSL due to changes in surface water flows, water level fluctuations and groundwater level changes.

Impacts to threatened bird species in the pipeline project area include loss of individuals or populations through direct clearing for construction, and encroachment of weeds and invasive species along the pipeline easement.

Specific threatened bird species are discussed further below.

Australian painted snipe

Australian painted snipe is considered likely to occur in the dam project area. While not recorded in field surveys, historic records show these to exist within the study area and the study area is within the species range. Wetlands associated with the Dawson River floodplain are likely to provide seasonal habitat for this species.

This species is also considered likely to occur in the vicinity of the pipeline. While not recorded in field surveys, the pipeline and associated infrastructure is located within the species range and historic records show it to exist in proximity. Well-vegetated wetlands associated with river floodplains are likely to provide seasonal habitat for this species.

Habitat for the Australian painted snipe includes REs present within the dam and pipeline areas. While the project is expected to result in the loss of vegetation providing habitat for this species, I have stated conditions defining maximum disturbance limits for REs as regulated vegetation, and recommended conditions requiring the proponents to provide offsets compensate for the loss of this vegetation as regulated vegetation. These offsets would be expected to provide a benefit to this species.

Grey falcon

The grey falcon is known to be present in the vicinity of the dam and surrounds. While limited suitable habitat was identified in the dam impact area, this species was observed in field surveys along the Dawson River within the inundation area.

The species is also considered likely to occur in the pipeline project area. While not recorded in field surveys, limited suitable habitat exists throughout the pipeline corridor within large waterway systems, and historic records show the species to exist in proximity.

Foraging and nesting habitat for the grey falcon includes REs present within the dam and pipeline areas. The EIS identifies that the project could result in the loss of 3,284 ha of potential habitat for this species (based on RE mapping) within the dam construction footprint and water storage, and additional areas along the pipeline alignment. I note also that suitable habitat for the grey falcon exists upstream of the FSL, therefore habitat loss due to the dam is not likely to be significant.

I have stated conditions defining maximum disturbance limits for REs as regulated vegetation, and recommended conditions requiring the proponent to provide offsets to compensate for the loss of this vegetation as regulated vegetation. These offsets would be expected to provide a benefit to this species.

Painted honeyeater

The painted honeyeater is considered likely to occur in the project area. An individual was observed during field surveys at Nathan Gorge downstream of the dam wall site. Potential habitat for this species occurs in the dam and surrounds project area.

Although the dam construction and inundation would see loss and fragmentation of potential habitat, the impacts on the species are not considered to be significant as this

is a mobile species and is expected to be able to utilise suitable good quality habitat in the surrounding area, in particular at Nathan Gorge.

Powerful owl

The powerful owl is considered to possibly occur in the project area. While not recorded during field surveys for the dam and surrounds, extensive tracts of suitable habitat are available in the surrounding area, including within and adjacent to Nathan Gorge, downstream of the dam wall site, and the species has been recorded in past surveys of the dam study area.

The powerful owl is also considered likely to occur in the pipeline area. It was not recorded in field surveys for the pipeline, but extensive tracts of habitat are available within and adjacent to Barakula State Forest and adjacent reserves along the pipeline alignment between Wandoan and Chinchilla.

The EIS identified mitigation and management measures for impacts to the above threatened bird species including:

- identification and salvage of some materials (tree hollows, large woody debris) for use in habitat rehabilitation surrounding the dam and along the pipeline alignment
- progressive vegetation clearing to allow for birds to move away from disturbance
- use of a fauna spotter catcher to facilitate clearing activities to minimise risk of injury or death to wildlife and possible relocation away from disturbance during clearing and construction.

The habitat values of the inundated riparian corridor, which provides potential habitat for identified bird species, would be enhanced via rehabilitation. The proponent has also committed to develop and implement rehabilitation and revegetation plans for connecting a northern wildlife corridor and environmentally important areas within the water storage area buffer with areas of remnant vegetation and the southern extent of Precipice National Park.

I have made a recommendation that these plans be provided as a wildlife corridor revegetation plan to EHP for approval prior to construction. This rehabilitation would connect areas of remaining vegetation, aid regeneration and improve habitat quality through weed and feral animal control, fire management and exclusion of cattle grazing in critical areas.

The proponent has committed to undertake pre-clearance surveys prior to commencing construction. Results of these surveys would inform implementation of mitigation and management measures, determine whether a significant residual impact is predicted for threatened bird species habitat, and would inform finalisation of the offsets strategy for the project. I have recommended to EHP that the pre-clearance surveys be undertaken, and results reported to EHP prior to commencement of clearing.

Conditions I have recommended to the Commonwealth Environment Minister support this approach.

Coordinator-General's conclusion

I am satisfied that the EIS has identified potential impacts that the project could have on listed threatened bird species. Subject to the mitigation measures, the proponent's commitments, and conditions stated and recommended in this report I consider that the project is unlikely to have an unacceptable impact on these species.

Mammals

As result of the EIS process, five 'threatened' or 'special least concern' terrestrial mammal species are identified as potentially occurring in the project area. These species are listed in Table 5.7.

The little pied bat (*Chalinolobus picatus*) also potentially occurs in the project area. However, listing status for this species under the NC Act has been reclassified to 'least concern' since the EIS was released and the species is therefore not discussed further in this report. Least concern species are afforded the protections of the NC Act that exist for all native species.

Table 5.7 NC Act-listed mammal species potentially occurring in the project area

Common name *Species name*	NC (Wildlife) Regulation listing status	EPBC Act listing status
Large-eared pied bat *Chalinolobus dwyeri*	Vulnerable	Vulnerable
Eastern long-eared bat (south-eastern form) *Nyctophilus timoriensis*	Vulnerable	Vulnerable
Brush-tailed rock-wallaby *Petrogale penicillata*	Vulnerable	Vulnerable
Echidna *Tachyglossus aculeatus*	Special least concern	-
Koala *Phascolarctos cinereus*	Vulnerable	Vulnerable

Potential impacts on the EPBC-listed mammal species in the above table are discussed in Section 6.6.5 of this report. I concluded that the project is unlikely to impact on any EPBC-listed threatened mammal species. The proposed offsets for regulated vegetation, connectivity corridors, the Brigalow EC and GAB spring EC and squatter pigeon would be expected to provide a benefit to threatened mammal species which may occur at these offset sites.

Koala

Background

The koala is listed as 'vulnerable' under both the NC Act and EPBC Act. As the EPBC listing occurred after the controlled action decision for this project, no evaluation for this species is required in the MNES section of this report and my evaluation is provided below.

Impacts and mitigation

Koalas were recorded at two sites along Cockatoo Creek within the proposed dam inundation area during EIS field surveys. The EIS also considered the koala likely to occur along the pipeline corridor as suitable habitat exists within large waterways along the corridor.

Submissions on the EIS raised issues about the assessment of project impacts on the koala. In later studies, presented in the AEIS, a single koala was observed near the dam construction site and signs of koala presence were found in the same area of riparian woodland and upstream of the dam wall. The AEIS concluded that individual koalas make infrequent and passing use of the project area.

Large areas of habitat suitable for the koala occur immediately downstream of the dam water storage area forming a relatively intact area of vegetation and habitat along the Great Dividing Range, which includes the Spring Creek property and Precipice National Park. The dam wall is proposed at the western fringe of this habitat and the project is not predicted to significantly impact its quality.

Upstream from the dam, potential habitat for the koala is fragmented and generally in poor condition due to cattle grazing, selective clearing, fire disturbance, edge effects, weed invasion and feral animals.

Despite the predicted loss of koala habitat resulting from the project, none of the outcomes noted in the significant residual impact guidelines would be anticipated, particularly given the proponent's commitment to develop a wildlife corridor to the north of the dam, to salvage large woody debris for use in habitat restoration and to manage large parts of the water storage buffer for environmental purposes. No specific offset is proposed for the koala.

I note that a species management program (SMP) would be required under the NC Act to scope, minimise, mitigate and manage potential impacts to the koala from the project. The proponent is required to submit a SMP to EHP for approval.

In addition I consider that conditions I have stated and recommended requiring offsets for the project's impact on a number of State matters, and recommended conditions for Commonwealth matters would also mitigate the project's impacts on koala habitat, and provide benefits for the species.

Coordinator-General's conclusion

I am satisfied that the EIS has identified the potential impacts that the project could have on the koala. I am satisfied that the proponent's commitments, legislative requirements and proposed measures to manage impacts would ensure the project does not result in adverse impacts on the koala. I consider that the project's impact on potential koala habitat would be addressed through the offsets I have required the proponent to provide for a number of State and Commonwealth matters.

Echidna

Background

The echidna is listed as a 'special least concern' species under the NC Act. Those are species that are important in maintaining ecosystems and a source of information integral to the evolution of Australian fauna, as well as a genetic resource of potential benefit to society.

The echidna is considered to be a habitat generalist (having no specialised habitat requirements), occurring in most areas that support ants or termites. Therefore, the entire project footprint is considered to be potential echidna habitat.

Impacts and mitigation

The EIS stated that dam inundation area and vegetation clearing for associated infrastructure is expected to result in the removal of potential echidna habitat. Construction of the pipeline is also expected to impact on echidna habitat.

Despite the loss of habitat associated with the dam and pipeline, none of the outcomes noted in the significant residual impact guidelines would be anticipated, particularly given the proponent's commitment to develop a wildlife corridor to the north of the dam, to salvage large woody debris for use in habitat restoration and to manage large parts of the water storage buffer for environmental purposes. It is expected that large areas of potential echidna habitat would remain in the surrounding areas and so additional offsets for this species are not likely to be required.

I consider the conditions I have stated and recommended requiring the proponent to provide offsets for the project's impacts on regulated vegetation and connectivity are likely to address impacts on foraging habitat for this species. Subject to compliance with these conditions, the project is not expected to have a significant residual impact on this species.

Coordinator-General's conclusion

I am satisfied that the EIS has identified the potential impacts that the project could have on the echidna. Subject to the proponent's commitment, mitigation measures and conditions stated and recommended in this report I consider that the project is unlikely to have an adverse impact on this species.

Invertebrates

As result of the EIS process, two threatened invertebrate species are identified as potentially occurring in the project area. These species are listed in Table 5.8.

Table 5.8 NC Act-listed invertebrate species potentially occurring in the project area

Common name *Species name*	NC (Wildlife) Regulation listing status	EPBC Act listing status
Boggomoss snail *Adclarkia dawsonensis*	Endangered	Critically endangered
Pale imperial hairstreak butterfly (northern subspecies) *Jalmenus eubulus*	Vulnerable	-

Boggomoss snail

The boggomoss snail is listed as 'critically endangered' under the EPBC Act. The species is also listed as 'endangered' under the NC Act and is ranked as a 'critical priority' for conservation under the Queensland's threatened species prioritisation process.

Evaluation of the potential impacts on the boggomoss snail resulting from the project is provided in the MNES section of this report (page 181). I concluded that project impacts on this species could be managed provided the avoidance and mitigation measures proposed are undertaken by the proponent, in addition to the conditions I have recommended.

For the boggomoss snail, my recommendations to the Commonwealth Environment Minister require the proponent to:

- develop and implement a boggomoss snail management plan which includes a management framework that includes measures for addressing the impacts of the project on the boggomoss snail during construction and operation of the project, including actions (direct and indirect) to reduce threats on populations downstream
- translocate the Mount Rose population of snails to suitable sites outside of the dam inundation area, secure the translocation sites via an appropriate conservation agreement, and manage these sites to ensure that viable populations are established and maintained
- manage water releases from the dam to ensure appropriate hydrological regimes are maintained at downstream sites known to support the boggomoss snails
- provide an offset for the loss of 2.4 ha of boggomoss snail habitat, secure the offset sites via an appropriate conservation agreement, and manage these sites to ensure that viable populations are established and maintained.

I note the advice on the boggomoss snail provided by EHP during the EIS process is reflected in my recommendations to the Commonwealth Environment Minister. In line with EHP's advice, I consider that a conservation gain can be made for the boggomoss snail if all mitigation measures, offset commitments and conditions are met.

Pale imperial hairstreak butterfly

Background

The imperial hairstreak butterfly (*Jalmenus evagoras eubulus*) is listed as vulnerable under the NC (Wildlife) Regulation. This species is likely to occur in brigalow dominated

vegetation communities, as its larvae feed exclusively on brigalow phyllodes. The brigalow invertebrate site, approximately 1 km to the west of the dam inundation area and previously listed on the Register of the National Estate, is known to be a significant habitat area for this species.

Impacts and mitigation

Due to the presence of suitable habitat, this species is considered likely to occur in the vicinity of the dam and surrounds. Several historic records exist for this species in the project area. Vegetation clearing for dam construction and inundation of the dam is predicted to remove 186 ha of brigalow dominant and co-dominant habitat for this species.

Evaluation of impacts on the brigalow EC has been discussed in detail in Section 6.6.2 of this report. I concluded that the project would not be expected to have an adverse net impact on the brigalow EC, provided that the proponent undertakes the proposed mitigation measures documented in their EMP and commitments, in addition to the conditions I have recommended to the Commonwealth Environment Minister requiring the proponent to provide offsets to compensate for the loss of the brigalow EC.

As patches of brigalow dominant and co-dominant habitat would remain around the dam impact area and with the establishment of offsets for the brigalow EC, I consider that the project impact on habitat for this species is not likely to be significant.

Coordinator-General's conclusion

I am satisfied that the EIS has identified potential impacts that the project could have on the pale imperial hairstreak butterfly (northern subspecies). Subject to the mitigation measures, the proponent commitments, and conditions stated and recommended in this report I consider that the project is unlikely to have an unacceptable impact on this species.

5.4.6 Protected wildlife habitat—protected animals and plants (aquatic)

The EIS identified three 'threatened' or 'special least concern' aquatic animal species as potentially occurring in the project area. These species are identified in Table 5.9.

Baseline field surveys for aquatic flora and fauna in the dam and surrounds study area were undertaken in November and December 2007 (pre-wet season) and June 2008 (post-wet season). Targeted surveys for listed threatened turtle species were undertaken in October 2008, October 2010 and September-October 2011.

A pre-wet season survey was undertaken to describe aquatic flora and fauna species present in freshwater habitats crossed by the pipeline route in January 2009.

Table 5.9 NC Act-listed aquatic freshwater species potentially occurring in the project area

Common name *Species name*	NC (Wildlife) Regulation listing status	EPBC Act listing status
Aquatic reptiles		
Fitzroy River turtle *Rheodytes leukops*	Vulnerable	Vulnerable
White-throated snapping turtle/southern snapping turtle *Elseya albugula*	Endangered	Critically endangered
Aquatic mammals		
Platypus *Ornithorhynchus anatinus*	Special least concern	Not listed

The only aquatic threatened plant species identified in the project study area is *Myriophyllum artesium*, known to inhabit a mound spring on Sandy Creek (a small tributary of Cockatoo Creek) approximately 20 km from the dam and 12 km from the pipeline corridor. This species is listed as 'endangered' under the NC Act. The spring *Myriophyllum artesium* inhabits is not near any proposed project works and no impact upon this species is predicted. This species is not discussed further in this report.

Potential impacts on waterways providing for fish passage are discussed in Section 5.4.8. Discussion of potential impacts on wetlands is presented on page 68.

White-throated snapping turtle

Background

The white-throated snapping turtle (*Elseya albagula)*, also known as the southern snapping turtle, was listed as 'endangered' under the NC Act on 27 August 2015. This species was listed as 'critically endangered' under the EPBC Act on 20 October 2014). As the EPBC listing occurred after the controlled action decision for this project, no evaluation for this species is required in Section 6 of this report and my evaluation is provided below.

The species is endemic to south Queensland with a distribution that is restricted to the Mary, Burnett and Fitzroy River catchments. Similar to the Fitzroy River turtle, the white-throated snapping turtle aggregates its nesting on the same banks revisited across the years.

Nests of the white-throated snapping turtle occupy a similar area to that of the Fitzroy River turtle, with nesting occurring at the top of steep slopes in sand and soil substrates which are up to 5 m from the water's edge and 3 m above the water level. The species nesting period is significantly longer than the Fitzroy River turtle, and extends from March to September. Hatching occurs around the same time as the Fitzroy River turtle, with hatching occurring in early summer (December and January).

The EIS presented desktop analysis of available literature and recorded sightings of the white-throated snapping turtle. This analysis was considered to inform field surveys. The white-throated snapping turtle was one of three species of turtles reported in literature as present at the existing Glebe Weir and in spring-fed creeks in the upper catchment of the Dawson River.

Baseline field surveys were conducted in the dam and surrounds in November-December 2007 (pre-wet season), and June 2008 (post-wet season). Targeted surveys for the Fitzroy River turtle in habitat areas also considered suitable for the white-throated snapping turtle were undertaken in October 2008, October 2010 and September-October 2011.The white-throated snapping turtle was located within the water storage area and downstream from the dam during the EIS baseline surveys. The species was also recorded at two survey sites during targeted Fitzroy River turtle surveys in 2010 and 2011.

A pre-wet season field survey of aquatic flora and fauna present in freshwater habitats crossed by the proposed pipeline route (in the Fitzroy and Condamine catchments) was undertaken in January 2009. The white-throated snapping turtle was not recorded during this survey, however, the absence of barriers to movement and the presence of preferred habitat suggests it is likely that they are potentially present in the vicinity of the pipeline within the Fitzroy catchment.

Impacts and mitigation

The project is expected to have similar impacts on the white-throated snapping turtle as the Fitzroy River turtle. The project's potential impacts on Fitzroy River turtle are discussed in the Section 6.9.8 of this report.

The construction and operation of the project has the potential to impact on the white-throated snapping turtle by:

- fragmenting and modifying instream (aquatic) habitat
- creating barriers to movement
- inundating and altering nesting habitat
- reducing foraging resources
- resulting in the loss of micro-habitat associated with the loss of riparian vegetation
- increasing the risk of turtle injury or mortality.

The proposed avoidance and mitigation measures for the Fitzroy River turtle, discussed in Section 6.9.8, are considered to be applicable to the white-throated snapping turtle.

Mitigation of significant residual impacts

I have considered the proposed mitigation measures for impacts to the white-throated snapping turtle, outlined in EIS. To address significant residual impacts, the proponent has committed to:

- retain riparian vegetation along tributaries, and revegetation and rehabilitation of the flood buffer above FSL to protect habitat values for turtles on waterway banks

- survey impacted areas for turtles and nesting areas, identifying nesting areas, and capturing and relocating any turtles identified prior to undertaking any construction works
- maintain environmental flows downstream of the dam to minimise potential impacts on downstream turtle habitat
- monitor turtle nesting banks to identify any signs of degradation, and rehabilitate nesting banks that could not be rejuvenated due to changed flood flows
- design and construct turtle passage infrastructure to facilitate movement of turtle species upstream and downstream of the dam wall in consultation with advisory agencies and experts.
- ensure that the diversion channel constructed during construction is designed to allow for movement of aquatic fauna including turtles.
- ensure that the dam includes design features which minimise the risk of turtle injury and mortality
- employing an operating strategy which minimises risks of turtle injury and mortality
- replenish sand banks downstream due to reduced flood flows resulting from the presence of the dam
- implement a weed and pest management strategy, which would reduce the potential for nest predation by foxes and other predators and enhance nesting banks through the removal of weeds
- prepare and/or contribute funding to a catchment wide research and monitoring program to address the cumulative impacts of the project on the white-throated snapping turtle and the Fitzroy River turtle.

I have imposed a number of conditions requiring specific management actions for the white-throated snapping turtle including:

- developing a TMP which provide a set of practical actions for the management of the white-throated snapping turtle during project planning and design, construction and commissioning, and operation. The TMP must be developed in consultation with EHP and is to be approved by the EHP prior to construction.
- constructing a turtle way on the dam that provides safe passage for turtles. The turtle way design must be developed in consultation with EHP
- regulating water releases from the dam to maintain aquatic and nesting habitat downstream of the dam.
- quantifying the extent of aquatic and nesting habitat that would be impacted by the project.

As the proponent has not quantified the actual extent of nesting and aquatic habitat that would be impacted by the project, I have included a requirement in the TMP for the proponent to undertake further survey work to quantify these impacts.

When seeking subsequent approvals for the project (e.g. ERAs) the proponent will be required to provide further information about any prescribed activities to support the application. This information could be used to determine if offsets are required for any

impacts to prescribed environmental matters (particularly the white-throated snapping turtle).

Coordinator-General's conclusion

I am satisfied that the proponent has identified potential impacts the project could have on the white-throated snapping turtle.

While the EIS concluded that significant impacts were not expected for the white-throated snapping turtle have imposed conditions which require the proponent to

- develop a TMP which provide a set of practical actions for the management of the white-throated snapping turtle during project planning and design, construction and commissioning, and operation. The TMP must be developed in consultation with EHP and is to be approved by the EHP prior to construction
- construct a turtle way on the dam that provides safe passage for turtles. The turtle way design must be developed in consultation with EHP
- regulate water releases from the dam to maintain aquatic and nesting habitat downstream of the dam.
- quantify the extent of aquatic and nesting habitat that would be impacted by the project.

On the basis of the proposed avoidance and mitigation measures, and conditions in this report, I consider that the project is unlikely to have an unacceptable impact on the white-throated snapping turtle.

Fitzroy River turtle

The Fitzroy River turtle is listed as 'vulnerable' under both the NC and EPBC Acts. Potential impacts on the Fitzroy River turtle are discussed in Section 6.9.8 of this report. I concluded that the project is unlikely to have an unacceptable impact on this species, provided that the proposed avoidance and mitigation measures are undertaken by the proponent.

I have recommended conditions to the Commonwealth Environment Minister requiring the proponent to:

- construct a turtle way on the dam that provides safe passage for turtles. The turtle way design must be developed in consultation with EHP
- develop a TMP which provide a set of practical actions for the management of the Fitzroy River turtle during project planning and design, construction and commissioning, and operation. The TMP must be developed in consultation with EHP and is to be approved by the Commonwealth Minister prior to construction.

I have also recommended a condition requiring the proponent to

- regulate water releases from the dam to maintain aquatic and nesting habitat downstream of the dam.
- quantify the extent of aquatic and nesting habitat that would be impacted by the project and provide compensatory measures to address the loss of potential aquatic

and nesting habitat, should it be identified that there would be a residual significant impact.

In addition, the proponent has also committed to:

- ensure that the diversion channel constructed during construction is designed to allow for movement of aquatic fauna.
- ensure that the dam includes design features which minimise the risk of turtle injury and mortality
- employing an operating strategy which minimises risks of turtle injury and mortality
- maintain environmental flows downstream of the water storage area
- replenish sand banks downstream due to reduced flood flows resulting from the presence of the dam
- implement a weed and pest management strategy, which would reduce the potential for nest predation by foxes and other predators and enhance nesting banks through the removal of weeds
- prepare and/or contribute funding to a catchment wide research and monitoring program to address the cumulative impacts of the project on Fitzroy River turtle and the white-throated snapping turtle.

Platypus

Background

The platypus is listed as a 'special least concern' species under the NC Act. While no platypus were recorded during field surveys for the dam and surrounds, anecdotal evidence from landowners suggests that platypus occur in the Dawson River and tributaries upstream of the project area. Platypus may also occur in the pipeline corridor.

Impacts and mitigation

Construction and inundation of the dam would result in the loss of some potential habitat for the platypus. While this species can successfully inhabit highly modified systems including dams, nesting behaviours are dependent on water levels and access to firm banks to construct burrows. Construction of dam infrastructure and resulting changes to flow regimes may potentially impact on nesting behaviour for platypus in the project vicinity.

Mitigation strategies proposed in the EIS for impacts associated with the dam and surrounds include:

- obtaining specialist advice on platypus capture and relocation during dam construction
- revegetation and management (as part of rehabilitation and revegetation plan) of the wildlife corridor to the north of the dam
- salvaging large woody debris for use in habitat restoration
- management of large parts of the water storage buffer for environmental purposes.

Construction of the pipeline and associated infrastructure may impact on the platypus habitat through potential changes to water quality due to vegetation clearing or sediment disturbance. Impediments to platypus movement through watercourses may occur at waterway barrier works. Material removed from clay borrow pits during construction may also directly remove habitat values for the platypus.

Mitigation strategies proposed in the EIS for potential impacts from the pipeline and associated infrastructure include:

- minimising construction times at waterway crossings, and constructing during dry season to reduce construction impacts on water quality
- use of temporary creek crossings during construction to allow fauna passage
- re-contouring, revegetation, stabilisation and rehabilitation of banks of watercourses at pipeline crossings after construction, before significant flows in waterways occur.

I consider that the project would involve a number of elements and activities that have the potential to impact on platypus, including the construction of dam infrastructure, which would create a barrier to passage. Construction and operational activities would have the potential to impact on water quality or stability of potential nesting banks for platypus.

While no specific measures or design elements have been incorporated to cater for platypus, proposed fishway and turtle way infrastructure is likely to also provide passage for other aquatic fauna such as platypus.

In terms of potential water quality impacts during construction, the proponent has proposed a number of measures to manage potential water quality impacts including undertaking works during the dry season, complying with relevant erosion and sediment control guidelines and ensuring the appropriate storage of hazardous chemicals and substances. These measures would be expected to reduce the potential for any adverse water quality impacts on platypus inhabiting these areas.

Significant residual impacts and offsets

I consider that the project would not have a significant residual impact on platypus. In addition, the offset requirements for the project's impacts on aquatic habitat for turtles and the waterway barriers for fish would mitigate potential impacts on this species.

Coordinator-General's conclusion

I am satisfied that the proponent has adequately identified the potential impacts that the project could have on the platypus. Subject to the mitigation measures and conditions stated in this report I consider that the project is unlikely to have an adverse impact on this species.

5.4.7 Protected areas

Protected areas as defined by the NC Act in the vicinity of the project identified in the EIS include:

- Precipice and Isla Gorge National Parks to the north of the dam

- Mount Rose and Boggomoss nature refuges immediately to the north of FSL
- Lake Murphy Conservation Park, Boggomoss Springs and Palm Tree Creek, all listed in the Directory of Important Wetlands.

The EIS documentation concluded that there would be no impact on either national park due to the distance from the project. Potential impacts to nature refuges associated with inundation of the dam to FSL are discussed below.

Lake Murphy Conservation Park, Boggomoss Springs and Palm Tree Creek are not predicted to be impacted by the project as they are all over 4 km from FSL and therefore outside the area of groundwater impact from drawdown and inundation.

While the Boggomoss Springs, as listed in the Directory of Important Wetlands are located outside the area of groundwater impact, springs within the GAB spring EC are predicted to be impacted. These impacts are discussed in Section 6.6.1 of this report.

I note that places on the Register of the National Estate were identified in vicinity to the project in the EIS, including the Brigalow Invertebrate Site (road reserve along Leichhardt Highway), Boggomoss Area No. 1 and Boggomoss Area No. 2 to the north of FSL and below the dam wall. The Register of the National Estate is no longer a statutory list; the places identified in the EIS are protected through listings under the EPBC Act and listed threatened REs.

Mount Rose Nature Refuge

The EIS identified that 0.7 ha of the Mount Rose Nature Refuge is predicted to be impacted by inundation of the dam at FSL. While the proponent considers that the management intent of this nature refuge would not be affected as none of the protected significant values (mound springs and RE 11.3.22) identified in the nature refuge's conservation agreement are expected to be impacted, I share EHP's view that impacts to the nature refuge should be offset.

The approach to biodiversity offsets presented in the AEIS identifies that offsets for impacts to EPBC-listed GAB spring EC are proposed as an extension to the Boggomoss Nature Refuge (neighbouring the Mount Rose Nature Refuge) as this could protect mound springs and vegetation suited for incorporation into the northern wildlife corridor that the proponent proposes to rehabilitate and revegetate. Offset areas proposed by this approach would exceed any offset required under the *Queensland Environmental Offsets Policy*, with the maximum offset multiplier in this policy of five times for nature refuges.

I have recommended that the proponent provide offsets for the 0.7 ha impact to the Mount Rose Nature Refuge as part of a biodiversity offset strategy for the project. I note that the proponent may co-locate a nature refuge offset with other offset obligations, including those for impacts to the EPBC-listed GAB spring EC.

I am satisfied that impacts to the Mount Rose Nature Refuge are manageable with my recommendations along with conditions recommended to the Commonwealth Environment Minister requiring the proponent to provide offsets for predicted EPBC-listed GAB spring EC impacts which could also provide offsets for values within the nature refuge that would be impacted by the project.

Boggomoss Nature Refuge

Located to the north of the Mount Rose Nature Refuge, the Boggomoss Nature Refuge will not be inundated by the dam. Potential impacts on this nature refuge associated with groundwater impacts due to drawdown and inundation are considered for the GAB spring EC in Section 6.6.1 of this report.

5.4.8 Waterways providing for fish passage

Background

Movement along waterways is considered to be vital for native fish, including important recreational and commercial fishing species.

Waterway barrier works such as the construction or raising of, or maintenance on weirs and dams, culvert and road crossings can create barriers to fish passage and therefore have the potential to impact on fish life cycles.

It is a requirement under the *Fisheries Act 1994* (Fisheries Act) (section 76G) that such works include provisions (such as fish passage infrastructure) which adequately provide for fish passage.

Impacts and mitigation (dam and surrounds)

Construction of the dam wall constitutes waterway barrier works and would reduce the ability for fish to move into waters upstream and downstream. There is a requirement that the structure incorporates design features that allow for fish passage.

Under *the Queensland Environmental Offsets Policy Significant Residual Impact Guideline*, an action is likely to have a significant impact on a waterway providing for fish passage if the action would result in:

(a) a permanent modification to the volume, depth, timing, duration or flow frequency of the waterway

(b) permanent modification or fragmentation of fish habitat including but not limited to in-stream vegetation, snags and woody debris, substrate, bank or riffle formation necessary for breeding and/or survival of native fish species

(c) the mortality or injury of fish species

(d) works that permanently reduce the level of fish passage provided in a tidal waterway or a waterway identified as a major high-risk waterway for waterway barrier works, to a level that would increase stress on fish populations.

The following sub-sections outline predicted project impacts associated with the dam in the context of the relevant criteria from the significant residual impact guideline.

Impacts and mitigation (pipeline and associated infrastructure)

Most of the waterways crossed by the pipeline infrastructure are intermittent or ephemeral small streams characterised by a series of small, disconnected pools. As the pipeline is proposed to be buried, impacts to waterways providing for fish passage associated with the pipeline and associated infrastructure will be temporary, limited to the construction phase of the project.

Mitigation measures committed to by the proponent include:

- construction times of waterway crossings to be minimised and undertaken during dry seasons (to minimise risk of any stormwater run-off entering creeks)
- crossing structures at each waterway crossing designed pursuant to relevant Queensland government agency guidelines to allow fauna passage
- implementation of stormwater, erosion and sediment control measures, removal of culverts once pipeline construction is complete, and rehabilitation of riparian banks and vegetation.

Pipeline construction impacts are not likely to have a significant impact on waterways providing for fish passage, and are not discussed further in this report.

Reduction in the extent, frequency or duration of fish passage

Construction

Construction of the dam wall would see localised impacts on fish habitat which would be managed during the construction phase. A diversion channel would maintain flows during construction to facilitate safe fish passage in line with natural conditions during the dry season. To minimise impacts, construction is proposed to occur during consecutive dry seasons, when isolated pools and limited fish movement would be expected.

Operation

Without mitigation, the proposed dam wall would act as a complete barrier to fish passage. The existing Glebe Weir, located within the dam inundation area, has no fishway installed and therefore currently acts as an impediment to fish passage along the Dawson River. The barrier to movement due to the Glebe Weir would remain during construction of the dam, and would be resolved once the dam fish passage infrastructure becomes operational.

The EIS documentation outlined the intent for provision of fish passage using a fish lift structure to provide for mobility upstream and downstream of the dam. Submissions received on the EIS and AEIS from advisory agencies raised concerns over some parts of the preliminary design intent, and the lack of detailed plans for the design of fish passage infrastructure.

With fish passage infrastructure in place, some potential remains for fish injury or mortality at instream structures associated with fish passage infrastructure. The proponent has stated that design of fish passage infrastructure would aim to maximise potential movement while reducing the potential for physical damage to fish or fish mortality.

The proponent has committed to finalise design of fish passage infrastructure (including instream structures) during detailed design of the dam in collaboration with Fisheries Queensland, EHP and the Fitzroy Basin Association NRM Group. Recommendations made by advisory agencies in submissions provided during the EIS process regarding design elements would be considered in this process. I support this commitment, and required it to be undertaken.

I have recommended a condition for implementation by DAF requiring the proponent to maintain fish passage during the construction and operation of the project and requiring design of the fish passage infrastructure pursuant with requirements of the Fisheries Act and in consultation with DAF. I acknowledge the proponent's proposal to investigate upgrading of the Gyranda Weir downstream of the dam to provide for fish passage at that Weir.

Modification, destruction or fragmentation of fish habitat

Construction

Construction of the dam wall would see localised impacts on fish habitat which would be managed by the proponent during the construction phase. The EIS documentation proposes translocation of aquatic species prior to disturbance occurring as the dam construction site. While not proposed as a recreation of riverine habitat, a diversion channel would maintain flows during construction to facilitate safe fish passage in line with natural conditions during the dry season.

Filling and operation

Dam inundation would result in the loss or modification of fish habitat within the inundation area, over approximately 75.2 km of the Dawson River and 90.8 km of other major streams. The proponent estimates that the project would impact on 1,358.85 ha of aquatic fish habitat.

DAF does not consider the provision of fish passage infrastructure at the dam to be an adequate measure for mitigating the new inundation area and the modification of habitat. The provision of fish passage by the proposed fish passage structures would only mitigate the construction of the barrier and would not mitigate the permanent modification of habitat. The project would require an offset to compensate for the permanent modification of this habitat.

Water quality impacts

Construction

Construction activities involving ground disturbance and the removal of vegetation may result in temporary and localised impacts on water quality. As discussed in the previous sections for other aquatic species, the proponent has proposed a number of measures to manage potential water quality impacts. These include undertaking works during the dry season, complying with relevant sediment and control guidelines and ensuring hazardous chemicals and substances are stored appropriately. These measures are discussed under 'water quality impacts—construction' on page 205 of this report.

I consider that these measures would reduce the potential for adverse water quality impacts in the project area and consequential impacts on fish inhabiting these areas.

Filling and operation

Water releases from the dam would need to comply with the required WQOs for the Fitzroy Basin Plan and relevant operating plans.

The EIS indicated that water quality impacts associated with filling and operation of the dam would be due to the retention of vegetation within the water storage area. Decaying vegetation is expected to result in increased nutrient and sediment concentrations. Fish may be affected by these elevated nutrient and sediment concentrations, which may result in algal blooms and a reduction in dissolved oxygen levels.

Potential water quality impacts associated with decaying vegetation are discussed in further detail under 'Water quality impacts—operation' on page 205 of this report.

The proponent has committed to a number of measures which would assist in maintaining water quality during operation, including the use of multi-level offtakes in the dam design and manipulating flows to prevent the build-up of blue-green algae. I consider that these measures would reduce, but not eliminate build-up of nutrients within the water storage area. The proponent has also committed to undertake water quality monitoring and would take corrective actions in the event that any adverse water quality impacts are identified. In addition, any significant fish-kill events would have to be reported to EHP, and subsequently steps would need to be undertaken to identify the cause and appropriate measures undertaken to prevent further fish kills potentially caused by the project.

Significant residual impacts and offsets

The project would result in a significant residual impact of 1,358.85 ha on fish habitat. The conditions I have imposed and recommended to the Commonwealth Environment Minister requiring the proponent to provide an offset for any significant residual impacts on turtle nesting and foraging habitat could partly compensate fisheries impacts.

I have recommended a condition for implementation by DAF requiring the proponent to maintain fish passage during the construction and operation of the project and requiring design of the fish passage infrastructure pursuant with requirements of the Fisheries Act and in consultation with DAF.

I have recommended the proponent provide an offset for impacts on fish habitat. The proponent may provide either a financial offset settlement to DAF or provide a proponent-driven direct offset which may include works on existing waterway barriers within the Fitzroy catchment.

I acknowledge the proponent's proposal to investigate upgrading of the Gyranda Weir downstream of the dam to provide for fish passage at that weir. I note that consideration of any potential benefits associated with upgrade of the Gyranda Weir as a contribution to fish passage offset obligations remains a matter for negotiation with DAF during future detailed design.

Coordinator-General's conclusion

I am satisfied that the proponent has identified potential impacts of the project on fish passage. I have made recommendations that the proponent maintain fish passage during the construction and operation of the dam and each waterway crossing to design all fish passage infrastructure in consultation with DAF.

The project would have a significant residual impact 1,358.85 ha of fish habitat. I have recommended the proponent provide an offset for impacts on fish habitat that would need to be determined with DAF. The condition I have recommended to the Commonwealth Environment Minister would require the proponent to provide offsets to compensate for the project's impacts on aquatic habitat would also partly compensate fisheries impacts. I consider that this may be provided as either a financial or land-based offset.

5.4.9 Environmental offsets

In my evaluation of potential impacts of the project on MSES, I have imposed, stated and recommended conditions to require environmental offsets. The suite of conditions and recommendations related to environmental offsets comprise:

- imposed conditions requiring quantification of significant residual impacts to turtle nesting and foraging habitat in consultation with EHP, and provision of offsets for any significant residual impacts to this habitat
- a stated condition defining maximum disturbance limits as a result of prescribed activities for state-listed protected regional ecosystems and connectivity values under the *Sustainable Planning Act 2009*
- a recommended condition detailing required inclusions in a biodiversity offsets strategy to compensate for the loss of listed MSES as required under the *Environmental Offsets Act 2014*
- recommended conditions for consideration by the Commonwealth Minister requiring the proponents to provide a biodiversity offsets strategy to compensate for the loss of MNES under the EPBC Act
- recommended conditions requiring offsets for impacts to waterways providing for fish passage be delivered in negotiation with DAF, as required by the Fisheries Act.

5.5 Social and economic impacts

A social impact assessment (SIA) and economic impact assessment (EIA) were undertaken for the project. The policy framework applicable at the time of the assessments included the Queensland Government's 2010 *Social Impact Assessment: A Guideline for Developing a Social Impact Management Plan* and the Queensland Government's 2011 Major Resource Projects Housing Policy.

The SIA and EIA addressed the potential social and economic impacts of the project within the relevant study areas of the Banana Shire Council (BSC) area (including the former Taroom Shire Council area where the project is located) and the Western Downs Regional Council (WDRC) area.

The SIA and EIA further documented proposed mitigation and management measures to address impacts throughout the construction and operational phases of the project.

5.5.1 Submissions received

Public submissions received in response to the draft EIS and the AEIS raised the following key issues regarding the social and economic impacts of the project:

- the consultation process with directly affected stakeholders, including concerns regarding transparency, timeliness and accuracy of project information
- loss of land and associated land compensation/acquisition issues, including access to land, whether reduced, removed or changed
- inundation impacts on farm productivity, including stock routes, water entitlements and ability to graze stock and stock disturbance
- loss of viability of property for agricultural production
- need for land access protocols during field studies and site investigations
- impacts on agriculture infrastructure including fencing, pumps and property access
- potential increase in noise and dust impacts
- impacts from housing arrangements for construction workforce
- impacts on local employment and local supply chains
- impacts to community, health and wellbeing, including: potential contamination of community water sources, increase in traffic volumes and road safety, the need for emergency planning processes and protocols and the deterioration of local and cultural amenity.

I have considered the submissions and the responses provided by the proponent in my evaluation of the potential impacts of the project, and my assessment is provided below.

5.5.2 Regional and local economy

The BSC area and WDRC area form part of the Fitzroy and Darling Downs region in South West Queensland. The region supports a diverse economy dominated by agriculture, mining, manufacturing, and retail trade with a gross regional product of just over $33.1 billion in 2010–11.[10]

The economy of the BSC area is dominated by agriculture. The gross value of agricultural production within the BSC area for 2010–11 was $190.2 million, incorporating the major commodities of livestock, cotton, legumes and cereal crops.[11] This accounted for approximately 2 per cent of Queensland's total value of agricultural production in 2011.[12]

Queensland Budget 2016-17 Regional Action Plans outline key initiatives which identify pathways to support infrastructure, employment and economic growth. The plans for the Fitzroy and Darling Downs regions specifically identify the need to support rural

[10] OESR, Experimental Estimates of Gross Regional Product 2010-11
[11] Banana Shire Council <www.banana.qld.gov.au/economic-development#Four Pillars>
[12] ABS Agricultural Census 2010-2011

producers and communities through job creation, education and critical infrastructure development.

BSC has adopted a four-pillar strategy as a framework for sustainable economic growth outlining agriculture, mining and resources, tourism, and construction as the four industries of strategic importance to the local and regional economy. WDRC has also recently adopted new economic development and tourism strategies with a strong focus on enabling industry and developing their tourism product.

5.5.3 Economic impacts and mitigation

The EIS estimated the potential positive impacts to the local, regional and state economies during the construction and operational phases of the project. These positive impacts included:

- provision of a secure water supply for mining and existing agricultural and urban uses
- increased local and regional, direct and indirect, employment opportunities during the construction phase
- increased opportunities for local and regional industry to tender for a range of services during the construction period
- capital expenditure of $1.2 billion (based on 2012 values) of which $980 million is expected to be spent directly in Queensland.

As a compensatory measure for the loss of existing recreational facilities, the project also incorporates the development of new recreation areas at the proposed dam including a camping area, which could potentially provide additional long-term benefits for regional tourism.

Potential adverse impacts from the project include reduced agricultural production due to water storage and inundation and reduced access to existing surface water and groundwater for some existing harvesters (refer to Section 5.1).

The proponent is committed to entering into negotiations to reach agreement with landholders directly impacted by the project to assess the fair market value for their land. The proponent's policy is to also pay reasonable costs relating to the purchase of the property and relocation of residents or other infrastructure.

If agreement is not reached, the proponent may request DNRM undertake the compulsory acquisition of land. DNRM would assess the compensation payable for any loss of land or interest in land, in accordance with the provisions of the *Acquisition of Land Act 1967.*

The proponent has identified that water harvesters would be affected by the dam operation and has committed to a program of financial compensation to offset any negative impacts attributed to the project on existing water harvesters. Submissions on the EIS and AEIS identified concerns regarding consultation with potentially impacted existing water harvesters. The proponent has committed to one-on-one consultation with water harvesters prior to project construction. This will support a compensation

strategy to be developed by the proponent and approved by DNRM to ensure that water harvesters are compensated fairly and in accordance with the Water Act.

The proponent has undertaken a groundwater impact assessment and I have recommended that the proponent prepares a detailed groundwater monitoring and management plan which will include a bore monitoring and management plan, and be prepared in consultation with DNRM and EHP (refer to Section 5.3). To ensure issues identified by affected groundwater users are appropriately managed, the proponent has committed to consult with affected groundwater users and to replace, rehabilitate or implement other make-good agreements.

5.5.4 Social impacts and mitigation

The SIA identified and evaluated the potential social impacts of the project, and developed strategies so that any residual impacts of the project can be mitigated and managed through, environmental management measures, and ongoing engagement with key stakeholders.

The SIA considered information and data relevant at the time of the assessment in 2012. The assessment and management of social impacts is a dynamic process, requiring adaptive outcomes based adaptive management approach to effectively respond to the changing social circumstances that can be associated with the development of projects.

To ensure that the proponent's mitigation and management measures are based on the social environment at the time of project construction, I have imposed a condition requiring the proponent to update the SIA and associated mitigation and management strategies presented in the EIS, prior to construction.

Community and stakeholder consultation

Consultation and engagement activities undertaken by the proponent commenced early in the EIS process and included broad information dissemination and engagement with affected stakeholders.

The process was guided by the proponent's 2008 stakeholder communication and engagement strategy and targeted relevant key stakeholders including affected landholders, federal and local governments, state agencies, nearby communities, Indigenous groups, business and industry organisations, and special interest groups.

While communication and engagement with affected stakeholders was broad during the period 2008-2012, submissions on the EIS identified that the overall communication and engagement strategy required greater depth and inclusiveness. In particular, affected stakeholders were of the view that the consultation process was not sufficiently responsive to their needs.

Submissions received on the AEIS similarly reflected concern regarding the absence of consultation after 2012, and the lack of information on a number of issues including:

- Indigenous employment opportunities
- noise, traffic and safety associated with construction camps

- flooding and road deterioration from cumulative impacts associated with proposed nearby resource and infrastructure development projects
- local business opportunities during construction
- public safety during pipeline maintenance
- interference with existing underground cables and pipelines.

Mitigation and management

The EMP for the construction phase includes development of a communication program which would identify strategies to appropriately notify landowners and communities regarding activities that may affect them prior to the commencement of construction. To further enhance the engagement process, I note that the proponent has also committed to ongoing liaison with local governments, industry and the community to contribute to the regional management of potential cumulative impacts.

To ensure that the proponent's consultation and engagement activities are effective and responsive to stakeholder concerns, I have imposed a condition that requires the proponent to develop a detailed stakeholder engagement plan to be submitted for my review and approval six months prior to compulsory acquisition of land and be made publicly available on the proponent's website.

The plan will be required to include the following components:

- an analysis of stakeholders and stakeholder issues
- engagement schedules and programs
- communication activities and tools
- roles and responsibilities for engagement
- opportunities for stakeholder review and comment
- grievance mechanisms and a complaints register
- monitoring and reporting requirements and protocols.

I require that the plan also include tailored engagement procedures with groundwater users, and address all issues raised in public submissions, including cumulative impacts.

Workforce and housing

It is estimated that, in total, peak construction for the dam and pipeline would employ 525 workers over a three-and-a-half-year dam construction period and a two-year pipeline construction period. During operation, both the dam and the pipeline will be operated and maintained remotely in the proponent's facilities in Theodore and Pittsworth, with at least two duty operators at any one time (a total operational workforce of up to five people).

Training and recruitment priorities for the project will be affected by local employment levels and the relative competition for skills and labour from other developers. A number of submissions to the EIS expressed the need for specific workforce

management and recruitment strategies to target both local and minority groups in the community.

The proponent's SIA identified minimal impacts on housing and accommodation in local and regional communities during construction as workers will be accommodated in purpose-built camps. The SIA anticipated that only a small number of workers are likely to relocate to the local area for construction of the dam, and none are expected to relocate for the construction of the pipeline.

Mitigation and management

The proponent has committed to consulting with Jobs Queensland to assess how local employment opportunities may be realised locally or regionally. This includes the development of a workforce management plan that will consider the project's skill needs and requirements, and include strategies to support increased local and regional workforce participation The proponent has also committed to maximising employment and training opportunities for Indigenous people. I require these commitments to be undertaken.

Through its proposed workforce accommodation and housing strategy, the proponent has committed to minimising the potential impacts on local housing during the construction phase of the project and maximising opportunities for positive workforce contributions to the local community. This strategy will be developed in consultation with local governments prior to construction.

I expect that these mitigation and management measures will be continually reviewed and publicly communicated by the proponent in order to ensure that changes to the housing market, general economic environment, and community concerns are taken into consideration.

Community health, safety and wellbeing

Consultation undertaken for the EIS and AEIS, identified stakeholder concerns regarding the health, safety and well-being of local communities, including:

- noise levels from worker accommodation camps
- lack of worker interaction with the local community
- flooding and inundation
- contamination of community water sources
- increased traffic volumes and road safety concerns
- increased localised incidents of crime
- deterioration of local and cultural amenity
- increased pressure on local emergency services.

Mitigation and management

The proponent has committed to developing strategies that constructively protect community health and safety, and that encourage positive worker interaction with the local communities. These strategies include:

- placement of signage and regular communication material regarding changes to local access, potential road hazards, expected traffic volumes, and other potential risks to the public
- consultation with schools and bus operators regarding school bus access and safety procedures for students
- establishment of a community sponsorship program to encourage and enhance community well-being and health
- consultation with local community groups and recreation clubs to encourage workers to participate in local events and recreation ventures
- location of construction camps outside of local townships
- construction of two recreation areas at the dam site
- development of a workforce code of conduct to minimise anti-social behaviour
- development of a worker fatigue management plan to reduce road safety risks
- provision of bus transport from workers camps to site and to key localities
- coordination of emergency response planning and ongoing relationships with local fire and ambulance stations at each affected township.

Local business and industry content

The proponent identified a number of opportunities for local and regional businesses, particularly for suppliers of materials and a range of construction services. This may include services for plant and equipment hire, transport, vegetation management, and agricultural land reinstatement.

Local suppliers of support services such as accommodation and hospitality services and retail should also benefit from the project, although this may be limited by the demands from other projects and discounted accommodation pressure through the construction of worker camps. There would also be potential indirect benefits for local businesses in the retail sector through increased expenditure in the regional community.

The proponent has also identified that over the long term the project may provide opportunities for recreation-based tourism and business development, including fishing, boating, hiking and camping, and hence stimulate opportunities for local tourism operators and accommodation providers.

The proponent acknowledged that during consultation with stakeholders it was identified that some local businesses and suppliers may not be ‘project ready’ and therefore unable to access supply opportunities and take advantage of the follow-on effects of the project.

Mitigation and management

I note that the proponent has committed to adhere to the Queensland Procurement Policy (June 2013) and is therefore committed to provide fair and reasonable opportunity to tender to local industry. This will include the development of a local industry participation plan to encourage the use of local resources and businesses.

The proponent has committed to a number of mitigation and management strategies to facilitate access to opportunities for local businesses. These include:

- early communication of supply chain opportunities through the project website, local organisational networks, and other project communications materials
- engagement with the Department of State Development, and the Industry Capability Network, to implement programs and strategies that equip local and regional businesses to access project opportunities
- engagement with state and local government agencies to contribute to an integrated approach to tourism development and marketing
- construction of two recreation areas at the dam site which would enhance the local tourism industry.

5.5.5 Coordinator-General's conclusion

Overall, I consider the project would deliver positive social and economic benefits to the state and region.

Economic

The EIS estimated potential positive impacts to the local, regional and state economies during the construction and operational phases of the project including through the creation of construction jobs, capital expenditure and the delivery of water security.

Land and water compensation

Land acquisition and compensation will be managed by DNRM. I am satisfied that a due process will be followed with landholders directly impacted by the project, to assess the fair market value of any loss of land or interest in land in accordance with the provisions of the Acquisition of Land Act.

Existing water harvesters will be affected by the dam operation. In accordance with the Water Act, DNRM will be responsible for the approval of a final compensation strategy to ensure that water harvesters are compensated fairly. The proponent has committed to support this with one-on-one consultation with water harvesters prior to project construction.

To ensure issues identified by affected groundwater users are appropriately managed, the proponent has committed to consult with affected groundwater users and to replace, rehabilitate or implement other make-good agreements.

Social

The SIA identified the potential impacts of the project; however, a substantial amount of time has passed since the public release of the EIS in 2012 and the social baseline data has changed significantly.

I have therefore imposed a condition requiring the proponent to update the SIA and associated mitigation and management strategies presented in the EIS, prior to construction. This will ensure that the proponent's social impact mitigation and management strategies are based on the social and economic environment at the time

of project construction. I require that the updated SIA and associated mitigation and management strategies be made publicly available on the proponent's website.

I have also imposed a condition requiring the proponent to provide an annual social impact management report. The reports will detail the implementation of the proponent's social impact management commitments and imposed social conditions. The reports would be provided for my review annually for five years from the commencement of construction and must be made publicly available on the proponent's website during each year of reporting.

Community and stakeholder consultation

I acknowledge that the proponent has committed to the development of a transparent communication program to guide engagement with affected landowners and the broader community.

I also acknowledge comments by stakeholders that the proponent's overall communication and engagement strategy required greater depth and inclusiveness. To ensure that the proponent's stakeholder engagement is responsive and tailored, I have imposed a condition to requiring the proponent to develop a project-wide stakeholder engagement plan for my review and approval six months prior to any compulsory land acquisition.

Workforce and housing

I acknowledge that the proponent has committed to develop a detailed workforce accommodation and housing strategy for the project in consultation with relevant stakeholders. I consider that the information presented in the EIS and AEIS sufficiently demonstrates minimal impacts on housing and accommodation in local and regional communities during construction and operation. Impacts will be lessened through the accommodation of workers in purpose-built camps.

Community health, safety and wellbeing

I am satisfied that the proposed mitigation and management strategies for community health, safety and well-being issues are appropriate, including those strategies that relate to community concerns regarding weed management, traffic and road conditions, dust and noise.

Local business and industry content

I am satisfied that the proponent has identified and committed to providing fair and reasonable opportunity for local business and suppliers to tender, in consultation with local and state government agencies, and in line with the Queensland Procurement Policy (2013).

5.6 Cultural heritage

The EIS assessed the potential impacts of the project on Indigenous and non-Indigenous cultural heritage values of the project area and found that construction of both the dam and the pipeline, and inundation of land in the water storage area have

the potential to impact on some significant cultural heritage sites. These sites include Glebe Homestead, Taroom Aboriginal Settlement, Binghi Slab Hut, and a former Aboriginal camp located at Glebe Weir.

5.6.1 Non-Indigenous cultural heritage

Existing environment

The *Queensland Heritage Act 1992* (QH Act) regulates the conservation and management of Queensland's heritage places. Both the Queensland Heritage Council (QHC) and the Queensland Heritage Register (QHR), which lists places of cultural heritage significance in Queensland, are established under the QH Act. Any work that impacts on a site listed on the QHR must be evaluated in accordance with the QH Act.

In assessing potential impacts on non-Indigenous cultural heritage values for the EIS, the proponent used a combination of desktop research (statutory and non-statutory heritage register searches), consultation and field surveys. The study area covered the proposed pipeline, dam and surrounds[13] plus a buffer zone of 5 km.

Fifteen sites of non-Indigenous cultural heritage value were identified within the dam and surrounds, and 24 sites were identified within 5 km of the pipeline alignment. For each site identified, a significance assessment was undertaken in accordance with the Burra Charter and the QH Act.[14]

Of the 15 sites identified within the dam and surrounds, five were listed on the QHR, two were sites of historical significance and eight were listed on local heritage registers. The 15 sites identified were:

Malara Homestead	*State*	Corduroy Crossing	*Local*
Spring Creek Homestead	*State*	Barkla Camp	*Local*
Taroom Aboriginal Reserve	*State*	Binghi Slab Hut	*Local*
The Glebe Homestead	*State*	Inscribed Rock (The Glebe)	*Local*
Leichhardt Tree, Taroom	*State*	Baxter's Hut	*Local*
Inscribed Rock (Beaumont)	*Local*	Old Road and Telegraph Alignment	*Local/state*
Site of Barkla's Bridge	*Local*	Stone Crossing	*Local/state*
Taroom Cemetery	*Local*		

Submissions received

Key issues raised in submissions on the EIS and AEIS included the following:

- further information sought on proposed management strategy for Glebe Homestead
- the requirement to use Queensland guidelines instead of NSW guidelines when undertaking an archival recording of a heritage place.

[13] The dam and surrounds includes the dam construction footprint and water storage area (EIS p. 2-4).
[14] Tables 23-2 and 23-3 of the EIS list the 39 sites identified within the dam and surrounds and the pipeline. Table 23-4 presents the results of the significance assessment for each site. Further information is also available in Appendix 23-A of the EIS (Historic heritage management plan).

I have considered all submissions and the responses provided by the proponent in my evaluation of the potential impacts of the project.

Impacts and mitigation (dam and surrounds)

The EIS concluded that the project will impact on two sites of state significance that are located within the proposed water storage area (and which would therefore be either wholly or partly inundated). These are:

- Glebe Homestead (fully inundated)—a functioning homestead site, which has been continuously occupied since 1901
- Taroom Aboriginal Settlement (partly inundated)—see Section 5.6.2 for discussion on this site.

Additionally, field surveys identified five sites of historical or archaeological significance within the water storage area (not listed on a register) that would also be permanently inundated. The sites identified were: Barkla Camp, Inscribed Rock (Beaumont), the site of Barkla's Bridge, Binghi Slab Hut and Corduroy Crossing.

State significant site—Glebe Homestead

The Glebe Homestead is located within the proposed water storage area, and would be wholly and permanently inundated.

In its submission on the EIS, the Queensland Heritage Council (through EHP) provided valuable advice on the preservation of heritage values. While acknowledging the proponent's commitment to prepare a site-specific archaeological management plan, EHP requested further information on the conservation and management of Glebe Homestead, as required under the QH Act.

Under sections 68 and 71 of the QH Act, a proponent of a proposed development that will destroy or substantially reduce the cultural heritage significance of a Queensland Heritage place must first undertake a 'no prudent and feasible alternative' options analysis to determine whether there is are options apart from the proposed approach.

Given that the proposed relocation or destruction of Glebe Homestead would trigger the provisions of the QH Act, I have made a recommendation (Appendix 4) detailing the specific information requirements for this options analysis. Further, I require the information to be prepared in accordance with the EHP *Guideline: No prudent and feasible alternative*[15], and to be provided to EHP as soon as practicable.

Other impacted sites

The EIS concluded that whole and permanent inundation impacts on the following sites would be unavoidable if the project proceeds:

- Barkla Camp:
  - The Barkla family, who originally established the Malara Homestead, camped at this site before they constructed the homestead. The site is marked by several fence posts, but no other material is visible.

[15] Available from: http://www.ehp.qld.gov.au/assets/documents/land/heritage/gl-feasible-alternative.pdf

- Inscribed Rock (Beaumont):
  - The inscribed rock was originally part of The Glebe when that station was much larger than its current size. The inscription, from top to bottom, reads '1912 Rigby 1931'. The significance of the inscription is open to speculation, though George Rigby, the original owner of The Glebe, died in 1931.
- the site of Barkla's Bridge:
  - located to the west of Malara Homestead, and, according to landholder consultation, was part of the original road network connecting the stations north of the Dawson with the township of Taroom. The bridge is a wooden construction.
- Corduroy Crossing:
  - A Corduroy Crossing is a record of an early road infrastructure prior to the use of motor vehicles used for crossing over wetland soils and wet areas. A corduroy crossing is a tangible example of the surveying of roads and associated development of infrastructure around Taroom and is significant as corduroy roads are now very rare throughout Queensland. A corduroy crossing across the Dawson River, near the former Taroom Aboriginal Reserve, was reported by local landowners. Although it was submerged during the field survey, the wooden road was visible beneath the waterline. It is likely to date to the early years of the twentieth century.
- Binghi Slab Hut (circa 1910):
  - The hut is divided into three rooms with a small verandah located at the rear and a large timber and corrugated iron awning extending from the front. The site also consists of an outdoor toilet, small timber enclosure with chicken wire and corrugated iron and the remains of what appears to be a raised garden bed. A larger enclosure, constructed with timber posts and enclosed with chicken wire, is situated close to the front of the hut. A fibro-clad house, which was probably constructed in the 1950s or 1960s, is situated immediately adjacent to the hut. A cattle yard and loading ramp are located to the north of the hut. It was constructed by Ted Barkla for the owners of the property, Charlie and Mary Hay and run as an outstation of Palm Tree Station. It is possible that Aboriginal labour from the Taroom Aboriginal Reserve was used during the construction of the hut.

For the first four sites, the proponent has committed to undertake a basic level of photographic recording prior to works commencing. The recording would capture the nature of the item and its context within the cultural environment and within the study area.

In relation to Binghi Slab Hut, where the main building and its associated structures are largely intact, the proponent has committed to engage a suitably qualified professional to undertake a full archival recording to capture the nature of the site. A full archival recording is warranted at this site, as the largely intact site provides a clear picture of the use and functions of the various parts of the complex.

Impacts and mitigation (pipeline)

The underground pipeline would require a 30-metre-wide construction easement resulting in an 15-metre wide easement in operation. Proximity to cultural heritage

values was a consideration when selecting the pipeline alignment and easement, in order to avoid or minimise impacts. The EIS indicated that pipeline-related cultural heritage impacts (such as restricting access to a heritage place or changing the view to a heritage place) would be temporary and limited to the construction phase.

Depending on the final pipeline route, the easement may travel close to heritage sites and so there is the potential for non-Indigenous cultural heritage sites to be affected by construction activities. Of the sites identified along the proposed pipeline alignment, five were originally anticipated to be impacted as a result of pipeline construction. These were two survey trees (Nathan Road), the railway corridor between Chinchilla and Dalby; the Juandah Heritage site and the Warra Mine. However, I note that the altered pipeline alignment (see Section 2) has reduced the extent of impact, and that the Juandah Heritage site, Warra Mine and railway corridor would no longer be affected.

In the EIS, the proponent has proposed a number of mitigation measures for affected sites, including delineation of buffer zones and temporary fencing where works are required in close proximity to sites. The draft EMP also specifies a number of general measures to protect cultural heritage sites and artefacts. This includes developing site-specific archaeological management plans that consider options for the project to mitigate specific impacts on items of cultural heritage significance, and liaison with, and approval of, relevant stakeholders, particularly the local community.

I have made a recommendation that, prior to construction, the proponent must carry out an assessment of significance of all identified heritage places in the project area and propose conservation actions for the places. I am confident that this recommendation, together with the proponent's commitments and the measures proposed in the EMP, would protect cultural heritage sites during pipeline construction.

Coordinator-General's conclusion

I am satisfied that the methodology the proponent used to identify heritage sites in the EIS, for the dam, surrounds, and pipeline was appropriate as it follows standard practices for identification of heritage places. I note that the proponent selected the pipeline route to actively avoid sites of cultural heritage and that the revised pipeline alignment now avoids several sites of cultural significance.

In relation to the potential impact on Glebe Homestead I require the proponent to further consider the options of relocating, or recording and abandoning the homestead. Under the provisions of the QH Act, the proponent is required to undertake a 'no prudent and feasible alternative analysis' to determine the most appropriate actions to conserve the character of the Glebe Homestead, the outbuildings and the garden setting before a decision can be made.

Accordingly, I have made a recommendation at Appendix 4, that the proponent engage with EHP as soon as practicable to discuss the options in relation to Glebe Homestead. I have also made a recommendation that specifies the information that should be provided as part of the options analysis that would assess the alternatives of relocating, or recording and abandoning the homestead. This analysis would consider the relative costs, conservation strategies, ongoing management and potential offsets.

Furthermore, to ensure that any archival recording is conducted in accordance with the provisions of the QH Act, and that the unique qualities of state and local heritage places are appropriately captured, I have recommended that any archival recording undertaken on culturally significant sites be done in accordance with Queensland archival guidelines.

5.6.2 Indigenous cultural heritage

Existing environment

The Queensland *Aboriginal Cultural Heritage Act 2003* (ACH Act) imposes a 'duty of care' upon all persons undertaking development activities to take 'all reasonable and practicable' measures to ensure that their activities do not harm matters of Indigenous cultural heritage (ICH). To comply with the duty of care provision of the ACH Act, proponents of projects that require an EIS must prepare a cultural heritage management plan (CHMP) that provides for the management of ICH.

Surveys undertaken for the EIS identified two Aboriginal cultural heritage sites within the dam water storage area. These are:

- a former Aboriginal camp located at Glebe Weir
- parts of the former Taroom Aboriginal Settlement site (at Bundulla, which is the name of the property where the former settlement stood).

No Aboriginal cultural heritage sites were recorded on the register within the pipeline alignment (which includes access tracks, pump stations and balancing tanks).

Native title

The Aboriginal Parties for the project area are the Wulli Wulli People, Iman People #2, Western Wakka Wakka People and the Barunggam People. CHMPs have been prepared for Aboriginal parties with an interest in the dam and surrounds; however, for the new section of pipeline between Wandoan and Warra, CHMPs are yet to be negotiated and finalised. I note that the proponent has committed to continue pursuing these negotiations prior to construction.

In preparing the CHMPs, the EIS stated that detailed heritage surveys were undertaken by representatives from each Aboriginal Party and their archaeologists within the project area. These surveys identified significant Aboriginal objects and significant Aboriginal areas. The contents of the survey results are confidential, however the results informed the development of the CHMPs.

Submissions received

Key issues raised in submissions on the EIS and AEIS included the following:

- requirement for an archaeological management plan for the Taroom Aboriginal Settlement
- the need for further consultation with Aboriginal nations potentially affected by the project, particularly in relation to the former Taroom Aboriginal Settlement

- suggestion to build a flood-proof barrier to protect the cemetery at the Taroom Aboriginal Settlement from inundation, or alternatively lower the dam level
- the need for the project's cultural heritage consultant to sensitively manage the views of people who are Traditional Owners of the area around the former Taroom Aboriginal Settlement, and Aboriginal people who have an association with the place, but who are not Traditional Owners.

I have considered these submissions and the response provided by the proponent in my evaluation of the potential impacts of the project and my assessment is provided below.

Impacts and mitigation

Former Taroom Aboriginal Settlement

The former Taroom Aboriginal settlement is an important feature in Queensland's history, demonstrating the systematic and forced removal of Aboriginal people from their country. At the time of the field survey, the site consisted of an extant building, meat shed, cattle yards, remains of a bore and windmill, an extant windmill and bore, and two cemeteries.

Parts of the site would be partially inundated by the project. This would include the windmill and bore close to Slippery Hole waterhole, agricultural land that would have been used by some inhabitants and a small section of the lower cemetery. The EIS stated that parts of the site would no longer remain accessible, but that access to the rest of the site would not be affected during construction or operation.

At the time of preparing the EIS, the site had only recently been listed on the Queensland Heritage Register as a State Heritage Place (which would impose obligations on the proponent, under the QH Act, to protect the cultural heritage of the former settlement). The mitigation measures proposed in the EIS did not reflect the listing of the former settlement on the QHR; therefore, more detail would be required prior to any application being made under the QH Act.

To ensure the record of the site is complete and that appropriate conservation measures are taken, I have made a recommendation that the proponent, in conjunction with the site custodians, carry out an archaeological investigation over the entire former Taroom Aboriginal Settlement site. Further, I recommend that the proponent engage as soon as practicable with EHP about a heritage agreement for the site, under the QH Act, particularly in relation to the scope of any management plan for the place, which should cover matters of historic heritage and archaeology. The archaeological management plan would be approved by EHP prior to any construction works commencing at ICH sites. Finally, I recommend that any archival recording conducted for the site be conducted in accordance with EHP's *Guideline: archival recording of heritage registered places*.

In relation to the partial inundation of the cemetery on this site, I note that the ACH Act includes requirements for the protection of Aboriginal human remains. The project's CHMPs cover the impacted areas of the site and include a process that enables the identification of, and communication with, the descendants of those buried at the

cemetery, regarding management of the part of the former reserve that is impacted by the project. I am satisfied that the requirements of the ACH Act have been followed in relation to the process of negotiating and executing CHMPs with the relevant Aboriginal parties.

Former Aboriginal camp (Glebe Weir)

A former Aboriginal camp at Glebe Weir, listed on the Queensland Aboriginal Cultural Heritage Database and Register, is located within the water storage area. The camp, which was used in the late historic period, would be completely inundated. The proponent's AEIS stated that CHMPs with the relevant Aboriginal parties (Wulli Wulli and Iman People #2) had been entered into and registered with the Department of Aboriginal and Torres Strait Islander Partnerships; and that the affected Aboriginal parties had been engaged in the process of developing the CHMPs.

The confidential CHMPs cover the water storage area and set out the mitigation measures for both the former camp and the Taroom Aboriginal Settlement. The proponent has committed to continue consulting with affected Aboriginal parties during the detailed design phase, and to comply with the requirements of the agreed CHMPs and I am satisfied that these measures are appropriate.

Coordinator-General's conclusion

The proponent's draft EMP proposed a range of general mitigation measures to protect ICH sites and artefacts. This includes conducting cultural heritage awareness training for on-site personnel, establishing and communicating procedures to follow in the event that ICH artefacts are found during construction works, and procedures for the ongoing monitoring and reporting of cultural heritage items. I am satisfied that these general measures would assist in protecting and preserving important sites and artefacts in the dam and surrounds and along the pipeline alignment.

To ensure that all important cultural heritage sites within the dam and surrounds are appropriately considered, I have made a recommendation that the proponent should conduct a significance assessment of all identified heritage places and proposed conservation actions for the places, prior to construction. I am confident that this assessment would assist in identifying potentially affected sites and developing appropriate conservation strategies.

The AEIS detailed substantial consultation activities with Aboriginal parties dating back to 2007, and I note that CHMPs have been executed with affected Aboriginal parties for the water storage area and part of the pipeline. I am satisfied with the extent of consultation activities undertaken to date and that the proponent has entered into agreements with affected parties. I note that the proponent has committed to negotiate and execute CHMPs for the areas impacted by the new section of pipeline between Wandoan and Warra and also that consultation with affected Aboriginal parties will continue as part of the agreed CHMPs.

To ensure the impacts on parts of the former Taroom Aboriginal Settlement are managed, I have made a recommendation at Appendix 4. Prior to construction, the proponent should engage as soon as practicable with EHP about a heritage agreement

under the QH Act and the scope of a management plan that should cover the matters of historic heritage and archaeology. To ensure that any archival recording is conducted in accordance with the provisions of the QH Act, and that the unique qualities of Indigenous cultural heritage are appropriately captured, I recommend that any archival recording conducted at the site be done in accordance with EHP's *Guideline: Archival recording of heritage registered places*.

I expect that the proponent's commitments, the general recommendations included at Appendix 4, and the general mitigation and management measures proposed in the draft EMP will be implemented to ensure protection of sites of ICH. While I note that further consultation with affected Aboriginal parties is proposed at the detailed design stage (as part of the CHMPs), I have imposed a condition regarding engagement with stakeholders to ensure this occurs. The proponent must provide an annual Social Impact Management Report (SIMR) for approval to the Coordinator-General, for a period of five years from the commencement of construction. The SIMR will describe the strategies and actions implemented and the outcomes achieved to engage with stakeholders and demonstrate that stakeholders' concerns have been considered.

5.7 Traffic and transport

The EIS confirms the project area's existing road network includes both state-controlled roads (SCR) and local government roads (LGR) in both the WDRC and BSC LGAs.

There are a number of existing stock routes that traverse the project area and a number of school bus services that operate around the project site.

5.7.1 Submissions received

Submissions on traffic and transport impacts were received on both the EIS and AEIS and included the following matters:

- further assessment of reduced flood immunity on the Leichhardt Highway north of Taroom
- ongoing consultation on assessment and mitigation measures for traffic impacts including ongoing consultation with QPS on a traffic management plan (TMP)
- the need for Stoney crossing to be considered a major stock route to access the Taroom clearing dip
- concern regarding an increase in traffic around Taroom from construction camps and the impact on rural ambience
- RIA requires updated traffic census data at detailed design stage
- assessments of un-signalised intersection turn warrants treatments to occur through the RIA at the detailed design stage
- further assessment required for backwater flooding impacts, including reduced flood immunity on the Leichhardt Highway north of Taroom
- the need for further information about access requirements and assessment of traffic and pavement impacts on Eidsvold-Theodore Road.

I note that submissions received during the EIS consultation process relate to the initial (and longer) pipeline alignment, and that the alignment was revised during the AEIS process.

I have considered the submissions and the responses provided by the proponent in my evaluation of the potential impacts of the project.

5.7.2 Impacts and mitigation

The EIS confirms that the traffic impact assessment was undertaken in accordance with the TMR *Guideline for Assessment of Road Impacts of Development.*

The EIS identified that the greatest impact on state and local roads is likely during the construction phase of the project as a result of construction material delivery, workforce transportation and spoil haulage. The operational phase of the project would impact on the local road network through inundation of the dam at FSL. The EIS considered the likely transport needs for the project and assessed the impact on both the local and state-controlled road network, stock routes and the requirement for new roads, road upgrades, road closures and access tracks. Project impacts include:

Construction

- temporary impacts to stock routes during construction
- construction of both temporary and permanent access tracks (including pipeline maintenance tracks)
- impacts to local and state roads as a result of construction material delivery, workforce and waste transportation (including spoil haulage)
- temporary impacts to local roads during pipeline construction
- altered traffic patterns and journey times for road users during construction.

Operation

- the closure of local roads due to inundation when the dam is at FSL
- potential reduced flood immunity to stock routes and roads
- realignment of private access roads
- altered traffic patterns and journey times for road users during operation.

Local roads

The EIS identified that seven local roads and a number of unformed road reserves would be fully or partially inundated at FSL, requiring closure, realignment or upgrade for both construction and operation access requirements. Local access roads would also be impacted and new access tracks created as a result of the project. Impacted local roads and proposed mitigation measures (where relevant) are shown in Table 5.10.

Table 5.10 Key local roads and access tracks: impacts and mitigation

Road	LGA Jurisdiction	Project component	Project activity	Proposed mitigation
Glebe Weir Road	BSC	Dam	Material delivery, workforce transportation, waste transport, operational access to the dam	Close portion of road, realign and upgrade to a two-lane sealed road and an upgrade to the intersection with the Leichhardt highway
Glebe Road	BSC	Dam	Material delivery, inundated at FSL	No mitigation proposed. Road to be closed
Dam access road (new)	BSC	Dam	To increase connection to dam	Construction of a new two-lane sealed road connecting Spring Creek Road to dam
Taroom-Cracow road	BSC	Dam	Construction traffic, inundated at FSL	Road to be raised, bridge and culverts installed (at Cockatoo Creek) and road and culverts installed (at Bentley Creek)
Spring Creek Road	BSC	Dam	Material delivery, workforce transportation, waste transport	Upgrade to a two lane sealed road connecting to the new dam access road
Bundulla Road	BSC	Dam	Inundated at FSL	Closure of inundated road, turning circles installed at severed ends
The Bend Road	BSC	Dam	Inundated at FSL	Realignment
Brodies Road	BSC	Dam	Inundated at FSL	Realignment
Southern recreation area access	BSC	Dam	Inundated at FSL	Realignment
Red Range Road	BSC	Dam	Material delivery	Road-use management plan (RMP)/traffic management plan (TMP) to confirm mitigation in consultation with relevant stakeholders and agencies
Nathan Road	BSC/WDRC	Dam/ pipeline	Material delivery	RMP/TMP to confirm mitigation in consultation with relevant stakeholders and agencies
Unformed road reserves	BSC	Dam	Inundated at FSL	No mitigation proposed. Road to be closed
Access roads to private property (Balcarris, Glebe, Mt Rose, and	BSC	Dam	Inundated at FSL	Realignment/ reinstatement of access for affected properties

Road	LGA Jurisdiction	Project component	Project activity	Proposed mitigation
Bentley.)				
66 local roads along the pipeline alignment	WDRC	Pipeline	Crossed by pipeline alignment, temporary impact during construction	RMP/TMP to define in consultation with relevant stakeholders and agencies
Maintenance track	WDRC	Pipeline	Required for access to maintain infrastructure, workforce transportation	Construction of a new graded but unsealed track, located within the permanent easement
Access track	WDRC	Pipeline	Required for access to pump stations and balancing storages	Construction of a new graded but unsealed track
Temporary access track	WDRC	Pipeline	Required for access across creek crossings	Compacted fill and gravel/roadbase, overlaying parallel pipe

Construction of the pipeline may have a temporary impact on the local road network where it is traversed by the pipeline. This impact is short in duration and therefore expected to cause minimal disruption with each work front only opening as much trench as could be laid in a day and backfilling occurring simultaneously. Roads would be impacted and reinstated under a permit with the relevant LGA for alteration or addition of a local government road. Approval would be required from the relevant LGA prior to impact.

The EIS identified that works requiring traffic diversions on local roads could result in delays for local road users, including landholders and school bus services. The proponent has committed to consult with affected parties, including school bus operators, landowners, businesses and emergency service providers in relation to potential delays and timing of works.

Stock routes

The EIS identified that six stock routes would potentially be impacted by the project, either temporarily during pipeline construction or due to inundation of the dam and flooding.

A submission raised the need to consider impacts on Stoney crossing, located at the south-west end of North Street in Taroom. The ford is currently unpassable during high flow events and is cut off for six times per year, with the event lasting an average of 10 days. This equates to the ford being unpassable for approximately 16 per cent of the time. With the dam in place the ford would be unpassable for 57 per cent of time and therefore would need to be upgraded or an alternative measure provided.

To mitigate impacts to the stock route network, the proponent has committed to consult with DNRM and stock route officers from the local councils during the detailed design phase of the project to ensure stock routes impacted by the project remain functional during both construction and operation of the project (this includes the BSC stock route

officer in relation to Stoney crossing). I consider this a reasonable approach to ensure stock route connectivity is maintained within the vicinity of the project.

State roads

For construction, the EIS identified that the delivery of materials and supplies, transportation of workers to the dam and pipeline work sites and waste transport would impact upon the SCR network. The EIS estimates 40 light vehicle trips per day to transport workers for both the dam and pipeline construction, with additional bus trips at each roster change. Dam construction would require 52 articulated vehicle trips daily and 15 single unit trucks for construction material and equipment. Construction of the pipeline would require 262 articulated vehicles and 16 single unit trucks daily for construction material and plant equipment movement.

The SCRs anticipated to be affected by the project are outlined in Table 5.11.

Table 5.11 SCR network involved in construction of the project

Roads	Jurisdiction	Project component	Project activity
Ipswich Motorway and Warrego Highway to Toowoomba	SCR	Dam/ pipeline	Material delivery
Warrego Highway west from Toowoomba	SCR	Dam/ Pipeline	Material delivery, spoil haulage Crossing of the road by the pipeline alignment (500m south of Hastings Road)
Leichhardt Highway (north of Miles)	SCR	Dam/ pipeline	Material delivery, workforce access to and from construction camps, waste transport, reduced flood immunity during dam operation
Dawson Highway Gladstone to Biloela	SCR	Dam	Material delivery
Dawson Highway Biloela to Leichhardt Highway	SCR	Dam	Material delivery
Taroom – Roma Road	SCR	Dam	Material delivery
Fitzroy Development Road	SCR	Dam	Material delivery
Jackson-Wandoan Road	SCR	Dam	Material delivery
Warra-Kogan Road	SCR	Dam/ pipeline	Material delivery

In accordance with TMR guidelines, the proponent considered the proportion of additional Average Annual Daily Traffic (AADT) that would occur as a result of the construction of the project. Modelling identified that traffic generation would be expected to exceed five per cent of AADT (regulatory definition for significant project traffic) at several locations along the Leichhardt Highway (ranging from 6.5 per cent to 10.5 per cent), Jackson-Wandoan Road (20.3 per cent), and Warra-Kogan Road (6.3 per cent).

To mitigate the impacts to the SCR network, the EIS stated that the transport strategy and routes would be reviewed with the construction and haulage contractors prior to the finalisation of the Traffic Impact Assessment (TIA). I consider refinement of the TIA at the detailed design stage an appropriate point to determine traffic-related impacts on the state and local road network, and I have set a requirement for that to be undertaken.

The EIS identified the potential for reduced flood immunity to the Leichhardt Highway Bridge as a result of the dam. The bridge currently has immunity for a 1-in-20 AEP flood event, however flood modelling undertaken for the EIS found that the bridge approaches have a lower flood immunity than the bridge itself and as such would prevent access prior to the bridge flooding. For a 1-in-100 AEP flood event, the bridge would expect an increase in peak flood levels from 0.6 m to 1.2 m. The proponent has committed to revise flood modelling and confirm flooding impacts on roads during detailed design (see Appendix 5).

To mitigate the impacts of the project on the state-controlled and local road network, the proponent has committed to develop a road-use management plan (RMP) and TMPs in consultation with TMR, QPS and the local councils at the detailed design stage. Through these plans, more specific mitigation measures would be developed and approved by the regulators.

Key mitigations included in the RMP and TMPs would include:

- opportunities to reduce project-related traffic demand (e.g. staging change-over times) or use alternative routes (such as construction easements or maintenance tracks)
- the location of haulage routes
- temporary road detours
- traffic signalling and intersection safety controls
- safety barriers and lighting
- speed controls and guides
- safe provision for pedestrian and cyclist movements
- maintaining safe property access
- maintaining connectivity for the local community
- consultation with relevant parties
- road works would be in accordance with regulators' guidelines and conditions of approvals

- contingency and emergency planning will be undertaken to prepare for the wet season, and flood events
- scheduling of works to reduce impacts to school bus runs.

The proponent would be required to obtain the necessary permits and approvals following a more detailed design assessment. Refer to Section 4 for a list of transport-related permits and approvals.

5.7.3 Coordinator-General's conclusion

The EIS presented a desktop assessment of the transport-related impacts of the project, including impacts on local and state-controlled roads and the area's stock route network.

The proponent presented preliminary mitigation measures for the impacts of the project and proposes to refine the transport strategy for the project (including routes) with the construction and haulage contractors at the detailed design stage. When appointed contractors for the project will update the TIA, RMP and TMP in consultation with TMR, BSC, WDRC and QPS.

I consider the approach of refining the TIA and subsequent plans at detailed design stage an appropriate response to determining precise project impacts and specific mitigation measures.

To inform subsequent approvals that need to be obtained prior to works commencing, additional updated information will need to be provided when applications are made. I have made a number of recommendations at Appendix 4 covering process and information requirements for RIAs, RMPs, approvals and standards of road works, SCR works, infrastructure agreements, permits and approvals and traffic management plans and timing for the completion of roadworks prior to significant project road works.

I accept the proponent's commitment to consult with relevant authorities and key stakeholders and I am confident that these commitments in conjunction with the relevant approvals and my recommendations in Appendix 4 are appropriate to manage the traffic and transport impacts of the project.

5.8 Air quality and greenhouse gases

5.8.1 Existing environment

Key air pollutants in the project area are due to dust deposition from agricultural cultivation and the use of unsealed roads by local traffic. The EIS stated rotating vertical columns of air known as willy-willies take significant amounts of dust into the atmosphere in the summer months. Intermittent traffic along dry, unsealed roads within the project area may generate large volumes of dust locally for short periods of time and exhaust emissions. However given the intermittent traffic, the dust and exhaust emission impacts are not considered to be significant.

Greenhouse gases (GHG) are emitted from a number of sources including electricity production, transportation, industry, commercial and residential, agriculture and land

use change. Within the project area, the existing land use of broad acre cropping and grazing as well as transportation and residential activities contribute to GHG emissions.

Due to the project's remote location, EHP does not conduct air quality monitoring and accordingly there is no publicly available air quality monitoring data in proximity to the project. Baseline air quality values have been adopted based on a review of baseline monitoring undertaken for projects in the Western Downs region, in conjunction with dust deposition monitoring undertaken by the proponent in the Taroom area.

This data indicates that the project area in 2012 was expected to have low levels of particulate matter (20 micrograms per cubic metre [µg/m^3]) and total suspended particles (40 µg/m^3) and high levels of dust deposition (average 94.6 milligrams per square metre per day [mg/m^2/day]) when compared to air quality criteria set out in the Environmental Protection (Air) Policy 2008 (EPP (Air)).[16]

High levels of dust deposition are attributable to local land use. The existing air quality does not exceed the air quality criteria set out in EPP (Air) and the EHP dust nuisance guideline.[17] The EIS concluded existing air quality within the dam FSL is relevant for clay borrow area and road work activities as they are proposed to occur within or in close proximity to the dam FSL.

The proponent did not conduct air quality monitoring along the 149.3-km pipeline route. Instead the EIS undertook a preliminary desktop review to determine ambient air quality along the pipeline route. The EIS concluded existing air quality within the dam FSL is expected to be similar along the pipeline.

I note the review of baseline monitoring and dust deposition monitoring was undertaken in 2008 and assessed in 2012. The existing land use within the project area has not substantially changed, and therefore the EIS air quality assessment is relevant for my evaluation. All air quality criteria applicable in 2012 are applicable in 2017 and are used in the assessment of project-related air quality impacts.

Local meteorology and topography at the project site affects dust transportation via wind. The EIS identified winds for the Taroom area are predominately from the north-east during the day, changing to east and south-east in the afternoon. Landforms at and surrounding the project construction sites can influence both wind strength and direction; and accordingly, dust transportation and deposition. The topography along the pipeline is relatively flat or gently undulating. The dam wall is proposed to be located in a steep sided valley in a relatively straight section of the Dawson River. Topography of the project area is discussed in Section 5.1.

[16] EPP (Air) criteria are designed to protect environmental values conducive to suitability for the life, health and wellbeing of humans.
[17] Department of Environment and Heritage Protection (EHP), *Guideline – Application requirements for activities with impacts to air*, EHP, 2015.

5.8.2 Methodology

Dust deposition assessment

The EIS stated short-term air quality monitoring was undertaken at three locations between 20 October 2008 and 3 November 2008 to identify background dust deposition levels surrounding the dam FSL. Three dust deposition monitoring locations were chosen to avoid areas which currently generate dust and in close proximity to existing sensitive receivers which surround the proposed dam FSL.

In order to simulate the impacts from construction activities, dispersion modelling software known as California Puff Model (CALPUFF) was used to predict particulate matter concentrations at the closest sensitive receivers. The Air Pollution Model (TAPM) was used to generate broad scale meteorological inputs to inform CALPUFF modelling. Sampling and analysis of deposited dust levels was undertaken in accordance with AS/NZS 3580.10.1:2003.[18]

The EIS confirmed the project dust and pollutant criteria were adopted from criteria within the EPP (Air) for total suspended particles (TSP) and PM_{10} and EHP dust nuisance guideline[19] for dust deposition. Air quality criteria adopted for the project site at sensitive receivers include:

- 90 µg/m^3 of TSP, averaged annually
- 50 µg/m^3 of PM_{10}, averaged over a 24-hour period (5 days per year exceedance)
- 120 mg/m^2/day of dust deposition, averaged monthly.

In order to demonstrate compliance with project air quality criteria, the EIS modelled construction activities to inform buffer distances required between emitting project activities and sensitive receivers.

Greenhouse gas assessment

The EIS stated GHG emissions were determined by adopting emission factors published by the Department of Climate Change and Energy Efficiency[20] in the National Greenhouse Accounts Factors.[21]

5.8.3 Sensitive receivers

Dam

Sensitive receivers are defined in the State Planning Policy[22] and include dwellings, schools, hospitals and protected areas. The EIS identified 34 sensitive receivers surrounding the dam when it is at FSL.

The nearest sensitive receivers to the dam wall construction activities would be sensitive receiver (SR) 6, a dwelling located 6.7 km west-south-west and SR 1, a

[18] Australian Standard/New Zealand Standard, *AS/NZS 3580.10.1:2003 – Methods for sampling and analysis of ambient air – Determination of particulate matter – Deposited matter – Gravimetric method,* 2003 and reconfirmed in 2014.
[19] Department of Environment and Heritage Protection (EHP), *Guideline – Application requirements for activities with impacts to air*, EHP, 2015.
[20] The Commonwealth Department of Climate Change and Energy Efficiency was dissolved on 25 March 2013.
[21] Department of Climate Change and Energy Efficiency, *National Accounts Factors,* 2010.
[22] Department of Infrastructure, Local Government and Planning (DILGP), *State Planning Policy,* DILGP, 2016.

dwelling located 9.9 km north-west. The EIS stated that SR 2, a dwelling located 6.6 km north-west of the dam wall, is owned by the State of Queensland. The proponent advises SR 2 would be unoccupied during construction and therefore the air quality criteria do not have to be met at this sensitive receiver.

In close proximity to the dam wall is Precipice National Park, with the boundary located approximately 7 km north-east of the dam wall. Precipice National Park is a protected area under the *Nature Conservation Act 1992* and is classed as a sensitive receiver.

The dam's associated infrastructure includes construction clay borrow activities and road construction works. The EIS identified dwellings located near the nine potential clay borrow areas and road works. The nearest sensitive receiver to a potential clay borrow area is SR 5 and SR 6, located 1.5 km from potential clay borrow areas No. 5 and 6. The nearest sensitive receiver to construction of the dam access road is SR 1, located 200 m from road works. The nearest sensitive receiver to construction of a bridge over Cockatoo Creek on Cracow Road is SR 10, located 240 m from road works.

Pipeline

For the 149.3 km pipeline, construction works would occur near sensitive receivers, with the closest located approximately 350 m away from dwellings in Wandoan and Chinchilla. Sensitive receivers near operational pump stations area located more than 6 km away.

5.8.4 Submissions received

The key air quality issues raised in submissions on the EIS included the following:

- selection of an alternative location for a clay borrow area from potential clay borrow area No. 8 due to exceedances of air quality criteria in the EPP (Air)
- development of a complaints management system for construction activities which exceed air quality criteria in the EPP (Air)
- calculations of greenhouse gas emissions should consider the indirect contribution associated with the end use of water from Nathan Dam, particularly by mines
- the lost opportunity with respect to carbon farming due to the inundation of farming land within the water storage area.

I have considered each submission and the responses provided by the proponent in my evaluation of the potential impacts of the project on air quality.

5.8.5 Impacts and mitigation

Construction dust emissions

The EIS identified the construction phase of the project has the highest potential for air quality impacts by dust generation associated with vegetation clearing, excavation and construction of various project components. Operational dust impacts are expected to be minor as low vehicle traffic on the sealed dam access road is predicted.

The EIS identified the main pollutant of concern during construction would be dust. High levels of dust can reduce the amenity of the local area and affect the health and wellbeing of humans. The EIS reported that construction activities would generate localised dust impacts at the Nathan Dam wall, the pipeline laying front, clay borrow areas, road construction areas and along access roads. I note the EIS proposed for construction activities to be undertaken seven days a week, 12 hours per day from 6am – 6pm.

The EIS confirmed blasting is required for construction of the diversion channel, but not for construction of the pipeline.

Dam

Dust emissions would be generated by activities such as:

- construction machinery movement over unsealed access roads
- excavation activities for dam wall construction
- excavation activities for diversion of the Dawson River
- exposed soil under high wind conditions from land clearing activities within the FSL
- concrete batching activities within the dam area
- construction of the dam wall
- construction of pump station adjacent to dam wall
- blasting of the spillway
- decommissioning of Glebe Weir
- decommissioning of 10.3 km of W2G pipeline.

The EIS reported that air quality impacts are not expected to affect any sensitive receivers during dam construction activities. The EIS air quality assessment concluded, that without mitigation, SR 2, the closest to the dam wall construction site, would experience maximum concentration of PM_{10} less than 25 µg/m^3, TSP from 45–50 µg/m^3, and a dust deposition rate less than 4 mg/m^2/day; each which would be below the air quality criteria.

The most intensive dust-generating activity during dam construction would be blasting at the diversion channel site given that the dust emissions factor for this activity is often several times greater than that of other activities.

The EIS undertook a preliminary assessment of dust generated by blasting. The EIS presented blast modelling for Connors Rivers Dam project which required similar blasting to Nathan Dam. The modelling found that the PM_{10} concentration was two orders of magnitude under the air quality criteria at a distance of 5 km. The closest sensitive receiver to blasting activities is SR 6, located 6.7 km away. Air quality impacts are therefore not expected at SR 6.

Pipeline

The EIS indicated the pipeline construction may affect a number of receivers, mostly dwellings, located in the townships of Wandoan and Chinchilla. Dust emissions would be generated by activities such as:

- construction machinery movement over unsealed access roads
- excavation and vegetation clearing require for pipeline construction within the pipeline easement
- exposed soil under high wind conditions from land clearing activities within the pipeline easement
- excavation and vegetation clearing required for the construction of a three pump station and three associated balancing storages.

The EIS air quality assessment concluded that unmitigated pipeline construction activities within 350 m of sensitive receivers may result in exceedances of EPP (Air) criteria for PM_{10} and TSP. The EIS predicted sensitive receivers would experience a maximum concentration of PM_{10} between 50 and 200 $\mu g/m^3$; which would be above the air quality criteria of 50 $\mu g/m^3$. Similarly, the maximum concentration of TSP ranged from 90–200 $\mu g/m^3$, which would be above the air quality criteria of 90 $\mu g/m^3$. The closest sensitive receivers are dwellings in Wandoan and Chinchilla, located approximately 350 m away from pipeline construction. Impacts on any one sensitive receiver would likely occur for a few days.

Associated infrastructure

Dust emissions would be generated by activities related to the extraction of clay and road works.

Clay extraction

The EIS indicated that emissions could be generated by these activities during daytime hours over the 3.5-year construction period. The exact duration of the impacts would be finalised during detailed design and communicated to affected persons prior to the commencement of activities.

The EIS air quality assessment concluded that unmitigated clay borrow area activities within 600 m of sensitive receivers may result in exceedances of EPP (Air) criteria for PM_{10} and TSP. The EIS reported potential clay borrow area No. 4 is the preferred area. All sensitive receivers are located more than 600 m from No. 4 and are therefore not likely to experience impacts.

Road works

The EIS indicated that noise would be emitted by activities related to the construction of dam access roads, and road diversions and bridging due to inundation.

With regard to road construction activities, the EIS air quality assessment concluded that unmitigated road construction activities within 200 m of sensitive receivers may result in exceedances of EPP (Air) criteria for PM_{10} and TSP. The EIS indicated road construction activities would create temporary noise impacts during daytime hours on nearby sensitive receivers within the 3.5-year construction period. The exact duration of the impacts would be finalised during detailed design and communicated to affected persons prior to the commencement of activities.

SR 1, a dwelling located 9.9 km north-west from the dam wall would be impacted by construction of the dam access road. SR 10, a dwelling located approximately 12 km

south-west of the dam wall, would be impacted by the construction of a bridge over Cockatoo Creek on Cracow Road.

The EIS predicted SR 1 and SR 10 would experience a maximum concentration of PM_{10} of 75 µg/m^3 which would be above the air quality criteria of 50 µg/m^3. Similarly, the maximum concentration of TSP would be 200 µg/m^3, which would be above the air quality criteria of 90 µg/m^3. To reduce the PM_{10} and TSP impacts, the draft EMP included in the EIS and updated in the AEIS provided mitigation measures to be implemented.

Construction mitigation measures

The project's EMP identified a range of strategies to minimise, manage and mitigate dust impacts of the project to comply with air quality criteria. To reduce the dust impacts over the life of the project, the EIS stated where possible, activities would be undertaken outside of the buffer distance from emitting activities and sensitive receivers. Where buffer distances cannot be implemented due to the location of dust emitting activities and sensitive receivers, the EMP stated that the proponent would:

- use water trucks on unsealed roads to prevent visible dust emissions travelling off-site with their use increased wherever there is a potential for high emissions such as during high winds
- use water sprays (hand held hoses or sprinklers) at the excavation site to control visible dust
- use bag filters when loading cement into concrete batching plant
- minimise areas of cleared and exposed soil
- stabilise/rehabilitate exposed soils as soon as possible
- minimise vehicle speeds on unsealed access routes
- water unsealed access routes
- cover/dampen stockpiles
- cover haul trucks
- undertake public consultation to inform the community of the potential duration and extent of impacts during construction.

The EMP describes the monitoring and corrective actions that would be implemented in the event of air quality complaints. The EIS confirmed all complaints about air quality during construction would be received through the proponent's existing telephone and online enquiries service.

The proponent has committed that within 24 hours of receipt of a complaint the person with the authority to take action will be notified, followed by an appropriate resolution of the issue. I am satisfied the buffer distances and proposed mitigation measures within the EMP would be adequate to manage potential dust impacts on sensitive receivers and I require them to be undertaken.

Other construction emissions

Other sources of air emissions include fugitive emissions and exhaust emissions. Fugitive emissions would be released from dam and pipeline stockpiles and areas of land cleared of vegetation. Exhaust emissions from construction vehicles and machinery include oxides of nitrogen, carbon monoxide and hydrocarbons. These compounds are classed as greenhouse gases; however, the EIS air quality assessment concluded impacts from these emissions are not considered to be significant.

Greenhouse gas emissions

The greenhouse gas (GHG) emissions assessment included in the EIS considered emissions that could be generated during the construction and operation of the project. The EIS identified land use change as the largest contributor to GHG emissions from dam construction due to the clearing of vegetation and the subsequent release of carbon from the inundated decaying vegetation. The potential GHG emissions as a result of vegetation clearing are estimated to be 448,001 tonnes of carbon dioxide equivalent (tCO_2-e).

The EIS reported the total potential GHG emissions due to the construction of the dam and pipeline are 612,889 tCO_2-e. This includes GHG emissions from:

- diesel fuel used for transportation of construction materials
- diesel fuel used in machinery for clearing of vegetation
- upstream emission for construction inputs for diesel fuel, concrete and pipe
- clearing of vegetation and subsequent burning or decay
- decay of biomass and decomposition of soil organic matter following inundation.

A total of 71,645 tCO_2-e of GHG emissions is expected to be released per year during operation from electricity consumption to power the four pump stations.

I note the *National Greenhouse and Energy Reporting Act 2007* requires annual reporting of GHG emissions released by the project. As a consequence, mitigation measures are not proposed for the GHG emissions from clearing of vegetation and inundation of land except beneficial re-use of cleared vegetation. However, I note benefits may be provided by vegetation offsets which could reduce carbon emissions.

Remaining GHG emissions produced during construction and operation would be minimised by measures listed in the EMP, such as the use of energy-efficient machinery, GHG awareness training and strategies to minimise waste from construction. In addition, the proponent is committed to the continued implementation of SunWater's Energy Management Standard to minimise GHG emissions.

Operational impacts

The EIS indicated operational dust and exhaust emission sources relate to traffic from maintenance vehicles and use of recreational areas. No adverse air quality impacts are expected during dam operation as the dam access road would be sealed and dust generated by a single light vehicle inspecting the pipeline via an unsealed road is

considered negligible. The frequency of maintenance activities would be determined during detailed design. Accordingly, no mitigation measures are considered necessary.

Cumulative impacts

The EIS air quality assessment provided an assessment of the cumulative dust emissions associated with the project, surrounding potential mining operations and other sources of dust generation due to local land use. The EIS reported no significant cumulative dust impacts were likely to occur at the dam area when in construction or operation as it is distant from any other proposed projects.

The EIS reported the pipeline construction and operation may be in the vicinity of other projects including the Surat Basin Rail project, the Wandoan Coal Project and a number of coal seam gas related pipeline projects if they proceed.

In areas where the project may cause cumulative air quality impacts on sensitive receiver, the EIS stated that additional water would be used to suppress dust. The proponent has committed to participate in regional coordination processes with other proponents to ensure impacts from multiple projects are minimised. I support this commitment and require this to be undertaken.

5.8.6 Coordinator-General's conclusion

Based on the results of predictive modelling undertaken in the EIS, I am satisfied that air quality impacts resulting from the project's construction and operation can be suitably managed for the life of the project. The proponent has identified the most likely sources of emissions and the EMP identified specific mitigation measures, such as implementing buffer distances, to reduce potential impacts. I note the additional information to the EIS adequately addressed the matters raised in EIS submissions regarding air quality.

I am satisfied the EMP adequately describes the monitoring and corrective actions required in the event of complaints. The proponent has committed that within 24 hours of receipt of a complaint the person with the authority to take action will be notified, followed by an appropriate resolution of the issue. In addition, the proponent has committed to the continued implementation of SunWater's Energy Management Standard to minimise GHG emissions.

In relation to GHG emissions, I am satisfied that the proposed mitigation measures, (included as commitments in Appendix 5 and outlined in the draft EMP) would mitigate and reduce GHG emissions generated during construction and operation and ensure potential impacts are appropriately managed.

5.9 Noise and vibration

5.9.1 Existing environment

The existing land use within the proposed dam area and pipeline route is predominately broad acre cropping and grazing. The pipeline route follows a number of

major roads and a railway line. Key noise sources in the project area are animals, farming equipment, surrounding residential properties and road traffic.

The EIS identified construction noise would have the greatest impact on sensitive receivers due to the project's low background noise levels from being located in a rural landscape. Noise would be generated by machinery movement for excavation and construction of the dam wall, pipeline and associated infrastructure. During operation, noise would be generated by the pumping stations.

In 2008, the proponent undertook noise monitoring at four locations to determine baseline noise levels surrounding the dam. The noise logger locations were chosen to represent the potentially noise affected sensitive receivers that surround the dam, such as dwellings in a rural landscape and the Taroom hospital located in an urban landscape.

The EIS reported the baseline noise levels for:

- day period (7 am – 6 pm) ranged from 26 decibels A-weighted (dB(A)) to 38 dB(A) (in Taroom)
- evening period (6 pm – 10 pm) ranged from 30 dB(A) to 37 dB(A) (in Taroom)
- night period (10 pm – 7 am) ranged from 20 dB(A) to 33 dB(A) (in Taroom).

The proposed dam area has low background noise levels. The EIS undertook a preliminary desktop review of background noise levels expected to occur at clay borrow areas and road works. The review concluded the dam background noise levels are relevant to these activities as they are proposed to occur within or in close proximity to the dam FSL. The EIS reported no significant ground vibration sources that are likely to influence ambient vibration levels in the dam area.

The EIS reported that due to the length of the pipeline (149.3 km), baseline noise monitoring was not undertaken. Instead the EIS undertook a preliminary desktop review to determine background noise levels along the pipeline. Australian Standard AS1055.2-1997[23] was used to estimate background noise levels at sensitive receivers along the pipeline. This standard sets out general procedures for the description and measurement of environmental noise in Australia.

The standard estimates that rural areas along the pipeline with negligible traffic would experience background noise levels ranging from 20 dB(A) at night to 34 dB(A) during the day and evening. In rural areas with increased traffic, such as along the Warrego Highway, it is expected noise levels would range from 40 dB(A) at night, 50 dB(A) during the evening and 55 dB(A) during the day.[24] The EIS reported no significant ground vibration sources that are likely to influence ambient vibration levels in the dam area.

I note the background noise monitoring was undertaken in 2008 and assessed in 2012. The existing land use within the project area has not substantially changed, and therefore the EIS noise and vibration assessment is relevant for my evaluation. All

[23] Australian Standard, *AS 1055.2-1997 – Acoustics – Description and measurement of environmental noise – Application to specific situations,* 1997.
[24] Ibid, Noise Category R3 or R4 of Appendix A.

noise and vibration criteria applicable in 2012 are applicable in 2017 and are used in the assessment of project-related noise and vibration impacts.

5.9.2 Methodology

Noise assessment

The EIS stated monitoring was undertaken at four locations between 20 October 2008 and 3 November 2008 to identify background noise levels in the project area. Four noise loggers were placed in close proximity to existing noise sensitive receivers which surround the proposed dam area (see Section 2).

Noise monitoring and analysis was undertaken in accordance with AS1055.1-1997.[25] Meteorological data collected by the Bureau of Meteorology was used for the EIS noise and vibration assessment to take into consideration the influence of weather on noise levels. AS1055.1-1997 states data is considered to be wind affected if the maximum wind gust exceeded 5 m/s for a total of four hours within any day. The EIS stated all rain and wind affected data was excluded from the noise logger results. Meteorological data used was collected at the Taroom Weather Station, located 32 km south-west of the dam wall.

The EIS confirmed the project noise criteria were adopted from criteria within the Environmental Protection (Noise) Policy 2008 (EPP (Noise)) [26] and EHP's *Guideline: Planning for noise control.*[27] The criteria included:

- maximum noise level of 50 dB(A) $LA_{eq,1hr}$ [28] for construction activities
- maximum noise level range from 29 dB(A) to 46 dB(A) during the day (7 am – 6 pm) for operational activities
- maximum noise level range from 28 dB(A) to 40 dB(A) during the evening (6 pm – 10 pm) for operational activities
- maximum noise level range from 28 dB(A) to 33 dB(A) during the night (10 pm – 7 am) for operational activities

In order to simulate the impacts from construction and operational activities, noise modelling software known as SoundPLAN was used to predict noise levels at the closest sensitive receivers. The calculation method CONCAWE was used to generate broad scale meteorological inputs to run SoundPLAN.

To ensure the project's compliance with noise criteria, the EIS modelled construction activities to inform buffer distances required between emitting project activities and sensitive receivers.

[25] Australian Standard, *AS 1055.1-1997 – Acoustics – Description and measurement of environmental noise – General procedures,* 1997.
[26] EPP (Noise) criteria are designed to protect environmental values conducive to suitability for the health and wellbeing of humans.
[27] Department of Environment and Heritage Protection (EHP), Guideline – Planning for noise control, EHP, 2016.
[28] As defined in EPP (Noise).

Vibration assessment

Analysis of blasting impacts to be undertaken for construction of the spillway was undertaken in accordance with AS 2187.2-2006.

The EIS confirmed the project vibration criteria were adopted from criteria within the EHP Guideline on Noise and vibration from blasting. The criteria included:

- ground vibration velocity limit of 5 mm/s for blasting during construction
- air blast overpressure of 115 dB(linear) for blasting during construction.

To demonstrate and ensure the project's compliance with vibration criteria, the EIS modelled construction and operational activities to inform buffer distances required between emitting project activities and sensitive receivers.

5.9.3 Sensitive receivers

Dam

Sensitive receivers (SRs) are defined in the EPP (Noise) and include dwellings, schools, hospitals and protected areas. The EIS identified 34 SRs surrounding the dam when it is at FSL.

The nearest sensitive receivers to the dam wall construction activities would be SR 2, a dwelling located 6.6 km north-west; SR 6, a dwelling located 6.7 km west-south-west and SR 1, a dwelling located 9.9 km north-west.

In close proximity to the dam wall is Precipice National Park, with the boundary located approximately 7 km north-east of the dam wall. Precipice National Park is a protected area under the *Nature Conservation Act 1992* and is classed as a sensitive receiver.

The dam's associated infrastructure includes construction clay borrow activities and road construction works. The EIS identified dwellings located near the nine potential clay borrow areas and road works. The nearest SRs to a potential clay borrow area are SR 5 and SR 6, located 1.5 km from potential clay borrow areas No. 5 and 6. The nearest SR to construction of the dam access road is SR 1, located 200 m from road works. The nearest SR to construction of a bridge over Cockatoo Creek on Cracow Road is SR 10, located 240 m from road works.

All SR locations for dam wall construction and road works are applicable for dam operation.

Pipeline

For the 149.3 km pipeline, construction works would occur near sensitive receivers, with the closest located approximately 350 m away from dwellings in Wandoan and Chinchilla. Sensitive receivers near operational pumping stations are located more than 6 km away.

To ensure compliance with the project noise and vibration criteria is achieved, the EIS modelled the pipeline infrastructure, including pump stations and balancing storages, to inform buffer distances required between noise emitting project activities and sensitive receivers.

I note impacts on all sensitive receiver types has been assessed. The EIS focused on residential dwelling sensitive receiver types as they are the majority of sensitive receivers nearby construction and operational activities.

5.9.4 Submissions received

The key noise and vibration issues raised in submissions on the EIS included the following:

- more detailed mitigation strategies for operational noise impacts on fauna is required
- justification of the noise and vibration standard to be implemented for the project
- impacts on sensitive receivers other than residential dwellings was not assessed in the EIS
- demonstrate the shock wave from blasting is absorbed by the soil before reaching the sensitive receiver
- more detailed mitigation strategies for operational pump station noise impacts, as these impacts are substantial.

I have considered each submission and the responses provided by the proponent in my evaluation of the potential noise and vibration impacts of the project.

5.9.5 Impacts and mitigation

Construction noise impacts

The EIS identified noise would have the greatest impact on sensitive receivers during construction. Noise may cause harm when it negatively affects environmental values, including human health and wellbeing by interfering with sleep, relaxation or recreational activities.

The EIS reported that construction activities would generate localised noise impacts at the Nathan Dam wall location, the pipeline laying front, clay borrow areas, road construction areas and along access roads. I note the EIS proposed for construction activities to be undertaken seven days a week, 12 hours per day from 6 am – 6 pm.

In relation to noise impacts from construction traffic, the EMP stated entry and departure of heavy vehicles to and from the project site are restricted to the standard daytime construction times (6 am – 6 pm). Also designated access routes to the site would be established with construction vehicle speeds limited in critical areas both on site and off site.

The EIS confirmed blasting is required for construction of the diversion channel, but not for construction of the pipeline.

Key project noise impacts on nearby sensitive receivers result from vegetation clearing within the dam FSL, pipeline construction activities and road works.

Dam

Noise would be emitted by activities such as:

- construction machinery movement over unsealed access roads
- excavation activities for dam wall construction
- excavation activities for diversion of the Dawson River
- vegetation clearing activities within the FSL
- concrete batching activities within the dam area
- construction of the dam wall
- construction of pump station adjacent to dam wall
- blasting of the diversion channel
- decommissioning of Glebe Weir
- decommissioning of 10.3 km of W2G pipeline.

The EIS reported that noise generated by all dam construction activities, excluding vegetation clearing, are not expected to affect any sensitive receivers. The EIS predicted SR 2, the closest to the dam wall construction site, would experience a maximum 23 dB(A) noise level during dam construction activities; which would be below the EPP (Noise) criteria of 50 dB(A).

The project requires 4,737 ha of trees and shrubs to be cleared for construction of the dam, pipeline and associated infrastructure. Approximately 90 per cent (4,263 ha) of the clearing would occur within the dam water storage area to FSL.

The EIS noise assessment concluded that unmitigated vegetation clearing activities within the dam FSL within 580 m of sensitive receivers may result in exceedances of the EPP (Noise) criteria of 50 dB(A). The EIS predicted sensitive receivers located within 100 m of activities would experience a maximum noise level of 65 dB(A) with noise levels reducing with distance.

I note these impacts would occur during the construction phase; and the community would be informed of the likely duration of impacts prior to commencement of vegetation clearing activities. To reduce noise impacts, the proponent proposes to implement mitigation measures within the EMP (discussed below).

Pipeline

The EIS indicated the pipeline construction may affect a number of receivers, mostly dwellings, located in the townships of Wandoan and Chinchilla. Noise would be emitted by activities such as:

- construction machinery movement over unsealed access roads
- excavation and vegetation clearing required for pipeline construction within the pipeline easement
- excavation and vegetation clearing required for the construction of a pump station and associated balancing storage.

The EIS noise assessment concluded that unmitigated pipeline construction activities within 870 m of sensitive receivers may result in exceedances of EPP (Noise) criteria of 50 dB(A). The EIS predicted sensitive receivers located within 100 m of activities would experience a maximum noise level of 69 dB(A) with noise levels reducing with distance. The closest sensitive receivers are dwellings in Wandoan and Chinchilla,

located approximately 350 m away from pipeline construction. Noise impacts on any one sensitive receiver would occur for a few days.

Associated infrastructure

Noise, both audible and low frequency, would be emitted by activities such as:

- extraction of clay
- off-road truck movement associated with clay extraction
- road works.

Clay extraction

The EIS indicated that noise emissions could be generated by activities related to the extraction of clay during daytime hours over the 3.5-year construction period. The exact duration of the impacts would be finalised during detailed design and communicated to affected persons prior to the commencement of activities. The EIS noise assessment concluded that unmitigated clay borrow area activities within 800 m of sensitive receivers may result in exceedances of EPP (Noise) criteria of 50 dB(A). The EIS reported potential clay borrow area No. 4 is the preferred area. All sensitive receivers are located more than 600 m from No. 4 and are therefore not likely to experience impacts.

Off-road truck movement

The EIS noise assessment concluded unmitigated off-road truck movement within 180 m of sensitive receivers may result in exceedances of EPP (Noise). This activity is likely to occur during daytime hours over a 3.5-year construction period.

Road works

The EIS indicated that noise would be emitted by activities related to the construction of dam access roads, road diversions and bridging due to inundation.

The EIS noise assessment concluded that unmitigated road construction activities within 880 m of sensitive receivers may result in exceedances of EPP (Noise) criteria of 50 dB(A). The EIS indicated road construction activities would create temporary noise impacts during daytime hours on nearby sensitive receivers within the 3.5 year construction period. The exact duration of the impacts would be finalised during detailed design and communicated to affected persons prior to the commencement of activities.

SR 1, a dwelling located 9.9 km north-west from the dam wall and 200 m of road works would be impacted by construction of the dam access road. SR 10, a dwelling located approximately 12 km south-west of the dam wall and 240 m of road works would be impacted by construction of a bridge over Cockatoo Creek on Cracow Road. The EIS predicted SR 1 would experience a maximum noise level ranging from 64-66 dB(A). The EIS predicted SR 10 would experience a maximum noise level ranging from 62-64 dB(A). To reduce the noise impacts, the proponent proposes to implement mitigation measures within the EMP (discussed below).

Construction vibration impacts

The EIS indicated the most intensive vibration-generating activity during dam construction would be blasting at the diversion channel site. The nearest sensitive receivers to the blasting site are SR 10 and SR 11, which are residential dwellings located approximately 12 km south-west of the dam wall. The blast modelling presented in the EIS indicated the ground vibration velocity limit of 5 mm/s and air blast overpressure of 115 dB(linear) would be achieved within 1,750 m of blasting. To reach the ground vibration velocity limit of 5 mm/s at SR 10 or SR 11 would require an effective charge mass per delay[29] of 40,633 kg. The EIS states a 500-kg effective charge mass per delay is significant and is unlikely to be used during construction. Vibration impacts are therefore not expected at SR 10 or SR 11.

The EIS stated blasting for pipeline construction is not required, and the balancing storage proposed to be located at chainage 38 km has been approved as part of the W2G pipeline project; and accordingly, vibration impacts are not assessed as part of the project. No vibration impacts are expected from road works or clay borrow area activities.

Mitigation measures

The project's EMP identified a range of strategies to minimise, manage and mitigate noise and vibration impacts of the project to ensure compliance with noise and vibration criteria. To reduce the noise and vibration impacts over the life of the project, the EIS stated where possible, activities would be undertaken outside of the buffer distance from emitting activities and sensitive receivers. Where buffer distances cannot be implemented due to the location of noise emitting activities and sensitive receivers, the EMP states that the proponent would:

- undertake public consultation to inform the community of the potential duration and extent of impacts during construction
- implement respite periods for particularly noisy activities where possible
- avoid the coincidence of noisy plant equipment operating at the same time adjacent to sensitive receivers
- use noise abated equipment on site
- use designated project access routes to minimise areas where traffic noise would impact sensitive receivers
- minimise construction vehicle speeds on access routes to reduce noise
- consider weather forecasts in the management of blast impacts
- conduct trial blasts to determine the site constants and actual noise levels at the closest sensitive receiver.

The EMP describes the monitoring and corrective actions that would be implemented in the event of noise and vibration complaints. Complaints during construction would be received through the proponent's existing telephone and online enquiries service. I am

[29] Refer to glossary for definition.

satisfied the buffer distances and proposed mitigation measures would be adequate to manage potential noise and vibration impacts on sensitive receivers.

Construction noise and vibration impacts to fauna

The EIS reported construction activities would have an impact on fauna given the high noise and vibration levels proposed to be emitted. The EIS reports noise may act as a stressor for animals as well as acting to mask acoustic signals that are essential for functions such as communication, predator detection and mating. However, there is limited understanding on how noise from human activities impact the fauna present in the project area. The available literature suggests that most fauna would avoid the immediate areas where noise or vibration presents an annoyance to them. In order to mitigation impacts, and in the absence of more detailed information, the proponent proposes to:

- clear and fence construction areas to prevent fauna access
- maintain buffer distances between construction activities and protected fauna species
- select equipment with the lowest noise rating to meet project requirements
- minimise noise from plant equipment by maintaining the equipment in good working condition.

Operational noise and vibration impacts (dam)

The EIS indicated operational noise and vibration sources relate to the release of water from the dam wall outlet, traffic from maintenance vehicles and use of recreational areas. The frequency of maintenance activities would be determined during detailed design with light vehicles expected to be used. No adverse noise and vibration impacts are expected during dam operation; accordingly, no mitigation measures are considered necessary.

Operational noise and vibration impacts (pipeline)

Operational noise impacts on sensitive receivers

The EIS indicated noise impacts are expected from the four pump stations when in operation at night. The EIS stated the pump stations would start automatically when water level sensors at each balancing storage station detect a drop in water level within the pipeline. The pump stations are located in rural areas and accordingly, the night time noise criteria to be met is LAeq 28 dB(A).[30]

The EIS predicted unmitigated pump stations would produce 106 dB(A) of noise when in operation. The EIS assessment concluded sensitive receivers within 6 km of pump stations may experience exceedances of the noise criteria.

In response to submitter concerns regarding the very high noise levels being generated by the pumping stations resulting in an exceedance of the 28 dB(A) noise limit, the

[30] As defined in EPP (Noise).

AEIS identified the use of a 10 dB(A) reduction noise enclosure to be oriented away from sensitive receivers to manage noise impacts from pump stations.

The AEIS presented a revised noise assessment in response to submissions incorporating the suggested mitigation measure. The AEIS assessment concluded mitigated pump station operations within 500 m of sensitive receivers may result in exceedances of the noise criteria. In order to mitigate noise impacts, the proponent proposes to situate pump stations more than 500 m from sensitive receivers and to implement mitigation measures proposed for the construction noise such as using noise abated equipment on site.

To ensure impacts from the operation of pumps does not cause noise impacts on sensitive receivers, the proponent has committed to implementing appropriate measures such as installing noise enclosures. These measures would ensure that noise from pump stations does not exceed 28 dB(A) at the nearest noise sensitive receiver. This commitment is included in Appendix 6 and I require this to be implemented.

Operational impacts on fauna

The noise generated by the operation of pump stations has the potential to impact fauna within the pipeline area. The EIS stated that most mobile fauna would avoid the immediate areas where noise or vibration presents an annoyance to them. In addition, fauna may become desensitised to noise to some degree with exposure over time, known as habituation.

In response to submissions, the proponent proposes to undertake additional mitigation measures including clearing and fencing the pump stations to exclude fauna and using noise abated equipment on site.

Low frequency noise impacts

The operation of pump stations has the potential to create adverse low frequency noise impacts at night. The EIS stated low frequency noise impacts would be mitigated by maintaining buffer distance of 500 m from pump stations and sensitive receivers.

The EIS confirmed all complaints about noise during operation would be received through the proponent's existing telephone and online enquiries service. The proponent's draft EMP (EIS Chapter 29) outlines the basic requirements for dealing with complaints and states that the project's construction and operation EMPs will establish the procedures for complaints.

Cumulative impacts

The EIS provided an assessment of the cumulative noise and vibration impacts associated with the project, surrounding potential pipeline operations, and other sources of noise and vibration due to existing land use. The EIS reported no long-term cumulative noise and vibration impacts were likely to occur at the dam area when in construction or operation as it is distant from any other proposed projects.

The EIS reported the pipeline construction and operation may be in the vicinity of other projects including the Surat Basin Rail project, the Wandoan Coal Project and a number of coal seam gas related pipeline projects if they proceed.

In areas where the project may cause cumulative noise impacts on sensitive receiver, the proponent has committed to participate in regional coordination processes with other proponents to ensure impacts from multiple projects are minimised. I support this commitment and require this to be undertaken.

5.9.6 Coordinator-General's conclusion

Based on the results of predictive modelling undertaken in the EIS, I am satisfied that noise and vibration impacts resulting from the project's construction and operation can be suitably managed for the life of the project. The proponent has identified the most likely sources of noise and the EMP identified specific mitigation measures, such as implementing buffer distances, to reduce potential impacts.

I am satisfied the EMP adequately describes the monitoring and corrective actions required in the event of noise and vibration complaints. The proponent has committed that within 24 hours of receipt of a complaint the person with the authority to take action will be notified, followed by an appropriate resolution of the issue. The proponent has also committed to participate in regional coordination processes with other proponents to ensure impacts from multiple projects are minimised. I support these commitments and require them to be undertaken.

To ensure noise impacts from pump stations do not affect nearby sensitive receivers when in operation, the proponent has committed to ensure that noise from pump stations does not exceed 28 dB(A) at the nearest noise sensitive receiver. I am confident the proposed mitigation measures will appropriately mitigate pump station noise impacts.

5.10 Waste management

5.10.1 Introduction

The regulatory framework governing waste generation and disposal includes the National Waste Policy and National Environment Protection Measures. The *Waste Reduction and Recycling Act 2011,* Queensland's Waste Reduction and Recycling Strategy 2010-2020, the *Environmental Protection Act 1994* (EP Act), Environmental Protection Regulation 2008, Environmental Protection (Waste Management) Regulation 2000 and the Environmental Protection (Waste Management) Policy 2000 (EPP (Waste)) regulate waste at a State level; and the Banana Shire Council Waste Reduction and Recycling Plan and Western Downs Regional Council Waste Management Policy at the local level.

Under the EP Act, waste is categorised as either regulated waste or non-regulated waste and under the EPP (Waste), the movement of regulated waste within Queensland is subject to a waste tracking system.

5.10.2 Existing environment

The existing waste streams in the project area are largely from domestic and agricultural sources. Existing licensed waste facilities within the BSC LGA are located at Taroom, Trap Gully, Cracow, Theodore and Wowan; and within the WDRC LGA, are located at Wandoan, Chinchilla and Dalby. These facilities may have the potential to accept project waste. The EIS noted detailed waste projections would be undertaken during detailed design. At this stage, the amount of waste and the point of generation would be understood to enable consultation with the local council to manage waste produced by the project. SunWater has committed to liaise with the relevant local councils prior to the commencement of construction and to enter into waste contracting agreements.

I note the proponent is not seeking approval for the workforce accommodation camps as part of the project, and accordingly, waste impacts from camps are not assessed.

5.10.3 Submissions received

Waste management issues raised in submissions on the EIS included:

- local council waste facilities' lack of capacity to handle the volumes of waste expected to be generated by the project
- the appropriate treatment of soil excavated from the pipeline trench to ensure the disposal method does not cause environmental harm.

I have considered the submissions and the responses provided by the proponent in my evaluation of the potential impacts of the project and my evaluation is provided below.

5.10.4 Impacts and mitigation

Construction impacts

The construction phase involves construction of the dam, pipeline and associated infrastructure; and decommissioning and removal of the Glebe Weir and part of the W2G pipeline.

The EIS reported that waste types potentially generated during project construction may include:

- construction building waste including timber, metal off-cuts, plastics, cardboards and concrete
- excavated spoil from construction of the dam, pipeline and associated infrastructure
- vegetation waste from land clearing
- regulated waste including paints, oils, tyres, batteries and sewage
- office and domestic waste from the construction workforce including food and packaging
- stormwater run-off from roads and construction areas and construction wastewater.

Approximate volumes for key waste streams are provided in Table 5.12.

Table 5.12 Construction phase: expected waste streams and estimated volumes

Waste type	Estimated quantity
Non-regulated waste	
Excess and excavated spoil	**Dam:** 260,000 m^3 **Pipeline:** 340,200 m^3
Wastewater	**Dam:** 262 ML **Pipeline:** 134 ML
Cleared vegetation	**Dam, pipeline and associated infrastructure:** 4,737 ha Approximately 90 per cent (4,263 ha) of the clearing would occur within the dam water storage area
Concrete	**Dam and pipeline:** Approximately 2,929 m^3 (1 per cent of 292,900 m^3 of total concrete produced)
Regulated waste	
Sewage	6,000 L per day

The EIS identified the construction phase would involve a number of environmentally relevant activities (ERAs) such as ERA 43 Concrete Batching and ERA 63 Sewage Treatment. The EIS confirmed the management of waste related to ERAs would be provided in development applications. The applications would be lodged when a contractor has identified the specific locations on site for the ERAs following a final investment decision on the project.

Construction mitigation strategies

The project's EMP included in the EIS identified a range of strategies to minimise, manage and mitigate waste impacts of the project. The proponent has committed to develop and implement a site-specific waste management plan (WMP) prior to the commencement of construction activities. The WMP would identify the most appropriate transport, storage and disposal for each waste type. The plan would be developed in compliance with the EP Act, associated regulations and national and state waste management policies.

In accordance with regulatory requirements, the WMP would incorporate sustainable waste management practices which include a waste management hierarchy and cleaner production practices. The hierarchical approach to waste management prioritises waste management strategies from the most preferable (avoidance, re-use or recycling) to the least preferable (disposal). Cleaner production practices include procuring only the amount of raw materials necessary.

All waste generated on site during the construction phase would be managed in accordance with the WMP and EMP. All waste would be separated by type, assessed for potential re-use onsite prior to transport for disposal or treatment off-site by licensed contractors in accordance with the relevant legislation or policy.

I note the proponent has committed to liaise with the relevant local council on waste management prior to the commencement of construction (refer to Appendix 5). I support this commitment, and require this to be undertaken.

The key mitigation measures for each major waste stream are listed below.

Excavated and excess spoil

All excavated spoil would be treated in accordance with the proponent's soil management protocol prior to re-use to prevent soil contamination. The bulk of the excavated spoil from dam construction would be used in construction of the coffer dams and disposed of within the dam FSL. Following backfilling of the pipeline trench, excess spoil would be used to form a low mound over the pipeline easement. Any remaining excess spoil would be used in local erosion control works.

The proponent has committed to prepare a sediment and erosion control plan and to provide the remaining spoil, if suitable for use as landfill capping, to Western Downs Regional Council. Soils and potential land contamination are further discussed in Section 5.1.

Cleared vegetation

A total of 4,737 ha of trees and shrubs would be cleared, with grasses left undisturbed, for construction of the dam, pipeline and associated infrastructure. Approximately 90 per cent (4,263 ha) of the clearing would occur within the dam water storage area to FSL. Millable timber would be sold and the remaining material would be mulched for use in construction site rehabilitation where suitable or used to create aquatic and fauna habitat. Burning of vegetation in excavated pits would be undertaken as a last resort.

Concrete

The proponent intends to minimise concrete waste by procuring only the amount necessary with any waste to be crushed and re-used in the concrete batching plant or used as fill.

Sewage

Sewage from construction sites would be pumped out and disposed of at a licensed facility.

Wastewater

The EIS confirmed that wastewater, including stormwater run-off and wastewater from kitchen/laundry facilities would be treated and used for concrete batching, dust suppression and watering of rehabilitated areas.

Decommissioning of Glebe Weir

The proponent has proposed to follow decommissioning practices established by the Australian National Committee on Large Dams (ANCOLD) for referrable dams as defined in the Water Act despite Glebe Weir not being a referable dam. The EIS stated the proponent would prepare a decommissioning plan to address dam safety, economic, environmental and social issues. The decommissioning plan is required to be approved by an experienced engineer prior to the commencement of decommissioning of Glebe Weir.

The EIS stated that the decommissioning plan would seek to remove all lightweight infrastructures from Glebe Weir and, where possible, re-use it in the project. Lightweight infrastructure includes steel shutters, pumps, compressors and signage. The Glebe Weir Road and associated boat ramp would be left in place however buildings would be demolished with bricks and concrete waste to be pushed into the Glebe Weir pool. Water quality impacts from the abandonment of this material would be addressed in the decommissioning plan.

Decommissioning of W2G pipeline

The EIS stated the decommissioning plan would seek to remove all aboveground infrastructures and re-use it on the Nathan pipeline where possible. Underground infrastructure would be capped and sealed. The 3.1 km of maintenance track, where not inundated, would be removed and the easement rehabilitated with pasture species or native vegetation.

The decommissioning process for Glebe Weir and W2G pipeline is further discussed in Section 2 (About the project).

Operational impacts and mitigation strategies

Waste expected to be generated during the operational phase include pumps, valves, motors, and timber beams that need to be replaced. The EIS confirms that minimal volumes would be generated during the operations phase.

5.10.5 Coordinator-General's conclusion

I am satisfied that the potential impacts of waste can be adequately managed through the proponent's commitments to consult with the relevant local council and to develop and implement a WMP, EMP and associated plans (Appendix 5). I support these commitments and require them to be undertaken by the proponent to ensure the sustainable management of waste.

I note the management strategies of waste related to ERAs would be provided in development applications in the future. I consider that the EIS assessment demonstrates appropriate disposal to avoid adverse impacts on the life, health and wellbeing of people and ecological processes and associated ecosystems that may be potentially affected by the project.

6. Matters of national environmental significance

This section addresses the potential impacts of the Nathan Dam and Pipelines project (the project) on matters of national environmental significance (MNES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

On 17 June 2008, the project was referred to the then Department of Sustainability, Environment, Water, Population and Communities ([SEWPAC] now the Department of the Environment and Energy [DEE]) for consideration under the EPBC Act. On 30 July

2008, the Commonwealth Environment Minister determined that the project was a controlled action under the EPBC Act (reference number EPBC 2008/4313) for the following controlling provisions:

- World Heritage properties (sections 12 and 15A)
- National Heritage places (sections 15B and 15C)
- wetlands of International Importance (sections 16 and 17B)
- listed threatened species and ecological communities (sections 18 and 18A)
- listed migratory species (sections 20 and 20A)
- Commonwealth marine areas (sections 23 and 24A).

6.1 Project description

SunWater (the proponent) proposes to construct and operate a new dam and associated water delivery infrastructure 8 km upstream of Nathan Gorge at adopted middle thread distance (AMTD) 315.3 km on the Dawson River in central Queensland.

At full development (FSL of 183.5 m AHD), the dam would have a storage capacity of 888,312 ML and would be able to store sufficient water to supply 66,100 ML per annum (ML/a). At FSL the dam would be expected to inundate an area of 13,508 ha.

The intended purpose of the proposed action is to provide long-term reliable water supplies to mining, power, urban and existing agricultural customers in the Surat Coal Basin, and the Dawson Callide sub-region of Central Queensland.

No water from the proposed action is proposed to be allocated to new agricultural users. Water may also be reserved to meet critical urban supply needs in the lower Fitzroy and other parts of Queensland.

Water from the dam storage is anticipated to be supplied to water users via a trunk pipeline and downstream releases from the dam. The pipeline would primarily supply water to coal mines and power stations in the Surat Coal Basin.

The downstream releases would be intended to supply water to new mining customers in the Southern Bowen Coal Basin, and to existing and potentially new customers in the Dawson Valley Water Supply Scheme (DVWSS).

The DVWSS extends along the Dawson River from upstream of Theodore to downstream of Boolburra, north of the Capricorn Highway. It contains two channel systems: Theodore and Gibber Gunyah. Whilst irrigation customers are the predominant users of water in the scheme, water is also supplied to urban and mining customers.

The scheme provides water for the towns of Theodore, Moura, Baralaba and Duaringa. Coal mines and an ammonium nitrate plant in the Moura- Kianga area, and a gold mining venture at Cracow are also supplied from the DVWSS.

The key project components include:

- a dam with:
  - an earth and rock-fill embankment (dam wall) extending 1240 m

  - a spillway varying between 200 and 300 m in width on the right abutment (embankment). The spillway would incorporate energy dissipation structures to dissipate the flow energy of water releases.
  - fish and turtle passage infrastructure.
  - a selective withdrawal system (multi-level offtake) providing for both downstream and pipeline releases.
  - outlet mechanisms to provide flexible options for environmental flow releases and re-aeration of water released downstream.
- a pipeline extending 149.3 km south-east to Warra.
- 10,603 ha flood mitigation buffer.

Other project activities include:

- decommissioning of Glebe Weir.
- road works including:
  - a new 6.5 km dam access road from the north, being an extension of the existing Glebe Weir Road
  - upgrade of Glebe Weir Road to the Spring Creek junction and intersection with the Leichardt Highway
  - closing of the Bundulla Road crossing of the Dawson River and portion of Glebe Weir Road near Glebe Weir
  - realignment of The Bend and Brodies Roads
  - new rural road bridge or causeway on Cracow Road at Cockatoo Creek and Bentley Creek
- construction of new power and telecommunications infrastructure to service the dam site during construction and operation and the pipeline pump stations
- provision of two recreation areas and viewing platform at the dam
- installation of septic tanks at the dam site office and dry composting toilets at the new recreation facilities.

Changes to the pipeline alignment

I note that the pipeline route has substantially changed from the original proposal and was modified during the EIS process with the reduction in length from 219 km to 149 km. The modification of the alignment has occurred as a result of the proponent constructing the Woleebee to Glebe Weir (W2G) pipeline which was completed in 2015. The W2G pipeline currently transports treated coal seam gas (CSG) water from south-west of Wandoan to Glebe Weir for beneficial re-use.

Once the dam is constructed, it would be connected to this pipeline and the direction of flow in the W2G pipeline would be reversed such that river water can be delivered to pipeline customers. Approximately 10.3 km of the W2G pipeline between Glebe Weir would be decommissioned to allow for this to occur.

A connecting pipeline would be constructed from W2G pipeline at a point (chainage 72.7 km) near Wandoan. From this point a connecting pipeline would be constructed,

extending approximately 100 km south-east to Chinchilla and then approximately 40 km to the township of Warra where it would terminate.

6.2 Project location

6.2.1 Dam and surrounds

The Fitzroy Basin catchment covers an area of 142,600 km^2 and consists of six major sub-catchments, namely the: Fitzroy; Dawson; Isaac; Connors; Nogoa; Comet; and the Mackenzie sub-catchments. The rivers within the catchment are significantly modified with more than approximately 36 per cent of the Fitzroy, Dawson and Mackenzie sub-catchments being impounded by water infrastructure including six weirs on the Dawson River, a weir and a tidal barrage on the Fitzroy River and three weirs on the Mackenzie River.

The project would be located on the Dawson River, within the lower Dawson sub-catchment. This sub-catchment has a total catchment area of 23,185 km^2. The Dawson River flows into the Fitzroy River which eventually discharges to the sea towards the southern end of the Great Barrier Reef, approximately 620 km downstream of the proposed dam at the Fitzroy River mouth.

The proposed location of the dam is 75 km downstream of the town of Taroom, 8 km upstream of Nathan Gorge and 315 km (315.3 km ATMD) upstream of the Dawson River and Fitzroy River confluence.

The EIS indicates that the water storage area predominantly consists of cleared and non-remnant vegetation, which accounts for 76 per cent (9,257 ha) of the total water storage area. Most of this area is currently used for cattle grazing, with a small area of 296 ha designated as cropping land. The remaining areas of remnant vegetation include a mix of broad habitat types including:

- tall open forest of river red gum (*Eucalyptus camaldulensis*) and/or Queensland blue gum (*Eucalyptus tereticornis*) along the Dawson River and associated tributaries
- cypress pines and/or iron bark on sands which occurs as large patch close to the dam site and surrounding Nathan Gorge
- coolabah woodland on alluvium which occurs as fragmented patches predominantly on the low flood plains of the Dawson River and associated tributaries
- brigalow and/or belah open forest with occasional emergent eucalypt species on clay or sand
- boggomoss springs (springs fed by the Great Artesian Basin [GAB]). There are two registered boggomoss areas within the storage area.

The project area also contains wetland areas including river red gum and paperbark communities within Nathan Gorge, lowland floodplains adjacent to the Dawson River and smaller wetlands with fringing cabbage tree palm (*Livistona australis*) near Taroom and along creeks and streams.

There are a number of significant wildlife corridors throughout the project area including a corridor between Nathan Gorge and Precipice National Park and Taroom Town

Common and the Dawson River which is an east-west corridor that runs through the project area. Another corridor running north-south occurs 10 km downstream of the location of the proposed dam wall between Precipice National Park and Isla Gorge National Park.

6.2.2 Pipeline

The northern section of the pipeline (from the dam site to Wandoan) would traverse areas that have been largely been cleared with some areas of vegetation retained along the road reserves and waterways. Fauna habitats are limited to several localised patches of remnant vegetation which are in poor condition (affected by cattle grazing and weeds).

The mid-section of the pipeline (Wandoan to Chinchilla) deviates from the Leichhardt Highway 5 km south of Wandoan heading south-east to connect with the Warrego Highway at Chinchilla. This section of the pipeline crosses several creeks and traverses large tracts of vegetation that provide continuous linkages between Barakula, Binkey, Gurulmundi and Cherwondah State Forests.

Large tracts of remnant narrow-leaved ironbark, cypress pine and belah woodland were observed throughout the pipeline corridor. Suitable habitat features were observed in these areas which are likely to support terrestrial reptiles (i.e. fallen trees and branches and leaf litter).

The pipeline also crosses several creeks with remnant riparian *Eucalyptus tereticornis* woodland fringing draining lines (RE 11.3.25) and *E. tereticornis* woodland on alluvial plains (RE 11.3.4). Hollow bearing trees were also common in these areas, which would be expected to support a range of birds, arboreal (tree-dwelling) mammals and bats. Areas of high-quality habitat were also identified at two other sites including a patch of vegetation on Little Creek Road and another patch along Grays Lane off Engine Road. These areas had habitat features which would be suitable for supporting terrestrial reptiles (i.e. fallen trees and branches and leaf litter).

The land surrounding the southern section of the proposed pipeline route (Chinchilla to Warra) is largely characterised by expansive crop fields. Remnant vegetation occurs in small fragmented patches along the creeks and drainage lines and occasionally within the road reserves.

The vegetation in the road reserves is relatively intact with corridors of vegetation less than 50 m in width and small stands of regrowth trees. The habitat values along this section of the pipeline route are considered to be poor.

There are a number of bioregional wildlife corridors which intersect the pipeline corridor. There are two corridors of state significance: Western Creek/Dunmore to Barakula State Forest and Barakula State Forest to Yuleba. There are also several creeks intersecting the corridor which are mapped as corridors of State significance and provide connections between large areas of core habitat (e.g. Barakula State Forest).

6.3 World Heritage properties

6.3.1 Background

The World Heritage property relevant to the project site is the Great Barrier Reef World Heritage Area (GBRWHA), which is located approximately 620 km downstream from the project site and includes the waters of the Fitzroy River estuary and Keppel Bay.

The Great Barrier Reef World Heritage Area

The GBRWHA is one of the world's largest World Heritage properties, extending 2,000 km along the Queensland coastline and covering an area of approximately 348,000 km^2. The Great Barrier Reef (GBR) was listed as a World Heritage Area in 1981 and meets all four natural World Heritage criteria which are detailed in the statement of outstanding universal values (OUVs) (see Appendix 7 of this report).

The four natural criteria relevant to the GBRWHA are:

- Criterion VII—contains superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance
- Criterion VIII—be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features
- Criterion IX—be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals
- Criterion X—contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

For each criterion, there are a number of attributes for which the property was listed.

The EPBC Act *Referral Guidelines for the Outstanding Universal Value of the Great Barrier Reef World Heritage Area* (2014) details the attributes which underpin each criterion. These attributes may not be expressed equally over the whole GBRWHA, and as such only attributes that are relevant to the project have been assessed in this report.

Criterion VII and VIII are not considered to be relevant to the project. Due to the considerable distance from the GBRWHA, the project would not have an impact on the aesthetics of the GBR coastal zone or impact on coastal geological processes.

As the project has the potential to impact on water quality and flow regimes of the Fitzroy River, which discharges into the GBRWHA, Criterion IX and X are relevant to the project.

The Fitzroy River estuary and the adjacent marine waters provide habitat for a range of marine fauna which are considered to be OUVs of the GBRWHA. The coastal areas surrounding the Fitzroy River estuary provide important habitat for a number of migratory shore bird species and threatened species of bird, including the Capricorn

yellow chat. These bird species inhabit and/or use areas which are subject to varying degrees of fresh and saltwater (tidal) influence.

The marine waters surrounding these areas are known to support a number of threatened turtle species and inshore dolphins. The presence of these marine species is influenced by factors including water quality and hydrological processes, which influence the distribution of suitable foraging resources.

Reef 2050 plan

In March 2015 the Australian and Queensland governments released the *Reef 2050 Long-term Sustainability Plan* (Reef 2050 Plan), which provides an overarching framework for the future protection and management of the GBR for a 35-year period (until 2050). The overarching vision of the plan is 'to ensure the GBR continues to improve on its OUV every decade between 2015 and 2050 to be a natural wonder for each successive generation to come'.

To meet this vision the plan sets out clear actions, targets and objectives to drive and guide the short, medium and long-term management of the Reef. The Reef 2050 Plan is informed by both the GBR Outlook Report 2014 and the Strategic Assessment undertaken by the Queensland Government, and also builds on the *Reef Water Quality Plan* 2013 (Reef Plan) targets.

The Reef 2050 Plan identifies tangible outcomes, objectives and measurable targets across seven themes —ecosystem health, biodiversity, heritage, water quality, community benefits, economic benefits and governance—to form an integrated management framework.

Prior to the development of the Reef 2050 Plan the Australian and Queensland Governments developed the Reef Plan. The purpose of this plan was to provide a more coordinated and cooperative approach to halt and reverse the decline in water quality entering the GBR from broadscale land use (e.g. agricultural activities, such as grazing, cropping and horticulture and forestry.

The plan was first endorsed in 2003 and was substantially updated in 2009 to include clear goals and targets for reducing pollutant levels. Building on the Reef Water Quality Plan 2013 targets, (Reef Plan) the Reef 2050 Plan focuses on activities which will safeguard the OUV of the Reef into the future.

6.3.2 Impacts and mitigation

Removal of riparian vegetation

In the Reef 2050 Plan, the Queensland Government has committed to ensuring that development in the GBR coastal zone occurs in an ecologically sustainable manner. One of the key actions in the plan for maintaining and enhancing the ecological health of the reef includes: strengthening vegetation management laws to protect remnant and high-value regrowth native vegetation (including riparian zones). In addition, one of the targets in the plan is to increase the extent of riparian vegetation by 2018.

A riparian area is defined as an area within 100 m of a mapped stream or riverine wetland[31]. Retaining riparian vegetation along the banks of waterways is important for maintaining good water quality. Riparian vegetation provides stability to stream banks which reduces sediment losses and also acts as a filter by removing water-borne pollutants.

Riparian vegetation is also important for shading in-stream habitat, which helps maintain water temperatures and provides cover for fish and other aquatic fauna. These riparian areas also provide important habitat for a range of terrestrial fauna.

The GBR regions with the largest amount of riparian areas are the Burdekin (2.42 million hectares [M ha]) and the Fitzroy (2.2 M ha). Between 2009 and 2013, the Fitzroy region had the largest increase in the loss of riparian vegetation with an increase of 0.7 per cent (approximately 14,800 ha) compared with loss between 2005 and 2009[32]. Since European settlement, approximately 37 per cent of forested riparian areas have been lost in the Dawson River catchment.

Much of the landscape surrounding the project area has been cleared, predominantly for cattle grazing. As a result, vegetated areas tend to be concentrated along the riparian fringes of the Dawson River and adjoining creeks.

The EIS indicates that the project is expected to result in the removal of 3,554.5 ha of remnant vegetation and 136.7 ha of high-value regrowth as a result of clearing for construction and inundation of vegetation within the dam.

I note that this clearing would exclude some riparian areas, as the proponent has proposed to retain riparian vegetation up to 1.5 m within the FSL. Construction of the pipeline is expected to result in the loss of 61.81 ha of remnant vegetation.

The loss of this vegetation is expected to disrupt connectivity between habitats, result in the loss of EPBC Act-listed threatened ecological communities including brigalow (brigalow EC) and wetland vegetation associated springs fed by the Great Artesian Basin (GAB spring EC).

I have stated a condition under Queensland legislation requiring the proponent to provide offsets to compensate for the loss of regulated vegetation and connectivity areas and have recommended a condition to the Commonwealth Environment Minister requiring the proponent to provide offsets for the loss of habitat for threatened species (boggomoss snail) and ecological communities (brigalow and GAB spring ECs).

These offsets would also be expected to compensate the loss of riparian vegetation associated with the project and possibly increase and improve the quality of riparian vegetation throughout these areas. In addition, the proponent has proposed to rehabilitate and revegetate the areas around the dam which would be used as a water

[31] Australian Government 2014, Riparian methods: Great Barrier Reef Report Card 2014, Australian Government, Canberra, viewed 15 November 2016, http://www.reefplan.qld.gov.au/about/assets/gbr-report-card-2014-riparian-methods.pdf

[32] Commonwealth of Australia, Reef Water Quality Protection Plan Great Barrier Reef Report Card 2014: Riparian results, Australian Government, Canberra, 2015, viewed 7 November 2016, http://www.reefplan.qld.gov.au/about/assets/gbr-report-card-2014-riparian-results.pdf

storage flood buffer (covering up to a 1-in-100 AEP event) and to be used in part to mitigate and offset the environmental impacts of the project.

Revegetation of this area would assist in attenuating peak flood flows, by slowing run-off and absorbing excess water, in addition to compensating for the loss of vegetation from the FSL footprint. This area is predominantly cleared land with patches of remnant and regrowth vegetation.

The riparian zones along this buffer would be enhanced as part of these revegetation works and the proposed offsets in this area for State matters (regulated vegetation and connectivity areas.

In addition to requiring offsets for threatened species and ecological communities, I have recommended a condition to the Commonwealth Minister requiring that the works ensure the water storage flood buffer provides suitable habitat for terrestrial and aquatic species. I consider that this would ensure that riparian areas are adequately revegetated and rehabilitated.

Provided that the proponent achieves a conservation gain through increasing areas of riparian vegetation in the Fitzroy Basin catchment through their proposed mitigation measures and offset obligations, the project would be expected to contribute to meeting the Reef 2050 Plan '2020' target for riparian vegetation: there is no net loss of the extent, and a net improvement in the condition, of natural wetlands and riparian vegetation that contribute to Reef resilience and ecosystem health.

Impacts on flow regimes

The EIS stated that the flow regime changes as a result of the dam operation would be most noticeable immediately downstream of the dam. Based on the modelling presented in the EIS, changes to flow regimes would generally decrease with increasing distance downstream from the dam.

It is predicted that the flow regimes would return to the existing conditions at around 297 km downstream of the dam. Given the distance of the GBRWHA from the dam (approximately 620 km downstream) the project is unlikely to have a significant effect on the flow regimes of the GBRWHA.

In addition, the proponent would be required to ensure that water releases from the dam are meeting environmental flow objectives (EFOs) for the surface water reporting nodes at key locations within the Water Plan (Fitzroy Basin) Plan 2011 (Water Plan) area. The purpose of these EFOs is to protect the health of ecosystems from future decisions made under the Water Plan and to minimise changes to natural flow conditions.

There are five surface water reporting nodes downstream of the dam, two of which have EFOs. The Fitzroy Barrage is relevant as is closest reporting node to the GBR (59 km from the mouth of the Fitzroy River) and is located at where the Fitzroy River transitions from freshwater to marine.

Key threats to the GBR's ecosystem and heritage values

The GBR Outlook Report 2014 assessed the risk of current and potential threats to the GBR's ecosystem and heritage values. The highest risks have been grouped into four influencing factors:

- long-term risks associated with climate change
- immediate considerations around:
  - land-based run-off
  - coastal land-use change
  - direct use.

These influencing factors are taken into account in the Reef 2050 Plan and are relevant to the GBRWHA. The two influencing factors which are relevant to the project include the long-term risks associated with climate change and the immediate risks associated with land-based run-off.

The other two immediate risks: coastal land-use change and direct use are not relevant as the project is not expected to undertake or result in activities within the GBRWHA or directly change land uses within the adjacent coastal zone.

Long-term risks associated with climate change

The Reef 2050 Plan indicates that the biggest long-term threat to the GBR is climate change. The Australian Government has committed to effective climate change mitigation and adaption both domestically and internationally.

Direct impacts

In terms of direct GHG emissions associated with the construction and operation of the dam and pipeline, the proponent would be required to report and manage GHG emissions in accordance with the *National Greenhouse and Energy Reporting Act 2007*.

The EIS indicates that project operations over the 100-year design asset life of the project are expected to be approximately 7 metric tonnes carbon dioxide equivalent (Mt CO2-e) based on annual GHG emissions estimates of 0.072 Mt CO2-e. Based on the *Quarterly Update of Australia's National Greenhouse Gas Inventory: March 2015*[33]*,* this represents 0.01 per cent of Australia's annual emissions.

The proponent has committed to using efficient energy sources to minimise total energy consumption and to reduce the amount of greenhouse gas emissions produced during the construction and operation of the dam and pipeline.

Indirect and consequential impacts

In terms of climate change impacts, the EIS does not assess the indirect GHG emissions generated from the mining and industrial activities that water from the dam would be supplied to. This is because these would be classified as 'Scope 3 or 'Other

[33] Department of the Environment 2016, Quarterly Update of Australia's National Greenhouse Gas Inventory: August 2015, Commonwealth of Australia, viewed 19 April 2017,

Indirect' emissions, which are not reported under the National Greenhouse and Energy Reporting scheme.

These are defined as emissions that are a consequence of the operations of an organisation, but are not directly owned or controlled by the organisation. The reporting requirement for these emissions would be the responsibility of the mining and industry operators using the water. As such the proponent for the dam would not be responsible for reporting the GHG emissions generated by any water users.

Land-based run-off

The Fitzroy Basin catchment where the project would be located covers approximately 37 per cent of the total GBR catchment area and contributes substantial amounts of contaminants to the GBR lagoon, particularly during large-scale flood events. For example, the 2014 GBR Report Card indicated that total suspended solids (TSS) water quality guidelines were exceeded in over 50 per cent of the waters in the inshore GBR lagoon in the Fitzroy region during 2013/2014, as a result of repeated flood events during this period.

In addition to flooding events, land uses within the catchment also contribute a large source of contaminants. Agriculture accounts for almost 90 per cent of land use in the Fitzroy Basin and is a large contributor to water quality impacts associated with land-based run-off. The GBR Outlook Report 2014 highlighted that the largest source of nutrients entering the GBR system include dissolved inorganic nutrients in river discharges, largely derived from fertilisers used for high-intensity cropping lost through run-off.

Mining activities account for a small percentage of land use (0.5 per cent) within the Fitzroy Basin catchment. Water quality impacts from mining activities are generally managed under conditions set out in environmental authorities. These authorities place limits on water quality indicators such as pH, electrical conductivity or total dissolved solids and total suspended solids.

The management of the water quality impacts from mining activities which the dam would supply water for would not be the responsibility of the Nathan Dam and Pipelines proponent and would be the responsibility of the mining operators undertaking these activities. Likewise industrial and urban water users are highly regulated and the management of water quality impacts from their activities would be the responsibility of these users.

The Reef 2050 Plan has set a number targets for improved water quality and land management practices and identifies actions to improve the quality of water entering the GBR. The plan has set the following targets for anthropogenic, end-of-catchment water quality flow from priority areas to the GBR by 2018:

- 50 per cent reduction in dissolved inorganic nitrogen, on the way to achieving up to an 80 per cent reduction by 2025
- 20 per cent reduction in sediment, on the way to achieving up to a 50 per cent reduction by 2025
- 20 per cent reduction in particulate nutrients

- 60 per cent reduction in pesticide loads.

The plan is a significant part of the overall strategy of Queensland and Australian governments to protect and preserve the GBR. It incorporates and supports the actions of industry, community groups and government that impact on reef health and links with a number of other legislative and planning initiatives.

Direct impacts-construction water quality impacts

An action is considered likely to have a significant impact on the natural heritage values of a World Heritage property if there is a real chance or possibility that the action will substantially increase concentrations of suspended sediments, nutrients, heavy metals and other pollutants and substances in a river or water body within that property.

Given its distance from the GBRWHA (620 km away), construction of the project is unlikely to have any direct impacts on the water quality of the GBRWHA. In addition the proponent has committed to a number of measures to ensure that water quality impacts are adequately managed during construction, including:

- undertaking the more significant ground-disturbing activities, such as embankment excavations and construction of coffer dams, during drier periods
- diverting minor flows around construction areas to reduce run-off collecting sediment from disturbed areas and collecting and treating site-affected water before being discharged to the river
- implementing sediment and erosion control measures in compliance with accepted guidelines[34]
- ensuring that hazardous chemicals and substances, including hydrocarbons and oils, are only stored and handled within bunded areas that have been designed and constructed in accordance with Australian standards
- directing dewatering wastewater to sedimentation ponds for treatment before being discharged to the river or being used for other purposes
- undertaking regular water quality monitoring in accordance with a water quality monitoring program and undertaking corrective actions to address any actual/ observed water quality impacts.

These measures would ensure any water quality impacts during construction are minimal. Any water quality impacts associated with these activities would also be expected to be localised and therefore not pose any significant risk to the Reef.

The proponent has committed to further develop these measures as part of developing a construction environmental management plan (EMP) and the proponent would need to seek relevant approvals (e.g. environmental authorities, riverine protection permit and other permits or licences) for undertaking activities which may contribute to water quality impacts.

[34] e.g. the IECA (2008) *Best Practice Erosion and Sediment Control Guideline*; and the Queensland Division of the Australian Institute of Engineers' (1996) *Erosion and Sediment Control: Engineering Guidelines for Queensland Construction Sites.*

I note that if the project is approved, these approvals would be sought at a later stage. I consider that these measures would reduce the potential for any water quality impacts on the GBR and therefore not have a negative impact on progress towards meeting the Reef 2050 Plan water quality targets.

Direct impacts-water quality impacts associated with decaying vegetation

The EIS indicates that approximately 76 per cent (9,257 ha) of the area within the FSL is mapped as non-remnant vegetation with a large proportion of this area being agricultural pasture or farming land (i.e. land that has been cleared for cattle grazing and cropping). The remaining 23 per cent (3,895.2 ha) is mapped as woodland vegetation (regrowth and remnant vegetation).

The EIS stated that the areas of agricultural pasture would be retained, and that all other areas (i.e. areas of remnant and regrowth woodland vegetation) would be mechanically cleared with the exception of the riparian zone of the Dawson River and any tributaries where vegetation would be cleared up to within 1.5 m of the FSL. The proponent has estimated that 4,381.3 ha of woody vegetation would be cleared within the FSL.

The removal of trees and shrubs within the FSL would be expected to reduce overall water quality impacts associated with decaying vegetation, by reducing the amount of woody vegetation that would have otherwise died during the filling of the dam. In addition the retention of ground vegetation (i.e. grassed areas) would also assist in reducing water quality impacts by reducing the potential for erosion.

While much of the woody vegetation would be removed, the remaining areas of non-woody vegetation in the FSL (i.e. grazing land, of approximately 8,125 ha) would be expected to die-off due to inundation impacts when the dam reaches FSL for an extended period. The EIS indicated that the timeframe for this would be dependent on the rate of filling the dam and it has been estimated to likely take three years after inundation commences.

During this time, it is expected that the water storage would experience temporary water quality impacts as result of the decomposing organic matter including an increase in nutrients and turbidity and subsequently lower levels of dissolved oxygen. As most of the woody vegetation would be removed from the water storage area prior to filling, these increases are expected to be small.

While the proponent did not quantify the increase in nutrients and turbidity resulting from the decomposition of the remaining non-woody vegetation in the EIS, the proponent has committed to undertaking water quality monitoring during the operation of the dam as part of their obligations under the Water Act. The proponent has also committed provide the results of this monitoring to DEE for consideration in terms of potential water quality impacts on the GBR.

The proponents have committed to develop operational strategies to manage the quality of water being released from the dam to reduce impacts on water quality during this time. The use of a multi-offtake would also assist in managing water quality impacts by providing a mechanism for selective delivery of water. This would allow for higher quality water to be released to the receiving environment.

Water quality impacts during operation would also be expected to be reduced through the inclusion of a vegetated buffer above FSL, where vegetation would be expected to filter any sediments or contaminants in run-off.

Indirect and consequential impacts

A submission on the EIS raised concern about the potential consequential impacts of the project on the GBR and requested that the proponent provide detailed information about the impacts potentially caused as a consequence of mining, urban and agricultural development that would be enabled by the project.

The project is not expected to facilitate an increase in agricultural production. I note that the major purpose of the original Nathan Dam proposal (reference number EPBC 2002/770), which was referred by Sudaw Developments Ltd to the then Commonwealth Environment Minister in August 2002 was to supply irrigation water, mostly to grow cotton.

The revised Nathan Dam and Pipelines proposal (i.e. the proposal being evaluated in this CG evaluation report), which has replaced the original proposal, does not propose to supply water to new agricultural users. The purpose of this project is to supply water to coal mines and power stations in the Surat Coal Basin. To ensure the supply of water from the dam does not result in the expansion of agricultural activities, I have recommended a condition to the Commonwealth Minister, requiring that there are new allocations for agricultural use.

Water would continue to be released downstream to existing irrigation customers in the DVWSS. As these unsupplemented allocations would be regulated, this would not be expected to result in increased agricultural activities. It is expected that these irrigators would receive the same amount of water or less than they are currently receiving.

The EIS indicates that water from the dam would be transported via a pipeline to primarily service coal mines and power stations (and associated urban communities) in the Surat Basin. Water would also continue to be released downstream to towns along the Dawson River as well as to new mining customers in the Southern Bowen Basin and water may also be reserved as required to meet critical urban supply needs.

A future demand study was undertaken as part of the EIS to identify demands for water for the coal mining, power generation, other mining, and quarry materials sectors; and local authorities in the Surat Basin and adjacent areas that could be supplied from Nathan Dam. This study identified 19 coal mine and power generation projects and five local authorities where water could be supplied from the dam.

Point source pollutant loads from mining, factories, chemical processing and waste treatment, are all sources of various pollutants that can ultimately enter waterways. Major sources of point source loads are licensed environmentally relevant activities (ERAs) in Queensland and are regulated through a licensing system (environmental authority) under the *Environmental Protection Act 1994* (EP Act). These activities would be regulated under separate approvals which would be held by the relevant mining and industrial operators to whom water would be supplied to.

Given that the project is not expected to significantly increase agricultural activities in the catchment and activities which the project would supply water are regulated under Queensland legislation, it is considered that the project is unlikely to contribute to any substantial increase of sediments and nutrients entering the GBR system and GBRWHA. The project would therefore unlikely to negatively influence progress towards meeting the Reef 2050 Plan water quality targets.

6.3.3 Coordinator-General's conclusion

I am satisfied that the EIS has identified the potential impacts that the project could have on the OUVs of the GBRWHA. The proponent would be required under State legislation to ensure that water releases are made to meet the EFOs at the Fitzroy Barrage reporting node to the extent possible and therefore have no impact on flow regimes downstream of the barrage and the waters of the GBRWHA.

I consider that any losses of riparian vegetation would be compensated by my stated conditions requiring the proponent to provide offsets to compensate for the loss of vegetation regulated under State legislation (regulated vegetation and connectivity) and my recommended conditions to the Commonwealth Environment Minister requiring the proponent to provide offsets for the loss of habitat for EPBC Act-listed threatened species (boggomoss snail) and threatened ecological communities (brigalow and GAB spring ECs). I also consider that the rehabilitation and revegetation of the flood buffer area around the dam would also assist in enhancing and increasing the area of riparian vegetation around the dam. The project would therefore unlikely to negatively influence progress towards meeting the Reef 2050 Plan targets for riparian vegetation.

I note the proponent's commitment to mechanically clear woody vegetation from the water storage area prior to filling would significantly reduce the potential for water quality impacts on the GBRWHA from decaying vegetation. I consider that the proponent's commitment to an operational release strategy after filling the dam would also assist in reducing water quality impacts downstream.

I also note the proponent's commitment to undertake water quality monitoring during the operation of the dam as part of their obligations under the Water Act and to provide the results of this monitoring to DEE for consideration in terms of potential water quality impacts on the GBR. I consider that the provision of a buffer area above FSL would also be expected to assist in reducing water quality impacts by reducing the potential for sediments and contaminants entering waterways through land-based run-off.

As no water is proposed to be allocated to new agricultural users, the dam is not expected to result in any substantial increase in land-based run-off from agricultural activities. To ensure the supply of water from the dam does not result in the expansion of agricultural activities, I have recommended a condition to the Commonwealth Minister, requiring that there are no new water allocations for agricultural use. I note that the mining, industrial and urban operators that the dam would supply water to would be subject to separate approvals for undertaking activities which have the potential to impact on water quality.

These activities would be regulated under Queensland legislation. As such there would be legislative controls to ensure these activities do not have an adverse impact on the

water quality of the receiving environment. As such it is considered that the project is unlikely to contribute to any substantial increase of sediments and nutrients entering the GBR system and GBRWHA. The project would therefore unlikely to negatively influence progress towards meeting the Reef 2050 Plan targets for water quality.

In light of the proposed avoidance, mitigation and offset measures and conditions in this report, I consider that the project would not have unacceptable impact on the OUVs of the GBRWHA.

6.4 National Heritage places

6.4.1 Background

The GBR was placed on the National Heritage list in May 2007. The criteria for a National Heritage place are that it has outstanding heritage value to the nation due to its:

- importance in the course and pattern of Australia's natural or cultural history
- possession of uncommon, rare and endangered aspects of Australia's natural or cultural history
- potential to yield information that will contribute to an understanding of Australia's natural or cultural history
- importance in demonstrating the principal characteristics of Australia's natural or cultural places or cultural environments
- importance in exhibiting particular aesthetic characteristics valued by a community or cultural group.

A management plan for the GBR National Heritage place has not been prepared under section 324S of the EPBC Act.

6.4.2 Impacts and mitigation

As the GBR National Heritage place covers a similar area to the GBRWHA, I consider that the matters discussed in this chapter for World Heritage properties (refer to Section 6.3) apply equally to National Heritage places.

6.4.3 Coordinator-General's conclusion

As the GBR National Heritage place covers a similar area to the GBRWHA, I consider that the matters discussed in this chapter for World Heritage properties (refer to Section 6.3) apply equally to National Heritage places.

Consistent with the discussion on World Heritage properties, I consider that the project is not expected to have any unacceptable impacts on the GBR National Heritage place.

6.5 Wetlands of international importance

Wetlands that are designated under the Ramsar Convention are those recognised as being internationally important that are considered to be representative, rare or unique; or important for conserving biological diversity. Ramsar wetlands are recognised as a matter of national environmental significance under the EPBC Act.

The nearest designated Ramsar wetland is: the Shoalwater and Corio Bays Area Ramsar site, located about 75 km to the north of the Fitzroy River mouth) and nearly 700 km downstream of the dam.

The Shoalwater and Corio Bays Area Ramsar site was designated as a wetland of international importance under the Ramsar Convention on 11 March 1996, based on six of the nine criteria used for identifying wetlands of international importance.

6.5.1 Impacts on ecological character

Approval is required for an action occurring within or outside a declared Ramsar wetland if the action has, will have, or is likely to have a significant impact on the ecological character of the Ramsar wetland.

The Ramsar Convention defines the ecological character of a wetland as the combination of the ecosystem components, processes, benefits and services that characterise a wetland at a given point in time.

Impacts on water quality, hydrodynamics and wetland-dependent fauna

Construction

Given its distance from the Shoalwater and Corio Bays Area Ramsar site (nearly 700 km away), construction of the project is unlikely to have any direct impacts on the hydrodynamic processes and water quality of the Ramsar site. As discussed in the World Heritage properties section of this report (Section 6.3), the project would not be expected to result in any substantial or measurable change in the water quality or hydrological regime of the wetland therefore be unlikely to impact on the habitat or lifecycle of any species of fauna which are dependent on the Ramsar site.

Operation

Given its distance from the Shoalwater and Corio Bays Area Ramsar site, the operation of the project is unlikely to have any direct impacts on the hydrodynamic processes of the Ramsar site. As discussed in Section 6.3, modelling undertaken for the EIS indicates that flow regimes would be expected to return to the existing conditions at around 297 km downstream of the dam.

Likewise water quality impacts on the Shoalwater and Corio Bays Area Ramsar site during the operation are expected to be negligible given the distance downstream of the dam and the proposed measures that would be undertaken by the proponent to manage water quality.

If the project is approved, I consider that the proponent's obligations under Queensland legislation including the Water Act and the Environmental Protection (Water) Policy

2009 would ensure that the project does not have adverse impact on water quality and hydrological processes downstream.

As such the project would not be expected to result in any substantial or measurable change in the water quality or hydrological regime of the Shoalwater and Corio Bays Area Ramsar site therefore unlikely to impact on the habitat or lifecycle of any species of fauna which are dependent on this Ramsar site.

6.5.2 Coordinator-General's conclusion

I conclude that project would not be expected to result in any substantial or measurable change in the water quality or hydrological regime of the wetland therefore unlikely to impact on the habitat or lifecycle of any species of fauna which are dependent on the Ramsar site. I therefore consider that the project is unlikely to have adverse effect on the ecological character of the Shoalwater and Corio Bays Area Ramsar site.

I therefore consider that the project would not have an unacceptable impact on the ecological character of the Shoalwater and Corio Bays Area Ramsar site.

6.6 Listed threatened species and communities

In deciding whether or not to approve the proposal for the purposes of a subsection of section 18 or section 18A of the EPBC Act, and what conditions (if any) to attach to such an approval, the Commonwealth Environment Minister must not act inconsistently with Australia's obligations under the:

- Convention on Biological Diversity (CBD)
- Convention on Conservation of Nature in the South Pacific (Apia Convention)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- a recovery plan or threat abatement plan (TAP).

The Minister must also, in deciding whether to approve the taking of the action, have regard to any approved conservation advice for the threatened species or ecological community that are likely to be or would be significantly impacted by the project.

6.6.1 Threatened ecological communities

The EIS indicated that there are four threatened ecological communities (ECs) listed under the EPBC Act which have the potential to occur in the project area, including:

- the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin (GAB spring EC)
- brigalow EC
- natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (natural grasslands EC)
- semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar bioregions (SEVT EC).

The natural grassland EC was listed after the controlled action decision date and the brigalow EC was recorded in the water storage area and along the pipeline route. The GAB spring EC was recorded in the water storage area.

The SEVT EC was recorded near the pipeline route associated with RE 11.9.4a. This EC was recorded as a fragmented patch adjacent to the roadside of Nathan Road south of the dam wall. The EIS indicates no SEVT EC is expected to occur within the proposed pipeline easement and therefore impacts on this EC have been avoided.

The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin

Background

The GAB spring EC is listed as 'endangered' under the EPBC Act. The distribution of this EC extends along the northern, western and southern margins of the GAB in Queensland, New South Wales and South Australia. The community is characterised by the plants and animals which rely on the spring wetland areas created by groundwater discharged from the GAB.

The EC is known to support a wide variety of plants and aquatic and semi-aquatic animals, including fish, frogs and aquatic invertebrates (e.g. snails, flatworms and insects), a number of which are considered endemic (found nowhere else) to the areas associated with the EC and/or are listed as threatened at a National and State level.

In Queensland, the GAB spring EC includes areas of wetland vegetation classified as REs 11.3.22 (associated with recent and ancient alluvia and metamorphic rocks) and 11.10.14 (associated with sandstone), both of which are listed as 'of concern' under the Queensland *Vegetation Management Act 1999*.

The EIS indicates the spring communities within the proposed storage area are generally associated with RE 11.3.22 and the communities in Nathan Gorge are generally associated with RE 11.10.14.

Spring wetlands within the GAB can be classified into two categories: 'recharge' and 'discharge'[35]. The definition of the GAB spring EC only includes 'discharge' spring wetlands.

Discharge springs occur in areas where the bedrock or confining bed is sufficiently thin or weak enough (i.e. weakened by faults) to allow for groundwater to be discharged (as a result of artesian pressures) from the underlying aquifer to the surface. The spring flows in these types of springs are not related to recent rainfall events.

In contrast spring flows in 'recharge springs' are related to recent rainfall events. These springs occur within outcropping areas of sandstone where water drains out of the rocks under gravity or through the groundwater surface rather than welling upwards under artesian pressures.

[35] Fensham RJ & Fairfax RJ 2003, 'Spring wetlands of the Great Artesian Basin, Queensland, Australia', Wetland Ecology and Management, vol. 11, pp. 343–62.

The project area contains the spring complexes (clusters of springs with consistent hydrogeological characteristics) which form part of the 'Springsure' supergroup; one of the 12 supergroups within the GAB region. The term 'supergroup' refers to spring complexes at the regional scale.

The Springsure supergroup is the most easterly in the GAB and comprises of mostly recharge springs, although some discharge springs are present. The spring complexes relevant to the project include the Boggomoss and Dawson River complexes.

Based on investigations undertaken for the EIS, it is suggested that all of the spring complexes in the project area (Spring Creek, Boggomoss (south) and Cockatoo Creek) are primarily sourced from the Precipice Sandstone aquifer, except for Dawson River 8 (to the west of the water storage area) which is thought to be primarily sourced by the Hutton Sandstone aquifer.

EIS studies indicate that regional groundwater flow in the Precipice Sandstone occurs to the south-east towards the low-lying areas associated with the Dawson River and that regional groundwater flow in the Hutton Sandstone also flows towards the Dawson River in a south-easterly direction.

Assertion that springs are recharge springs

During the preparation of the EIS it was the proponent's understanding, based on existing literature and database information, that the springs in the project area would be considered to be recharge springs and therefore not considered to meet the definition of GAB spring EC.

During the EIS consultation period, EHP raised concern about this assertion that the springs in the project area would not be considered to meet the definition of the GAB spring EC.

It was requested that more up to date information be provided to support this assertion and to provide assessment of the project's impacts on the GAB spring EC, in the event that this additional information did not support this assertion.

Further updates to the Queensland Springs Database inventory in 2012 and 2015 resulted in the reclassification of several springs within the project area from recharge springs to discharge springs.

Subsequently it was determined that a number of springs in the project area would meet the definition of GAB spring EC and the proponent provided an assessment of the potential impacts of the project on these springs as part of the additional information to the EIS.

Subsequent studies on hydrochemistry (water quality) undertaken for the EIS supports the conceptualisation that springs in the project area are predominantly driven by discharge from the underlying GAB aquifers at each of the springs, with limited mixing with infiltrating rainfall and run-off (i.e. springs have greater groundwater input).

This suggests that there are a number of springs in the project area that are classified as 'discharge' springs and therefore part of the GAB spring EC. This is further supported by studies by Fensham and others which indicate that there are at least 92 springs which meet the definition of GAB springs EC within the Springsure supergroup including springs within the project area.

The EIS indicates that the closest discharge springs (i.e. meet the definition of the GAB spring EC) down-gradient of the dam wall are those within the Prices complex.

Recovery plan, conservation advice and threat abatement plans

There is a recovery plan[36] for these species: *Recovery plan for the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin*[37]. The overall objective of the recovery plan is to maintain or enhance groundwater supplies to GAB spring EC, maintain or increase habitat area and health, and increase all populations of endemic organisms.

Key threats identified in the recovery plan include:

- aquifer draw-down
- excavation of springs
- exotic plants
- stock and feral animal disturbance
- impoundments.

Relevant recovery plan objectives which are relevant to the project include:

- ensuring that impoundments do not degrade spring values (i.e. causes the extinction of endemic species or the loss of other significant natural spring values)
- enhancing aquifer pressures and ensuring that flows from springs do not decrease
- achieving appropriate tenure-based security to protect against future threatening processes
- minimising impacts from stock grazing pressures and feral animal disturbances
- minimising the threat of exotic plants and aquatic animals and reducing their effects
- maintaining populations and improving habitat for endemic organisms.

There is no approved conservation advice for the GAB spring EC.

There is one threat abatement plan relevant to the EC: *Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads*. The recovery plan for the EC indicates that cane toads have been found at many of the springs on the eastern part of the GAB in Queensland. It is considered that in high numbers cane toads have the potential to pose a significant threat to invertebrate populations at these springs.

The EIS indicates that cane toads were identified in the project area. The presence of the permanent water body associated with the dam is likely to increase the presence of cane toads in the area. While the cane toad is not a prohibited or restricted invasive animal under the Queensland *Biosecurity Act 2014*, everyone by law (under this Act)

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[36] Fensham, R.J., W.F. Ponder & R.J. Fairfax (2010). Recovery plan for the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin. City East, Queensland: Department of Environment and Resource Management. Viewed 2 Decembhttp://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=26

[37] W Houston and A Melzer, *Yellow chat (Capricorn subspecies) Epthianura crocea macgregori recovery plan: Report to Department of the Environment, Water, Heritage and the Arts, Canberra*, Queensland Environmental Protection Agency, Brisbane, 2008, viewed 12 September 2016, https://www.environment.gov.au/system/files/resources/ecd1aa78-2135-49d0-8b0b-dce3325b3f98/files/e-c-macgregori.pdf

has a general biosecurity obligation to take reasonable and practical steps to minimise the risks associated with invasive plants and animals under their control.

The proponent has committed to implement a weed and pest management plan. The plan would include measures for reducing the potential introduction and spread of cane toads in the project area.

Methodology

As part of the EIS, a numerical groundwater model was developed to estimate the potential impacts of the project on local and regional groundwater systems including aquifers, bores and springs.

During the EIS, DNRM and the then Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) sought clarification on the information that was used to inform the conceptual and numerical models.

Further desktop and field based hydrogeological assessments were undertaken between July 2012 and December 2013 in response to these comments. As part of the field-based hydrogeological assessments a series of bores were installed which were intended for long-term monitoring purposes. The bores were installed into the source aquifer for the spring at five spring clusters of the Springsure group.

Five new bores were installed and two pre-existing bores were refurbished. The installation of these bores was intended to:

- increase the conceptual understanding of the groundwater system associated with the springs
- increase the conceptual understanding of the landscape processes associated with spring groups
- increase the capacity to monitor the potential impacts of the dam, especially with respect to providing key baseline data.

From these assessments it was concluded that the conceptual understanding presented in the EIS and the conceptual modelling was appropriate for estimating the likely impacts on the groundwater system.

In November 2014, I engaged RPS Aquaterra Pty Ltd (RPS) to provide an independent review of the methods employed by the proponent to determine the potential impacts to the GAB, specifically the springs from the Springsure group resulting from the project. RPS was requested to comment on the:

- adequacy and appropriateness of the proponent's proposed desktop study, field investigations and conceptual modelling approach
- hydrogeological investigative methodologies undertaken by the proponent, including an analysis of input data and results used in assessment of impacts
- current industry practice of assessing the impact to springs as it relates to projects of this nature
- adequacy and appropriateness of the data used to estimate the impact of the dam on the GAB springs, and the accuracy and reliability of the impact assessment results provided in the final report.

RPS concluded that supplementary EIS documentation sufficiently addressed the terms of reference and the submissions on the EIS and presented sufficient data to adequately evaluate risks to groundwater in the Nathan Dam study area.

Further monitoring would need to be undertaken to determine the actual effects of the project on groundwater systems and the springs in the project area. As part of the additional information to the EIS, a preliminary framework was developed for a groundwater and springs monitoring program. Should the project be approved, the program would be further refined post-approval.

Spring groundwater monitoring program

The EIS indicates that a monitoring program would be required to record the groundwater system response to the project. The Joint Industry Plan developed by CSG operators for groundwater monitoring and management for EPBC-listed springs from CSG activities in the region has been used to inform the development of the framework for the groundwater monitoring program for the Nathan Dam and Pipelines project.

As discussed in the methodology section above, five new bores were installed and two pre-existing bores were refurbished as part of the additional information investigations for the EIS. Once the dam wall is installed, it is recommended that additional monitoring bores are to be installed downstream of the dam wall. These bores would be fitted with data loggers and included in the monitoring network.

The monitoring program would need to take into account the aspects of the spring systems that are likely to respond or change due to an increase in pressure from the dam.

Groundwater monitoring at observation bores would allow for any changes to springs to groundwater to be related back to the springs (i.e. groundwater level variations would be used a proxy for impacts to ecosystems supported by springs) and possibly detect any changes to the hydrological system before they manifest at the springs. This is likely to involve surveying spring vent locations and elevations, collection of water to test for a range of chemical parameters, measurement of spring flow and spring wetland area, and monitoring the physical condition of the spring. The proponent has proposed to undertaken monitoring of the springs every two years.

Continued monitoring of DNRM's existing network of groundwater monitoring bores in the project area would also support assessment at a regional scale. DNRM's existing groundwater monitoring network includes 21 bores: 18 of which monitor the Precipice Sandstone, two of which monitor the Dawson River alluvium, and one that monitors the Eurombah Formation.

Impacts and mitigation

The recovery plan identifies impoundments as a key threat to the GAB spring EC. The relevant recovery objective for this community with regard to impoundments is to ensure that impoundments do not degrade spring values. To meet this objective the recovery plan recommends that:

- the impact of impoundments on spring values are properly considered in environmental impact assessments
- these assessments should ensure that the impoundments do not cause the extinction of endemic species or the loss of other significant natural spring values. Other significant spring values include threatened species of flora and fauna and disjunct populations of species considered to be important to the springs.

Inundation of springs within the impoundment (water storage area)

The EIS indicates that 23 springs from the Dawson River 6 (6 springs), Dawson River 8 (1 spring) and Boggomoss 5 (16 springs) spring complexes which meet the definition for the GAB spring EC would be inundated at FSL. Based on the information contained in the Queensland Springs Database this equates to a wetland area of 5.6 ha. The proponent has considered that this would represent a 25 per cent loss of springs from the Springsure supergroup (which has a total of 92 springs).

Based on the Species Profile and Threats database[38] (SPRAT) on the DEE website, the loss of 23 springs (5.6 ha) would represent a 22 per cent loss of GAB spring EC wetland area (25.5 ha) in the Springsure supergroup, and a 7.5 per cent loss of the total GAB spring EC wetland area (74.7 ha) in Queensland.

SPRAT indicates that there is a total of 348 discharge spring complexes within the GAB, including 7 discharge spring complexes in the Springsure supergroup. The project would result in the loss of 23 springs from 3 spring complexes, which would be less than 1 per cent (0.86 per cent) of discharge spring complexes in the GAB.

The project is discussed in the Recovery Plan for this community. The Recovery Plan refers to a study undertaken by Dr Rod Fensham in 1998 which assesses the impact of the original Nathan Dam proposal (proposed by Sudaw Developments Pty Ltd) on the springs in the Springsure supergroup. Dr Fensham concluded that 26 of the 69 spring wetlands would be inundated by the dam.

I note that the number of springs identified within the Springsure group which meet the definition of the GAB spring EC has increased from 69 springs to 92 springs since Fensham's 1998 surveys. Fensham's 1998 study also concluded that no spring plant species would be expected to be made extinct as a result of the water storage area.

However it was considered that the loss of sub-populations may increase the likelihood of species being lost in the future. Studies undertaken for the EIS, support Fensham's assertion. The EIS indicates that no endemic spring flora or fauna species have been recorded at the springs that would be inundated by the dam. As such the project is not expected to impact on any endemic species associated with the GAB spring EC.

Endemic flora species including salt pipewort (*Eriocaulon carsonii)* and *Myriophyllum artesium* are known to be supported by springs outside of the inundation area. The salt pipewort currently inhabits nine spring complexes in South Australia, 12 in Queensland and one in New South Wales which occur on the margins of the GAB.

[38] http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=26

The EIS indicates that in the project area the salt pipewort is known to be supported by springs in the Prices and Cockatoo Creek complexes. These springs are above the FSL and not expected to be affected by the dam. *Myriophyllum artesium's* distribution is widely spread across 14 complexes in the GAB. In the project area it is known to occur in the springs within the Cockatoo Creek complex. These springs are also located outside of the FSL.

Only one threatened species included within the community, hairy-joint grass (*Arthraxon hispidus*), is known to occur at the impacted springs. This species is known to occur at 24 of the springs (including 17 springs which meet the GAB spring EC definition) within the Springsure supergroup and was found at four of the springs which would be inundated by the dam. This would represent a loss of 16 per cent of springs at which this species is known to occur within the Springsure supergroup.

The EIS indicates that there are disjunct populations of six flora species associated with the impacted springs including hairy-joint grass, *Eleocharis tetraquetra*, *Fimbristylis tetragona*, *Salomonia ciliate*, *Stylidum rotundifolium*, *Wahlenbergia strictas subsp. alterna*. It is considered that all six species are readily translocated. The proponent has committed to translocate (via propagation or physical removal) these plants to a site outside of the inundation area prior to filling the dam.

Increased groundwater levels associated with dam inundation

The impact of dam inundation was modelled at the FSL and median supply level. It should be noted that it is difficult to model future spring discharge with any certainty. As such the proponent has considered their estimates to be conservative.

Based on modelling, the proponent considers that during the operation of the dam, the weight of the dam water body would be expected to increase pressure (increase artesian head) on the underlying aquifers.

This would be expected to increase the groundwater levels of the underlying aquifers and result in increased aquifer flows. The EIS stated that the increase in discharge from existing springs is likely to either manifest as an increased flow out of the current spring area or as an increase in the overall spring area, or both.

The EIS indicates that the project would be expected to impact on the springs (including the springs which meet the GAB spring definition) within the Dawson River 6, Dawson River 8, Boggomoss 5, Cockatoo Creek and Prices Creek, Scotts Creek, Lucky Last, Crystal Ball, Yebna2 and Elgin2 spring complexes.

The EIS indicates that 49 springs that meet the definition for the GAB discharge spring wetland EC are likely to be affected by increased groundwater pressures resulting from the dam.

Based on the proponent's modelling it was concluded that at FSL:

- assuming an existing artesian head of 25 m at the Prices Creek spring complex (the closest discharge springs downstream of the dam wall), a modelled increase in artesian head of 9.1 m would be expected to increase aquifer flows by 36 per cent. The proponent considers that this increase would be comparable with increases experienced during the December 2010 and January 2011 rainfall events in this

area (which increased groundwater elevation up to 10 m). However, unlike the flooding events where levels would return to baseflow levels after the flood, these levels would remain higher for longer due to the presence of the dam.

- assuming an existing artesian head of 12 m at the Boggomoss and Dawson 6 spring complexes (the discharge springs to the north of the dam FSL) a modelled increase in artesian head of 2.68 m would be expected to increase aquifer flows by 22 per cent
- the seven springs in the Cockatoo Creek complex are not expected to be affected by changes in pressure.

In terms of impacting on springs the EIS concluded that based on the result of modelling that:

- the majority of springs above the FSL are likely to show no or little change relative to baseline conditions so the spring values are unlikely to be adversely affected as a result of the project
- for the springs which experience a more significant increase in pressure and water level, this increase will vary over time as floods or droughts occur and dam storage levels change
- during periods of sustained dry weather, spring discharge would be mostly similar to current levels.

The EIS indicates that there is a strong linear relationship between flow rates and wetland area, which means an increase in flow rate from the springs, is likely to increase the area of wetland surrounding that spring.

The EIS indicates that the extent of the change would vary depending on the local topography and soil. It is considered that during periods of sustained higher pressure increased discharge from the springs within or near watercourses would be more likely to discharge to the watercourse rather than lead to a significantly expanded wetland area. This is likely for the Price Creek springs and springs closest to Boggomoss Creek).

For springs further away from watercourses the increased discharge may result in increased ponded areas around the spring. This would be dependent on local conditions and is more likely to occur at sites where currently flow rates are already high and the increase in flow rates is significant.

I have recommended a condition to the Commonwealth Environment Minister requiring the proponent to prepare a groundwater monitoring program to be approved by EHP, DNRM and the Commonwealth Environment Minister.

The monitoring would determine whether there are any negative impacts on the springs resulting from the increased pressure. The proponent would be required to take specific measures if any adverse effects are identified.

Reduction in groundwater levels

The recovery plan for the GAB spring EC lists aquifer-drawdown as a key threatening process for the EC. The maintenance of spring flows is sensitive to the pressure head

of the aquifer. Extraction of groundwater has the potential to reduce aquifer pressures and therefore a reduction in flows to a spring.

The EIS indicates groundwater would not be extracted for the purpose of supplying water for construction activities. It is proposed that during construction of the dam wall, clean water would be sourced from the Dawson River upstream of the construction site.

While there is no proposal to extract groundwater for the purpose of supplying water for construction activities, the project would however involve a number of construction activities that would have the potential to impact on groundwater including dewatering of the dam chimney filter. The chimney filter is a structure which intercepts and controls any water seeping through the dam foundation.

It is expected that there are 20 springs located downstream of the dam wall that are likely to be impacted by groundwater drawdown, however none of these springs are considered to meet the GAB spring EC definition.

As no GAB spring ECs are expected to be impacted by groundwater drawdown this section does not provide any further assessment with regard to the impacts of drawdown on the EC as a result of construction activities.

The impacted spring wetlands which do not meet the EC definition are further discussed in Section 5.4.6 of this report as these spring wetlands overlap with State prescribed regulated vegetation. The EIS indicates that groundwater drawdown where these springs occur would be expected to be minor (between 1-2 m for four of the springs which are closest to the dam wall and less than 1 m for the other 16 springs).

This drawdown would be temporary with groundwater levels returning to pre-watering levels after the dewatering activities have ceased. Springs potentially affected by drawdown would be monitored and if necessary irrigated to keep moisture levels adequate.

The proponent has proposed a framework for a groundwater monitoring and management program for addressing groundwater drawdown during construction. The program is likely to include:

- a series of monitoring bores at the edge of the expected area of drawdown to monitor the extent of drawdown and additional bores outside of this area to act as controls to ensure the extent of drawdown does not exceed the expected range. The bores would test groundwater levels, electrical conductivity and pH. Soil moisture would also be monitored at the periphery of targeted springs
- a transect of shallow bores at targeted springs to get an understanding of the effects of drawdown on the area of discharge and saturation.

Physical damage to the springs

The EIS indicates that no springs which meet the definition for the GAB spring EC would be directly or indirectly impacted during activities associated with construction of the pipeline or the dam wall. I have recommended a condition to the Commonwealth Minister requiring the proponentto ensure that pipeline construction activities do not result in any physical damage to any springs that meet the GAB spring EC definition.

Water quality impacts

Any rises in the water table associated with increased groundwater pressures from the dam may bring salt to the surface. This could lead to a gradual build-up of salt on surface soils where the water level fluctuates. This risk is considered to be low as the soil in the project area is not saline and the groundwater is typically fresh to brackish. Groundwater in the underlying aquifer within the vicinity of the dam is considered to be typically fresh to brackish.

Groundwater sampling recorded groundwater salinities ranging between 61 and 555 mg/L in the Precipice Sandstone and between 70 to 4,485 mg/L in the Hutton Sandstone. The EIS has not assessed whether the increase in groundwater flows would have an impact on the water quality of the existing springs.

The proposed groundwater monitoring program would include monitoring for any changes in groundwater quality. Where any adverse impacts are detected the proponent would be required to take remedial action. Where any adverse impacts on these springs cannot be avoided or mitigated, the proponent would be required to provide additional offsets.

Seepage of low salinity dam water may result in freshening of the underlying groundwater. The EIS indicates that this would be most significant in the vicinity of the water storage and it is expected that the fresher water would eventually equilibrate. Any springs in this area are likely to be already impacted by the inundation. I have recommended a condition to the Commonwealth Minister requiring the provide offsets to compensated for the loss of these springs.

As discussed above with regard to potential impacts associated with groundwater drawdown no springs that meet the GAB spring EC definition are expected to be impacted by groundwater drawdown. Therefore no water quality impacts associated with groundwater drawdown are expected.

The proponent has proposed to implement a groundwater monitoring and management program that would include monitoring of groundwater drawdown to determine if there are any effects on springs within the expected drawdown area or beyond this area and measures for addressing any adverse water quality impacts on springs. Such measures may include injecting high quality water into the springs which are affected by groundwater drawdown.

Residual significant impacts and offsets

Based on the information provided in the EIS, it is expected that 5.59 ha of wetland associated with 23 springs which meet the definition for the GAB spring EC would be inundated by the dam. As this represents a loss of 25 per cent of the springs from the Springsure supergroup which meet the definition of the EC, this is considered to be a significant residual impact and would require an offset to compensate for this loss.

To compensate for this loss the proponent has proposed to establish secure tenure for 24 springs (covering a wetland area of 5.07 ha) outside of the project area and to improve the condition of these springs through active management (e.g. rehabilitation, exclusion of livestock, weed and pest management measures and fire management).

The proponent has committed to establish secure tenure for as many of the nearby non-impacted springs (above the FSL) as possible and as many other springs as necessary to satisfy the offset requirement. The offset would extend the existing Boggomoss Nature Refuge. This expansion would also include areas that overlap with the offsets for brigalow and the squatter pigeon.

The project is not expected to impact on any endemic species. Only one threatened species which is listed as an important to the GAB spring EC, being hairy-joint grass, would be impacted as a result of the dam. The proposed offsets for the GAB spring EC would be expected to benefit this species. The EIS indicates that this species occurs at a number of springs which are proposed to be protected and managed as part of the GAB spring EC offset.

I have recommended a condition to the Commonwealth Environment Minister requiring the proponent to provide an offset to compensate for the loss of springs from within the inundation area.

Proposed offset sites

The *Approach to provision of Environmental Offsets* (Appendix B1-B) document provided as additional information to the EIS identified a number sites considered potentially suitable for providing GAB springs EC offsets. The proponent identified a number of springs within the proposed flood buffer area above the FSL, the proposed wildlife corridor between Spring Creek and the Boggomoss and Mount Rose nature refuges and on properties at Cockatoo Creek and Prices Creek that would be considered potentially suitable for offsets.

These springs are on land currently not protected under any conservation agreement and are subject to threatening processes including stock grazing and feral pigs. The springs at these sites are considered to be degraded as result of these threatening processes. The proponent has proposed to secure the tenure of these sites through a conservation agreement (i.e. nature refuge tenure) and manage the offset sites to reduce impacts from threatening processes and subsequently improve the habitat quality of these springs. Such measures may include fencing, weed control, feral animal control, fire management and rehabilitation.

The proponent also identified an additional seven springs in the Boggomoss Nature Refuge which could also be considered suitable for offsets. While these springs are protected under nature refuge tenure, they are considered to be degraded and not well managed. It is proposed that these measures could be undertaken as part of the offset strategy to improve the management of these springs.

I note that based on the modelling undertaken for the EIS, the areas closest to the dam where these springs have been identified (i.e. within the proposed buffer area and wildlife corridor and the adjacent Boggomoss Nature Refuge) are likely to experience increased spring flows as result of the dam. As it is unclear whether increased aquifer flows resulting from the dam would have a positive or negative impact on springs within these proposed offset sites, the proponent may need to consider other sites outside of this zone.

As discussed in the previous section the proposed spring monitoring program would need to take into account the aspects of the spring systems that are likely to respond or change due to an increase in pressure from the dam including changes in groundwater flows and quality.

The results of this modelling would be used to determine whether springs are being negatively affected by the dam. As part of their offset strategy, the proponent would need to demonstrate that the proposed offsets are appropriate for achieving a conservation gain for the EC. In the event that offsets are not achieving a conservation gain for the EC I have recommended a condition requiring the alternative offsets are proposed.

Coordinator-General's conclusion

I am satisfied that the EIS has identified the potential impacts that the project could have on the GAB spring EC. I am satisfied that the proponents' commitments to implement weed and pest management measures (as specified in the draft EMP) are appropriate for maintaining this EC.

Should the Commonwealth Environment Minister decide to approve the project, recommend the following conditions requiring the proponent to::

- avoid and limit physical disturbance to the springs within the pipeline route
- develop a groundwater dependent ecosystem management plan which monitors for an includes measure to address any impacts on spring ECs during the construction and operation of the project
- provide an offset management plan to address the project's residual significant impacts on the GAB spring EC. I have recommended that the offset management plan includes details of a monitoring program to monitor GAB spring ECs at the offset sites for any signs of adverse impacts including changes in groundwater aspects resulting from the dam and measures for addressing impacts.
- In the event that the proposed offsets for the GAB spring EC are not achieving a conservation gain for the EC, I have recommended a condition requiring that alternative offsets are proposed.

In light of the proposed mitigation and offset measures and conditions recommended in this report, I conclude that the proposed management actions are not inconsistent with the recovery plan for the GAB spring EC.

Brigalow (*Acacia harpophylla* dominant and co-dominant)

Background

The brigalow EC is listed as 'endangered' under the EPBC Act. In Queensland, areas of brigalow EC include vegetation that meet the description of 16 REs, all of which are listed as 'endangered' under the Queensland *Vegetation Management Act 1999* (VM Act). There are four REs associated with the brigalow EC that occurs in the project area (REs 11.3.1, 11.9.1, 11.9.5 and 11.9.5a) and four within the pipeline easement (REs 11.3.1, 11.4.3, 11.9.5 and 11.9.6). The Queensland Herbarium's RE Description

Database (Queensland Herbarium Version 9.0, 2015) provides the following short descriptions of these vegetation communities:

- RE 11.3.1—*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains
- RE 11.4.3—*Acacia harpophylla* and/or *Casuarina cristata* shrubby open forest on Cainozoic clay plains
- RE 11.9.1—*Acacia harpophylla-Eucalyptus cambageana* woodland to open forest on fine-grained sedimentary rocks
- RE 11.9.5—*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks
- RE 11.9.5a—*Acacia harpophylla* predominates and forms a fairly continuous canopy (10-18 m high)
- RE 11.9.6—*Acacia melvillei* ± *A. harpophylla* open forest on fine-grained sedimentary rocks.

Impacts and mitigation

In Queensland, the brigalow EC has been extensively cleared for cropping and grazing, and is now highly fragmented across most of its range. The brigalow EC has also been impacted by altered fire regimes and the introduction of weeds and feral animals. The EIS demonstrated that areas of brigalow EC within the project footprint are fragmented as a result of historic and current land-use practices.

There is no 'recovery plan' under the EPBC Act relevant to this ecological community. There is an approved 'conservation advice' for the brigalow EC: *Approved Conservation Advice for the Brigalow (Acacia harpophylla dominant and co-dominant) ecological community*[39]. Relevant priority recovery and threat abatement actions in the conservation advice include:

- protecting and conserving remnant and regrowth areas of the ecological community
- mitigating the severity of impacts where further clearance is unavoidable and providing offsets which consider the location and emulate qualities of affected patches
- managing areas of the ecological community to reduce threats, including fire management, targeted weed and feral animal control with a particular focus on exotic grasses and feral pigs.

There is one 'threat abatement plan' relevant to the brigalow EC: *Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads*[40]. While the current geographic range of the cane toad falls within the brigalow

[39] Commonwealth of Australia, Approved Conservation Advice for the Brigalow (*Acacia harpophylla* dominant and co-dominant), Department of the Environment, Canberra, 2013, viewed 11 July 2016, http://www.environment.gov.au/biodiversity/threatened/communities/pubs/028-conservation-advice.pdf

[40] Commonwealth of Australia, Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads, Department of the Environment and Energy, Canberra, 2011, viewed 31 October 2016, http://www.environment.gov.au/system/files/resources/2dab3eb9-8b44-45e5-b249-651096ce31f4/files/tap-cane-toads.pdf

community, the conservation advice indicates that the cane toad is not a threat to the community.

Clearing and inundation impacts

The project is expected to impact on a total of 173.3 ha of brigalow EC. This includes 128.9 ha of remnant brigalow EC (including 128.5 ha from the water storage area and 0.4 ha from the pipeline and associated infrastructure footprint), and 44.4 ha of regrowth brigalow EC. The actual amount to be cleared would be confirmed during pre-clearance surveys.

The EIS stated that the project is not expected to result in further fragmentation of the brigalow EC as impacts would be limited to a number of small areas along the boundary of the water's edge.

Fire regimes and weed/pests

Under the Queensland *Biosecurity Act 2014* landowners have a general obligation to take all reasonable and practical steps to minimise the risks associated with invasive plants and animals on a person's land. The proponent has committed to keep the project site free of invasive weeds in accordance with a weed management plan.

Fire poses a serious threat to areas of brigalow EC, which are often infested with exotic grass species. The conservation advice indicates that the most appropriate fire regime for the brigalow EC is fire-exclusion. The management of weeds throughout the project site and offset areas would reduce the potential for fire impacts on this EC. I have recommended a condition to the Commonwealth Environment Minister that the proponent, to the extent possible, exclude fire from patches of brigalow EC near to the dam infrastructure and FSL buffer.

Residual significant impacts and offsets

The EIS indicated that the project is expected to have a residual impact of 173.3 ha of brigalow EC, which is considered to be significant. The proponent has investigated offset availability within the dam properties surrounding the project area and has identified a total of 1,100 ha of potentially suitable habitat for offsets.

I have recommended a condition to the Commonwealth Environment Minister requiring the proponent to provide offsets for the brigalow EC in accordance with an approved offset management plan. The final offset obligation is to be confirmed through pre-clearance surveys which would be used to determine the actual area of the brigalow EC that would be impacted by the project.

Coordinator-General's conclusion

I am satisfied that the EIS has identified the potential impacts that the project could have on the brigalow EC. I am satisfied that the proponent's commitments to implement weed and pest management measures (as specified in the draft environmental management plans) are appropriate for maintaining the brigalow EC.

If the Commonwealth Environment Minister decides to approve the proposed action, I recommend that the Minister consider the following recommended conditions:

- undertake a pre-clearance survey to determine the actual area of the brigalow EC that would be impacted by the project
- provide an offset for the residual significant impacts on brigalow EC

I conclude that the approved conservation advice for this species has been considered and the proposed management actions are not inconsistent with the relevant threat abatement plans.

6.6.2 Threatened terrestrial flora

Survey effort and methodologies

Field surveys were undertaken for the EIS over the course of one year in 2008 to capture a range of seasons. Surveys were undertaken between:

- 26 March to 1 April (late summer)
- 6 to 8 May (autumn)
- 12 and 18 June (winter)
- 4 and 5 September (spring)
- 1 December (early summer)

One pre-wet season field survey was conducted between 19 and 24 January 2009 to describe aquatic flora and fauna present in the freshwater habitats crossed by the proposed pipeline route. This included eleven sites: ten within the Condamine River sub-catchment and one within the Fitzroy Basin (Juandah Creek).

An additional survey was conducted for the pipeline route between 15 and 22 June 2010 due to changes in the route. The EIS indicates that site selection for the surveys was limited by access to private property and the presence of water.

Habitat assessment

A search of the protected matters search tool database (PMST) identified four threatened flora species listed under the EPBC Act as potentially occurring within 5 km of the project site. These species are listed in Table 6.1.

Table 6.1 EPBC Act-listed threatened flora potentially occurring in the project area

Common name *Species name*	EPBC Act listing status
Hairy-joint grass *Arthraxon hispidus*	Vulnerable
Bertya opponens	Vulnerable
Ooline *Cadellia pentastylis*	Vulnerable
King bluegrass *Dichanthium queenslandicum*	Endangered

Hairy-joint grass was recorded within four impacted GAB springs within the Dawson River 6 spring complex. This species occurs within 17 GAB springs located in the project area. Modelling undertaken for the EIS indicates that groundwater pressure resulting from the water storage area may increase wetland extent.

The ooline was recorded to the north of Taroom outside of the project area. This species grows mainly in dry rainforest and semi-evergreen vine thickets (SEVT). There is only one identified SEVT community and this is adjacent to Nathan Road south of the dam wall within the pipeline study area. It is outside of the pipeline easement and will not be impacted.

Bertya opponens has been associated with SEVT. As discussed for the ooline, only one SEVT community was identified in the project area and is considered unlikely to be impacted as it falls outside of the pipeline easement.

King blue grass is known to be associated with grassland regional ecosystems 11.9.12 which are not found in the project area. This species was not identified during field surveys.

Other threatened flora species listed under the EPBC Act that were identified as potentially occurring or known to occur in the project area include:

- salt pipewort (*Ericaulon carsonii*), listed as 'endangered'. The salt pipewort was recorded outside of the project area in the GAB springs along Cockatoo Creek. This species is a perennial herb that is only found in spring wetlands. It is a mound spring endemic and a part of the GAB springs community. No important populations for this species associated with the Springsure springs complex are listed in the Recovery plan for the community of native species dependent on natural discharge of groundwater from the GAB.
- Bean's ironbark (*Eucalyptus beaniana*), listed as 'vulnerable'. There are no records of Bean's ironbark in the project area, however suitable habitat associated with RE 11.3.1, 11.9.5 does occur within the impact area both within the pipeline and dam footprints. It is considered unlikely to occur in the project area, as the area is outside of its known range.

- *Prostanthera spp,* listed as 'vulnerable'. No *Prostanthera spp* were identified in the project area, but suitable habitat associated with RE 11.3.1 is present in the impact area both within the pipeline and dam footprints.
- *Zieria verrucosa,* listed as 'vulnerable'. There are no records or suitable habitat present in the project area for *Zieria verrucosa*.
- Belson's panic grass (*Homopholis belsonii*)*,* listed as 'vulnerable'. There are no records of Belson's panic grass in the project area, however the EIS indicates there is potential habitat for this species associated with brigalow in the road reserves.
- *Calytrix gurulmundensis*, listed as 'vulnerable'. There are no records of *Calytrix gurulmundensis* in the project area. This species is known to occur in the Gurulmundi and Barakula area so is considered to potential occur within the pipeline alignment.
- small-leaved denhamia (*Denhamia parviflora*), listed as 'vulnerable'. There are no records of small-leaved denhamia in the project area, however this species is considered to potentially occur within the pipeline alignment as vine forest species is known to occur in association with the brigalow EC.
- Kogan waxflower (*Philotheca sporadica*)*,* listed as 'vulnerable'. The Kogan waxflower is known from Braemar State Forest which is located to the south-west of the end of the pipeline route.
- *Acacia handonis,* listed as *'vulnerable'. Acacia handonis* is known only from Barakula State Forest.
- *Eucalyptus argophloia,* listed as 'vulnerable'. *Eucalyptus argophloia* is only known to occur from a small area north-east of Chinchilla. The species is known to be associated with the brigalow EC.
- *Homoranthus decumbens,* listed as 'endangered'. *Homoranthus decumbens* is known to occur in Barakula State Forest. There are no records or suitable habitat in the project area.
- ball nut (*Floydia praealta*)*,* listed as 'vulnerable'. The ball nut occurs in riverine and lowland subtropical rainforest and has been recorded in the project area around the pipeline alignment.
- austral cornflower (*Rhaponticum australe*) listed as 'vulnerable'. Grows in woodland and grasslands and is known to be associated with *E. tereticornis* which occurs throughout the dam footprint and within the pipeline easement.
- austral toadflax (*Thesium australe*), listed as 'vulnerable'. Grows in grassland and grassy woodland. This species is known to be associated with REs 11.3.2, 11.3.21, 11.8.2, 11.8.5 and 11.8.8 and has been recorded in the project area around the pipeline alignment.
- curly-bark wattle (*Acacia curranii*), listed as 'vulnerable'. Potential habitat for the curly-bark wattle was noted for the pipeline route. This species is known to be associated with brigalow EC and the natural grassland EC which are both known to occur in the dam and pipeline footprints. The species has been recorded from three sites within Gurulmundi State Forest located approximately 15 km west of the pipeline route.

The EIS also identified finger panic grass (*Digitaria porrecta*), Cobar greenhood orchid (*Pterostylis cobarensis*), *Diuris tricolor*, *Pterostylis cobarensis* and *Commersonia argentina*. These species have since been delisted under the EPBC Act and are not considered further in this assessment.

6.6.3 Impacts and mitigation

Hairy-joint grass

There is no recovery plan or threat abatement plan under the EPBC Act relevant to this species. There is an approved conservation advice: *Commonwealth Conservation Advice on Arthraxon hispidus (Hairy-joint Grass)*[41]. Relevant priority recovery and threat abatement actions include:

- monitoring known populations to identify key threats
- monitoring the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary
- identifying populations of high conservation priority
- investigating further formal conservation arrangements, management agreements and covenants on private land, and for crown and private land investigate inclusion in reserve tenure if possible
- undertaking appropriate seed collection and storage and investigating options for linking, enhancing or establishing additional populations
- implementing national translocation protocols (Vallee et al., 2004) if establishing additional populations is considered necessary and feasible
- controlling access routes to suitably constrain public access to known sites on public land and suitably controlling and manage access on private land
- minimising adverse impacts from land use at known sites
- avoid slashing or mowing around rainforest edges and protecting areas of rainforest, wet eucalypt forest and swamp from clearing and development
- identifying, removing, and preventing introduction of weeds in the local area, which could become a threat to hairy-joint grass, using appropriate methods
- controlling introduced grasses in areas with known populations
- ensuring that chemicals or other mechanisms used to eradicate weeds do not have a significant adverse impact on hairy-joint grass
- ensuring that livestock grazing, if it occurs in the area, uses an appropriate management regime and density that does not detrimentally affect this species
- managing total grazing pressure (where appropriate) at important/significant sites through exclusion fencing or other barriers

[41] Threatened Species Scientific Committee (2008). *Commonwealth Conservation Advice on Arthraxon hispidus (Hairy-joint Grass)*, Department of the Environment, Water, Heritage and the Arts 2008, viewed 29 May 2017, http://www.environment.gov.au/biodiversity/threatened/species/pubs/9338-conservation-advice.pdf

- implementing an appropriate fire management regime for local populations, excluding fire from sites where this species occurs and protecting habitat from frequent fire.

The project is expected to impact hairy-joint grass as a result of inundating four springs within the dam footprint, where it was recorded. The proponent has not quantified the number of individuals that would be impacted. However, it is expected that impacts on this species would be addressed through offsets for the GAB spring EC.

I have recommended a condition to the Commonwealth Minister requiring the proponent to undertake a pre-clearance survey for threatened plants in impact areas prior to disturbance.

As discussed in the GAB spring EC section above, the proponent has also committed to translocate any EPBC Act-listed plants identified during pre-clearance surveys to a site outside of the inundation area prior to filling the dam. The proponent would need to undertake measures to demonstrate that these plants can be translocated successfully (i.e. with a high survival rate). If plants cannot be successfully translocated, I have recommended another condition requiring the proponent to provide offsets where a residual significant impact is identified.

Curly-bark wattle

The EIS indicates that the changes to the pipeline route have reduced the impacts on potential habitat for this species associated with the brigalow EC and natural grassland EC. The pipeline alignment has been modified to largely avoid impacts on the brigalow and natural grassland ECs.

I have recommended a condition to the Commonwealth Minister requiring the proponent to undertake a pre-clearance survey for threatened plants in impact areas prior to disturbance and would be required to provide an offset where surveys identify that the project would have a residual significant impact on this species.

6.6.4 Coordinator-General's conclusion

I am satisfied that the EIS has identified the potential impacts that the project could have on listed threatened flora.

In addition, I have recommended conditions to the Commonwealth Environment Minister requiring the proponent to undertake pre-clearance surveys in the dam impacts areas and within the pipeline route for threatened flora prior to disturbance.

6.6.5 Threatened fauna

Invertebrates

A search of the PMST database identified one threatened invertebrate species listed under the EPBC Act as potentially occurring within 5 km of the project site: the boggomoss snail (*Adclarkia dawsonensis*).

Boggomoss snail

Background

The boggomoss snail is listed as 'critically endangered' under the EPBC Act and 'endangered' under the Queensland *Nature Conservation Act 1992* (NC Act). The species is also a 'critical priority' for conservation under the Queensland's threatened species prioritisation process.

The boggomoss snail's listing under the EPBC Act came into effect on 2 June 2003. When the species was first listed, it was listed as 'critically endangered' for the following listing criteria:

- decline in numbers
- geographic distribution.

At the time of its listing the total population size had not been fully estimated, but was suggested to be around 1,100 mature individuals. The known distribution for the species was restricted to two sites on the Dawson River, with the known area of occupancy covering 43.8 ha. The two sites included:

- a small patch of vegetation surrounding a mound spring on a property on Mount Rose station near Taroom
- a small patch of riparian vegetation approximately 67 km downstream on a camping and stock reserve at the Isla Delusion Road river crossing.

The 2003 listing advice speculates that the boggomoss snail had undergone a severe reduction in numbers during the 1990s due to the extent of land clearing activities which had occurred in the Dawson River Valley during that period which would have resulted in the removal of most of its known preferred habitat (riparian vegetation on alluvial flats).

The loss in snail numbers as a result of this land clearing was estimated to be as much as 80-90 per cent. The 2003 listing advice speculated that without the protection from any conservation agreement and/or the management of threatening processes at the two sites where it was known to occur, it was estimated that there is a 50 per cent probability of the species being extinct within the next 20 years.

The listing advice discussed that the survival of the Mount Rose population was limited, given its small size (0.5 ha) and the presence of threatening processes including a proposal for a dam on the Dawson River, predation by rodents, trampling by grazing cattle and fire.

At the time of the advice there was a proposal to develop a dam on the Dawson River which would be expected to result in the inundation and subsequent loss of the Mount Rose population. It was also considered that the regulation of flows by the dam could potentially impact on the habitat downstream at Isla Delusion crossing.

Recovery Plan

A recovery plan made under the EPBC Act for boggomoss snail was published in 2008.When the recovery plan was developed, the species was still known to occur in only two locations (i.e. Mount Rose station and Isla Delusion crossing), with the

protection of these locations considered to be critical for the long-term viability of the species. At the time of writing the recovery plan the boggomoss snails known extent of occurrence was 67 km (river length) and its area of occupancy was 43.8 ha. Based on its known distribution and presumed preference for alluvial flats along drainage lines, the recovery plan considered the species likely to be associated with the following Queensland regional ecosystems:

- 11.3.3—*Eucalyptus coolabah* woodland on alluvial plains
- 11.3.4—*Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland on alluvial plains
- 11.3.25—*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines.

The recovery plan discussed that the species has been found in leaf litter at the bases of sandpaper figs adjacent to the mound spring on Mount Rose and under logs among dense vegetation at the Isla Delusion crossing site.

The recovery plan identifies habitat loss from land clearing as the most significant threat to the species. Other key threatening processes identified in the recovery plan include:

- fire—areas of habitat known to support the boggomoss snail are susceptible to fire given their small patch size and high fuel loads associated with leaf litter
- weed infestation—weeds have the potential to alter the lower shrub layer as well as contributing to increased fuel loads for fires
- grazing—cattle grazing is particularly destructive to snail habitats through compression of leaf litter and direct trampling of snails
- earthworks— earthworks activities associated with quarrying and road works have the potential to affect snail habitat through direct removal or associated run-off
- changes to hydrology—changes to hydrology by structures such as dams and weirs have the potential to impact on snail habitat by directly inundating snail habitat or by altering river flows and subsequently drying out areas of riparian vegetation which support snail microhabitats.

Survey results and validity

As part of the EIS, six surveys for the boggomoss snail were carried across the Dawson River valley region between 2008 and 2013. Surveys were undertaken during the following survey periods:

- 7 to 16 October; and 24 November to 3 December 2008 (Biodiversity Assessment and Management (BAAM))
- 19 and 25 July; and 17 to 21 August 2009 (SKM)
- 28 June and 2 July 2010 (JKR Ecological)
- 18 and 30 September; and 11 and 12 October 2012 (EcoSM)
- 18 to 24 March; 2 to 10 April; and 21 to 25 April 2013 (AMEC).

These surveys indicate that the boggomoss snail is far more widely distributed than first thought when the recovery plan for the species was published in 2008. Surveys confirmed the presence of the snail at the locations where it had been previously

recorded (i.e. Mount Rose station and Isla Delusion crossing) and also confirmed the presence of the species at four new locations. These locations included Gyranda, Southend, Kia Ora and Nardoo, which are located downstream of the proposed dam.

This resulted in increasing the species known extent of occurrence from 67 km (river length) to 180 km^2 (90 km river length and within 2 km of the river) and its known area of occupancy from 43.8 ha to 449.1 ha. The surveys have also resulted in increasing the known area of boggomoss snail habitat at the Mount Rose station from 0.5 ha (as quoted in the recovery plan) to 2.4 ha.

The EIS surveys also provided new information on known habitat preferences for the species. The survey report prepared by AMEC in 2014 indicates that in addition to confirming the species association with REs 11.3.3, 11.3.4, and 11.3.25, the species also appears to be associated with RE 11.3.27 'freshwater wetlands'.

The 2009 survey report prepared by BAAM suggests that brigalow shade lines may also constitute suitable habitat. At the sites found downstream of the proposed dam (i.e. Gyranda, Isla Delusion, Southend, Nardoo, and Kia Ora) the species was found to have a strong association with the forest red gum (*Eucalyptus tereticornis*) and Carnarvon palm (*Livistona nitida*).

At these sites the species was repeatedly found under deep accumulations of palm fronds. Surveys conducted at Mount Rose station repeatedly identified snails in vegetation associated with a single mound spring and snails were also recorded on a single occasion near two other mound springs in this area.

The 2009 and 2010 survey reports extrapolated boggomoss snail population estimates across the survey sites. In 2012, a submission on the EIS from Dr John Stanisic, who is a leading expert on Australian land snails, raised concern about the validity of population estimates provided in these survey reports. It was considered that the statistical method used to extrapolate the results of the surveys was inappropriate for a species that has scarce and heterogeneous habitat.

Consequently, the numbers provided in these reports were considered likely to be a gross overestimate of actual snail numbers. In its submission, the then Department of the Sustainability, Environment, Water, Population and Communities (DSEWPAC) also raised concern about the methodology used for estimating the size of the boggomoss snail population and requested further clarification and justification of the methodology used for sampling.

In response the Coordinator-General commissioned an independent review of the survey methodologies used by the proponent in order to provide advice about the adequacy and appropriateness of the data used to estimate the population size, and the accuracy and reliability of the snail population estimates provided by the proponent. The final review included an assessment of all surveys undertaken between 2008 and 2013.

The review concluded that the primary aim of the proponent's surveys was to enhance the knowledge of where the snail occurred and that population size estimates were made secondarily to several of the surveys. It also concluded that the population estimates provided do not represent an accurate picture of snail populations and that

population size estimates (the number of snails) should not be made using the survey data.

Based on this advice, the population size estimates provided by the proponent have not been considered as part this evaluation. I consider that knowledge of the area of occupancy and the number of populations to be more relevant to this assessment.

While the independent review indicates that population estimates should be disregarded, the review concludes that the surveys undertaken by the proponent have added much knowledge about the distribution of the species in the region including:

- the known distribution of the snail in 2013 is far greater than the presumed distribution when the initial recovery plan was put in place in 2008
- there will probably be more sites containing the snail that have yet to be surveyed and that these sites are most likely to be located downstream of the proposed dam wall.

The effects of the 2010 and 2011 flood events

EIS surveys indicate that there has been a marked decline in the number of live snails recorded between 2008 and 2013. The EIS stated that this decline is likely to be attributed to consecutive flooding events in the Dawson River that occurred in March 2010, December 2010 and January 2011. These floods are significant in a historical context, with only two larger events on record, both pre-1900 (1870 and 1890).

EIS surveys indicate that the majority of the habitat known to be occupied by the boggomoss snail was impacted by these events with a reduction in the number of snails and the availability of suitable micro-habitat observed at the sites where the snail is known to occur. Surveys undertaken in 2012 indicate that many of the areas known to support snail habitat had been inundated for extended periods of time.

The 2013 survey report indicates that there is potential for the Mount Rose population to recover, however this would be dependent on future flooding events, fires and rates of predation. The most recent surveys in 2013 indicate that the habitat at the Mount Rose site is in good condition with no evidence of canopy die-back or degradation from fire and there has been some recovery of micro-habitats. However, there is some evidence of habitat degradation from feral pigs and micro-habitat disturbances from flooding, and introduced grasses.

The higher number of snails recorded at the downstream sites post 2010/2011 floods suggests that the downstream population sites are likely to be less vulnerable to flooding impacts than the Mount Rose site which is upstream of Nathan Gorge. It is considered that this is likely to be attributed to the anabranching nature of the Dawson River below Nathan Gorge, which would result in lower energy flows during flooding events.

The presence of snails from multiple age classes at Isla Delusion, Southend and Nardoo indicates that there has been repeated successful breeding and recruitment despite the flooding events. Based on the results of the surveys the proponent considers that the downstream sites support more robust populations than the Mount Rose site.

Recovery plan review

On 10 June 2014 the proponent wrote to the then Department of the Environment formally requesting that the Minister review and update the recovery plan to take into account the new information collected as part of the EIS process. This includes new information regarding the species distribution, range and habitat preferences.

It is my understanding that the recovery plan is now under review by EHP and DEE and a revised plan is yet to be endorsed by the Commonwealth Environment Minister. I note that until a revised recovery plan has been endorsed, the current recovery plan remains applicable to the project.

Impacts and mitigation

The project would involve a number of activities which could have the potential to impact on the boggomoss snail and its habitat including the:

- inundation of boggomoss snail habitat on Mount Rose station, which occurs within the proposed water storage area
- hydrological impacts on boggomoss snail habitats downstream at Gyranda, Nardoo, Southend, Isla Delusion and Kia Ora.

Inundation impacts

The Mount Rose site is the only population located within the project footprint. The project is expected to result in the permanent loss of habitat at the Mount Rose site and consequently the population at this site, as this area would be permanently inundated by the dam.

This would result in the reduction in the snail's overall area of occupancy and the loss of one of six known boggomoss snail populations. Based on surveys conducted for the EIS, it is estimated that 2.4 ha of potential boggomoss snail habitat would be permanently lost as a result of constructing the dam.

The loss of 2.4 ha equates to a loss of 0.53 per cent of the total habitat (449.1 ha). This impact is considered to be unavoidable and is also considered to be a residual significant impact under the EPBC Act offsets policy as it would reduce the overall range of the species.

To address the loss of the Mount Rose population, the proponent proposes to translocate snails from the Mount Rose site to a suitable site/s outside of the inundation area, prior to construction.

The translocation strategy would involve collecting all individuals from Mount Rose and transferring them to an area of suitable habitat, which is not currently occupied by any boggomoss snails.

A report produced by Biodiversity Assessment and Management (BAAM) Pty Ltd for the EIS in 2010 concluded that the population at Mount Rose could be relocated to suitable habitat outside of the dam inundation area. The report identifies two potentially suitable receiving sites in close proximity to the Mount Rose site for the translocation, including:

- nearby boggomoss habitat on either Mount Rose or Boggomoss Station. These areas are outside of the inundation levels of the proposed dam
- an area of riparian habitat along Spring Creek, downstream of the dam wall which is adjacent to Precipice National Park.

As translocations have never been undertaken for this species I have recommended a condition requiring the proponent to undertake a translocation trial, before undertaking a full translocation program.

The trial would need to demonstrate that there is high degree of certainty that a translocation would be successful in contributing to the long-term conservation of the species.

EHP have indicated that notwithstanding the projects impacts, significant gains would be made in securing and managing populations and habitat for the species, provided that the proponent delivers the proposed offsets and undertakes the protection measures committed in the EIS.

EHP have also advised that the proponent would need a species management program (SMP) approved by EHP before interfering (i.e. inundating) with the boggomoss snail's breeding place (i.e. Mount Rose station). The SMP would assess the impact of the project on the snails breeding place and incorporate management actions to avoid or minimise the immediate and the long term impacts of removing or altering this breeding place and would also set monitoring and reporting requirements that demonstrate the management actions in the SMP are being achieved.

Hydrological impacts

It is discussed in the existing recovery plan that changes to hydrology via interruption of normal river flows has the potential to result in the drying out the riparian zones which are known to support viable populations of the boggomoss snail.

As part of the EIS assessment modelling was undertaken to assess any potential flow-related impacts of the dam on riparian vegetation known to support the boggomoss snail populations downstream. Based on the modelling results, it is considered that the operation of the dam would not have an adverse impact on downstream riparian vegetation known to support the species.

Two riparian flow statistics, half-bankfull and bankfull flows, were used for this assessment, and modelling was undertaken for two locations on the Dawson River including the Isla Delusion (67 km downstream of the dam) and Southend where boggomoss snails have been found.

It was concluded that the riparian vegetation in these areas are not reliant solely on river flows and these areas of vegetation are more likely to be supported by a combination of water sources including groundwater and rainfall events. The EIS indicates that the current storages on the Dawson River are relatively small and have limited capacity to impact on higher flows (i.e. half-bankfull and bankfull flows).

As result it is considered that the current regulation of flows by the existing storages is not adversely impacting on riparian vegetation downstream.

While the operation of the dam would be expected to result in a reduction in medium to high flows, modelling for Isla Delusion shows that the seasonality of half-bankfull flows would be maintained, however there would be some minor decreases in peak flow volumes throughout most of the year. Based on modelling results, it is considered that these changes would not be expected to have an adverse impact on the riparian habitats downstream.

Modelling also indicates that the seasonality of the bankfull flows would also be maintained. It is expected that large flood flows would continue after the construction of the dam. However the degree of flooding would be altered by managing flow releases (as a dam flood mitigation measure) so that the maximum extent of flooding is reduced. The EIS stated that the reduction in bankfull and overbank flooding events may have a benefit to snail populations at these downstream sites.

Based on the information in the EIS I consider that water releases from the dam could be managed to ensure no adverse impacts on the hydrological regime of the downstream riparian habitats known to support the boggomoss snails, provided that releases from the dam are appropriate for maintaining these habitats.

Compensatory measures and offsets

As discussed in the previous section the proponent has proposed to address the loss of the Mount Rose population by creating a new population in close proximity to the Mount Rose site. This would essentially involve translocating snails from Mount Rose site to an area of suitable habitat nearby (and currently not occupied by any snails and outside of the inundation footprint), which would be maintained until it can be demonstrated that self-sustaining population is established.

To ensure that this new population is protected in perpetuity, this area would be secured under a conservation agreement. Before undertaking the translocation program the proponent would be required to demonstrate that the receiving site can support a self-sustaining population. This would need to be demonstrated before any impact on the Mount Rose site.

To compensate for the permanent loss of 2.4 ha of habitat at Mount Rose station as a result of inundation, the proponent has proposed a land-based offset. Using the Australian Government's offset calculation tool, the proponent has estimated that the provision of at least 16 ha of high-moderate condition habitat would be adequate for offsetting the loss of 2.4 ha of boggomoss snail habitat.

The proponent has committed to purchase 16 ha of known boggomoss snail habitat across at least three locations as part of the offset strategy. As part of the EIS investigations the proponent identified a number of properties within the surrounding area which would be considered suitable offset sites. These sites include properties at Isla Delusion, Southend, Nardoo, Kia Ora, Gyranda and Cabbage Tree Creek.

To ensure that the best conservation outcome is achieved for the species, I have recommended a condition to the Commonwealth Minister requiring the proponent to provide an offset to compensate for the loss of 2.4 ha of habitat and to secure the offset sites via an appropriate conservation agreement and for the proponent to manage these sites to ensure that viable populations are maintained.

Consistency with the existing Recovery Plan

The existing recovery plan has five specific recovery objectives:

- Objective 1. Protect the boggomoss snail habitat to ensure survival of the species
- Objective 2. Protect populations of the boggomoss snail
- Objective 3. Identify additional living populations of the boggomoss snail in the wild
- Objective 4. Increase understanding of the distribution and ecology of the boggomoss snail
- Objective 5. Increase public awareness of the boggomoss snail.

Given that the project would be expected to result in the permanent loss of habitat at the Mount Rose site, it is considered that the project is likely to be inconsistent with recovery objective 1 and recovery objective 2. I note that when the recovery plan was written in 2008, the species was known only to occur at two locations and that the protection of these areas was considered to be critical for the long-term viability of the species.

I also note that information resulting from field surveys undertaken between 2008 and 2013 as part of the EIS for this project shows that:

- the species' known extent of occurrence increasing from two to six locations
- the species' known area of occupancy increasing from 43.8 ha to 449.1 ha
- the species' known extent of occurrence increasing from 67 km (river length) to 180 km^2 (90 km river length and within 2 km of the river).

EHP's advice is that the proposed translocation plan would be consistent with the existing recovery plan objective 1 by securing habitat and objective 3 by translocating snails to new sites.

I also note that the management of the proposed area of new habitat for the translocated snails and the offset sites would include the provision of fencing to exclude snail habitat from grazing cattle, control measures for weeds and pests, and fire risk management. I consider that these actions would be consistent with a number of recovery actions identified in the recovery plan including:

- the management of weeds, pests and fire in at least two known habitats of the boggomoss snail
- fencing habitat critical to the survival of the boggomoss snail to exclude cattle
- undertaking actions to protect newly discovered populations
- collaborating with landowners with habitat suitable for the boggomoss snail to maintain those areas for the purpose of the conservation of the snail.

Coordinator-General's conclusion

I am satisfied that the EIS has identified the potential impacts that the project could have on the boggomoss snail. I consider that water releases from the dam could be managed to ensure that there are no adverse impacts on the hydrological regime of the downstream riparian habitats known to support the boggomoss snail, provided that releases from the dam are appropriate for maintaining these habitats.

Based on the information provided in the EIS, the project would be expected to result in the permanent inundation and subsequent loss of 2.4 ha of the suitable habitat and the loss of one of the six boggomoss snail populations.

I note that the recovery plan for this species is currently under review. Should the Commonwealth Environment Minister decide to approve the project, I recommend the conditions requiring the proponent to:

- Develop and implement a boggomoss snail management plan (BSMP) which includes a management framework that includes measures for addressing the impacts of the project on the boggomoss snail during construction and operation of the project, including actions (direct and indirect) to reduce threats on populations downstream
- manage water releases from the dam to ensure appropriate hydrological regimes are maintained at the boggomoss snail habitat downstream at Gyranda, Nardoo, Southend, Isla Delusion and Kia Ora.
- undertake long-term monitoring of flow regimes during the operation of the dam to ensure boggomoss snail habitats downstream are not being adversely affected, and undertake corrective actions if monitoring shows that habitat areas are being adversely affected
- undertake a boggomoss snail trial translocation project at a suitable site outside of the inundation footprint (currently not occupied by any snails). The trial must demonstrate that the receiving translocation site can support a self-sustaining population. The trial should be used to inform success criteria and ongoing management actions. If the trial demonstrates that the receiving translocation site can support a self-sustaining population, the Mount Rose population should be translocated to the receiving site which should be secured under a conservation agreement and managed to maintain a viable population. Long-term monitoring should be undertaken to ensure success criteria for translocation are being achieved or corrective action is applied where the criteria are not being achieved
- provide an offset for the loss of 2.4 ha of boggomoss snail habitat. Ensure that the offset site/s is secured under a conservation agreement and managed to maintain a viable population.

Mammals

A search of the PMST database identified six threatened mammal species listed under the EPBC Act as potentially occurring within 5 km of the project site. These species are listed in Table 6.2.

Table 6.2 EPBC Act-listed threatened mammals potentially occurring in the project area

Common name *Species name*	EPBC Act listing status
Large-eared pied bat *Chalinolobus dwyeri*	Vulnerable

Common name *Species name*	EPBC Act listing status
Northern quoll *Dasyurus hallucatus*	Endangered
Corben's long-eared bat *Nyctophilus corbeni*	Vulnerable
Greater glider *Petauroides Volans*	Vulnerable
Brush-tailed rock-wallaby *Petrogale penicillata*	Vulnerable
Koala *Phascolarctos cinereus*	Vulnerable

The greater glider and koala were listed as a 'threatened species' under the EPBC Act after the controlled action decision and therefore, in accordance with section 158A(4) of the EPBC Act, are not considered in this assessment.

While the EIS indicated that the project area provides potentially suitable habitat for the following species that are listed, none of these species were identified during EIS field surveys:

- large-eared pied bat—the EIS indicated that suitable roosting habitat is limited in the project area and that suitable habitat may exist in the caves of the Dawson ranges. This species was not identified during field surveys and there are no existing records in the project area. Due to limited suitable roosting habitat and no records of this species in the project area it is considered unlikely to be using the project area.
- Corben's long-eared bat—the EIS indicates that suitable habitat does occur in the project area associated with open ironbark or box woodland including REs 11.3.3, 11.3.2, 11.11.9 and 11.11.1. There is an unconfirmed record of this species in the lower Dawson floodplain. This species was not identified during EIS field surveys.
- northern quoll—the EIS indicates that suitable habitat occurs within the project area within large patches of habitat including the Barakula State Forest. This species was not identified during EIS field surveys and there are no existing records in the project area.

The EIS indicates that the vegetation in the project area is unlikely to support the brush-tailed rock-wallaby. This species typically inhabits rock piles and cliffs with ledges which are absent from the project site. This species was not identified during EIS field surveys and there are no existing records in the project area.

Birds

A search of the PMST database identified six threatened bird species listed under the EPBC Act as potentially occurring within 5 km of the project site. These species are listed in Table 6.3.

Table 6.3 EPBC Act-listed threatened birds potentially occurring in the project area

Common name *Species name*	EPBC Act listing status
Terrestrial species	
Red goshawk *Erythrotriorchis radiatus*	Vulnerable
Squatter pigeon (southern) *Geophaps scripta scripta*	Vulnerable
Painted honeyeater *Grantiella picta*	Vulnerable
Star finch (eastern) and (southern) *Neochmia ruficauda ruficauda*	Endangered
Australian painted snipe *Rostratula australis*	Endangered
Marine species	
Curlew sandpiper *Calidris ferruginea*	Critically endangered, migratory wetland

The painted honeyeater, Australian painted snipe and the curlew sandpiper were listed as a 'threatened species' under the EPBC Act after the controlled action decision and therefore, in accordance with section 158A(4) of the EPBC Act, are not considered in this assessment.

The red goshawk is not considered likely to occur in the water storage footprint. There are no existing records of this species in the project area and the species requires large trees for nesting which are within 1 km of a permanent watercourse. The impacted vegetation in the project area is considered to be highly fragmented and unsuitable habitat for the red goshawk nesting. It is considered that the riparian vegetation within the Barakula State Forest and other State forests around the mid-section of the pipeline corridor may provide potentially suitable habitat for this species.

While the EIS indicated that the project area provides some suitable habitat for the star finch there are no existing records of this species in the project area and the species was not identified during EIS field surveys. The closest record of this species is from the Taroom region; however, this record is over 30 years old.

Only one threatened bird species, the squatter pigeon (southern) (*Geophaps scripta scripta*) was recorded from the project area.

Squatter pigeon (southern)

Background

The squatter pigeon (southern) is listed as 'vulnerable' under the EPBC Act. This species was recorded during field surveys within the proposed water storage area. The EIS indicates that there is suitable habitat for this species in the project area associated

with REs: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.18, 11.3.19, 11.3.25, 11.3.39, 11.10.7, 11.10.7a, 11.10.11 and 11.10.13a.

There is an approved conservation advice for this species: *Approved Conservation Advice for Geophaps scripta scripta (Squatter Pigeon (southern))*[42]. Key threats to this species identified in the conservation advice are:

- ongoing clearance of habitat for farming or development
- grazing of habitat by livestock and feral herbivores
- predation from feral cats and foxes.

Key priority recovery and threat abatement actions which are relevant to the project include:

- managing threats to areas of vegetation that support important populations
- developing and implementing management plans for the control and eradication of feral herbivores
- implementing appropriate recommendations outlined the threat abatement plans for feral cats and the European red fox.

Threat abatement

The squatter pigeon is listed as a species that may be adversely affected by pest animal species in the following threat abatement plans:

- *Threat abatement plan for predation by feral cats*[43]
- *Threat abatement plan for predation by the European red fox*[44]
- *Threat abatement plan for competition and land degradation by rabbits*[45].

The European red fox and the rabbit are Category 3, 4, 5 and 6 restricted matters and the feral cat is a Category 3, 4, and 6, restricted matter under the Queensland *Biosecurity Act 2014*. Under this Act, landowners have a 'general biosecurity obligation' to take all reasonable and practical steps to minimise the risks associated with invasive plants and animals on a person's land. I note that the proponents have committed to keep the project sites free of feral animal pests in accordance with a feral animal management plan. This would be expected to reduce the risk of predation on the squatter pigeon in the project area.

Impacts and mitigation

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[42] Commonwealth of Australia, Approved Conservation Advice for *Geophaps scripta scripta* (Squatter Pigeon (southern)), Threatened Species Scientific Committee (TSSC), Department of the Environment, Canberra, 2015, viewed 1 November 2016, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64440

[43] Commonwealth of Australia, Threat abatement plan for predation by feral cats, Department of the Environment, Canberra, 2015, viewed 2 November 2016, https://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats

[44] Commonwealth of Australia, Threat abatement plan for predation by the European red fox, Department of the Environment, Water, Heritage and the Arts, Canberra, 2008, viewed 2 November 2016 http://www.environment.gov.au/biodiversity/threatened/publications/tap/predation-european-red-fox

[45] Commonwealth of Australia, Threat abatement plan for competition and land degradation by rabbits, Department of the Environment, Water, Heritage and the Arts, Canberra, 2008, viewed 2 November 2016, http://www.environment.gov.au/system/files/resources/7097f100-4a22-4651-b0e1-df26e17c622c/files/tap-rabbitreport.pdf

The project is expected to result in a loss of 3,306 ha of remnant habitat including 3,282.5 ha as a result of the dam and 23.5 ha as a result of constructing the pipeline and other associated infrastructure. The EIS considers that the loss of this vegetation is unlikely to have an adverse impact on the squatter pigeon as they are known to readily traverse open and disturbed areas and would continue to use existing habitat surrounding the water storage area.

Using the Australian Government's offset calculation tool, the proponent has estimated that the provision of at least 9,500 ha of remnant squatter pigeon habitat would be adequate for compensating the loss of 3,306 ha of habitat from the project site. The EIS indicates that the areas proposed for revegetation and rehabilitation works within the water storage buffer zone and the proposed wildlife corridor and the GAB spring EC and brigalow EC offset areas would compensate for any loss of squatter pigeon habitat. These areas would be rehabilitated and managed from threatening processes in addition to being secured under the conservation agreement. The EIS indicates these works would provide approximately 10,000 ha of vegetation which would be considered suitable habitat for the squatter pigeon.

Feral animal management would also be undertaken in the proposed flood buffer and offset areas for other State and Commonwealth matters, which would also be expected to have a benefit for this species.

Coordinator-General's conclusion

I am satisfied that the EIS has adequately identified the potential impacts that the project could have on the squatter pigeon.

I consider that the proposed revegetation and rehabilitation works within the water storage buffer zone, wildlife corridor, and the GAB spring EC and brigalow EC offset areas would compensate any loss of squatter pigeon habitat. I consider the impacts on the squatter pigeon are not unacceptable. I also consider that the proposed mitigation measures including weed and pest management are not inconsistent with the relevant threat abatement plans.

Reptiles––terrestrial and aquatic species

A search of the PMST database identified four threatened reptile species listed under the EPBC Act as potentially occurring within 5 km of the project site. These species are listed in Table 6.4.

Table 6.4 EPBC Act-listed threatened reptiles potentially occurring in the project area

Common name *Species name*	EPBC Act listing status
Terrestrial	
Collared delma *Delma torquata*	Vulnerable
Ornamental snake *Denisonia maculata*	Vulnerable

Common name *Species name*	EPBC Act listing status
Dunmall's snake *Furina dunmalli*	Vulnerable
Yakka skink *Egernia rugosa*	Vulnerable
Aquatic	
Fitzroy River turtle *Rheodytes leukops*	Vulnerable
White-throated snapping turtle *Elseya albagula*	Critically endangered

The white-throated snapping turtle was listed as a 'threatened species' under the EPBC Act after the controlled action decision and therefore, in accordance with section 158A(4) of the EPBC Act, is not considered in this assessment.

While the EIS indicated that the project area provides potentially suitable habitat for the following four species listed in Table 6.4, field surveys failed to identify individuals:

- collared delma—was not assessed in the EIS. While there are no existing records of this species in the project area the woodland areas throughout the project area may provide suitable habitat for this species.
- ornamental snake—there is suitable habitat is present within the mid- and northern sections of the pipeline corridor for this species. This species inhabits brigalow woodland, riparian woodland, and open forest growing on natural levees.
- Dunmall's snake—there is suitable habitat present within the mid-section of the pipeline corridor. This species inhabits brigalow, belah and cypress pine communities.
- yakka skink—there is suitable habitat for this species present within the mid-section of the pipeline corridor. This species inhabits rocky areas within areas of dry sclerophyll forest and woodland.

The EIS indicates that project is likely to result in the removal of approximately 3,284 ha of habitat which would be considered to be suitable for a number of threatened terrestrial reptiles (i.e. includes micro-habitat features such as rocks, logs, bark and other coarse woody debris, and leaf litter.

The loss of this vegetation would be addressed through offsets for the brigalow EC and state offset requirements for regional ecosystems and connectivity areas. I have recommended a condition to the Commonwealth Environment Minister requiring the proponent to undertake pre-clearance surveys for threatened fauna prior to commencing construction and to provide offsets for species if it is identified that the project is expected to have a residual significant impact on a threatened species.

Only one species of threatened reptile, the Fitzroy River turtle, is considered likely to be present in the project area due to the presence of suitable habitat and existing records of the species in the region.

Fitzroy River turtle

Background

The Fitzroy River turtle, also known as the Fitzroy tortoise, is listed as 'vulnerable' under both the EPBC and NC Acts and is also listed as a high priority species under EHP's 'Back on Track' prioritisation framework for the Fitzroy Basin catchment.

The species is endemic to the Fitzroy Basin catchment and occurs widely within the permanent freshwater habitats of the middle and lower reaches of the Fitzroy, Dawson, Mackenzie and Comet rivers. The species has also been observed in isolated large permanent water holes of the upper Connors River and Duck Ponds on the lower Nogoa River.

The Fitzroy River turtle inhabits flowing riverine habitats. The species can respire aquatically (extract oxygen from water) which allows it to remain submerged underwater for longer periods (days or weeks at a time). This ability also allows the species to use fast-flowing riffle zones from which air-breathing turtle species are primarily excluded, allowing access to a higher abundance and diversity of food resources.

The species is considered to have a relatively small home range (up to 4 ha). However, it is known to travel much greater distances (in the order of tens of kilometres) for the purposes of dispersal, courtship and repositioning after floods. Upstream and downstream migrations may also occur during the nesting season.

The Fitzroy River turtle nests in spring (between September and October) with hatchlings emerging in the summer months (between December and January). Nesting is typically restricted to alluvial sand/loam banks (approximately 5 m from the water's edge) that have a relatively steep slope, a low density of the ground/understorey vegetation and partial shade cover. Female turtles tend to nest in aggregations, nesting in the same general area.

The EIS stated that no important populations of this species are known to occur within the immediate project area. However nesting is known to occur in the reach between Orange Creek and Theodore Weir, approximately 45 km downstream of the dam wall. Important nesting habitat is known to occur at Alligator Creek which is located within the upper reaches of the Fitzroy Barrage impoundment approximately 565 km downstream of the proposed dam.

This area supports the largest known nesting aggregation of Fitzroy River turtles. Nesting aggregations have also been recorded within the upper reaches of the Tartrus Dam impoundment on the Isaac River and immediately downstream of the Tartrus Dam on the Mackenzie River.

Results of surveys

Targeted surveys were undertaken for the EIS in 2008, 2010 and 2011 to confirm the presence of the Fitzroy River turtle. These surveys were undertaken during the following survey periods:

- October 2008

- 29 October 2010 to 8 November 2010
- September to October 2011
- 27 September – October 2012.

During the 2008 surveys seven sites were chosen for turtle surveys in the main Dawson River channel including one site above the inundation area, four sites within the inundation area and two sites below the dam.

During October 2010, surveys for nests were undertaken across 13 sites, beginning at Theodore Weir, through to the proposed inundation area and upstream of the proposed inundation area.

Aquatic habitat surveys were undertaken from 26 November to 3 December 2007 and 17 to 24 June 2008 and one pipeline survey for aquatic fauna was undertaken between 27 and 31 October 2008.

Despite survey effort, no Fitzroy River turtles were recorded in the project area. EHP considers that surveys undertaken to date have been insufficient due to limitations in survey methodologies used. The survey methodologies considered most effective for identifying this species (i.e. snorkelling and spotlighting) were only used to a limited extent due to turbid conditions at the time of the surveys.

Likelihood of occurrence

While no Fitzroy River turtles were identified during surveys, the species is still considered likely to potentially occur in the project area based on the presence of suitable habitat in the project area and existing records in the Dawson River catchment. There is one record of this species in from Glebe Weir which is located within the dam footprint.

The species has also been recorded at Theodore Weir (approximately 86 km downstream of the proposed Nathan Dam). In addition, other species of turtle which have similar habitat requirements to the Fitzroy River turtle, including the state-listed white-throated snapping turtle (*Elseya albagula*) and Krefft's river turtle (*Emydura macquarii krefftii*) are known to occur in the project area and were identified during surveys.

Relevant measures associated with managing impacts on the white-throated snapping turtle

While the white-throated snapping turtle has not been included in this MNES assessment due to the species being listed after the controlled action decision, it is still a State consideration under the NC Act.

The white-throated snapping turtle is listed as 'endangered' under the NC Act and is known to occur in the project area. The species was recorded during EIS surveys and areas of potentially suitable foraging and nesting habitat were identified throughout the project area.

The white-throated snapping turtle has very similar habitat requirements and biological characteristics to the Fitzroy River turtle and as such it is considered that the project

would have similar impacts on both species. In my evaluation of the white-throated snapping turtle in the MSES chapter of this report I identified that the project would:

- without any mitigation, create a significant barrier to turtle passage in the Dawson River
- involve construction activities which have the potential to disturb or injure turtles
- modify and fragment aquatic habitat potentially reducing in foraging opportunities within the proposed water storage area
- potentially improve foraging opportunities for turtles downstream of the dam as releases would be expected to increase riffle habitat in the downstream areas known to support nesting habitat (i.e. Orange Creek and Theodore weirs)
- result in the loss of potential nesting habitat as a result of being inundated by the dam
- potentially result in a reduction in nesting areas downstream of the dam as a result of reduced flood flows required to replenish nesting banks
- have the potential to result in turtle injury or mortality as a result of structural design features and operating regimes of the dam.

To address these potential impacts the proponent has made a number of commitments including:

- ensuring that the diversion channel constructed during construction is designed to allow movement of aquatic fauna
- ensuring that the dam includes design features which minimise the risk of turtle injury and mortality
- employing an operating strategy which minimises risks of turtle injury and mortality
- maintaining environmental flows downstream of the water storage area
- replenishing sand banks downstream, where it is identified that nesting banks are not being maintained as a result of reduced flood flows resulting from the presence of the dam
- implementing a weed and pest management strategy, which would reduce the potential for nest predation by foxes and other predators and enhance nesting banks through the removal of weeds from nesting banks.

In addition I have imposed conditions requiring the proponent to:

- construct a turtle way on the dam that provides safe passage for turtles. The turtle way design must be developed in consultation with EHP and the final design approved by EHP prior to construction. I have also required the proponent to monitor the effectiveness of the turtle way once it is constructed and to provide adaptive management measures in the event that monitoring shows that turtle passage is being restricted and/or turtles are being injured, and to implement contingency measures (i.e. a catch and release program) until it can be demonstrated that safe passage is being achieved
- develop a turtle management plan (TMP) which provides a set of practical actions for the management of the white-throated snapping turtle during project planning and design, construction and commissioning, and operation. The TMP must be

developed in consultation with EHP and is to be approved by EHP prior to construction

- undertake further work to determine the extent of impacts on nesting and foraging habitat.

The TMP includes a requirement for the proponent to regulate water releases from the dam to maintain aquatic and nesting habitat downstream of the dam. This would be in addition to meeting EFO requirements.

As the imposed conditions and recommendations for the white-throated snapping would apply equally to the Fitzroy River turtle, I have recommended similar conditions for the Commonwealth Minister's consideration for addressing the impacts on the Fitzroy River turtle.

Recovery plans, conservation advice and threat abatement

There is currently no recovery plan for this species, however there is an approved conservation advice: *Approved Conservation Advice for Rheodytes leukops (Fitzroy Tortoise).*[46]

The conservation advice identifies a number of key threats to the species, including loss and disturbance of habitat from agriculture, mining, damming of rivers, and pollution and siltation of rivers and creeks. The most significant threat to this species is the loss of nests to predation.

The species is threatened by very high rates of nest predation by feral animals (pigs and foxes), goannas and water rats, with nearly 100 per cent of nest clutches being predated each season. Nests are also trampled by cattle. With the lack of hatchling recruitment into the population, the species is considered to be at a high risk of extinction.

The regional and local priority recovery and threat abatement actions in the conservation advice which are relevant to the project include:

- protecting areas of riparian habitat where populations are known or have the potential to occur
- ensuring infrastructure or development activities do not impact on known populations
- managing changes in hydrology that may result in changes to water table levels, increased run-off, sedimentation or pollution
- controlling or eradicating feral animals around breeding colonies
- improving recruitment of hatchlings into the population
- maintaining stream flow and the continuity of turtle populations between impoundments

[46] Commonwealth of Australia, *Approved Conservation Advice for* Rheodytes leukops *(Fitzroy Tortoise)*, Department of the Environment, Canberra, 2008, viewed 2 September 2016, http://www.environment.gov.au/biodiversity/threatened/species/pubs/1761-conservation-advice.pdf

- controlling and managing access to nest sites and managing known threats on private land
- considering the requirements and protection of this species in all proposals for impoundment developments
- minimising adverse impacts from land use at known sites
- maintaining nesting banks and protecting turtle nests from predation and disturbance
- improving water quality in the lower Fitzroy River catchment.

The threat abatement plans for the feral cat and the European red fox are relevant to the Fitzroy River turtle. The project has the potential to increase the abundance of predators, through increasing permanent water resource availability which could result in increased predation of Fitzroy River turtle nests within the water storage area. To address this potential impact the proponent has committed to keep the dam site free of invasive animals in accordance with a feral animal management plan.

Other relevant water infrastructure development

SunWater is currently the proponent or joint proponent for three project proposals in the Fitzroy Basin catchment including the Nathan Dam and Pipelines, Connors River Dam and Pipelines and Lower Fitzroy River Infrastructure projects.

Connors River Dam and Pipelines project

The Connors River Dam and Pipelines project was evaluated by the then CG on 20 January 2012 and was subsequently approved by the Commonwealth Minister's delegate on 19 April 2012. The Connors River Dam and Pipelines EIS stated that the Connors River Dam and Pipelines, Lower Fitzroy River Infrastructure and Nathan Dam and Pipelines projects would be likely to have residual impacts on the Fitzroy River turtle and there would be potential for cumulative impacts on the species.

To address the potential cumulative impacts resulting from the multiple water infrastructure developments the then CG imposed a condition which required SunWater to prepare a catchment wide conservation plan for the Fitzroy River turtle and white-throated snapping turtle (pursuant to section 112(2) of the NC Act). The Commonwealth approval also included this condition for the Fitzroy River turtle.

The conservation plan was to specify the research and management measures required to ensure the survival and natural development of the species' populations in the Fitzroy River Basin catchment. This plan was to be developed by the proponent in collaboration with the then Queensland Department of Environmental Resource Management (DERM), SEWPAC and the Fitzroy Basin Association (FBA), and implemented by DERM.

There was also a condition requiring the proponent to provide a financial contribution of $250,000 per year for five years, to fund implementation of the conservation plan. As the Connors River Dam and Pipelines project has not yet proceeded due to a lack of financial support and commitment from customers, the proponent has not yet started any preparation of a conservation plan.

Lower Fitzroy River Infrastructure Project

The Lower Fitzroy River Infrastructure project was evaluated on 8 December 2016 and was subsequently approved by the Commonwealth Environment Minister on 28 February 2017. In my evaluation of this project I concluded that the project would be likely to have a residual significant impact on 942 ha of aquatic habitat and the inundation of up to 80 per cent of nests within the two weir impoundments.

The conditions for the Lower Fitzroy Infrastructure Project did not specifically include a requirement for the proponent to prepare a conservation plan. Conditions required the proponent to undertake a nest protection program in addition to providing funding to EHP/DEE as part of their offset obligation to undertake works which compensate for the loss of aquatic habitat.

Impacts and mitigation

The construction and operation of the project has the potential to impact on the Fitzroy River turtle by:

- fragmenting and modifying instream (aquatic) habitat
- creating barriers to movement
- inundating and altering nesting habitat
- reducing foraging resources
- resulting in the loss of micro-habitat associated with the loss of riparian vegetation
- increasing the risk of turtle injuries or mortalities.

Fragmentation or modification of aquatic habitat–construction

The project would involve a number of construction activities that have the potential to impact on aquatic habitat including the removal of vegetation and resource extraction within the dam construction footprints, and excavations of the bed and banks. Impacts on riparian vegetation would be reduced by retaining areas of vegetation along the riparian zone of the tributaries and main channel of the Dawson River.

In addition, the activities associated with rehabilitating and revegetating the flood buffer area around the dam would also enhance and increase areas of riparian vegetation around the dam. Expected benefits for turtle species in the project area include provision of shading and assisting in improving water quality. Weed management in these areas would assist in preventing terrestrial and aquatic weeds from overgrowing these areas.

The proponent has also committed to improve habitat for turtles and other aquatic species through the creation of snag habitat (woody debris) within the water storage area. Snag habitat areas would provide greater opportunities for resting, sheltering and foraging. The addition of woody debris would also support more diverse and abundant macroinvertebrate communities and subsequently provide more foraging resources for turtles.

Fragmentation or modification of aquatic habitat–operation

Riffle zones provide Fitzroy River turtles with the opportunity to access good quality food resources. While Fitzroy River turtles are known to occur in impoundments where only flooded pool habitat is available, these slow-flowing pools have a lower carrying capacity than highly productive riffle zones.

Baseline surveys undertaken for the EIS indicate that section of the Dawson River where the dam is proposed has relatively low river channel diversity. This section of the river is mostly comprised of with isolated pools and very few areas of riffle habitat. This would be contributed to by the presence of Glebe Weir.

The EIS indicates that the construction of the dam would result in the conversion of 75.2 km of the Dawson River and 90.8 km of other major streams into a lake environment. Reduced potential foraging habitat for the Fitzroy River turtle due to the conversion of riffle habitat to deeper pool habitat within the storage area is expected. The dam is proposed in a section of the Dawson River which contains very few areas of riffle habitat and the proposed dam is expected to remove a small area of highly productive habitat. While there would a loss of some riffle habitat within the storage area, the operation of a low flow release strategy is expected to increase the frequency of riffle forming flows downstream which would be expected to provide greater foraging opportunities for turtles downstream.

I have recommended conditions to the Commonwealth Minister requiring the proponent to quantify the amount of the habitat that would be impacted and to undertake measures to compensate for the loss of aquatic habitat for the Fitzroy River turtle, should it be identified that the project would result in a residual significant impact.

Barriers to passage–construction

The EIS indicates that downstream flows in the Dawson River would be maintained during construction by constructing a diversion channel around the construction area. This would maintain river flow while keeping the construction site dry. While it is not designed specifically for movement of aquatic fauna, the proponent has committed to ensuring that the diversion channel is designed to allow movement of aquatic fauna. The addition of habitat features including boulders and logs would be added to the diversion channel to assist in facilitating fauna passage including turtles.

The EIS indicates that the coffer dams that would be constructed at both ends of the diversion channel would represent significant barriers to fauna movement until they are removed. The coffer dams would be checked by trained personnel throughout construction for turtles and any trapped turtles would be removed and relocated to a suitable habitat nearby. The coffer dams would be removed on the completion of works. The process for relocating any turtles would be outlined in a EMP. This would include a process for safely relocating turtles.

Barriers to passage–operation

Impoundment infrastructure and road causeways can impede the upstream and downstream movement of turtles. The restriction of movement may disrupt reproductive behaviours and subsequently result in genetically isolated populations.

Unmitigated, the construction of the dam wall would create a significant barrier to turtle passage in the Dawson River. To address this impact I have imposed a condition requiring the proponent to construct specifically designed turtle passage infrastructure (a turtle way). The proponent has committed to further refine the design of the turtle way in consultation with EHP during the detailed design phase.

The design is to be informed by turtle movement studies, which would be used to improve current knowledge of turtle movement and to develop quantifiable performance criteria to measure the effectiveness of the turtle way during operation.

I have recommended a condition to the Commonwealth Environment Minister requiring the proponent to design and construct a turtle way which maintains movement and provides safe passage around the dam wall. I have also recommended a condition to ensure that the effectiveness of the turtle way is monitored until it can be demonstrated that turtle movement is not being restricted. In the event that monitoring shows that turtle passage is being restricted and/or turtles are being injured, the condition would require the proponents to adaptively manage the turtle way and as a contingency undertake a catch and release program if it is shown that safe passage is not being achieved.

I have required that this contingency measure be undertaken until it can be demonstrated that turtles are safely moving through the passage. I have also recommended that the turtle way is maintained for the life of the project.

Construction impacts on turtles and nesting habitat

The project would involve a number of construction activities which have the potential to impact on nesting habitat including resource extraction and excavation activities. The EIS does not discuss whether any areas that have the high potential to support nesting habitat would be disturbed as a result of acquiring material during construction. However the proponent has committed to undertake measures during construction to avoid/minimise the potential loss or degradation of turtle nesting habitat.

Such measures would include:

- surveying impacted areas for turtles and nesting areas; and capturing and relocating any turtles identified during surveys prior to undertaking any works
- marking any identified nesting areas on field and construction maps; and undertaking measures to relocating and protecting any nests identified during surveys.

To ensure that impacts on the Fitzroy River turtle are adequately managed during the construction and operation of the project I have recommended a condition to the Commonwealth Minister requiring the proponent to develop a TMP that provides a management framework for avoiding and mitigating impacts of the project on the Fitzroy River turtle and its nesting and foraging habitats throughout the life of the project. TMP would need to be developed consultation with EHP and approved by the Commonwealth Environment Minister prior to construction.

Inundation of nesting habitat within the dam footprint

While there are no records of Fitzroy River turtle nesting in the project area, the EIS indicates that there are areas that could be considered suitable for nesting within the FSL inundation area. During the 2011 surveys suitable areas of nesting habitat were identified at five of the six sites surveyed within the dam footprint. Two of these sites (Glebe Weir and Cockatoo Creek sites) showed evidence of nesting however it was unclear whether these were Fitzroy River turtle nests.

The EIS has not attempted to quantify the amount of potential nesting habitat which would be inundated during the operation of the dam or discussed whether nesting areas would be re-established within or adjacent to the inundation area over time.

On the basis of the information provided in the EIS, I am taking a precautionary approach for this species. As such I have recommended a condition to the Commonwealth Environment Minister requiring the proponent to quantify the amount of the habitat that would be impacted and to undertake measures to compensate for the loss of nesting habitat for the Fitzroy River turtle, should it be identified that the project would result in a residual significant impact.

Alteration of nesting habitat downstream–construction

During construction, downstream flows in the Dawson River would be maintained throughout the construction process by undertaking a diversion strategy. As such construction activities are not expected to have any significant effect on flow regimes downstream and therefore any adverse impact on turtle nesting habitat downstream.

Alteration of nesting habitat downstream (normal flows)–operation

The operation of the dam has the potential to reduce or change the timing of key environmental flows. To address this impact the proponent has proposed to implement an environmental release strategy to ensure that releases are made to mimic natural downstream conditions as far as practicable.

The operational impacts on flow regimes downstream of the dam were assessed for a number of locations downstream where Fitzroy River turtle nesting is known to occur including the regulated reach between Orange Creek Weir and Theodore Weir. Three key ecological characteristics were used for this assessment including low flows (10 cm and 30 cm) that maintain riffles and flushing flows to maintain water quality.

The EIS stated that the flow regimes in the Dawson River where Fitzroy River turtles are known to nest are already highly impacted by existing water infrastructure and flow regulation. It was concluded in the EIS that operation of the dam is not expected to significantly impact on flow regimes downstream where nesting is known to occur.

The adoption of low flow release strategies would be expected to increase flows relative to the current levels. This would be expected to provide the required volume of flows for maintaining river connectivity (i.e. increasing riffle forming flows between pools) and water quality (flushing flows).

Modelling undertaken for the EIS indicates that the frequency of riffle forming flows would increase during the months that coincide with turtle nesting season (between September and December). Expected benefits for the species include greater

opportunities for turtle movement to nesting and foraging areas and maintaining water quality in riffle zones and pools which generate foraging resources.

The frequency of these flows would be slightly reduced for the 10 cm flow depth during the autumn and winter (April, May and August) when there is a reduced need for water. This reduction would not be expected to have an adverse impact as environmental flows would be maintained during this period.

I note that the proponents have committed to maintain environmental flows downstream of the water storage area. I have recommended a condition to the Commonwealth Minister requiring that the proponent manage water releases from the impoundments to maintain downstream habitat for this species. This recommendation is additional to the EFOs obligations under the Fitzroy Water Plan.

Alteration of nesting habitat downstream (flood flows)–operation

The EIS indicates that the closest area of known nesting habitat is located in the reach of the Dawson River between Orange Creek Weir and Theodore Weir, approximately 45 km downstream of the proposed dam wall.

The project would be expected to impact on turtle nests downstream by altering the frequency and magnitude of flood events. The availability of nesting habitat is largely dependent on the transport and sediment associated with large flooding events and would therefore be influenced by any changes to flood flows.

The EIS indicates that the operation of the dam is expected to reduce peak flood levels downstream, particularly in the minor to moderate flood range. This reduction in flood flows would have the potential to alter the availability of suitable nesting habitat downstream by disrupting the natural replenishment of nesting banks and enhancing conditions for plant growth in the potential nesting areas.

The proponent has committed to undertake monitoring of turtle nesting banks downstream of the dam to identify any signs of degradation and has also committed to rehabilitate any nesting banks that could not been rejuvenated at result of the reduced flood flows. This monitoring would be undertaken at sites where nesting is known to occur (i.e. within the Theodore Weir impoundment and the reach between Orange Creek Weir and Theodore Weir).

Loss of nesting habitat upstream of the water storage area

The potential for nests to be flooded upstream as a result of the project is considered to be low. The EIS indicates that no unseasonal flooding of turtle nesting banks is expected to occur as a result operating the dam. Surveys undertaken for the EIS identified potentially suitable nesting habitat at the site surveyed upstream of the Dam at Tarana Crossing. No areas of potential nesting habitat were identified at the site surveyed at Taroom. Modelling indicates that at FSL there would not be any measurable changes in flood levels upstream of the dam for events up to 1 in 10 AEP and only minor increases (0.1 m) for 1 in 20 events. As such it is considered that any flood related impacts on turtle nesting areas would be negligible.

Water quality impacts—construction

The project would involve a number of construction activities which have the potential to impact on water quality including:

- vegetation clearing and earthworks activities. These activities have the potential to impact on water quality by contributing to increased sediment loads entering adjacent and downstream waterways
- storage, transport and use of hazardous chemicals and substances. These activities have the potential to impact on water quality from spills and leaks which result in chemicals entering waterways.

One of the regional priority recovery actions in the conservation advice for this species is managing the run-off of sediments and pollutants into waterways to ensure that there is no detrimental impact on the species. The proponent has committed to a number of measures to ensure that water quality impacts are adequately managed during construction, including:

- undertaking the more significant ground-disturbing activities, such as embankment excavations and construction of coffer dams, during drier periods
- diverting minor flows around construction areas to reduce run-off collecting sediment from disturbed areas and collecting and treating site-affected water before being discharged to the river
- implementing sediment and erosion control measures in compliance with accepted guidelines[47]
- ensuring that hazardous chemicals and substances, including hydrocarbons and oils, are only stored and handled within bunded areas that have been designed and constructed in accordance with Australian standards
- directing dewatering wastewater to sedimentation ponds for treatment before being discharged to the river or being used for other purposes
- undertaking regular water quality monitoring in accordance with a water quality monitoring program and undertaking corrective actions to address any water quality impacts.

These measures would be expected to reduce the potential for any adverse water quality impacts in the project area and consequential impacts on Fitzroy River turtles using these areas and habitats downstream.

Water quality impacts—operation

The conservation advice for the Fitzroy River turtle identifies water quality impacts from pollution and siltation as key threat to the species. The EIS indicates that water quality is likely to be temporarily degraded as the dam fills.

During operation, the EIS indicates that key water quality parameters including dissolved oxygen, turbidity, temperature and nutrient concentration may be affected by

[47] e.g. the IECA (2008) *Best Practice Erosion and Sediment Control Guideline*; and the Queensland Division of the Australian Institute of Engineers' (1996) *Erosion and Sediment Control: Engineering Guidelines for Queensland Construction Sites.*

the dam. As discussed in the World Heritage properties section above, the proponent has proposed to mechanically remove trees and shrubs from the inundation area to assist in reducing the overall water quality impacts associated with decaying vegetation.

While some vegetation (i.e. grassed pasture areas) would be retained, the level of nutrients that would be released would be much less than if all of the vegetation had been retained. The retention of these grassed areas would also assist in reducing suspended sediment loads by reducing the potential for erosion.

It is expected that the water storage would experience temporary water quality impacts as a result of the decomposing organic matter after the filling of the dam including an increase in nutrients and turbidity and subsequently lower levels of dissolved oxygen.

The proponent has committed to develop operational strategies to manage the quality of water being released from the dam. The EIS indicates that the multi-offtake would provide a mechanism for selective delivery of water which can allow for higher quality water to be released to the receiving environment.

The increased storage capacity of the dam compared to the existing storage capacity of Glebe Weir would provide for increased low flow duration under a low flow release strategy. As discussed above, modelling undertaken for key ecological characteristics relevant to the Fitzroy River turtle indicates that dam releases under a low flow release strategy would be expected to provide the required volume of flows for maintaining water quality downstream of the dam.

The rehabilitation and revegetation of the flood buffer area around the dam would also assist in improving water quality of the dam by reducing sediment and nutrient run-off from the adjacent catchment.

Turtle injury and mortality—construction

The proponent has proposed a number of measures to avoid and minimise the potential for turtle injury or mortality during construction. These measures would be outlined in a TMP. As discussed in the previous section the TMP would need developed in consultation with EHP and approved by the Commonwealth Environment Minister, prior to commencing the proposed action. I have recommended this requirement as a condition of approval.

Turtle injury and mortality—operation

Impoundment structures create a number of risks for turtles. Studies in the Fitzroy River catchment have reported large numbers of turtles killed annually a as result of water supply infrastructure. Many of these deaths can be attributed to being trapped on trash screens and making contact with hard structures during over-topping events or high-volume water releases.

The EIS indicated that the structural components of the proposed dam would be designed to minimise the risk of turtle injury or mortality. This includes design features that would reduce the risk of turtles being projected against hard structures, being trapped and drowned, and features that would discourage turtles from moving into

unsafe locations. The proposed measures would be further refined during the detailed design phase in consultation with EHP.

In addition, the proponent has committed to ensure that the operating strategy for the dam includes actions that would avoid or minimise the risk of turtle injury and mortality. This includes:

- reducing the velocity of high-volume water release events
- gradually increasing the rate of water releases from outlet structures top reduce the potential for physical damage to turtles.

A part of a proposed TMP the proponent would undertake regular inspection of dam infrastructure including offtakes, outlet structures and the spillway for evidence of turtle injury or mortality. Any observations would be reported to EHP. In the event that there is evidence of turtle injury or mortality, the proponent has also committed to investigate opportunities to modify structures (where feasible/practical) to avoid and minimise such instances.

I consider that the provision of a properly functioning turtle way would also reduce the risk of injury and mortality. I have recommended a condition requiring the proponents to build a specifically designed turtle way on the dam and to ensure that the structural and operational design of the turtle way does not result in an increased risk of turtle injury or mortality.

Weeds

A weed management plan would be developed and implemented to enhance the quality of habitat within and adjacent to the project area. Specific management measures would include regular monitoring, removal and control of terrestrial and aquatic weeds within and adjacent to the dam. This would be expected to reduce overgrowth of weeds over potential nesting banks.

Cumulative impacts

As discussed in the previous section, the proponent for the project is currently the proponent or joint proponent for two other project proposals in the Fitzroy Basin catchment including the Connors River Dam and Pipelines and Lower Fitzroy River Infrastructure projects. In the EIS the proponent acknowledged the potential for cumulative impacts on the Fitzroy River turtle resulting from the development of the three projects. The construction of these projects would be expected to result in further modification of riverine habitat and an increased loss of nesting and foraging habitat within the Fitzroy Basin catchment.

To address the potential cumulative impact of the project on the Fitzroy River turtle the proponent has committed to undertake a catchment-wide research and monitoring program which would include research on the distribution, abundance, location of nesting areas within the catchment and measures that could be undertaken to reduce the impact of existing structures. In addition the proponent has committed to provide $100,000 per annum per project for five years towards conducting this program.

Residual significant impacts and offsets

As this species has not been identified within the project area, it is difficult to determine whether the project would be likely to have a residual significant impact on this species. While the species was not recorded during the EIS surveys, the species is still considered likely to occur due to the presence of suitable habitat and a record of this species from Glebe Weir. As such I recommend that a precautionary approach be undertaken for this species and have recommended a condition to the Commonwealth Minister requiring the proponent to quantify the extent of aquatic and nesting habitat that would be impacted by the project and provide compensatory measures to address the loss of potential aquatic and nesting habitat, should it be identified that there would be a residual significant impact.

Coordinator-General's conclusion

I consider that the proponent has adequately addressed the project's potential impacts on the Fitzroy River turtle. As a precautionary approach, I have recommended conditions to the Commonwealth Minister requiring the proponent to:

- construct a turtle way on the dam that provides safe passage for turtles. The turtle way design must be developed in consultation with EHP
- develop a TMP which provide a set of practical actions for the management of the Fitzroy River turtle during project planning and design, construction and commissioning, and operation. The TMP must be developed in consultation with EHP and is to be approved by the Commonwealth Minister prior to construction.

I have also recommended a condition requiring the proponent to:

- regulate water releases from the dam to maintain aquatic and nesting habitat downstream of the dam.
- quantify the extent of aquatic and nesting habitat that would be impacted by the project and provide compensatory measures to address the loss of potential aquatic and nesting habitat, should it be identified that there would be a residual significant impact.

In addition, the proponent has also committed to:

- ensure that the diversion channel constructed during construction is designed to allow for movement of aquatic fauna.
- ensure that the dam includes design features which minimise the risk of turtle injury and mortality
- employing an operating strategy which minimises risks of turtle injury and mortality
- maintain environmental flows downstream of the water storage area
- replenish sand banks downstream due to reduced flood flows resulting from the presence of the dam
- implement a weed and pest management strategy, which would reduce the potential for nest predation by foxes and other predators and enhance nesting banks through the removal of weeds

- prepare and/or contribute funding to a catchment wide research and monitoring program to address the cumulative impacts of the project on Fitzroy River turtle and the white-throated snapping turtle.

In light of the proposed avoidance and mitigation measures, and conditions in this report, I consider the impacts of the project on the Fitzroy River turtle are not unacceptable or inconsistent with the threat abatement plans relevant to the species.

Reptiles––marine species

Marine turtles

Background

The EIS identifies six species of threatened marine turtle, which may occur downstream of the project area within the Fitzroy River estuary and adjacent marine waters.

Impacts and mitigation

Given the distance of the project to marine areas (more than 620 km downstream from the project site) the project is not expected to have a direct impact on marine fauna. As discussed in the World Heritage properties section of this report, the proposed action is not expected to have any direct water quality or flow regime impacts on the estuarine/marine waters downstream of the Fitzroy Barrage and therefore no impacts on marine fauna including marine turtles are expected.

Coordinator-General's conclusion

I am satisfied that water quality impacts during the construction and operation of the dam would be adequately managed to avoid adverse impacts on the receiving environment and subsequently the estuarine/marine water downstream of the project site, which provide habitat for these marine fauna species.

In light of the proposed mitigation measures and conditions recommended in this report, I consider the impacts on listed threatened marine fauna would not be unacceptable.

6.7 Listed migratory species

In deciding whether or not to approve the proposal for purposes of section 20 or 20A of the EPBC Act, and what conditions to attach to such approval, the Commonwealth Environment Minister must not act inconsistently with Australia's obligations under the following conventions and agreements:

- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
- Japan–Australia Migratory Bird Agreement (JAMBA)
- China–Australia Migratory Bird Agreement (CAMBA)
- Republic of Korea–Australia Migratory Bird Agreement (ROKAMBA).

6.7.1 Terrestrial migratory birds

Background

A search of the PMST database identified nine listed migratory bird species as potentially occurring within 5 km of the project site. These species are listed in Table 6.5.

Table 6.5 EPBC Act-listed migratory birds potentially occurring in the project area

Common name *Species name*	EPBC Act listing status
Fork-tailed Swift *Apus pacificus*	Migratory marine
Oriental Cuckoo *Cuculus optatus*	Migratory terrestrial
White-throated needletail *Hirundapus caudacutus*	Migratory terrestrial
Yellow wagtail *Motacilla flava*	Migratory terrestrial
Satin flycatcher *Myiagra cyanoleuca*	Migratory terrestrial
Rufous fantail *Rhipidura rufifrons*	Migratory terrestrial
Curlew sandpiper *Calidris ferruginea*	Migratory wetland, critically endangered
Latham's snipe *Gallinago hardwickii*	Migratory wetland
Osprey *Pandion haliaetus*	Migratory wetland

A number of species listed in Table 6.5 are considered likely to occur in the project area on the basis of the presence of suitable habitat and/or existing records. These include:

- white-throated needletail—the EIS indicates that white-throated needletail were recorded within the water storage area and are considered likely to forage over the various wooded habitat types in the pipeline corridor. The white-throated needletail is found across a range of habitats, more often over wooded areas where it is almost exclusively aerial.
- satin flycatcher—the EIS indicates that satin flycatcher is considered likely to occur in the project area as there is suitable habitat present within the impact area associated with Nathan Gorge. These species is typically found in tall forests, preferring wetter habitats such as heavily forested gullies, riparian zones and other moist habitat types.

- rufous fantail—the EIS indicates that rufous fantail is considered likely to occur in the project area as there is suitable habitat present within the impact area associated with Nathan Gorge. This species is found in a range of habitats including rainforest, dense wet forests, swamp woodlands and mangroves.
- Latham's snipe—the EIS indicates that Latham's snipe may occur as the floodplain wetlands of the Dawson River within the storage area would provide ideal habitat for this species. While there is suitable habitat there are no records of this species in the project area.

The EIS did not assess the likelihood of occurrence for the fork-tailed swift, oriental cuckoo, yellow wagtail, osprey and curlew sandpiper. These species were not identified in the PMST database search at the time of the EIS. None of these species, with the exception of the fork-tailed swift, have been found in the project area and the area is not considered to provide significant habitat for these species.

The nearest record of the yellow wagtail is over 200 km north-west of the project site. The yellow wagtail typically occurs in well-watered open grasslands and the fringes of wetlands and is known to roost in mangroves and other dense vegetation.

The nearest record of the osprey is over 140 km north-east of the project site. The species is mostly found in coastal areas but occasionally travels inland along major rivers and may occur over atypical habitats such as heath and woodland when travelling to and from foraging sites.

The closest record of the curlew sandpiper is over 225 km south-east, from Lake Broadwater Conservation Park near Dalby.

The closest record of the oriental cuckoo is over 50 km north of the project site. This species is typically found in monsoonal rainforest, vine thickets, wet sclerophyll forest or open casuarina, acacia or eucalyptus woodlands.

There is one record of the fork-tailed swift in the project area, along the Dawson River in the water storage area. This species is found across a range of habitats, from inland open plains to wooded areas where it is exclusively aerial.

Other migratory species that the EIS assessed include:

- rainbow bee-eater (*Merops ornatus*)
- cattle egret (*Ardea ibis*)
- great egret (*Ardea alba*)
- painted snipe (*Rostratula benghalensis*)
- white-bellied sea-eagle (*Haliaeetus leucogaster*)
- barn swallow (*Hirundo rustica*)
- black-faced monarch (*Monarcha melanopsis*)
- little curlew (*Numenius minutus*)
- cotton pygmy-goose (*Nettapus coromandelianus albipennis*).

The rainbow bee-eater, cattle egret and great egret were removed from the list of migratory species under section 209 of the EPBC Act on 9 June 2016. The painted snipe and white-bellied sea-eagle was removed from this list on 30 June 2015. The

cotton pygmy-goose is not listed as a migratory species under the EPBC Act. As such these species are not discussed in this chapter.

The EIS indicates that there are no records of the barn swallow, black-faced monarch and little curlew in the project area however it is considered that the species may use the project area. The EIS indicates that the:

- barn swallow is known to use the disturbed agricultural areas present in the project area.
- black-faced monarch may use the waterways in the project area along its migratory route
- little curlew may use the floodplain and pasture areas during seasonal events.

Coordinator-General's conclusion

I consider that my recommended conditions requiring the proponent to undertake compensatory measures to address the loss of habitat for the squatter pigeon, and MSES and MNES vegetation (i.e. regulated vegetation, connectivity areas and the brigalow and GAB springs ECs) would have a benefit to migratory birds. This includes the provision of a buffer area above the dam FSL, a wildlife corridor to the north of the dam and vegetation offsets

The revegetation and regenerative works proposed by the proponent would involve the creation of similar habitat to that being impacted and would also improve connectivity between Spring Creek and the Boggomoss and Mount Rose nature refuges and would be relevant to the white-throated needle-tail, fork-tailed swift, rufous fantail, Satin flycatcher and Latham's snipe.

In light of the proposed avoidance and mitigation measures and conditions in this report, I consider the impacts on terrestrial migratory birds would not be unacceptable and the proposed management actions would not be inconsistent with Australia's obligations under the Bonn Convention, CAMBA, JAMBA and ROKAMBA and relevant threat abatement plans (TAPs).

6.7.2 Migratory marine fauna

Background

The EIS identifies a number of migratory marine fauna which may occur downstream of the project area within the Fitzroy River estuary and adjacent marine waters. This includes 12 species of marine mammal and 6 species of marine turtle.

The salt-water crocodile (*Crocodylus porosus*) was also included in the assessment on migratory fauna. The salt-water crocodile is considered unlikely to occur in the project area as there are no records and the main section of the Dawson River is considered to provide unsuitable habitat. The nearest record of this species is from the Fitzroy River.

Impacts and mitigation

Given the distance of the project to marine areas (more than 620 km downstream from the project site) the project is not expected to have a direct impact on listed migratory marine fauna. As discussed in the World Heritage properties section of this report, the proposed action is not expected to have any direct water quality or flow regime impacts on the estuarine/marine waters downstream of the Fitzroy Barrage and therefore no impacts on listed migratory marine fauna.

Coordinator-General's conclusion

I am satisfied that the EIS has identified the potential impacts that the proposed action could have on listed threatened marine fauna. I am satisfied that water quality impacts would be adequately managed to avoid adverse impacts on the receiving environment and subsequently the estuarine/marine water downstream of the project site, which provide habitat for these migratory marine fauna species.

In light of the proposed mitigation measures and conditions recommended in this report, I consider the impacts on migratory marine fauna would not be unacceptable.

6.8 Commonwealth marine areas

A 'Commonwealth marine area' (CMA) is defined in section 24 of the EPBC Act as any part of the sea, including the waters, seabed, and airspace, within Australia's exclusive economic zone (between 3 and 200 nautical miles offshore) and/or over the continental shelf of Australia, that is not State or Northern Territory waters.

The nearest CMA to the project is the Commonwealth Coral Sea Marine Reserve. The Coral Sea Marine Reserve is adjacent to, but does not include, the Great Barrier Reef Marine Park and covers Australian waters east of Cape York Peninsula, south to 24˚29′S (north-east of Bundaberg).

While the project is not located within the Marine Reserve, the marine fauna which are listed as key conservation values for the Marine Reserve include marine turtles which use the inshore habitats where water released from the dam would ultimately drain into (i.e. the Fitzroy River mouth and Keppel Bay.

As discussed in the World Heritage properties section, the project is not expected to have a direct impact on the marine environment, given the proximity of the dam site to the Great Barrier Reef (GBR) (more than 620 km away) and the measures proposed by the proponent during the construction and operation of the dam to manage water quality impacts. In addition the proponent would be required by the Fitzroy ROP to ensure that water releases for the dam are consistent with the EFOs for the Fitzroy Barrage.

I therefore consider that the project is unlikely to have an impact on any key conservation values relevant to the Coral Sea Commonwealth Marine Reserve and therefore the overall integrity of the whole of the environment of the CMA.

6.9 Coordinator-General's overall conclusion

I conclude that the proponent has adequately identified the impacts of the project on the OUVs of the GBRWHA, outstanding heritage values of the GBR, ecological value of the Shoalwater and Corio Bays Ramsar site, CMA, threatened species, ecological communities and migratory species listed under the EPBC Act.

I also conclude that provided the proponent adheres to the proposed avoidance, mitigation and offset measures proposed and committed to in the EIS, in addition to my imposed, stated and recommended conditions in this report that the project is unlikely to be inconsistent with any international conventions relevant to threatened species and communities, migratory species (Bonn Convention, JAMBA, CAMBA and ROKAMBA) and World Heritage properties and Ramsar areas.

6.9.1 Great Barrier Reef World Heritage Area

I am satisfied that the EIS has identified the potential impacts that the project could have on the OUVs of the GBRWHA. The proponent would be required under State legislation to ensure that water releases are made to meet the EFOs at the Fitzroy Barrage reporting node to the extent possible and therefore have no impact on flow regimes downstream of the barrage and the waters of the GBRWHA.

I consider that any losses of riparian vegetation would be compensated by my stated conditions requiring the proponent to provide offsets to compensate for the loss of vegetation regulated under State legislation (regulated vegetation and connectivity) and my recommended conditions to the Commonwealth Environment Minister requiring the proponent to provide offsets for the loss of habitat for EPBC Act-listed threatened species (boggomoss snail) and threatened ecological communities (brigalow and GAB spring EC).

I also consider that the rehabilitation and revegetation of the flood buffer area around the dam would also assist in enhancing and increasing the area of riparian vegetation around the dam. The project would therefore unlikely to negatively influence progress towards meeting the Reef 2050 Plan targets for riparian vegetation.

I note the proponent's commitment to mechanically clear woody vegetation from the impoundment prior to filling would significantly reduce the potential for water quality impacts on the GBRWHA from decaying vegetation. I consider that the proponent's commitment to an operational release strategy after filling the dam would also assist in reducing water quality impacts downstream.

I also note the proponent's commitment to undertake water quality monitoring during the operation of the dam as part of their obligations under the Queensland *Water Act 2000* and to provide the results of this monitoring to the DEE for consideration in terms of potential water quality impacts on the GBR. I consider that the provision of a buffer area above the FSL would also be expected to assist in reducing water quality impacts by reducing the potential for sediments and contaminants entering waterways through land-based run-off.

As no water is proposed to be allocated to new agricultural users, the dam is not expected to result in any substantial increase in land-based run-off from agricultural activities. I note that the mining, industrial and urban operators that the dam would supply water to would be subject to separate approvals for undertaking activities which have the potential to impact on water quality. These activities would be regulated under Queensland legislation.

As such there would be legislative controls to ensure these activities do not have an adverse impact on the water quality of the receiving environment. As such it is considered that the project is unlikely to contribute to any substantial increase and sediments and nutrients entering the GBR system and GBRWHA. The project would therefore unlikely to negatively influence progress towards meeting the Reef 2050 Plan targets for water quality.

In light of the proposed avoidance, mitigation and offset measures and conditions in this report, I consider that the project would not have unacceptable impact on the OUVs of the GBRWHA.

6.9.2 Great Barrier Reef National Heritage place

As the GBR National Heritage place covers a similar area to the GBRWHA, I consider that the matters discussed in this chapter for World Heritage properties (refer to Section 6.3) apply equally to the GBR National Heritage place.

Consistent with the discussion on World Heritage properties, I consider that the project is not expected to have any unacceptable impacts on the GBR National Heritage place.

6.9.3 Wetlands of international importance

I conclude that project would not be expected to result in any substantial or measurable change in the water quality or hydrological regime of the wetland therefore unlikely to impact on the habitat or lifecycle of any species of fauna which are dependent on the Ramsar site.

If the project is approved, I consider that the proponent's obligations under Queensland legislation including the *Water Act 2000* and the Environmental Protection (Water) Policy 2009 would ensure that the project does not have adverse impact on water quality and hydrological processes downstream.

I therefore consider that the project would not have an unacceptable impact on the ecological character of the Shoalwater and Corio Bays Area Ramsar site.

6.9.4 GAB spring EC

I am satisfied that the EIS has identified the potential impacts that the proposed action could have on the GAB spring EC. I am satisfied that the proponent's commitments to implement weed and pest management measures (as specified in the draft EMP) are appropriate for maintaining this EC.

Should the Commonwealth Environment Minister decide to approve the project, recommend the following conditions requiring the proponent to:

- avoid and limit physical disturbance to the springs within the pipeline route
- develop a groundwater dependent ecosystem management plan which monitors for an includes measure to address any impacts on spring ECs during the construction and operation of the project
- provide an offset management plan to address the project's residual significant impacts on the GAB spring EC. I have recommended that the offset management plan includes details of a monitoring program to monitor GAB spring ECs at the offset sites for any signs of adverse impacts including changes in groundwater aspects resulting from the dam and measures for addressing impacts.

In the event that the proposed offsets for the GAB spring EC are not achieving a conservation gain for the EC, I have recommended a condition requiring that alternative offsets are proposed.

In light of the proposed mitigation and offset measures and conditions recommended in this report, I conclude that the proposed management actions are not inconsistent with the recovery plan for the GAB spring EC.

6.9.5 Brigalow EC

I am satisfied that the EIS has identified the potential impacts that the proposed action could have on the brigalow EC. The project is expected to impact on a total of 173.3 ha of brigalow EC. I am satisfied that the proponent's commitments to implement weed and pest management measures (as specified in the draft environmental management plans) are appropriate for maintaining the brigalow EC.

If the Commonwealth Environment Minister decides to approve the proposed action, I recommend that the Minister consider the following recommended conditions:

- undertake a pre-clearance survey to determine the actual area of the brigalow EC that would be impacted by the project
- provide an offset for the residual significant impacts on brigalow EC.

In light of the proposed mitigation and offset measures and conditions recommended in this report, I conclude that the approved conservation advice for this species has been considered; the proposed management actions are not inconsistent with the relevant threat abatement plans; and the impacts on the brigalow EC are not unacceptable.

6.9.6 Boggomoss snail

I am satisfied that the EIS has identified the potential impacts that the proposed action could have on the boggomoss snail. I consider that water releases from the dam could be managed to ensure no adverse impacts on the hydrological regime of the downstream riparian habitats known to support the boggomoss snails, provided that releases from the dam are appropriate for maintaining these habitats. Based on the information provided in the EIS, the proposed action would be expected to result in the permanent inundation and subsequent loss of 2.4 ha of the suitable habitat and the loss of one of six boggomoss snail populations.

I note that the recovery plan for this species is currently under review. If the Commonwealth Environment Minister decides to approve the proposed action, I recommend that the Minister consider the following recommended conditions:

- Develop and implement a BSMP which includes a management framework that includes measures for addressing the impacts of the project on the boggomoss snail during construction and operation of the project, including actions (direct and indirect) to reduce threats on populations downstream
- manage water releases from the dam to ensure appropriate hydrological regimes are maintained at the boggomoss snail habitat downstream at Gyranda, Nardoo, Southend, Isla Delusion and Kia Ora
- undertake long-term monitoring of flow regimes during the operation of the dam to ensure boggomoss snail habitats downstream are not being adversely affected and undertake corrective actions in the event that monitoring shows that habitat is being adversely affected
- to address the loss of the Mount Rose population undertake a trial translocation project for at a suitable site outside of the inundation footprint (currently not occupied by any snails). The trial must demonstrate that the receiving translocation site can support a self-sustaining population and be used to inform success criteria and ongoing management actions. If the trial demonstrates that the receiving translocation site can support a self-sustaining population, translocate the Mount Rose population to the receiving site and ensure that the site is secured under a conservation agreement and managed to maintain a viable population
- undertake long-term monitoring to ensure success criteria for translocation are being achieved and take corrective action where the criteria are not being achieved
- provide an offset for the loss of 2.4 ha of boggomoss snail habitat. Ensure that the offset site/s is secured under a conservation agreement and managed to maintain a viable population.

6.9.7 Squatter pigeon (southern)

I am satisfied that the EIS has adequately identified the potential impacts that the project could have on the squatter pigeon. I consider that the proposed revegetation and rehabilitation works within the water storage buffer zone, wildlife corridor, and the GAB spring and brigalow EC offset areas would compensate any loss of squatter pigeon habitat. I consider the impacts on the squatter pigeon are not unacceptable. I also consider that the proposed mitigation measures including weed and pest management are not inconsistent with the relevant threat abatement plans.

6.9.8 Fitzroy River turtle

I consider that the proponent has adequately addressed the project's potential impacts on the Fitzroy River turtle. As a precautionary approach, I have recommended conditions to the Commonwealth Minister requiring the proponent to:

- construct a turtle way on the dam that provides safe passage for turtles. The turtle way design must be developed in consultation with EHP

- develop a TMP which provide a set of practical actions for the management of the Fitzroy River turtle during project planning and design, construction and commissioning, and operation. The TMP must be developed in consultation with EHP and is to be approved by the Commonwealth Minister prior to construction.

I have also recommended a condition requiring the proponent to

- regulate water releases from the dam to maintain aquatic and nesting habitat downstream of the dam.
- quantify the extent of aquatic and nesting habitat that would be impacted by the project and provide compensatory measures to address the loss of potential aquatic and nesting habitat, should it be identified that there would be a residual significant impact.

In addition, the proponent has also committed to:

- ensure that the diversion channel constructed during construction is designed to allow for movement of aquatic fauna.
- ensure that the dam includes design features which minimise the risk of turtle injury and mortality
- employing an operating strategy which minimises risks of turtle injury and mortality
- maintain environmental flows downstream of the water storage area
- replenish sand banks downstream due to reduced flood flows resulting from the presence of the dam
- implement a weed and pest management strategy, which would reduce the potential for nest predation by foxes and other predators and enhance nesting banks through the removal of weeds
- prepare and/or contribute funding to a catchment wide research and monitoring program to address the cumulative impacts of the project on Fitzroy River turtle and the white-throated snapping turtle.

In light of the proposed avoidance and mitigation measures, and conditions in this report, I consider the impacts of the project on the Fitzroy River turtle are not unacceptable or inconsistent with the threat abatement plans relevant to the species.

6.9.9 Migratory birds and other migratory fauna

I consider that my recommended conditions requiring the proponent to undertake compensatory measures to address the loss of habitat for the squatter pigeon, and MSES and MNES vegetation (i.e. regulated vegetation, connectivity areas and the brigalow and GAB springs ECs) would also have a benefit to migratory birds. This includes the provision of a buffer area above the dam FSL, a wildlife corridor to the north of the dam and offsets for other vegetation.

The proposed revegetation and regenerative works would involve the creation of similar habitat to that being impacted and would also improve connectivity between Spring Creek and the Boggomoss and Mount Rose nature refuges. This would be relevant to the white-throated needle-tail, fork-tailed swift, rufous fantail, satin flycatcher and Latham's snipe.

In light of the proposed avoidance and mitigation measures and conditions in this report, I consider the impacts on terrestrial migratory birds are not unacceptable and the proposed management actions are not inconsistent with Australia's obligations under the Bonn Convention, CAMBA, JAMBA and ROKAMBA and relevant TAPs.

6.9.10 Migratory marine fauna

I am satisfied that the EIS has identified the potential impacts that the proposed action could have on listed threatened marine fauna. I am satisfied that water quality impacts would be adequately managed to avoid adverse impacts on the receiving environment and, subsequently, the estuarine/marine water downstream of the project site which provide habitat for these migratory marine fauna species.

In light of the proposed mitigation measures and conditions recommended in this report, I consider the impacts on migratory marine fauna would not be unacceptable.

6.9.11 Commonwealth Marine Areas

The closest CMA to the project is the Commonwealth Coral Sea Marine Reserve. The Coral Sea Marine Reserve is adjacent to, but does not include, the Great Barrier Reef Marine Park and covers Australian waters east of Cape York Peninsula, south to 24˚29′S (north-east of Bundaberg).

While the project is not located within the Marine Reserve, the marine fauna which are listed as key conservation values for the Marine Reserve including marine turtles which use the inshore habitats where water released from the dam would ultimately drain into (i.e. the Fitzroy River mouth and Keppel Bay).

As discussed in the World Heritage properties section, the project is not expected to have a direct impact on the marine environment, given the proximity of the dam site to marine waters (more than 620 km) and the measures proposed by the proponent during the construction and operation of the dam to manage water quality impacts. In addition, the proponent would be required by the Fitzroy ROP to ensure that water releases for the dam and consistent with the EFOs for the Fitzroy Barrage.

I therefore consider that the project is unlikely to have an impact on any key conservation values relevant to the Coral Sea Commonwealth Marine Reserve and therefore the overall integrity of the whole of the environment of the CMA.

7. Conclusion

In undertaking my evaluation, I have considered the following:

- the EIS and AEIS prepared for this project
- submissions on the EIS and AEIS, including agency advice
- subsequent information provided by the proponent during the EIS evaluation stage.

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

The environmental assessment commenced with the declaration of this project as a significant project in 2008 and has involved a comprehensive body of work by the proponent.

As discussed in Section 2 (About the project), commencement of the project is contingent upon demand from mining customers and their development timeframes. Currently the region is experiencing a slow-down in the mining industry, and the demand for water that existed in 2008 has reduced significantly. Current water demands from mining customers are being met through the use of treated CSG water.

Should the projected level of demand from mining customers increase in the future, detailed feasibility studies would be undertaken prior to the project proceeding. If feasibility studies conclude that the project should proceed, the proponent would be required to undertake further work in the detailed design phase of the project.

I have assessed and considered the potential impacts identified in the EIS documentation and all submissions. I consider that the mitigation measures and commitments proposed by the proponent together with the conditions and recommendations included in this report would result in overall acceptable outcomes.

Section 6 of this report (MNES) describes the extent to which the material supplied by the proponent addresses the likely impacts on MNES of each controlled action for the project. I am satisfied that the proponent has addressed all potential impacts on MNES.

Based on the information provided by the proponent and outlined in this evaluation report, I conclude that the project could help deliver a secure water supply that would meet future water demands from the mining industry in the Surat Basin and industrial uses in the region. The project has the potential to generate economic benefits throughout the region, including 525 construction jobs, up to 5 operational jobs and capital expenditure of $1.2 billion (based on 2012 values). Accordingly, I recommend that the Nathan Dam and Pipelines project proceed subject to conditions and recommendations in Appendixes 1–4. In addition, I expect that the proponent's commitments will be fully implemented as presented in the EIS documentation and summarised in Appendix 5 of this report.

To proceed further, the proponent will be required to obtain a range of development approvals, including but not limited to:

- EPBC Act approval
- relevant environmental authorities under the EP Act
- relevant development approvals under the SP Act

The proponent will also be required to finalise and implement the EMP and finalise the environmental offsets plan for both MNES and MSES.

Copies of my report will be issued to:

- DEE
- EHP
- DNRM
- TMR
- DAF
- BSC
- WDRC
- The Commonwealth Minister for the Environment and Energy.

A copy of this report will be available at **www.statedevelopment.qld.gov.au**

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

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.

In accordance with 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.

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(4) of the SDPWO Act, I have nominated several entities to have jurisdiction for the conditions in this schedule.

Schedule 1 Social impact assessment

These imposed conditions specifically apply to the management of the social impacts associated with the project.

The Coordinator-General is to have jurisdiction for the conditions in this schedule.

Condition 1 Social impact assessment update

The purpose of this condition is to ensure that the social impact assessment and the social impact action plans for the project reflect the current social context.

Six months prior to the commencement of construction, provide to the Coordinator-General an updated social impact assessment for approval.

(a) The updated Social Impact Assessment must include:
  (i) a revised social baseline to ensure the assessment of impacts is accurate in the current social and economic environment
  (ii) revised social impact action plans which include:
    (A) identification of current positive and negative project impacts
    (B) current mitigation and management strategies for identified impacts
    (C) timeframes for implementation of mitigation and management strategies
    (D) outcomes to be achieved.

(b) Implement the revised social impact action plans throughout the construction and operation of the project.

(c) The social impact assessment update and subsequent action plans must be made publicly available by the proponent on its website within 1 month of the approval of the updated social impact assessment by the Coordinator-General.

Condition 2 Stakeholder Engagement Plan

The purpose of this condition is to enure that stakeholder interests in the project are clearly indentified and effectively managed.

(a) Submit a stakeholder engagement plan for Coordinator-General approval 6 months prior to the issuing of any notices of intention to resume in accordance with the *Acquisition of Land Act 1967*.

(b) The plan must include the following:

(i) an analysis of stakeholders and stakeholder issues

(ii) engagement schedules and programs including tailored engagement procedures with groundwater users

(iii) communication activities and tools

(iv) roles and responsibilities for engagement

(v) opportunities for stakeholder review and comment

(vi) grievance mechanisms and a complaints register

(vii) monitoring and reporting requirements and protocols

(viii) evidence of how issues raised in the EIS and AEIS public submissions will be addressed.

(c) Implement the stakeholder engagement plan prior to issuing notices of intention to resume for the project and during the construction and operation of the project.

(d) Make the stakeholder engagement plan publicly available on the proponent's website within 1 month of Coordinator-General's approval under (a).

Condition 3 Annual social impact management report

The purpose of this condition is to report on the effectiveness of measures to mitiagtae and manage the potential social impacts assocated with the construction of the project.

(a) Provide an annual social impact management report (SIMR) for approval to the Coordinator-General for a period of five years from the commencement of construction.

(b) The SIMR must describe the strategies and actions implemented and the outcomes achieved to:

(i) engage with stakeholders (including water entitlement holders under the Dawson Valley Water Supply Scheme and existing groundwater users) to demonstrate that stakeholder concerns have been considered in making decisions to avoid, mitigate and manage social impacts

(ii) provide local and regional employment, training and development opportunities and mitigate and manage any project-related impacts on the local labour markets

(iii) mitigate and manage project-related impacts on the local and regional housing markets

(iv) mitigate and manage project-related impacts on community health, safety and wellbeing.

(c) The SIMR report must be made publicly available on the proponent's website within 1 month of Coordinator-General's approval under Condition 3(a), during each year of the reporting period.

Condition 4 Notice of construction

(a) Provide written notice to the Coordinator-General of the start date of the construction works the subject of this approval. The notice must be provided at least one month prior to the construction works commencing unless otherwise agreed by the Coordinator-General.

Schedule 2 White-throated snapping turtle

These imposed conditions specifically apply to the management of project impacts on *Elseya albagula* (white-throated snapping turtle).

The entity with jurisdiction for these conditions is the Department of Environment and Heritage Protection (EHP).

Allied conditions applying to the Fitzroy River turtle (*Rheodytes leukops*), a listed threatened species under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), are specified in Appendix 3.

Impacts of the project on breeding habitat are addressed in the recommendations for a Species Management Program (SMP) under the *Nature Conservation Act 1992* (NC Act) required in Appendix 4, Schedule 5, Recommendation 9.

Part A Turtle management plan

Condition 5 Turtle management plan for the white-throated snapping turtle

The outcome sought by this condition is the development and delivery of a turtle management plan (TMP) that provides a management framework for avoiding and mitigating impacts of the project on the white-throated snapping turtle and its nesting and foraging habitats throughout the life of the project.

(a) Prior to commencement of construction, submit to EHP for approval, a TMP for the white-throated snapping turtle.

(b) The TMP must be prepared in accordance with the commitments made in EIS and AEIS documents and must be consistent with the conditions in this Coordinator-General's report.

(c) The TMP must be prepared by a suitably qualified person in consultation with EHP and have regard to the best scientific knowledge on the preferred foraging and nesting habitats, breeding timing and behaviours of the white-throated snapping turtle.

(d) Prior to commencing construction, survey the proposed dam construction and inundation areas to quantify the extent of actual and potential white-throated snapping turtle nesting and aquatic habitat that would be impacted by the dam. This must include any actual and potential impacts on areas outside the project's footprint.

(e) Surveys required by (d) must be:

  (i) completed by a suitably qualified person

  (ii) undertaken during appropriate time of the year (i.e. when turtles are most active and breeding).

(f) Provide the TMP to EHP, as soon as practical after the survey but no later than 3 months prior to any impacts, which identifies, maps and quantifies any aquatic and nesting habitat within the dam construction and inundation areas that will be directly or indirectly impacted by the project.

(g) The TMP must contain details of how the strategy would be applied on land, riparian areas and instream (including the impoundment) in relation to all habitats used by the white-throated snapping turtle.

(h) Delivery of the TMP must include engagement of third parties (e.g. adjacent landholders, NGOs, research bodies) as the life cycle of the white-throated snapping turtle and protection of its habitats may require protection outside the direct impacts of the project.

(i) The TMP must detail how the local population and habitats for the white-throated snapping turtle would be managed during construction and operation of the project.

(j) This TMP must include but not be limited to:

  (i) nest protection and management measures such as feral animal control, the use of protective mesh over nests, and the exclusion of cattle from nesting areas

  (ii) management of flow regimes downstream to avoid impacts on individual turtles and turtle habitats.

(k) The TMP must not be inconsistent with any SMP (if required) for the white-throated snapping turtle which would be required to be submitted separately to EHP under the requirements of the NC Act.

(l) The TMP must include requirements outlined in Schedule 2, Part A, Condition 5 to Condition 10.

(m) Implement the approved TMP during the construction and operation phases of the project.

Note: The proponent may prepare one TMP that addresses a combined management framework for avoiding and mitigating the project's direct and indirect impacts on the NC Act-listed white-throated snapping turtle and the EPBC-listed Fitzroy River turtle.

Condition 6 Turtle movement study

The outcome sought by this condition is the provision of sufficient information on the movement of the white-throated snapping turtle to inform the design of turtle passage infrastructure and adaptive management strategies for the dam.

(a) Prior to finalisation of the design for the turtle passage infrastructure, either undertake a turtle movement study to collect baseline data at locations approved by EHP or provide existing information which satisfies the same outcomes.

(b) The turtle movement study must:

  (i) collect data on seasonal movement patterns and home ranges of the white-throated snapping turtle. The study should include wet and dry season movements, breeding periods and nesting distribution

  (ii) be prepared and undertaken by a suitably qualified person in accordance with a methodology agreed in writing by EHP

  (iii) inform the development of the criteria for monitoring the success of turtle movement past the dam (the turtle movement success criteria) based on the data collected during turtle movement study.

(c) The methodology for the study must be submitted to EHP for approval, 90 days prior to commencing the turtle movement study, or as otherwise agreed with EHP.

(d) The turtle movement success criteria must be approved by EHP, in writing, prior to the construction of turtle passage infrastructure at the dam site.

Condition 7 Turtle passage infrastructure

The outcome sought by this condition is that the development of the dam does not restrict the long-term movement of the white-throated snapping turtle past the dam infrastructure and the impoundment.

(a) Infrastructure to facilitate turtle passage around the dam (turtle passage infrastructure) must be built prior to the commencement of operation of the dam.

(b) Construct the turtle passage infrastructure at the dam site generally in accordance with a design approved by EHP and informed by a turtle movement study as required by Schedule 2, Condition 6 or another turtle movement study carried out in the Fitzroy River catchment that has been approved by EHP.

(c) Ensure turtle passage infrastructure and dam design and operation avoid or minimise the incidence of turtle injury or mortality as a result of operation of the infrastructure.

(d) Monitor the effectiveness of the turtle passage infrastructure against success criteria approved by EHP in Schedule 2, Condition 6(d).

(e) Methodology to be used for the monitoring and reporting of the effectiveness of the turtle passage infrastructure must be prepared and externally peer reviewed.

(f) Monitoring and reporting must be undertaken by a suitably qualified person.

(g) Report to EHP on the effectiveness of the turtle passage infrastructure in relation to the turtle movement success criteria twelve months after the construction of the dam and annually thereafter.

(h) If monitoring evidence indicates that the turtle movement success criteria are not being met, the turtle passage infrastructure or its operation is to be modified to achieve the success criteria.

(i) Maintain the operation of the turtle passage infrastructure while the dam remains in operation and provide for the safe access to the dam infrastructure (including the turtle passage infrastructure) for monitoring and compliance purposes.

(j) Requirements for monitoring and reporting, as well as the success criteria (should be reviewed 5 years after the completion of construction and subsequently every 5 years).

Condition 8 Turtle movement contingency plan

The outcome sought by these conditions is to ensure that appropriate actions are implemented in the event that the success criteria are not met.

(a) Should the monitoring specified by Condition 7(d) provide evidence that turtle movement success criteria are not being met, implement an ongoing catch and release program until the criteria are met.

(b) The catch and release program must ensure turtle passage past the dam site in both directions.

(c) The catch and release program must be approved by EHP prior to implementation.

(d) The catch and release program must be prepared and implemented by a suitably qualified person generally in accordance with a methodology agreed by EHP.

Condition 9 Downstream turtle nest inundation management

The outcome sought by this condition is to support the breeding success of the white-throated snapping turtle.

(a) During the period from May to January each year (subject to river inflow), water releases should be managed to minimise the inundation of nests downstream of the dam site as far as Beckers.

(b) During the first year of operation, engage with EHP and DNRM to establish a volumetric flow performance regime that meets the objective stated in (a).

Condition 10 Maintenance of pool-riffle run habitat

The outcome sought by this recommendation is to maintain suitable aquatic habitat downstream of the dam for the white-throated snapping turtle.

(a) Subject to river inflows manage operational releases to mimic natural flow conditions as much as possible in order to maintain downstream pool-riffle-run sequences and associated habitat.

(b) During the first year of operation of the dam, engage with EHP and DNRM to establish a volumetric flow performance regime that meets the objective stated in (a).

(c) During the second year of operation of the dam, implement the performance regime derived in (b).

Definitions

Catch and release program: To capture turtles on one side of the physical barrier (dam infrastructure) and release them on the other side. The methodology and timing are to be approved by EHP.

Construction: any earthworks or building activities associated with the project other than:

(a) installation of wind monitoring masts or weather stations

(b) building / road dilapidation surveys or any other surveys

(c) investigative drilling and geotechnical investigations

(d) establishing temporary site offices and construction compounds

(e) material delivery

(f) installation of environmental impact mitigation measures, fencing and enabling works

(g) minor access tracks.

Suitably qualified person: means a person/s or entity who has professional qualifications, training or skills or experience relevant to the nominated subject matters and can give authoritative assessment, advice and analysis about performance relevant to the subject matters using relevant protocols, standards, methods or literature.

Appendix 2. Stated conditions

This appendix contains conditions stated by the Coordinator-General under section 39(1)(a) of the SDPWO Act.

Schedule 1 *Sustainable Planning Act 2009*

Part A Vegetation offsets

Condition 1 Regulated vegetation and connectivity offsets

The entity with jurisdiction for these conditions in this schedule is the Department of Natural Resources and Mines (DNRM).

The outcome sought by this condition is to ensure that suitable offsets are provided for any significant residual impacts of the project on regulated vegetation and connectivity. The relevant other Act for this condition under section 18(1) of the EO Act is the *Vegetation Management Act 1999*.

(a) Subject to (b) the significant residual impacts on prescribed environmental matters resulting from a prescribed activity are authorised to the maximum extent of impact identified for the prescribed environmental matters in Table A1.

Table A1. Authorised maximum extent of impact on prescribed environmental matters

Prescribed environmental matter	Estimated maximum disturbance (i.e. maximum residual impact to habitat) (ha)**	
	Dam, surrounds and associated infrastructure	Pipeline
Regulated vegetation		
Endangered regional ecosystem 11.3.1*	61.9	0
Endangered regional ecosystem 11.9.1*	36.8	0
Endangered regional ecosystem 11.9.5*	25.2	0.3
Endangered regional ecosystem 11.9.5a*	4.6	0
Endangered regional ecosystem 11.9.6*	0	0.1
Of concern regional ecosystem 11.3.2	441.3	1.2
Of concern regional ecosystem 11.3.3	1026.2	0.4
Of concern regional ecosystem 11.3.4	169.1	0.9
Of concern regional ecosystem 11.3.22	17	0
Of concern regional ecosystem 11.9.7	33.7	0
Of concern regional ecosystem 11.9.10	59.1	1.4
Essential habitat^	134.7	0
Vegetation intersecting a wetland^	19.1	0.1
Regional ecosystems located within a defined distance of the defining banks of a watercourse^	1669.3	6.8
Connectivity area[#]	2503.7	0

* Overlaps with Commonwealth offset for the brigalow ecological community.

** Estimated extents based on information disturbance figures in the EIS derived from the current Regulated Vegetation management map. These extents still need to be verified by the Queensland Herbarium.

^ Overlaps partially with endangered and of concern regional ecosystems.

Includes regulated vegetation (endangered and of concern regional ecosystems) and least concern regional ecosystems.

(b) Significant residual impacts on prescribed environmental matters identified in Table A1 resulting from a prescribed activity are not authorised unless:

  (i) the proponent, in consultation with the administering authority, prepares a notice of election to counterbalance the significant residual impacts of the prescribed environmental matters identified in Table A1

  (ii) the notices of election must be prepared generally in accordance with sections 18 and 19 of the EO Act and are given to the administering agency in the approved form (section 92 of the EO Act)

  (iii) the notice of election are given to the administering agency for approval no less than 90 days prior to the commencement of any disturbance activity that will result in a significant residual impact on the identified prescribed environmental matters in Table A1

  (iv) agreed delivery arrangements are entered into, in accordance with section 19 of the EO Act.

(c) Prior to the commencement of construction, a report completed by an appropriately qualified person, which includes an analysis of the following, must be provided to the administering agency:

  (i) the estimated significant residual impacts of the project to each prescribed environmental matter

  (ii) if applicable—the actual significant residual impacts to each prescribed environmental matter, to date.

(d) The report required by (c), must be approved by the administering agency before a notice of election, if applicable, is given to the administering agency.

Note: The proponent may co-locate offsets for multiple prescribed environmental matters arising from the different authorities regardless of whether the authorities are issued by Commonwealth, State or local government—provided that the proposed management activities provide benefits for all of the prescribed environmental matters, and that a conservation outcome can be achieved for all of the prescribed environmental matters.

Definitions

Notice of election: means a notice mentioned in section 18(2) of the EO Act by which an authority holder elects to deliver an environmental offset.

Prescribed environmental matters: Is any of the following matters prescribed under a regulation:

(a) a matter of national environmental significance

(b) a matter of state environmental significance

(c) a matter of local environmental significance.

Refer to section 10(1) of the EO Act for further detail.

Significant residual impact: as defined in Section 8 of the EO Act 2014.

Appendix 3. Recommended conditions for the Commonwealth Environment Minister

In accordance with clause 21 of the Bilateral agreement between the Commonwealth Government and the State of Queensland, this section recommends conditions for consideration by the Commonwealth Minister for the Environment and Energy in making a decision on the proposed action under sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999* EPBC Act.

These recommended conditions relate to the Nathan Dam and Pipelines project (the proposed action).

Schedule 1 Great Barrier Reef World Heritage property and National Heritage place

Part A Water quality

Condition 1 Monitoring of changes in nutrient concentrations due to decaying vegetation

The outcome sought by this condition is to provide information on any increase in nutrients released from the dam caused by decaying vegetation within the water storage area during the initial filling stage.

(a) In addition to their monitoring and reporting requirements under their Resource Operational Licence granted under the Queensland *Water Act 2000*, the proponent must provide a report to the Commonwealth Minister after the initial filling of the water storage area. The report must include:

  (i) water quality data confirming the contribution of nutrient concentrations resulting from decaying vegetation within the water storage area during the first filling period of the dam

  (ii) any measures that were or would be undertaken to mitigate potential water quality impacts on the GBRWHA and National Heritage place

(b) Engage with the Department of Environment and Energy (DEE) to determine residual significant water quality impacts (if any) on the GBRWHA and National Heritage place.

(c) If a residual significant impact is confirmed in (b), propose an offset strategy to address the residual significant water quality impacts (if any) on the GBRWHA and National Heritage place.

(d) The timeframe for submission of the proposed offset strategy must be agreed to in consultation with DEE.

Condition 2 Dam water allocations for agriculture

The outcome sought by this condition is to ensure the supply of additional water from the dam does not result in an expansion or intensification of agricultural activities that would affect the water quality of the GBRWHA and National Heritage place.

(a) In consultation with DNRM, the approval holder must ensure that no additional water is provided to agricultural users, which could otherwise intensify agricultural land uses and contribute to water quality impacts on the GBRWHA and National Heritage place.

Schedule 2 Threatened species and ecological communities

Part A Pre-clearance surveys for threatened species and ecological communities

Condition 3 Pre-clearance surveys

The outcome sought by this condition is to identify the presence and extent of impacts from the project to any EPBC Act-listed threatened species and their habitat; and ecological communities.

(a) Prior to clearing/inundation of vegetation, the approval holder must undertake pre-clearance surveys in the impact areas to identify the presence and extent of any EPBC Act-listed threatened species and their habitat; and ecological communities.

(b) Pre-clearance surveys must:

  (i) be undertaken generally in accordance with the DEE's survey guidelines in effect at the time of the survey, or another survey methodology agreed by the DEE prior to surveys being undertaken

  (ii) be undertaken by a suitably qualified person/s

  (iii) identify measures to minimise the mortality of EPBC Act-listed species and impacts on ecological communities as a result of the project

  (iv) identify measures to protect EPBC Act listed threatened species and ecological community habitat located adjacent to the areas to be cleared/inundated

(c) Due to the boggomoss snail being a cryptic species, the survey methodology undertaken to identify the presence and extent of the species must be developed in consultation with DEE and relevant malacologist or a suitably qualified person. The methodology must be approved by DEE prior to commencement of pre-clearance surveys.

(d) For any EPBC Act listed threatened species and ecological communities identified during these surveys, provide to the DEE:

  (i) precise data on the areas of habitat or ecological community directly and indirectly impacted by the action

  (ii) details of proposed mitigation and management

  (iii) an Offset Strategy for any residual significant impacts.

(e) The approval holder must provide a survey report to the Minister within 30 days of the completion of the surveys.

(f) The survey report must include details of survey methods, timing and information and management proposals.

Part B Offset strategy

Condition 4 Offsets for threatened species and ecological communities

The outcome sought by this condition is to provide offsets for EPBC Act-listed threatened species and ecological communities for which a residual significant impact remains after avoidance and mitigation strategies are implemented.

(a) Prior to commencing any part of the action which will have a significant impact on threatened species or ecological communities, the approval holder must submit for the Minister's written approval, an Offset Strategy for the residual impacts to the following Matters of National Environmental Significance (MNES):

  (i) brigalow (*Acacia harpophylla* dominant and co-dominant) ecological community

(ii) the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin (GAB spring EC)

(iii) hairy-joint grass (*Arthraxon hispidus*)

(iv) boggomoss snail (*Adclarkia dawsonensis*)

(v) any further species or communities for which a residual significant impact is determined based on pre-clearance surveys.

(b) The approval holder must provide offsets for the following impacts:

(i) loss of the area of brigalow (*acacia harpophylla* dominant and co-dominant) ecological community determined by the pre-clearance surveys required under Part A, Condition 3

(ii) loss of the area of habitat/or individuals of hairy-joint grass determined by the pre-clearance surveys required under Part A, Condition 3

(iii) loss of 2.4 ha of boggomoss snail habitat

(iv) the quantum determined as a residual significant impact for any further species or communities based on pre-clearance surveys.

(c) The Offset Strategy must include, but is not limited to:

(i) the proposed timeline and legal mechanism for securing the offset area/s or offset outcomes

(ii) details of the proposed minimum offset area/s informed by pre-clearance surveys Part A, Condition 3

(iii) a description and map to clearly define the location and boundaries of the proposed offset area/s accompanied by the offset attributes

(iv) information about how the proposed offset area/s provide connectivity with other relevant habitat

(d) Where monitoring required by Part D, Condition 7, (b)(iii) determines that the offset for the GAB spring EC is not providing a conservation gain for the community after applying corrective actions, provide details of alternative offset sites.

Part C Water storage flood buffer and wildlife corridor requirements

Condition 5 Water storage flood buffer

The outcome sought by this condition is to ensure the areas protected for environmental purposes in the water storage buffer area provide secure suitable habitat for terrestrial and aquatic species.

(a) Protected environmental areas within the water storage flood buffer (defined as 100 m from either the full supply level or 1-in-100-year flood line, whichever is larger*) should aim to:

(i) provide suitable habitat for terrestrial and aquatic species, particularly the threatened species identified in the EIS and those impacted by the project

(ii) use suitable locally endemic species in any rehabilitation areas for the ground cover, shrub and tree layer

(iii) protect areas of known habitats for listed threatened flora and fauna species and ecological communities (e.g. areas suitable for Fitzroy River turtle nesting)

(iv) monitor and report annually to the Minister on the success of rehabilitation and implement replacement planting or other strategies as necessary

(v) report progress in achieving these outcomes on a public website and to the Minister in line with the Offset Strategy for the project (Part B, Condition 4).

(b) The protected environmental areas within the water storage flood buffer must be maintained for the life of the project.

* At certain locations around the dam, this line may be adjusted to account for local topography, property boundaries and other features.

Condition 6 Wildlife corridor habitat

The outcome sought by this condition is to ensure the proponent establishes a protected, vegetated corridor that provides habitat connectivity between Precipice National Park, Spring Creek, the Boggomoss and Mt Rose nature refuges and existing protected remnant vegetation to the north and generally in accordance with Figure 3 of Appendix B1-B of the AEIS.

(a) Prepare a wildlife corridor revegetation plan as part of the rehabilitation and revegetation plans in the project EMP and submit to the Minister for approval prior to construction.

(b) Prepare a map of the proposed wildlife corridor (including tenures and revegetation areas) and include it in the wildlife corridor plan, EMP and Offset Strategy for the project.

(c) Implement protection of the wildlife corridor as soon as possible before impacts to the Dawson River wildlife corridor occur that will:

(i) establish a protected, vegetated corridor that would provide a habitat link for native animals and vegetation as generally shown in Figure 3 of Appendix B1-B of the AEIS

(ii) rehabilitate and manage the corridor to achieve the appropriate habitat quality gain

(iii) protect habitat using an appropriate protection mechanism such as Nature Refuge tenure/land use designation

(iv) control and manage stock (including fencing) and weeds and pests

(v) monitor the success of rehabilitated and revegetated areas and implement replacement planting or other strategies as necessary

(vi) monitor habitat and corridor function for target species.

(d) The wildlife corridor must be maintained for the life of the project.

Part D GAB spring ecological community

Condition 7 Offset Strategy—additional requirements for the GAB spring ecological community

The outcome sought by this condition is to ensure that the offsets for GAB spring EC achieve a long term conservation outcome for the ecological community (EC).

(a) The Offset Strategy for addressing the residual significant impacts on the GAB spring EC required by Part B, Condition 4 must include measures to ensure that a conservation gain is achieved for the GAB spring EC.

(b) The Offset Strategy must include:

(i) an analysis of the potential risks to delivering a successful conservation gain for the GAB spring EC

(ii) The risk analysis should:

(A) define all of the potential risks and include an assessment of likelihood and consequence of each risk

(B) include risks associated with increased flows related to changed groundwater pressure as result of the dam.

(iii) details of an offset monitoring and reporting program to identify whether or not the offset sites are successfully being managed to maintain the viability of the GAB springs ECs and achieving a conservation gain for the EC. The offset monitoring and reporting program is to be informed by the Groundwater Monitoring and Management Plan required by Appendix 4, Schedule 2, Recommendation 2 details of any corrective actions should monitoring identify that these risks, have eventuated.

Condition 8 GAB spring ecological community impacts—avoidance of physical impacts to springs associated with pipeline construction

The outcome sought by this condition is to ensure that activities associated with construction of the pipeline do not result in any physical damage to any springs that meet the GAB spring EC definition.

(a) The approval holder must ensure that construction activities associated with the pipeline do not result in any physical damage to any springs that meet the GAB spring EC definition.

Condition 9 Groundwater Dependent Ecosystem Management Plan

The outcome of this condition to ensure the approval holder prepares a Groundwater Dependent Ecosystem Management Plan (GDEMP) which includes appropriate measures for detecting and managing impacts on the GAB spring EC systems.

(a) The approval holder must prepare a GDEMP generally in accordance with the Spring Monitoring Program detailed in the AEIS (Appendix B15 – Supplementary Groundwater Technical Report; Appendix A – Groundwater and Springs Monitoring Program).

(b) The GDEMP must be approved by the Minister in writing and the GDEMP published on a website before the commencement of construction.

(c) The GDEMP must be informed by baseline monitoring undertaken for the GMMP (Appendix 4, Schedule 2, Recommendation 2).

(d) Monitoring should consider aspects of GAB spring EC systems that are likely to be impacted as a result of the project. This should include specific monitoring parameters, including but not limited to:

(i) wetland area (including historical records)

(ii) groundwater level and flow rate and quality at spring vents

(iii) wetland pool depth

(iv) wetland vegetation zone margins (e.g. pool, saturated, damp, dry)

(v) native wetland vegetation cover, diversity and condition.

(e) The frequency of monitoring during operation must be undertaken at least every 6 months until the FSL is reached. Once FSL is reached, monitoring must be undertaken at least every 6 months for the following 5 years.

(f) If significant impacts have not been detected, consult with DEE, DNRM and EHP to determine if the frequency of monitoring should be changed.

(g) The GDEMP should detail:

(i) adequate early warning triggers and impact thresholds to detect impacts to GAB spring ECs

(ii) corrective actions to address any adverse impacts on GAB spring ECs (if any).

(iii) how the proposed management measures take account for the objectives, performance criteria and relevant recovery actions detailed in the National recovery

plan for the community native species dependent on discharge of groundwater from the Great Artesian Basin.

(h) A report of GDEMP findings, including all monitoring results and interpretations, must be prepared and made available on request to DEE, DEHP and DNRM. The reporting frequency will be annually until 5 years after FSL is first reached then reducing to match the monitoring frequency (agreed under (f)). The report must include:

(i) an assessment of baseline groundwater levels collected in Appendix 4, Schedule 2, Recommendation 2

(ii) the condition of each GAB spring EC compared with all previous monitoring results

(iii) the suitability of current groundwater triggers and thresholds for determining impacts to GAB spring ECs

(iv) detail on the effectiveness of avoidance, mitigation and management actions in addressing adverse impacts on GAB spring ECs

(v) a description of any adaptive management initiatives implemented

(vi) any offsets required for any further residual significant impacts, with reference to the Offset Strategy required by Part B, Condition 4.

Note: The approval holder may prepare one GDEMP that addresses the projects impact on the GAB spring EC and regulated vegetation associated with springs protected under the *Vegetation Management Act 1999.*

Part E Boggomoss snail (*Adclarkia dawsonensis*)

Condition 10 Boggomoss snail management plan

(a) Prior to commencement of construction, submit to the Minister for approval a boggomoss snail management plan (BSMP) that adequately addresses the project's impacts on the boggomoss snail.

(b) The BSMP must detail how the population and habitat for the boggomoss snail would be managed during construction and operation of the project including actions (direct and indirect) to reduce threats on populations downstream.

(c) The BSMP must detail how the management measures take account for the objectives, performance criteria and relevant recovery actions detailed in the Recovery Plan for the species.

(d) The BSMP must be prepared generally in accordance with commitments made in EIS and AEIS documents.

(e) The BSMP must be prepared by a suitably qualified person in consultation with EHP and DEE.

(f) Implement the approved BSMP in the construction and operation phases of the project.

Condition 11 Relocation of Mt Rose station boggomoss snail population

The outcome of this condition is to ensure the approval holder prepares and implements a relocation and management plan which includes measures that ensure the Mount Rose sub-population of the boggomoss snail is successfully relocated to a site outside of the inundation area prior to the inundation.

(a) Prior to commencement of construction, prepare a Boggomoss Snail Relocation and Management Plan (Relocation and Management Plan) and submit to the Minister for approval.

(b) The Relocation and Management Plan must be prepared by a suitably qualitified person in consultation with EHP and DEE.

(c) The Relocation and Management Plan must be informed by pre-clearance surveys undertaken in Part A, Condition 3.

(d) The Relocation and Management Plan must contain, but is not limited to:

  (i) aims of snail relocation and ongoing management

  (ii) a description of habitat in the impact and relocation areas

  (iii) methods of relocation

  (iv) success criteria for relocation and ongoing management

  (v) monitoring and reporting requirements

  (vi) detail how the Relocation and Management Plan takes into account the objectives, performance criteria and relevant recovery actions detailed in the Recovery plan for this species.

(e) Relocation activities must be implemented before inundation of the dam and undertaken in consultation with the EHP and DEE.

Condition 12 Management of water flows for maintaining habitat

The outcome sought by this condition is to maintain the health of riparian habitat downstream of the dam, known to support boggomoss snail populations.

(a) Manage downstream flow regimes to the extent reasonably practical to minimise impacts on boggomoss snail habitat downstream of the dam, including maintaining the health of riparian vegetation for the life of the project.

Part F Fitzroy River turtle (*Rheodytes leukops*)

Condition 13 Turtle management plan for the Fitzroy River turtle

The outcome sought by this condition is the development and delivery of a turtle management plan (TMP) that provides a management framework for avoiding and mitigating impacts of the project on the Fitzroy River turtle and its nesting and foraging habitat throughout the life of the project.

(a) Prior to commencement of construction, submit to the Minister for approval, a TMP for the Fitzroy River turtle.

(b) The TMP must be prepared in accordance with the commitments made in EIS and AEIS documents and must be consistent with the conditions in this Coordinator-General's report.

(c) The TMP must be prepared by a suitably qualified person in consultation with EHP and DEE and have regard to the best scientific knowledge on the preferred foraging and nesting habitats, timing of breeding and behaviours of the Fitzroy River turtle.

(d) Prior to commencing construction, survey the proposed dam construction and inundation areas to quantify the extent of actual and potential Fitzroy River turtle nesting and aquatic habitat that would be impacted by the dam. This must include any actual and potential impacts on areas outside of the project footprint.

(e) Surveys required by (d) must be:

  (i) completed by a suitably qualified person

  (ii) undertaken during appropriate time of the year (i.e. when turtles are most active and breeding).

(f) Provide the TMP to the Minister, as soon as practical after the survey but no later than 3 months prior to any impacts, which identifies, maps and quantifies any aquatic and nesting habitats within the dam construction and inundation areas that will be directly or indirectly impacted by the project.

(g) The TMP must contain details of how the strategy would be applied on land, riparian areas and instream (including the impoundment) in relation to all habitats used by the Fitzroy River turtle.

(h) Delivery of the strategy must include engagement of third parties (e.g. adjacent landholders, NGOs, research bodies) as the life cycle of the Fitzroy River turtle and protection of its habitats may require protection outside the direct impacts of the project.

(i) The TMP must detail how the local population and habitats for the Fitzroy River turtle would be managed during construction and operation of the project.

(j) This should include but not be limited to:

  (i) nest protection and management measures such as feral animal control, the use of protective mesh over nests, and exclusion of cattle from nesting areas

  (ii) management of flow regimes downstream to avoid impacts on individual turtles and turtle habitats.

(k) The TMP must not be inconsistent with any species management program (SMP) (if required) for the Fitzroy River turtle which would be required to be submitted separately to EHP under the requirements of the Queensland *Nature Conservation Act 1992*.

(l) The TMP must include requirements outlined in Schedule 2, Part F, Condition 13 to Condition 20.

(m) Implement the approved TMP during the construction and operation phases of the project.

Note: The proponent may prepare one TMP that addresses a combined management framework for avoiding and mitigating the project's direct and indirect impacts on the EPBC-listed Fitzroy River turtle and NC Act-listed white-throated snapping turtle.

Condition 14 Turtle movement study

The outcome sought by this condition is the provision of sufficient information on the movement of the Fitzroy River turtle to inform the design of turtle passage infrastructure and adaptive management strategies for the dam.

(a) Prior to finalisation of the design for the turtle passage infrastructure, undertake a turtle movement study to collect baseline data at locations agreed in writing by EHP or provide existing information which satisfies the same outcomes.

(b) The turtle movement study must:

  (i) collect data on seasonal movement patterns and home ranges of the white-throated snapping turtle. The study should include wet and dry season movements, breeding periods and nesting distribution

  (ii) be prepared and undertaken by a suitably qualified person in accordance with a methodology determined in consultation with EHP

  (iii) inform the development of the criteria for monitoring the success of turtle movement past the dam (the turtle movement success criteria) based on the data collected during turtle movement study.

(c) The methodology for the study must be determined in consultation with EHP and submitted to the Minister for approval, 90 days prior to commencing the turtle movement study, or as otherwise agreed with EHP and DEE.

(d) The turtle movement success criteria must be determined in consultation with EHP and be approved by the Minister, in writing, prior to the construction of turtle passage infrastructure at the dam site.

Condition 15 Turtle passage infrastructure

The outcome sought by this condition is that the development of the dam does not restrict the long-term movement of the Fitzroy River turtle past the dam infrastructure and the impoundment.

(a) Infrastructure to facilitate turtle passage around the dam (turtle passage infrastructure) must be built prior to the commencement of operation of the dam.

(b) Construct turtle passage infrastructure at the dam site generally in accordance with a design agreed by EHP and informed by a turtle movement study as required by Condition 14 or another movement study that is considered to be acceptable by EHP.

(c) Ensure turtle passage infrastructure and dam design and operation avoid or minimise the incidence of turtle injury or mortality as a result of operation of the infrastructure.

(d) Monitor the effectiveness of the turtle passage infrastructure against success criteria determined in consultation with EHP and approved by the Minister by Condition 14(d).

(e) Report to EHP on the effectiveness of the turtle passage infrastructure in relation to the turtle movement success criteria twelve months after the construction of the dam and annually thereafter.

(f) The monitoring methodology and reporting of the effectiveness of the turtle passage infrastructure must be externally peer reviewed and undertaken by a suitably qualified person.

(g) If monitoring evidence indicates that the turtle movement success criteria are not being met, the turtle passage infrastructure or its operation is to be modified to achieve the success criteria.

(h) Maintain the operation of the turtle passage infrastructure while the dam remains in operation and provide for the safe access to the dam infrastructure (including the turtle passage infrastructure) for monitoring and compliance purposes.

(i) Requirements for monitoring and reporting, as well as the success criteria (should be reviewed 5 years after the completion of construction and subsequently every 5 years).

Condition 16 Turtle movement contingency plan

The outcome sought by these conditions is to ensure that appropriate actions are implemented in the event that the success criteria are not met.

(a) Should the monitoring specified by Condition 15(d) provide evidence that turtle movement success criteria are not being met, implement an ongoing catch and release program until the criteria are met.

(b) The catch and release program must ensure turtle passage past the dam site in both directions.

(c) The catch and release program must be prepared and implemented by a suitably qualified person in accordance with a methodology determined in consultation with EHP.

Condition 17 Downstream turtle nest inundation management

The outcome sought by this condition is to support the breeding success of the Fitzroy River turtle.

(a) During the period from September to February each year (subject to river inflow), water releases should be managed to minimise the inundation of nests downstream of the dam site as far as Beckers.

(b) During the first year of operation, engage with EHP and DNRM to establish a volumetric flow performance regime that meets the objective stated in (a).

Condition 18 Maintenance of pool-riffle run habitat

The outcome sought by this condition is to maintain suitable aquatic habitat downstream of the dam for the Fitzroy River turtle.

(a) Subject to river inflows, manage operational releases to mimic natural flow conditions as much as possible in order to maintain downstream pool-riffle-run sequences and associated habitat.

(b) During the first year of operation of the dam, engage with EHP and DNRM to establish a volumetric flow performance regime that meets the objective stated in (a).

(c) During the second year of operation of the dam, implement the performance regime derived in (b).

Condition 19 Residual significant impacts

The outcome sought by this condition is to quantify the residual significant impacts of the project on the Fitzroy River turtle.

(a) Provide detail on any avoidance, management or mitigation measures that would be undertaken to address the impacts identified by surveys required by Condition 13(d).

(b) In consultation with DEE and EHP, determine any residual significant impacts on Fitzroy River turtle nesting and aquatic habitats and the extent.

(c) Propose offsets to address residual significant impacts if determined in (b).

Condition 20 Offsets requirements

(a) If it is determined by Condition 19 that the project will have a residual significant impact on Fitzroy River turtle aquatic and nesting habitat, prepare an offset management plan.

(b) The offset management plan must be submitted for the Minister's written approval prior to operation.

(c) Offsets for nesting habitat may include:

  (i) developing a nest protection program for the Fitzroy River turtle in the Dawson River sub-catchment or wider Fitzroy Basin catchment

  (ii) providing financial contribution to any existing nest protection programs for the Fitzroy River turtle being undertaken in the catchment.

(d) Offsets for aquatic habitat may include:

  (i) providing financial contribution to an entity or agency endorsed by the Department of Environment and Energy in a manner approved by the Minister to compensate for the loss of aquatic habitat. The financial offset contribution may be calculated using the web-based Financial Settlement Offset Calculator available on the Queensland Government website and in agreement with DEE. All offset payments must be paid in full within one year of the completion of construction of the dam.

  (ii) a land-based offset considered appropriate for compensating for the loss of aquatic habitat. The land based offset obligation is to be determined using the Offsets assessment guide balance sheet tool on the Department of Environment and Energy website

(e) The offset management plan for Fitzroy River turtle must include, but is not limited to:

  (i) the proposed legal mechanism and timelines for securing the offset area/s

  (ii) details of the minimum offset area/s informed by surveys (Condition 13(d))

  (iii) justification that the offset/s are in accordance with the 2012 EPBC Act Environmental Offsets Policy including a populated copy of the EPBC Act Offsets Assessment Guide with detailed justification for each input.

(iv) a textual description and a map to clearly define the location and boundaries of the offset area/s accompanied by the offset attributes

(v) a description of the management measures (including timing, frequency and longevity) that will be implemented on the offset area/s for the protection and management of habitat for Fitzroy River turtle, including details of how the management measures proposed take account for the conservation advice and any relevant threat abatement plans for the species

(vi) performance and completion criteria for evaluating the management of the offset area/s and criteria for triggering remedial action (if necessary)

(vii) a program, including timelines to monitor and report on the effectiveness of the management measures, and progress against the performance and completion criteria

(viii) a description of the potential risks to the successful implementation of the offset/s, a description of the contingency measures that would be implemented to mitigate against these risks.

(f) The approved offset management plan must be implemented.

(g) The offset must be maintained for the life of the project.

Note: The proponent may be able to co-locate offsets for multiple prescribed environmental matters arising from the different authorities regardless of whether the authorities are issued by Commonwealth, State or local government—provided that the proposed management activities provide benefits for all matters, and that a conservation outcome can be achieved for all matters.

Definitions

Approval holder: means the person to whom the approval is granted or any person acting on their behalf, or to whom the approval is transferred under section 145B of the EPBC Act.

Brigalow EC: an ecological community, *Acacia harpophylla* dominant and co-dominant.

Construction: any earthworks or building activities associated with the project other than:

(a) installation of wind monitoring masts or weather stations

(b) building / road dilapidation surveys or any other surveys

(c) investigative drilling and geotechnical investigations

(d) establishing temporary site offices and construction compounds

(e) material delivery

(f) installation of environmental impact mitigation measures, fencing and enabling works

(g) minor access tracks.

Department of Environment and Energy (DEE): The Australian Government Department or any other agency administering the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth).

EHP: Queensland Government Department of Environment and Heritage Protection.

EPBC Act: is the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

EPBC Act Environmental Offsets Policy: the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (October 2012), or subsequent revision, including the Offset Assessment Guide.

Fitzroy River turtle: a turtle species, *Rheodytes leukops*.

Groundwater dependent ecosystems (GDEs): Ecosystems which require access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services'.

Typically, GDEs include:

- vegetation that access groundwater through their roots
- palustrine, lacustrine and riverine wetlands that receive groundwater discharge (including spring ecosystems)
- aquifer and cave ecosystems; and estuarine and near-shore marine systems that receive submarine discharge of groundwater.

Note that Appendix 3 only refers to the GDEs that are the EPBC Act listed GAB spring EC.

Matters of national environmental significance (MNES): are defined in the EPBC Act, and include listed threatened species and communities. Including, but not limited to, listed threatened species and ecological communities, world heritage properties, national heritage places, and migratory species.

Offset: means 'compensate for', and is interpreted in light of the Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy, October 2012.

Resource Operations Licence (ROL): A ROL is a licence that may be granted in relation to existing infrastructure in an area where a resource operations plan has been approved.

ROLs include:

- the resource operations plan to which the licence relates
- the water infrastructure, such as dams and weirs, covered by the licence
- any conditions that the holder of the licence must comply with, including operating arrangements and water supply requirements
- any transitional arrangements that the holder of the licence requires until the requirements of the plan can be met.

Residual significant impact: as referred to in the EPBC Environmental Offsets Policy 2012.

Suitably qualified person: means a person/s or entity who has professional qualifications, training or skills or experience relevant to the nominated subject matters and can give authoritative assessment, advice and analysis about performance relevant to the subject matters using relevant protocols, standards, methods or literature.

The Minister: is the Australian Government Minister administering the EPBC Act and includes the delegates of the Minister as established by a relevant legal instrument.

Appendix 4. Coordinator-General's recommendations

While the following recommendations guide assessment managers in assessing the development applications, they do not limit their ability to seek additional information nor power to impose conditions on any development approval required for the project.

If the project is subject to a community infrastructure designation, the recommendations in this appendix are also recommended requirements for the designation in accordance with section 43(1) of the *State Development and Public Works Organisation Act 1971* (SDPWO Act).

Schedule 1 *Water Act 2000*

This schedule is relevant to applications for which the *Water Act 2000* is applicable which is administered by the Department of Natural Resources and Mines (DNRM).

Recommendation 1. Resource operations licence requirements

(a) Prior to making an application for an amendment to the existing Resource Operations Licence for the Dawson Valley Water Supply Scheme, the proponent of the dam must:

  (i) complete assessments of the impacts of the dam on water supplies available to existing water entitlement holders on the Dawson River

  (ii) complete any necessary negotiations with the impacted holders of water entitlements to ensure the provision of water supplies equivalent to those provided under current water entitlements, or suitable negotiated outcomes

  (iii) provide to the Chief Executive administering the *Water Act 2000* the proposed arrangements for addressing impacts of the dam on holders of water entitlements for review and approval.

(b) The Resource Operations Licence for Dawson Valley Water Supply Scheme must meet the objectives of the Water Plan (Fitzroy Basin) 2011 or where impacts are assessed to occur, address recommendations (a)(ii) and (iii).

(c) Nathan Dam must be constructed generally in accordance with a Resource Operations Licence granted by the Chief Executive administering the *Water Act 2000*.

(d) During the construction of Nathan Dam the Dawson Valley Water Supply Scheme Operation Manual must be amended and approved by the Chief Executive administering the *Water Act 2000*.

(e) Prior to operation the Resource Operations Licence must include conditions for an Operations Manual applicable to Dawson Valley Water Supply Scheme including Nathan Dam.

(f) Nathan Dam must be operated generally in accordance with a Resource Operations Licence granted for the Dawson Valley Water Supply Scheme by the Chief Executive administering the *Water Act 2000*.

Schedule 2 General recommendations

The following are general recommendations for DNRM's consideration.

Recommendation 2. Groundwater Monitoring and Management Plan

The outcome sought by this recommendation is to adequately address the project's potential impacts on groundwater quality, groundwater levels and groundwater-dependent ecosystems (GDEs) protected under the *Vegetation Management Act 1999.*

(a) Prior to commencement of construction prepare a detailed Groundwater Monitoring and Management Plan (GMMP) generally in accordance with the commitments in the EIS and AEIS.

(b) The GMMP must be prepared by a suitably qualified person and in consultation with DNRM and EHP.

(c) The GMMP must be submitted to DNRM and EHP for approval, prior to commencement of construction.

(d) The GMMP must include:

  (i) a groundwater monitoring network that includes:

    (A) monitoring of groundwater levels and quality that must include at least 12 months of baseline data

    (B) monitoring over the construction phase of the project, with adequate monitoring bores to monitor potential impacts to GDEs and groundwater users

    (C) monitoring during operation, with adequate monitoring bores to detect potential impacts to State protected GDEs and groundwater users, including impacts from groundwater pressure increases

    (D) the parameters to be monitored and frequency of monitoring and reporting. The frequency of monitoring must be at least:

      (1) weekly during groundwater dewatering for construction

      (2) monthly during other construction activities

      (3) at least every 6 months during operation until the FSL is reached. Once FSL is reached, monitoring must be undertaken at least every 6 months for the following 5 years.

  (ii) a GDE Monitoring and Management Plan, as detailed in Appendix 4, Schedule 4, Recommendation 7

  (iii) a Bore Monitoring and Management Plan, as detailed in Appendix 4, Schedule 4, Recommendation 3.

Recommendation 3. Bore Monitoring and Management Plan

The outcome sought by this recommendation is to adequately address the project's potential impacts on registered groundwater users.

(a) As part of Appendix 4, Schedule 2, Recommendation 2 requiring preparation of a GMMP, prepare a Bore Monitoring and Management Plan (BMMP) generally in accordance with the commitments in the EIS and AEIS.

(b) The BMMP must be prepared by a suitably qualified person and in consultation with DNRM and EHP.

(c) The BMMP must be prepared and implemented prior to construction of the project.

(d) The BMMP should be informed by groundwater modelling undertaken in the EIS (Chapter 15) and AEIS (Appendix B15 Supplementary Groundwater Technical Report) and include:

(i) results of the groundwater bore survey, confirming:

(A) presence and condition of all groundwater bores potentially affected by groundwater drawdown (if any) and modelled increases in groundwater pressure for bores identified in EIS, Appendix 15B and any others found during the survey

(B) results of the bore risk assessment, confirming which bores are at low, medium and high risk of bore casing failure or collapse

(ii) proposed bore monitoring regime for operation of the project.

Recommendation 4. Make-good agreements and bore mitigation strategy

The outcome sought by this recommendation is to ensure that make good agreements are in place for groundwater users potentially affected by the construction and operation of the project.

(a) The operator of the infrastructure is required to prepare and implement a bore mitigation strategy to offset any impacts that the infrastructure has on affected bores.

(b) The development of the bore mitigation strategy will require consultation with groundwater users and the establishment of make good agreements with affected groundwater users.

(c) The strategies are to consider mitigation of impacts on bores that may begin to flow as a result of increase in groundwater pressure from the dam operation.

(d) The bore mitigation strategy is to be provided to DNRM for review and approval prior to commencement of construction.

Definitions

Bore casing: A tube used as a temporary or permanent lining for a bore.

Dawson Valley Water Supply Scheme: The water supply scheme for the Dawson River sub-catchment which currently extends along the Dawson River from the upstream limit of the Glebe Weir pool (AMTD 356.5 km) to downstream of Boolburra, north of the Capricorn Highway (ATMD 18.37 km).

Resource Operations Licence (ROL): A ROL is a licence that may be granted in relation to existing infrastructure in an area where a resource operations plan has been approved.

ROLs include:

- the resource operations plan to which the licence relates
- the water infrastructure, such as dams and weirs, covered by the licence
- any conditions that the holder of the licence must comply with, including operating
- arrangements and water supply requirements
- any transitional arrangements that the holder of the licence requires until the requirements of the plan can be met.

Resource Operations Plan: the Fitzroy Basin Resource Operations Plan 2015 which is now replaced by provisions in the Operations Manual for the Dawson Valley Water Supply Scheme

Water Plan (Fitzroy Basin) 2011: previously known as the Water Resource (Fitzroy Basin) Plan 2011.

Schedule 3 Material change of use application in a State Development Area under the SDPWO Act

This schedule is relevant to applications for which the *State Development and Public Works Organisation Act 1971* (SDPWO Act) is applicable, which is administered by the Coordinator-General.

Recommendation 5. MCU application within a State Development Area

(a) As part of any application to change the land use within the State Development Area, the proponent must provide to the Coordinator-General:

(i) a detailed description of all components of the project within the State Development Area, including maps and drawings at an appropriate scale

(ii) detailed information on how all components of the project will address and satisfy the requirements of the development scheme for the State Development Area

(iii) copies of any infrastructure agreements with state agencies and/or the relevant LGA

(iv) a properly made application in accordance with the relevant development scheme.

Recommendation 6. Construction and operational management measures and procedure requirements are to be included in MCU and development approval applications

(a) The proponent in any application for an MCU or development approval must prepare and document construction and operational management measures and procedures that will:

(i) ensure compliance with applicable environmental legislation and any stated conditions under the SDPWO Act

(ii) implement relevant commitments made by the proponent in the EIS

(iii) to the greatest extent practical minimise adverse impacts to:

(A) the functioning and biodiversity of ecosystems

(B) soil structure and quality

(iv) minimise the clearing of native vegetation to the greatest extent practical

(v) prevent environmental nuisance from dust, odour, light, smoke or noise at a nuisance sensitive place to the greatest extent practical

(vi) establish rehabilitation objectives, including a rehabilitation schedule.

(b) The construction and operational management measures and procedures must detail appropriate performance criteria and standards, monitoring and auditing and corrective actions so that all reasonable and practical measures to prevent or minimise environmental harm are identified.

(c) When approved, the approval holder must:

(i) implement and make available the construction and operational management measures and procedures in (b) to all employees, contractors and subcontractors

(ii) make the construction and operational management measures and procedures publicly available on the proponent's website prior to the commencement of any construction work

(d) regularly review and amend as necessary the construction and operational management measures and procedures in response to monitoring and auditing reports and changes in legislation and standards. Any construction and operational management measures and procedures must be updated on the proponent's website within 30 business days.

(e) Matters to consider in developing construction and operational management measures and procedures may include but are not limited to:

(i) soils (including geotechnical investigations, soil types, salinity, sodicity and acid sulphate potential)

(ii) erosion and sediment control (suggested guideline: International Erosion Control Australasia 2008, Best Practice Erosion and Sediment Control)

(iii) native flora and fauna

(iv) fauna passage, connectivity between populations and prevention of entrapment during construction

(v) weeds and pests

(vi) progressive rehabilitation of disturbed areas

(vii) surface waters (suggested guideline: Department of Natural Resources and Mines guideline *Riverine Protection Permit Exemption Requirements Version 1.01 WSS/2013/726)*

(viii) surface flood waters

(ix) dust and air quality

(x) noise and vibration from construction activities (suggested guideline *application requirements for activities with noise impacts,* DEHP)

(xi) chemical and fuel storage

(xii) waste management

(xiii) stock routes

(xiv) agricultural land integrity

(xv) lighting and visual amenity

(xvi) existing transport and utility infrastructure

(xvii) non-indigenous cultural heritage

(xviii) decommissioning and rehabilitation

(xix) hazard and risk (including managing any adverse impacts of flood, severe storms, bushfire and landslide).

Schedule 4 *Vegetation Management Act 1999*

The following are general recommendations for DNRM's consideration under the *Vegetation Management Act 1999.*

Recommendation 7. Groundwater-dependent Ecosystem Management Plan

The outcome south by this recommendation is to manage impacts on regulated vegetation associated with springs protected under the *Vegetation Management Act 1999*.

(a) Prepare a Groundwater Dependent Ecosystem Management Plan (GDEMP) generally in accordance with the Spring Monitoring Program detailed in the AEIS (Appendix B15 – Supplementary Groundwater Technical Report).

(b) The GDEMP must be approved by DEHP and DNRM in writing and the GDEMP published on a website before the commencement of construction.

(c) The GDEMP must be informed by baseline monitoring undertaken for the GMMP (Appendix 4, Schedule 2, Recommendation 2).

(d) The GDEMP should include details of specific monitoring requirements that consider aspects of GDE systems that are likely to respond of change resulting from the project. This should include specific monitoring parameters including, but not limited to:

(i) wetland area (including historical records)

(ii) groundwater level and vent flow rate

(iii) wetland pool depth

(iv) wetland vegetation zone margins (e.g. pool, saturated, damp and dry)

(v) native wetland vegetation cover, floristic composition and diversity and condition of the wetland vegetation.

(e) The frequency of monitoring must be at least:

(i) weekly during groundwater dewatering for construction

(ii) monthly during other construction activities

(iii) the frequency of monitoring during operation must be undertaken at least every 6 months until the FSL is reached. Once FSL is reached, monitoring must be undertaken at least every 6 months for the following 5 years.

(f) The GDEMP should detail:

(i) adequate early warning triggers and impact thresholds to detect impacts to GDEs

(ii) corrective actions to address impacts on GDEs

(g) The proponent must report results of monitoring and detail corrective actions for GDEs over the full period of construction and for at least 10 years of operation.

(h) A report of GDEMP findings, including all monitoring results and interpretations, must be prepared annually and made available on request to DEHP and DNRM. The report must include:

(i) an assessment of baseline groundwater levels collected in Appendix 4, Schedule 2, Recommendation 2.

(ii) the condition of each GDE compared with all previous monitoring results

(iii) the suitability of current groundwater triggers and thresholds for determining impacts to GDEs

(iv) detail on the effectiveness of avoidance, mitigation and management actions in addressing adverse impacts on GDEs

(v) a description of any adaptive management initiatives implemented

(vi) any offsets required for residual significant impacts, with reference to the Biodiversity Offset Strategy required by (Appendix 2, Condition 1).

(vii) recommendations regarding the need to continue monitoring (after at least 10 years of operations phase monitoring have been completed).

Note: The approval holder may prepare one GDEMP that provides a combined management framework and addresses the projects impact on regulated vegetation associated with springs protected under the *Vegetation Management Act 1999* and the EPBC-listed GAB spring EC.

Recommendation 8. Irrigation of regulated vegetation associated with springs protected under the *Vegetation Management Act 1999*

The purpose of this recommendation is to ensure suitable water quality is used to restore affected regulated vegetation associated with springs (if any).

(a) The quality of water to be used for any irrigation of any GDEs impacted by groundwater dewatering activities must be generally in accordance with the approved construction water quality management plan for the project.

Schedule 5 *Fisheries Act 1994*

This schedule is relevant to applications for which the *Fisheries Act 1994* is applicable, which is administered by the Department of Agriculture and Fisheries (DAF).

Recommendation 9. Waterway barrier works

The outcome sought by this recommendation is that the dam provides effective fish passage for life of the barrier.

(a) Prior to commencing the development, development permit/s for operational works that are constructing or raising a waterway barrier works under the *Sustainable Planning Act 2009* must be obtained for all relevant components of the development.

(b) The design, construction, and operation of the project must provide adequate fish passage, as defined in the *Fisheries Act 1994*.

(c) Prior to operational works permits being issued, a person who is a suitably qualified fishway professional must review the fishway design and demonstrate that effective fish passage would be provided.

(d) On completion of fishway works, a suitably qualified fishway professional must certify that the works are generally in accordance with the approved plans.

(e) The fish passage infrastructure must cater for the whole fish community taking into account species, size classes, life stages and swimming abilities as well as seasonal and flow related biomass of the fish community.

(f) The waterway barrier/s and any associated infrastructure including, but not limited to intakes, walls, access structures, pipe works, spillways and dissipation devices are to be designed, constructed and maintained to avoid fish injury, mortality and/or entrapment to the extent reasonably practical.

(g) At all times, the design, construction and operation of the project must take into account the management for fish passage on all existing barriers both upstream and downstream of the project, to ensure that all existing barriers do not become greater barriers to fish passage as a result of the project.

(h) The effective operation of the fish passage aspects of the structure must be maintained for the life of the barrier. This maintenance must include regular, documented inspections of the structures such as fishways, baffles and roughening especially after flood events, and prompt clearing of debris or rectifying any other failures, malfunctions, breakdowns or other impediments to fish movement.

(i) The permanent alteration of natural flows are to be managed to avoid impacts on the timing of natural fish spawning and migration within the system to the extent reasonably practical.

(j) A monitoring program must be developed and implemented by a suitably qualified fishway professional, to demonstrate the performance of the fish passage infrastructure.

(k) The monitoring program must:

  (i) involve the provision of monitoring reports at intervals specified in the operational works approval

  (ii) include an alert and action component, which will enable changes to be made to any deficiencies in the structures promptly and no later than prior to the commencement of the following wet season.

Recommendation 10. Offsets for waterway barrier works

The outcome sought by this recommendation is to provide suitable offsets for waterway barrier works.

(a) Prior to commencing the development, the proponent must provide an environmental offset in accordance with the *Environmental Offsets Act 2014*, to counterbalance the significant residual impact of 1,358.85 ha on major, high, moderate and low risk waterways providing for fish passage and fish habitat.

Definitions

Significant residual impact: Generally, a significant residual impact is an adverse impact, whether direct or indirect; of a prescribed activity on all or part of a prescribed environmental matter that:

- remains, or will or is likely to remain, (whether temporarily or permanently) despite on-site mitigation measures for the prescribed activity
- is, or will or is likely to be, significant.

Suitably qualified fishway professional: is a person/s with personal experience of the design and construction of fishways (in similar circumstances to the design being applied for); has experience and knowledge of the aquatic biology of Queensland's native fish species; and has professional experience in fishway monitoring and maintenance (rectification in designs etc.).

Schedule 6 *Nature Conservation Act 1992*

The following are general recommendations for EHP's consideration under the *Nature Conservation 1992.*

Recommendation 11. Species Management Programs

The outcome sought by this recommendation is the development Species Management Programs (SMPs) to assess the impacts of the project on animal breeding places. Animal breeding places include obvious structures such as bird nests and tree hollows, turtle nesting, as well as more cryptic places such as amphibian or reptile habitat where breeding takes place.

(a) SMPs must be prepared and submitted to EHP as per the requirements of the NC Act and EHP's information sheet for approval prior to construction.

Recommendation 12. Protected plants

The outcome sought by this recommendation is to determine the impacts of the project on any identified endangered, vulnerable or near threatened plants (EVNT plants) in the project footprint

(a) compliance with the requirements of the NC Act and the protected plant framework[48].

(b) Prior to any clearing, the proponent must check the flora survey trigger map[49] .

[48] https://www.ehp.qld.gov.au/licences-permits/plants-animals/protected-plants/
[49] https://www.ehp.qld.gov.au/licences-permits/plants-animals/protected-plants/map-request.php

Where required, flora surveys must be carried out by a suitably qualified person in accordance with the Flora survey guidelines – protected plants[50].

Schedule 7 General biodiversity recommendations

Recommendation 13. Vegetation mapping

The outcome sought by this recommendation is to verify the total impacts of the project on flora and regional ecosystems, including MSES prior to clearing/inundation.

(a) Prior to clearing of native vegetation, confirm on the the regional ecosystems by submitting vegetation maps for verification by the Queensland Herbarium. Use verified mapping to confirm the total impact on MSES.

(b) Update the Environmental Management Plan, MSES impact areas, and offset requirements based on verified mapping.

Recommendation 14. Water storage flood buffer

The outcome sought by this recommendation is to ensure that the areas protected for environmental purposes in the water storage buffer area provide secure suitable habitat for terrestrial and aquatic species.

(a) Protected environmental areas within the water storage flood buffer (defined as 100 m from either the full supply level or 1-in-100-year flood line, whichever is larger*) should aim to:

  (i) provide suitable habitat for terrestrial and aquatic species, particularly the threatened species identified in the EIS and those impacted by the project

  (ii) use suitable locally endemic species in any rehabilitation areas for the ground cover, shrub and tree layer

  (iii) protect areas of known habitats for NC Act-listed threatened flora and fauna species (e.g areas suitable for white-throated snapping turtle nesting)

  (iv) monitor and report annually to the EHP on the success of rehabilitation and implement replacement planting or other strategies as necessary

  (v) report progress in achieving these outcomes on a public website and to EHP in line with the Biodiversity Offsets Strategy (BOS) for the project by Recommendation 16.

  * At certain locations around the dam, this line may be adjusted to account for local topography, property boundaries and other features.

Recommendation 15. Wildlife corridor habitat

The outcome sought by this recommendation is to ensure the proponent establishes a protected, vegetated corridor that provides habitat connectivity between Precipice National Park, Spring Creek, the Boggomoss and Mt Rose nature refuges and existing protected remnant vegetation to the north.

(a) Prepare a wildlife corridor revegetation plan as part of the rehabilitation and revegetation plans in the project EMP and submit to EHP for approval prior to construction.

(b) Prepare a map of the proposed wildlife corridor (including tenures and revegetation areas) and include it in the wildlife corridor plan, EMP and Biodiversity Offset Strategy for the project.

(c) Before impacts occur to the Dawson River wildlife corridor, implement a wildlife corridor revegetation plan that will:

[50] https://www.ehp.qld.gov.au/licences-permits/plants-animals/documents/gl-wl-pp-flora-survey.pdf

(i) establish a protected, vegetated corridor that would provide a habitat link for native animals and vegetation as generally shown in Figure 3 of Appendix B1-B of the AEIS

(ii) rehabilitate and manage the corridor to achieve the appropriate habitat quality gain

(iii) protect habitat using an appropriate protection mechanism such as Nature Refuge tenure / land use designation

(iv) control and manage stock (including fencing), weeds and pests

(v) monitor the success of rehabilitated and revegetated areas and implement replacement planting or other strategies as necessary

(vi) monitor habitat and corridor function for target species

(vii) report progress in achieving these outcomes on a public website and to EHP in line with reporting on the project BOS.

Recommendation 16. Biodiversity offsets

The outcome sought by this recommendation is to address the significant residual impacts of the project on MSES.

(a) Offsets would be required for prescribed MSES , including but not limited to:

(i) regulated vegetation

(ii) connectivity areas

(iii) protected wildlife habitat

(b) Where MSES and MNES offset obligations overlap, the MNES offset would also satisfy the MSES offset obligation.

(c) Prior to commencement of construction, the proponent must:

(i) Confirm the extent of impacts on MSES and finalise offset obligations as required under the *Environmental Offsets Act 2014*.

(ii) Prepare BOS (generally in accordance with the AEIS, Appendix B1-B Approach to provision of environmental offsets) for impacts on MSES. The BOS should detail the impacts on matters proposed to be offset, consistent with the requirements of the *Environmental Offsets Act 2014,* and the most current version of the Queensland Environmental Offsets Policy. At minimum, the BOS must:

(A) describe and quantify impacts on MSES and any loss of values being offset

(B) describe the commitments and on-site mitigation measures to be implemented to minimise impacts on MSES from the dam construction and operation

(C) identify proposed offset areas including a description of current land use

(D) assess the ecological condition of potentially impacted areas within the project area and the proposed offset areas

(E) describe the offset commitments and methods of delivery for both direct, land based offsets and indirect offsets

(F) provide a summary of how proposed land-based offsets can be secured in perpetuity to ensure long-term protection of offset sites

(G) outline how the offsets will be delivered, including a description of proposed management and monitoring measures to ensure the required conservation outcomes occur[51].

Schedule 8 *Queensland Heritage Act 2009*

This schedule is relevant to applications for which the *Queensland Heritage Act 1992* is applicable, which is administered by DEHP.

Recommendation 17. Archival recording

(a) Any State heritage archival recording undertaken for the project should be done in accordance with the Queensland Government *Guideline: archival recording of heritage registered places*[52].

Recommendation 18. Management of Glebe Homestead

(a) Before making a decision about whether to 'record and destroy' or relocate the Glebe Homestead, the proponent must:

(i) carry out a 'no prudent and feasible alternative analysis' to determine the most appropriate actions to conserve the fabric of the Glebe Homestead, the outbuildings and the garden setting. The analysis should include the following alternatives:

(A) relocation:

(1) a cost benefit analysis of relocation

(2) where the Glebe Homestead and out buildings would be relocated

(3) method of relocating

(4) how the fabric and setting would be conserved in the relocation

(5) arrangements for the ongoing management of the relocated Glebe Homestead and outbuildings

(B) recording and abandonment including how the Glebe Homestead, outbuildings and setting will be recorded

(C) what offsets would be proposed for the community with regard to the loss of the Glebe Homestead and outbuildings.

(b) Sufficient details of the proposed management of Glebe Homestead should be included to enable EHP to determine if a development approval could be issued and if so, what conditions would need to be attached to that approval.

Recommendation 19. Management of Taroom Aboriginal Settlement

(a) In conjunction with the site custodians, the proponent should carry out an archaeological investigation over at least the area of the Taroom Aboriginal Settlement site which will be impacted by the project to ensure the record of the site is complete and appropriate conservation measures are taken.

(b) The proponent should engage as soon as practical with EHP about a heritage agreement for the Taroom Aboriginal Settlement under the *Queensland Heritage Act 1992*, particularly in relation to the scope of any management plan for the place that should cover matters of historic heritage and archaeology.

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[51] https://www.qld.gov.au/environment/pollution/management/offsets/delivering/
[52] http://www.ehp.qld.gov.au/assets/documents/land/heritage/archival-recording-heritage-places.pdf

Schedule 9 *Transport Infrastructure Act 1994*

This schedule is relevant to applications for which the *Transport Infrastructure Act 1994* is applicable, which is administered by the Department of Transport and Main Roads (DTMR).

Recommendation 20. Road impact assessment

(a) In consultation with the DTMR and the relevant LGA, the proponent must prepare a road impact assessment (RIA) to assess the impacts of the project on the safety, efficiency and condition of state-controlled and local roads. The RIA must:

(i) be developed in accordance with the *DTMR Guidelines for Assessment of Road impacts of Development (GARID)* and/or as required by the relevant LGA. The RIA must include a completed TMR 'Transport Generation proforma' (available from Transport System Management Branch, Brisbane) detailing project-related traffic and transport generation information or as otherwise agreed in writing with DTMR and the relevant LGA.

(ii) use DTMR's *Pavement Impact Assessment tools* or such other method or tools as agreed in writing with DTMR and/or the relevant LGA

(iii) clearly indicate where detailed estimates are not available and document the assumptions and methodologies that have been previously agreed in writing with DTMR and relevant LGA, prior to RIA finalisation.

(iv) detail the final impact mitigation proposals, including contributions to road works/maintenance and summarising key road-use management strategies

(v) be approved in writing by DTMR and/or the relevant LGA no later than six (6) months prior to the commencement of significant construction works, or as otherwise agreed between the proponent, DTMR and/or the relevant LGA.

Recommendation 21. Road-use management plan

(a) In consultation with the DTMR and the relevant LGA, the proponent must prepare or update the road use management plan (RMP) that must:

(i) be developed in accordance with DTMR's *Guideline to Preparing a Road-use Management Plan* (available from TMR District Offices or Transport System Management Branch, Brisbane) and/or as required by the relevant LGA, with a view to also optimising project logistics and minimising road-based trips on all state-controlled and local roads

(ii) include a table (available from TMR District Offices or Transport System Management Branch, Brisbane) listing RMP commitments and provide confirmation that all works and road-use management strategies have been designed and will be undertaken in accordance with all relevant TMR standards, manuals and practices[53] and/or as required by the relevant LGA

(iii) be approved in writing by DTMR and the relevant LGA no later than six (6) months prior to the commencement of significant construction works, or as otherwise agreed between the proponent, DTMR and the relevant LGA.

Recommendation 22. Approvals, permits and standards of road works

(a) Prior to the commencement of significant project-related construction works, the proponent must:

[53] http://www.tmr.qld.gov.au/business-industry/Technical-standards-publications.aspx

(i) Upgrade any necessary intersection/accesses and undertake any other required works in State-controlled and/or LGA road reserves, in accordance with the current DTMR and/or LGA road planning and design policies, principles and manuals, unless otherwise agreed in writing with the DTMR Darling Downs, DTMR Fitzroy District Office and/or LGA.

(ii) Prior to undertaking any of these works obtain the relevant licences and permits, for example, under the *Transport Infrastructure Act 1994* (Qld) for works and project facilities/infrastructure within the state-controlled road corridor.

Recommendation 23. State-controlled road access

(a) The proponent must undertake any required works and other impact mitigation strategies as required by the RIA and RMP, in accordance with the latest relevant DTMR and LGA policies and standards at the time of approval or agreement, unless otherwise agreed to in writing by DTMR and/or the relevant LGA.

Recommendation 24. Infrastructure agreements

(a) To formalise arrangements about transport infrastructure works, contributions and road-use management strategies detailed and required under the approved RIA and RMP, the proponent may enter into an infrastructure agreement with DTMR and/or the relevant LGA.

(b) The infrastructure agreement/s must identify all required works and contributions, and incorporate the following:

(i) project-specific works and contributions required to upgrade impacted road infrastructure and vehicular access to project sites as a result of the proponent's use of state-controlled and local roads by project traffic

(ii) project-specific contributions towards the cost of maintenance and rehabilitation to mitigate road or pavement impacts on state-controlled and local road infrastructure

(iii) infrastructure works and contributions associated with shared (cumulative) use of state-controlled and local road infrastructure by other projects subject to any EIS

(iv) performance criteria that detail protocols for consultation about reviewing and updating of project-related traffic assessments and impact mitigation measures that are based on actual traffic volume and impacts, should previously advised project details, traffic volumes and/or impacts change.

(v) the proponent's undertaking to fulfil all commitments as detailed in the 'Table for listing RMP commitments'.

(c) Any infrastructure agreement between the proponent, DTMR and the relevant LGA should be concluded three (3) months prior to commencement of project construction, or as otherwise agreed in writing between the proponent, DTMR and the relevant LGA.

Recommendation 25. Permits, approvals and traffic management plans

(a) To ensure efficient processing of the project's required transport-related permits and approvals, the proponent must, no later than three (3) months, or such other period agreed in writing with DTMR and/or the relevant LGA, prior to the commencement of significant construction works or project-related traffic:

(i) Submit detailed drawings of any works required to mitigate the impacts of project-related traffic for DTMR and the relevant LGA review and approval.

(ii) Obtain all relevant licences and permits required under the *Transport Infrastructure Act 1994* for works within the state-controlled road corridor (section 33 for road works approval, section 62 for approval of location of vehiclular accesses to state

roads and section 50 for any structures or activities to be located or carried out in a state-controlled road corridor).

(iii) Prepare a heavy vehicle haulage management plan for any excess mass or over-dimensional loads for all phases of the project in consultation with DTMR's Heavy Vehicles Road Operation Program Office, the Queensland Police Service and the relevant LGA.

(a) Prepare Traffic Management Plan/s (TMP) in accordance with DTMR's Guide to preparing a Traffic Management Plan (available from TMR District Offices of Transport System Management Branch, Brisbane) and/or as required by the relevant LGA. A TMP must be prepared and implemented during the construction and commissioning of each site where road works are to be undertaken, including site access points, road intersections or other works undertaken in the State-controlled road corridor.

Recommendation 26. Completing required roadworks before commencement of significant project traffic

(a) Prior to the commencement of any significant project-related construction traffic, the proponent must complete the required works/make contributions towards works as required, unless otherwise agreed in writing with the TMR Darling Downs and/or TMR Fitzroy District Office.

(b) The proponent must:

(i) construct any required road works before commencement of significant project-related construction traffic

(ii) prior to undertaking any works, obtain the relevant licences and permits under the Transport Infrastructure Act 1994 for works within the state-controlled road corridor. As required above, any required plans, permits and TMPs must be approved by DTMR three months prior to commencement of project construction traffic

(iii) implement the approved Traffic Management Plan for the works during construction and commissioning of the above mentioned intersection upgrade.

Definitions

DTMR 'Transport Generation proforma: Available from Transport System Management Branch, Brisbane.

DTMR standards, manuals and practices: Available at: http://www.tmr.qld.gov.au/businessindustry/Technical-standards-publications.aspx

Phase: Phase refers to planning, construction, commissioning and operations

Significant construction works: Significant construction works means physical construction, including significant and continuous site preparation work such as major clearing or excavation for foundations or the placement, assembly or installation of facilities or equipment at any site related to the project.

Significant project traffic: is an increase in traffic associated with the project which is equal to or greater than five per cent in either traffic numbers (annual average daily traffic) or axle loadings (equivalent standard axles); or the transport of oversized and overweight vehicles requiring a permit from DTMR

Table (for RMP commitments): Available from Transport System Management, Brisbane.

Schedule 10 *Water Supply (Safety and Reliability) Act 2008*

This schedule is relevant to applications for which the *Water Supply (Safety and Reliability) Act 2008* is applicable, which is administered by the Department of Energy and Water Supply (DEWS).

Recommendation 27. General

(a) The dam is to be kept safe, and be maintained and operated in accordance with the current versions of the guidelines issued in Queensland under the *Water Supply (Safety and Reliability) Act 2008* (where specifically referred to in this dam safety condition schedule):

(i) Queensland Dam Safety Management Guidelines

(ii) Guidelines for Failure Impact Assessment of Water Dams.

(b) The current Dam Safety Regulator in the State of Queensland is the Chief Executive, DEWS or the department's delegate officers.

Recommendation 28. Documentation

(a) Any documentation prepared in order to comply with these conditions must be stored securely until such time as the dam is decommissioned.

(b) The documentation must be made available for inspection by the Chief Executive, DEWS, within seven (7) days of a written request for access being received by the dam owner.

(c) On change of ownership of the dam, all documentation prepared in compliance with these conditions must be transferred to the new owner.

Recommendation 29. Incidents and failures

(a) In addition to the requirements detailed within the Emergency Action Plan (EAP), the dam owner must report in writing all incidents and failures (as defined in the Queensland Dam Safety Management Guidelines – February 2002, or updates thereof) to the Chief Executive, DEWS, within seven (7) days of becoming aware of the incident or failure.

(b) The dam owner must advise the Chief Executive, DEWS, of any proposed remedial actions in writing within thirty (30) days of the incident or failure.

Recommendation 30. Design report

(a) The dam owner must provide a copy of the design report for Nathan Dam to the Chief Executive, DEWS, at least thirty (30) days prior to any construction works.

(b) The design report should include:

(i) results of any additional hydraulic model studies during the detailed design phase

(ii) results of foundation and other investigations carried out during the detailed design phase

(iii) a complete set of construction drawings and specifications

(iv) final instrumentation arrangement for the dam

(v) details of managing risk during construction.

Recommendation 31. Design and construction

(a) The dam is to be designed and constructed to comply with the relevant DEWS and ANCOLD guidelines (including requirements for the completion of a failure impact assessment).

(b) The Nathan Dam must be constructed as per the final design drawings approved by the Chief Executive, DEWS.

(c) The dam owner must advise the Chief Executive, DEWS, of the 'practical completion of construction' of the works within seven (7) days of that point of construction being reached.

(d) Construction of any temporary works must be carried out in accordance with current engineering practice and standards.

(e) Any remedial works or reconstruction of the dam must be carried out in accordance with current engineering practice to ensure that the dam remains in accordance with the documentation listed within these conditions.

(f) Where remedial, reconstruction or upgrade works are proposed, a copy of the final design and construction methodology must be forwarded to the Chief Executive, DEWS, for consideration no later than thirty (30) days prior to commencement of any construction works.

Recommendation 32. Data book

(a) The dam owner must prepare a Data Book in accordance with this condition and the Queensland Dam Safety Management Guidelines – February 2002 or updates thereof.

(b) The Data Book must be prepared by no later than 90 days after 'practical completion of construction' of the dam.

(c) The Data Book must include all information as is required in the Queensland Dam Safety Management Guidelines – February 2002 (or updates thereof) including:

  (i) all pertinent records and history relating to the dam

  (ii) documentation of investigation, design, construction, operation, maintenance, surveillance, monitoring measurements and any remedial action taken during construction and subsequent operation of the dam

  (iii) known deficiencies such as seepage, cracking.

(d) The dam owner must ensure the Data Book is reviewed (and if necessary updated) in accordance with the Queensland Dam Safety Management Guidelines – February 2002 (or updates thereof) by the 1st day of June of each calendar year.

(e) A written notification confirming that the Data Book has been reviewed (and if necessary updated) must be signed by the dam operator and submitted to the Chief Executive, DEWS, by the 30th day of June of that same calendar year.

Recommendation 33. 'As constructed' documentation

(a) The dam owner must develop 'as constructed' documentation for Nathan Dam in accordance with this condition and the Queensland Dam Safety Management Guidelines – February 2002.

(b) The owner must provide one (1) copy of the 'as constructed' documentation to the Chief Executive, DEWS, on or within three (3) calendar months of 'practical completion of construction'.

(c) The 'as constructed' documentation must include:

  (i) a record of any decisions to adapt the nominated design to suit actual field conditions

  (ii) 'as constructed' drawings indicating the actual lines, levels and dimensions to which the structure is built a description of the construction process

  (iii) comprehensive photographs of the construction

  (iv) summary of material test results

  (v) summary of construction inspection reports

(vi) initial instrumentation data.

(vii) certification by an RPEQ that the works have been constructed in compliance with all relevant engineering standards.

Recommendation 34. Standard operating procedures

(a) The dam owner must develop Standing Operating Procedures (SOP) in accordance with the Queensland Dam Safety Management Guidelines – February 2002 or updates thereof. The SOP must include the following activities:

(i) Personnel training and procedural issues:

(A) operator training

(B) documentation control and review

(C) setting of normal operation criteria.

(ii) Emergency action and incident reporting:

(A) accident and incident reports

(B) review of EAP including verification of emergency contact numbers

(C) communication procedures and procedures covering loss of communication

(D) maintenance of Dam Log Book for recording of surveillance inspections, equipment testing, planned and unplanned maintenance and incident details.

(iii) Critical operating procedures:

(A) inspection, testing and maintenance of critical mechanical and electrical equipment

(B) water level monitoring procedures

(C) communication security and failsafe procedures.

(iv) Monitoring and surveillance:

(A) owners routine dam safety inspection including checklists and reporting requirements

(B) dam safety five-yearly comprehensive inspection

(C) inspection during and after flood or seismic events

(D) water level and piezometer monitoring procedures.

(b) The dam owner must submit a copy of the SOP to the Chief Executive, DEWS, within 30 days of the 'practical completion of construction'.

(c) The dam must be operated in accordance with the SOP.

(d) The dam owner must ensure the SOP are reviewed prior to Full Supply Level for Nathan Dam being achieved for the first time and by the 1st day of June of each calendar year, and updated and/or added to if necessary.

(e) Where amendments are made to any SOP, the updated documents are to be forwarded to the Chief Executive, DEWS, by the 30th day of June of that same calendar year.

(f) Where no amendments are necessary, a written notification confirming that the SOP have been reviewed shall be signed by the dam owner and forwarded to the Chief Executive, DEWS, by the 30th day of June of that same calendar year.

Recommendation 35. Detailed operation and maintenance manuals

(a) The dam owner must prepare detailed Operation and Maintenance Manuals in accordance with the Queensland Dam Safety Management Guidelines – February 2002 or updates thereof.

(b) The Operation and Maintenance Manuals must be prepared and finalised by three (3) months following the date of practical completion of construction.

(c) The dam owner must ensure that the Operation and Maintenance Manuals provide a comprehensive set of instructions on all equipment operated at the dam.

(d) The dam must be operated and maintained in accordance with the Operation and Maintenance Manuals.

(e) The dam owner must ensure the detailed Operating and Maintenance Manuals are reviewed, and if necessary updated, by the 1st day of June of each calendar year.

(f) A written notification confirming that the Operating and Maintenance Manuals have been reviewed, and if necessary updated, must be signed by the dam owner and forwarded to the Chief Executive, DEWS by the 30th day of June of that same calendar year.

Recommendation 36. Special inspections

(a) When directed by the Chief Executive, DEWS, a Special Inspection must be carried out at the cost of the dam owner and a report must be prepared in accordance with the Queensland Dam Safety Management Guidelines – February 2002 or updates thereof.

(b) The Chief Executive, DEWS shall be advised in writing of the date of the inspection and may elect to observe any or all procedures involved in the inspection process.

(c) The dam owner must provide one copy of the Special Inspection Report to the Chief Executive, Department of Energy and Water Supply within thirty (30) days of completion of inspection.

Recommendation 37. Comprehensive inspections

(a) The dam owner must carry out a Comprehensive Inspection of the dam in accordance with the Queensland Dam Safety Management Guidelines – February 2002 or updates thereof, within one (1) month of 'practical completion of construction' of the Nathan Dam, and on or before every fifth anniversary thereafter.

(b) The Chief Executive, DEWS, shall be advised in writing of the date of the Comprehensive Inspection and may elect to observe any or all procedures involved in the inspection process.

(c) A Comprehensive Inspection Report detailing the findings of the Comprehensive Inspection in accordance with the Queensland Dam Safety Management Guidelines – February 2002 must be submitted to the Chief Executive, DEWS, within three (3) months after completion of the Comprehensive Inspection.

Recommendation 38. Safety review

(a) The dam owner must carry out a Safety Review in accordance with the Queensland Dam Safety Management Guidelines – February 2002 or updates thereof by the 1st day of June (20 years from the year of construction completion).

(b) The dam owner must prepare a Safety Review Report and provide one (1) copy of the Safety Review Report to the Chief Executive, DEWS, within three (3) months of completing the review.

(c) Further safety reviews are to be carried out at twenty (20) year intervals, but may be required at more regular intervals by the Chief Executive, DEWS, in such cases as:

  (i) an absence of adequate documentation

  (ii) detection of abnormal behaviours of the structure

  (iii) changes to design standards or construction standards

  (iv) a regulatory requirement.

Recommendation 39. Decommissioning

(a) The dam must not be taken out of service (decommissioned) except in accordance with a Decommissioning Plan submitted to and accepted by the Chief Executive, DEWS.

(b) The Decommissioning Plan must indicate how the dam is to be rendered safe in the long term and how the contents are to be drained in a controlled and safe manner.

(c) The Decommissioning Plan must indicate how passage of aquatic fauna would be maintained during decommissioning works and immediately after decommissioning.

Schedule 11 *Land Act 1994, Stock Route Management Act 2002* and *Land Title Act 1994*

This schedule is relevant to applications for land tenure under the *Land Act 1994,* the *Stock Route Management Act 2002* and the *Land Title Act 1994* which are administered by the Department of Natural Resources and Mines (DNRM).

Recommendation 40. Land tenure strategy

The outcome sought by this recommendation is to ensure a land tenure strategy is prepared in consultation with DNRM prior to project construction, including information on:

(a) current land tenure of all lands affected by the project during construction and operation, including access arrangements

(b) proposed final land tenure arrangements of all lands affected by and ancillary to the project; including the full supply level, flood levels, water distribution infrastructure and dam wall

(c) proposed mitigation strategies to address all identified impacts to State land, including state leasehold land, reserves, roads, unallocated state land, and land identified as a stock route under the *Stock Route Management Act 2002.*

Appendix 5. Proponent commitments

This appendix includes commitments or management measures not captured in the draft environmental management plan (EMP) (EIS Chapter 29) or described in the EIS (including additional information to the EIS). I expect the proponent to implement all commitments, management measures and corrective actions listed below and detailed in the EIS.

Commitment number	Proponent Commitment
	Project Development (pre-construction)
1.	When triggered by market demand, finalise the Business Case for the project.
2.	If the Business Case is accepted, commence detailed design, which will include: • water storage buffer environmental areas, northern wildlife corridor and finalisation of offset plans • all project components in conjunction with the information generated through preparatory works.
3.	If the Business Case in accepted, commence preparatory works, which will include: • considering all relevant items from the draft EMP to assist the design process. • establishing community liaison and communication processes that assist to minimise impacts on landholders and maximise benefits for the local community • revising and/or finalising all required investigations, baseline studies, pre-clearance surveys and management plans as nominated in the draft EMP, these commitments, the EIS or conditions of approvals • obtaining all necessary permits, licences and approvals in time for their appropriate application.
	Detailed Design, Construction & Operation
	Topography, geology and soils
4.	Physical model studies will be undertaken to inform erosion protection works downstream of the dam.
5.	Geomorphic assessment will be undertaken to refine predictions in relation to potential impacts such as sedimentation, erosion prone soils, bank slump etc.
6.	Soil Management Protocols will be utilised across all project sites including the pipeline.
7.	Provide surplus spoil, if suitable for use as landfill capping, to Western Downs Regional Council.
	Land use and infrastructure
8.	Develop and implement a project land access strategy, land acquisition and compensation strategy.
9.	Land tenure will be obtained in accordance with applicable legislation (including the *Land Act 1994* and the *Acquisition of Land Act 1967*) at the appropriate time and by the appropriate entity.

Commitment number	Proponent Commitment
10.	Property based planning (including an agricultural land use constraints analysis) will be provided for properties impacted by the dam and water storage area in order to minimise the impact of project requirements, including infrastructure and environmental measures, on the agricultural productivity of remaining land.
11.	A recreational facility options study would be prepared in consultation with Banana Shire Council.
12.	A Dam Community Recreational Facilities Agreement will be executed with Banana Shire Council to offset the loss of the Glebe Weir recreation facility.
13.	Two recreational areas will be constructed adjacent to the water storage area, to be managed and maintained by Banana Shire Council over the long-term.
	Terrestrial flora
14.	Flora surveys will be undertaken during preparatory works to assist detailed design, to verify the area and condition of each community impacted by the final design and to confirm (or otherwise) the presence of threatened species. Maps of all impacted areas will be submitted to the Queensland Herbarium for verification.
15.	Where flora surveys identify any threatened plants in impact areas, implement national translocation protocols[54] if establishing additional populations is considered necessary and feasible.
16.	An offset management plan for flora will be developed and agreed with State and Commonwealth authorities.
	Terrestrial fauna
17.	Fauna surveys will be undertaken during preparatory works to assist detailed design, to verify the species present, to confirm (or otherwise) the presence of threatened species, and to confirm if species are breeding in the impact areas. SMPs will be developed as necessary if works will interfere with the breeding place of a threatened species or special least concern species.
18.	An offset management plan for threatened fauna will be developed and agreed with State and Commonwealth authorities including the detailed design of the water storage buffer environmental areas and northern wildlife corridor.
	Aquatic ecology
19.	A Fishway Operations Plan will be developed in consultation with Fisheries Queensland.
20.	Investigate providing a financial commitment to restoring fish passage at Gyranda Weir.
21.	Filters will be included within the design of pipeline offtake and balancing storage infrastructure to minimise the likelihood of successful transfer of noxious fish species.

[54] Vallee, L, Hogbin, T, Monks, L, Makinson, B, Matthes, M & Rossetto, M 2004, Guidelines for the Translocation of Threatened Plants in Australia - Second Edition, Australian Network for Plant Conservation, Canberra.

Commitment number	Proponent Commitment
22.	The dam should incorporate design features that minimise the risk of death and injury to turtles and other aquatic animals. The features would incorporate but are not limited to: • exclusion devices around inlets that aim to not trap fauna while preventing them from being drawn into the structures • features which minimise the 'climbability' of the dam wall • outlet works that (during normal operations) would not release water at such a velocity or in such a manner that it would injure turtles and other fauna • separation of attractant flows for fish and turtle ways from high velocity outlet structures for downstream flows. • providing a 'soft landing' e.g. a deep stilling basin, to reduce mortality and injury to turtles during over-topping events.
23.	Undertake regular assessment of the effectiveness of the operation of the fishway and turtle way.
	Turtles
24.	Further develop the proposed mitigation measures for addressing project impacts on white-throated snapping turtle (*Elseya albagula*) and the Fitzroy River turtle (*Rheodytes leukops*) in consultation with relevant State and Commonwealth Government agencies (e.g. Department of Environment and Heritage Protection and Department of Environment and Energy).
25.	Improve habitat for turtles and other aquatic species within the dam impoundment through the creation or placement of snag habitat (woody debris).
26.	Undertake monitoring of confirmed turtle nesting banks downstream of the dam as far as Theodore to identify any signs of degradation as result of the reduced flood flows and rehabilitate as required.
27.	During construction of the project, night works during turtle nesting periods (if turtles are shown to be nesting in the area of works) would be avoided.
28.	Catchment-wide turtle monitoring: • Commitment to provision of $100,000 per annum for five years toward conduct of ecological surveys directed at assessment of distribution, abundance and location of turtle nesting areas. The funding will be triggered upon the commencement of construction.
	Subterranean aquatic ecology
29.	Sampling for presence of stygofauna will be undertaken: • prior to the commencement of dewatering • 3 and 6 months after the completion of the dewatering to determine if re-colonisation of stygofauna communities has taken place • prior to dam inundation • annually throughout dam operation to reconfirm presence of stygofauna.
30.	Stygofauna investigations will consider the Department of Science Information Technology and Innovation 2015 '*Guideline for the Environmental Assessment of Subterranean Aquatic Fauna'* (or later version) when developing the investigatory program.

	Water resources–surface water
31.	A detailed geomorphic site assessment will be undertaken including: • A geomorphic condition assessment at selected sites upstream of the future impoundment area, within the future impoundment area and downstream of the dam. • Stability assessments to describe pre-development characteristics of the river bed and banks, channel stability, the potential for failure and erodibility, amongst others. • The identification of key indicators for long-term monitoring of geomorphic and fluvial characteristics within the project development area as part of an adaptive management programme.
32.	Information will be provided to DNRM in order to augment and/or develop a new Resource Operations Plan (ROP) for the Fitzroy Basin to include Nathan Dam, including negotiation and compensation for changes to existing water entitlements (including water harvesting entitlements). A ROP amendment will be required due to changes to existing operational rules for the Dawson Valley Water Supply Scheme.
33.	Long-term monitoring of downstream riparian habitat will be undertaken to confirm predictions of no impact as a result of flow regime change. Should decreases in riparian health be observed and related to flow regime change as a result of the project, then remedial measures will be developed, possibly including alterations to the operational flow regime.
34.	A "first-filling strategy" will be developed which will provide management responses to various filling scenarios and include potential compensation if water entitlement holders are impacted.
35.	In order to maintain river flows during construction, continue operation of Glebe Weir until dam closure.
36.	In order to manage potential impacts on water entitlement holders during the initial filling period or unanticipated longer filling period, consultation with DNRM would be undertaken to agree on implementation of appropriate mitigation measures. Mitigation measures could include but are not limited to: • emptying of Glebe Weir (uppermost storage) prior to dam closure • maintain water levels within downstream water storages at higher levels than usual to minimise the risk of shortfall by the dam • drawdown of downstream water storages lower than normal to compensate for the unanticipated longer filling period of the dam • allow forward draw on entitlements, therefore increasing access to flows immediately prior to dam closure. In consultation with DNRM and affected water entitlement holders (if any), compensation would be provided to relevant water entitlement holders.
37.	Undertake construction of those aspects of the project which are largely weather dependent during the dry season or when rainfall is low.
38.	A contingency plan approach will be considered in discussion with DEWS, DNRM and relevant local authorities to ensure that urban communities retain sufficient water supply to meet essential human needs in line with the level of service parameters adopted by the communities in question.
39.	Finalise the compensation strategy in consultation with affected water entitlement holders.
40.	Upon finalisation of detailed design of the dam, flood modelling will be updated and provided to Banana Shire Council.

	Water resources—groundwater
41.	Consultation with groundwater users will be undertaken prior to construction of the project to agree on make good agreements for all impacted bores during construction and operation of the project.
42.	No grout curtain will be installed at the dam wall so as to ensure that downstream surface water and groundwater connectivity is not affected.
43.	Undertake regular maintenance and monitoring of the pipeline to reduce the likelihood of pipeline rupture.
	Water quality
44.	Monitoring for blue-green algae will be undertaken throughout operation of the project.
45.	No water will be released downstream in the event of an algal bloom outbreak, unless it is safe to do so.
46.	A vegetation clearing strategy will be prepared and woody vegetation other than within 1.5m vertical of FSL within the water storage will be mechanically cleared prior to inundation to reduce potential water quality impacts.
	Noise and vibration
47.	Use plant equipment with the lowest noise rating to meet project requirements.
48.	Develop and implement a communication program to inform the community of construction activities, including timing, duration and likely impacts.
49.	Avoid the coincidence of noisy plant equipment operating at the same time adjacent to sensitive receivers.
50.	Use designated project access routes to minimise areas where traffic noise would impact sensitive receivers
51.	Ensure that noise from pump stations does not exceed LAeq 28dB(A) at the nearest sensitive receiver from pumping stations, by implementing appropriate measures such as a noise enclosure.
52.	Participate in regional coordination processes to ensure pump stations associated with other pipelines are not in close proximity to the project's pump stations to minimise cumulative noise impacts.
	Waste
53.	Provide the remaining excavated spoil, if suitable for use as landfill capping, to Western Downs Regional Council. Transport of the excavated spoil from the point of generation is the responsibility of the Western Downs Regional Council.
54.	Manage waste in line with the principles of the waste management hierarchy: waste minimisation, re-use and recycling, primarily onsite.
55.	Liaise with the relevant local council on waste disposal options prior to the commencement of construction.
56.	Liaise with both the relevant local councils to investigate suitable options for alleviating potential capacity impacts on local facilities as a result of the accommodation camps.
57.	Provide detailed waste projections following detailed design to the relevant stakeholders.
58.	Develop and implement a site-specific waste management plan prior to the commencement of construction activities.
59.	Develop and implement a plan for the decommissioning of Glebe Weir.

	Transport
60.	Detailed traffic management plans (TMPs) complementing the Project road use management plans (RUMPs) will be developed in consultation with Department of Transport and Main Roads (TMR), Western Downs Regional Council, Banana Shire Council and Queensland Police Service (QPS).
61.	Subsequent to TMR and Council approvals, the proposed controls will be implemented in consultation with TMR, QPS, Queensland Fire and Rescue Service (QFRS), Queensland Health and the Councils as appropriate prior to the commencement of the construction and/or operational works.
62.	Development of the RUMP and TMP will include consideration of cumulative traffic movements associated with other developments active at the time.
63.	Nominated transport strategy and routes will be reviewed with the construction and haulage contractors once appointed.
64.	Property access will be realigned or replaced where impacted.
65.	Roads constructed as part of the project will meet relevant standards and will accommodate emergency vehicles
66.	Construction near or encroaching on a road reserve will be agreed with the relevant authority and conform to statutory requirements/ permitting requirements.
67.	Mitigation measures for school travel, such as new/revised bus routes, will be developed in consultation with the affected stakeholders (DTMR, Taroom, Theodore, Wandoan, Guluguba, Miles and Chinchilla State Schools, QPS, QFRS, Queensland Health and the Councils) at detailed Project design.
68.	DNRM, BSC and WDRC will be consulted on stock route impacts and mitigations during the detailed design phase of the project
69.	The functionality of the entire stock route network impacted by the project will be retained during both construction and operation, but may include temporary alternative access arrangements.
70.	The need to upgrade and raise the ford at Stoney crossing will be investigated in consultation with the stock route officer, BSC.
	Cultural heritage
71.	Negotiations with all remaining affected Aboriginal parties will be undertaken to develop and finalise a Cultural Heritage Management Plan (CHMP) that covers the impacted area.
72.	The Cultural Heritage Management Plan will be developed with the relevant Aboriginal parties and approved by the State Government.
73.	Further studies will be commissioned at the former Taroom Aboriginal Settlement to better ascertain the project impacts on the site. Consultation will be undertaken with the wider community regarding the management strategies developed with the Iman and Wulli Wulli people for inclusion in the CHMP for a joint area of interest.
74.	A suitably qualified professional will be engaged to undertake a full archival recording to capture the nature of the site.at Binghi Slab Hut.
75.	For the cultural heritage sites of Barkla Camp, Inscribed Rock (Beaumont), the site of Barkla's Bridge and Corduroy Crossing, prior to works commencing, a basic level of photographic recording will be undertaken to capture the nature of the item and its context within the cultural environment and within the study area.
	Social impacts

76.	A Social Impact Management Plan will be finalised on the basis of the preliminary framework outlined in Section 24.9 of the EIS.
77.	Regional government, industry and the community will be regularly liaised with to contribute to the regional management of potential cumulative impacts.
	Economics
78.	Negotiations will be undertaken with landholders directly impacted by the project to assess the fair market value for their property to reach an agreement for compensation payable for any loss of land or interest in land, in accordance with the provisions of the *Acquisition of Land Act 1967.*
	Environmental management
79.	The Construction and Operation EMP provided in the additional information to the EIS will be further refined during the detailed design stage of the project and implemented accordingly.
	Landscape character and visual amenity
80.	The proponent commits to considering the following mitigation measures for construction of the project in their EMP: • restricting project activities to daylight hours to ensure limited lighting impacts during construction and operation • using directional sensor-activated lighting to reduce sky glow • avoiding installing lighting within the impoundment or at river crossings. Project lighting during operations would be limited to directional sensor activated lighting for safety and security purposes.

Appendix 6. Threat abatement plans, species recovery plans and conservation advices

The following threat abatement plans and recovery plans relate to MNES as discussed in Section 6 of my report.

Threatened species and communities recovery plans

The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin––2010

The overall objective of the recovery plan is to maintain or enhance groundwater supplies to GAB discharge spring wetlands, maintain or increase habitat area and health, and increase all populations of endemic organisms.

Specific objectives and a summary of their recovery actions, identified in the recovery plan are as follows:

(1) Enhance aquifer pressure and ensure flows from springs do not decrease (lower than natural variability) by:
   a) controlling bores that may benefit flows to springs
   b) developing and implementing techniques to increase landholder participation in the GABSI
   c) completing historical documentation of spring flows
   d) controlling new groundwater allocations
   e) effectively monitoring spring flows
   f) improving understanding of the physical processes sustaining spring wetlands.

(2) Achieve appropriate tenure-based security to protect against future threatening processes by:
   a) securing populations of native species within GAB discharge springwetlands through perpetual conservation agreements
   b) ensuring landholders understand that excavation and related direct threatening processes are regulated activities
   c) minimising the impact of stock and feral animal disturbance and managing total grazing pressure
   d) establishing fencing where appropriate including the option to regulate stockuse rather than exclude stock
   e) controlling feral animals.

(3) Minimise the threat of exotic plants and aquatic animals, and reduce their effects by:
   a) studying the interaction between native and exotic fauna
   b) preventing further spread of gambusia and other exotic fauna
   c) eradicating exotic plants from springs and ensure no further deliberate introductions of exotic species occur.

(4) Ensure that impoundments do not degrade spring values by ensuring that the impact of impoundments on spring values are properly considered in environmental impact assessments.

(5) Maintain populations and improve habitat for endemic organisms where required using monitoring and adaptive management by:
   a) completing an inventory of endemic species in GAB discharge spring wetlands

b) monitoring populations of endemic species and understanding their ecology and biology

c) implementing protocols to avoid transportation of organisms from one spring to another

d) re-establishing natural values of reactivated springs.

(6) Engage custodians in responsible management of springs by:

a) fostering responsible landholder management of spring wetlands

b) increasing the involvement of Indigenous custodians in spring management.

(7) Develop community education and extension programs by:

a) raising community awareness of the importance of GAB discharge spring wetlands and their conservation requirements

b) developing and implementing tourist visitation management plans for selected sites

c) identifying information and develop communication products that can be used to further describe the present EPBC listed ecological community and the responsibilities pertaining to the listing.

(8) Co-ordinate the implementation and evaluation of recovery plans relating to GAB springs by:

a) establishing a recovery team or substitute to co-ordinate implementation and evaluations of the recovery plan

b) convening a GAB springs forum at appropriate intervals.

Boggomoss snail (*Adclarkia dawsonensis*)––2008

The overall objective of the recovery plan is to manage and protect the boggomoss snail and its habitat.

Specific objectives and a summary of their recovery actions, identified in the recovery plan are as follows:

(1) Protect the boggomoss snail habitat to ensure survival of the species by:

a) undertaking field surveys to assess weed problems in the two known habitats of the boggomoss snail and develop and implement control programmes, if necessary. Use of chemicals to be avoided

b) developing and implementing fire risk management plans for the two known habitats of the boggomoss snail

c) undertaking field surveys to identify and map all essential habitat and habitat critical to the survival of the boggomoss snail

d) fencing the habitat critical to the survival of the boggomoss snail to exclude cattle.

e) developing and implementing a post-fencing fire and weed management plan.

(2) Protect populations of the boggomoss snail by:

a) reviewing the conservation status of the boggomoss snail under the Queensland *Nature Conservation Act 1992*

b) entering into negotiations with owners of the Mt Rose Station to protect the population of snails through a conservation covenant such as a Nature Refuge agreement or another voluntary conservation agreement

c) conducing field investigations to investigate significance of other threats (e.g. predators); develop a management plan; and implement actions identified in the management plan.

(3) Identify additional living populations of the boggomoss snail in the wild by:

a) conducting scientific surveys of the Taroom-Theodore area

b) undertaking actions to protect any new population/s, if discovered.

(4) Increase the understanding of the distribution and ecology of the boggomoss snail by:

a) developing specific guidelines for the conduct of research and survey on the boggomoss snail

b) conducting research into the ecology and life cycle of the boggomoss snail.

c) monitoring the presence or absence of the boggomoss snail twice yearly

d) undertaking genetic research into the living populations of the boggomoss snail in order to determine degree of genetic diversity among populations.

(5) Increase public awareness of the boggomoss snail by:

a) preparing and distributing a community awareness brochure

b) conducting a high profile media campaign about the boggomoss snail

c) collaborating with landowners with habitat suitable for the boggomoss snail to maintain those areas for the purpose of the conservation of the snail.

Threat abatement plans

Threat abatement plan for predation by the European red fox—2008

The goal of the European red fox TAP is to minimise the impact of foxes on biodiversity in Australia and its territories by protecting affected native species and ecological communities, and preventing further species and ecological communities from becoming threatened. The specific objectives and action items to achieve this are as follows:

(1) Prevent foxes occupying new areas in Australia and eradicate foxes from high-conservation-value 'islands' by:

(a) collating data on offshore islands and isolated mainland 'islands', assess their conservation value, the likelihood of significant biodiversity impacts from foxes and, if there are no foxes present, rank the level of risk of foxes being introduced and establishing populations

(b) developing management plans to prevent, monitor and, if incursions occur, contain and eradicate any fox incursion, for 'islands' with high conservation values

(c) implementing management plans for high-conservation-value 'islands', including prevention and monitoring actions, and containment or eradication actions if incursions occur

(d) eradicating established populations of foxes from 'islands' with high conservation values (including Tasmania) where this is cost-effective, feasible and a conservation priority.

(2) Promote maintenance and recovery of threatened species and ecological communities that are affected by fox predation by

(a) identifying priority areas for fox control based on:

(i) the significance of the population of the affected native species or of the ecological community

(ii) the degree of threat posed by foxes to species and ecological communities relative to other threats

(iii) the cost-effectiveness of maintaining fox populations below an identified 'damage threshold' in the region, and

(iv) the feasibility of effective remedial action

(b) conducting and monitoring regional fox control, through new or existing programs, in priority areas identified in Action 2.1

(c) applying incentives (other than bounties), partnerships and negotiated agreements to promote and maintain on-ground fox control on private or leasehold lands within or adjacent to priority sites identified in Action 2.1.

(3) Improve knowledge and understanding of fox impacts and interactions with other species and ecological processes by:

(a) developing simple and cost-effective methods for monitoring populations of foxes and the impacts of foxes, including reliable methods for monitoring foxes and key native species at different densities, including very low densities

(b) investigating interactions between foxes and native carnivores to identify the significance of competition and predation by foxes to these native species

(c) determining the nature of interactions between foxes, feral cats, wild dogs and rabbits to effectively integrate fox control activities for all four species

(d) Identifying any unintended effects that fox control may have if conducted in isolation from other management activities

(e) developing means for estimating the environmental and other associated costs of impacts arising from foxes.

(4) Improve the effectiveness, target specificity, integration and humaneness of control options for foxes by:

(a) conducting research and extension to improve the effectiveness, target specificity and humaneness of existing toxin-bait media and baiting methods

(b) conducting further work on the development of new, or improvements to existing, control techniques

(c) testing and disseminating information on exclusion fence designs and other control methods regarding their cost-effectiveness for particular habitats or topography

(d) investigating the feasibility of control techniques to target foxes, but not dingoes, in some areas

(e) developing training programs to help land managers identify locally appropriate control method(s) and when (i.e. circumstances and times) to apply them in controlling foxes

(f) ensuring that habitat rehabilitation and management of potential prey, competitors and predators of foxes are considered in fox control programs

(g) continuing to promote the adoption and adaptation of the model codes of practice and standard operating procedures for humane management of foxes.

(5) Increase awareness of all stakeholders of the objectives and actions of the TAP, and of the need to control and manage foxes by:

(a) promoting:

(i) broad understanding of the threat to biodiversity posed by foxes and support for their control

(ii) support for the actions to be undertaken under this plan

(iii) the use of humane and cost-effective fox control methods

(iv) best-practice effective fox control in all tenures

(v) understanding of predation by foxes as a key threatening process.

Threat abatement plan for predation by feral cats—2015

The goal of the feral cat threat abatement plan (TAP) is to minimise the impact of cats on biodiversity in Australia and its territories by:

(1) Protecting affected threatened species

(2) Preventing further species and ecological communities from becoming threatened

To achieve this goal, the plan has four objectives:

(1) Effectively control feral cats in different landscapes

(a) Ensure broad-scale toxic baits targeting feral cats are developed, registered and available for use across all of Australia, including northern Australia

(b) Develop and register other cat control tools, including devices exploiting cat grooming habits

(c) Continue research into understanding interactions between feral cats and other predators: (i) in different landscapes; and (ii) any potential beneficial/perverse outcomes if other predator populations are modified

(d) Continue research into understanding the role of other major landscape modifiers, such as fire or grazing by introduced herbivores, in feral cat activities and control

(e) Continue research into the scale, efficiency, cost-effectiveness, sustainability and risks of feral cat control options

(f) Continue development of new or enhanced attractants for cats to improve cat control and monitoring. Ensure availability of any attractants that are developed

(g) Research into other control and monitoring technologies and enhancing available technology

(h) Re-investigate diseases and other potential biocontrol agents, biotechnology and immunocontraceptive options for cats, and commence research on promising options. Undertake social research on promising options to gauge community support

(i) Code of Practice and/or Standard Operating Procedures developed for new tools and agreed by governments

(2) Improve effectiveness of existing control options for feral cats

(a) Understand motivations and provide incentives for land managers to include feral cat management into standard land management for biodiversity outcomes

(b) Provide information, in various media and through training, on best practice methods and standard operating procedures for controlling and monitoring feral cats

(c) Ensure areas prioritised for feral cat management across Australia maximise benefits to biodiversity at a local, regional and national level

(d) Governments agree to consistent legislation that identifies feral cats as a pest, has requirements for control, and identifies control techniques that may be used

(3) Develop or maintain alternative strategies for threatened species recovery

(a) Eradicate, or control, cats on offshore islands of high, or potentially high, biodiversity value

(b) Establish, enhance or maintain biosecurity measures for cat-free offshore islands to prevent incursions

(c) Establish and maintain further fenced reserves (“mainland islands”) for threatened species where it is identified cats cannot be controlled to the level required for threatened species recovery

(d) Research methods to understand thresholds of cat abundance required to improve survival rates for threatened species heavily preyed upon by feral cats. Research ways in which adaptation by threatened species may improve survival rates.

(e) Continue research into cat diseases, including Toxoplasma gondii and sarcosporidiosis, their prevalence, ability to transmit to other species (including livestock and humans) their impacts, and ways to mitigate the impacts.

(4) Increase public support for feral cat management and promote responsible cat ownership.

(a) Quantify the proportion of the domestic and stray cat population that transitions to the feral cat population

(b) Promote to and seek engagement of the community in:

(i) an understanding of the threat to biodiversity posed by cats and support for their management;

(ii) an understanding of the transitions between domestic, stray and feral cats, and the need for responsible ownership;

(iii) support for the containment of domestic cats where their roaming may impact on identified conservation areas

(c) Promote and seek community engagement on the reduction of food and other resources to stray cats

(d) Develop specific communication campaigns to accompany the release of new broad-scale cat control techniques and other current/new cat control techniques and management programs—2015

Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads––2011

The goal of the cane toad TAP is to address the key threatening process (lethal toxic ingestion) of this species on native fauna in a feasible, effective and efficient manner. The three main objectives and associated recovery actions in order to achieve this goal are as follows:

(1) Identifying priority native species and ecological communities at risk from the impact of cane toads by:

(a) identifying native species, ecological communities and off-shore islands currently known to be at high to moderate risk

(b) lientifying the ways in which cane toads impact the native species and ecological communities listed in (a)(i)

(c) establishing and supporting research where impacts are unknown but may be high, to further understand the impact of cane toads on the native species and ecological communities. Where appropriate, research ways to assist with the recovery of priority native species and ecological communities

(d) developing a prioritisation tool to guide allocation of resources for protection of native species and communities. Apply it to native species and ecological communities identified: first from (a)(i), then from (a)(iii)

(2) Reducing the impact of cane toads on populations of priority native species and ecological communities by:

(a) focusing the management of cane toad impacts by Australian Government agencies on designated high priority native species and ecological communities, and seek cooperative action on priorities by jurisdictions and other stakeholders

(b) implementing and monitoring emergency management of cane toad impacts for known high priority native species and ecological communities using currently available tools and techniques (e.g. trapping, fencing of small areas, manual removal from designated sites)

(c) implementing or adjusting the management of cane toad impacts using available tools and techniques as new species and communities are added to the list of priority native species and ecological communities. Additional tools and techniques will become available with the registration of toxins for euthanasia of captured toads and development of other impact management or cane toad control techniques. Codes of practice and standard operating procedures for cane toad control will provide guidance on these techniques

(d) preparing guidelines, including codes of practice and standard operating procedures that can be applied to both emergency responses and on-going management for high priority native species and ecological communities for endorsement by the VPC

(e) preparing and implementing management plans, (including identifying and addressing gaps in management techniques and tools) for designated high priority species and ecological communities on land managed by Australian Government agencies

(f) providing the guidelines for emergency and on-going cane toad management to all stakeholders. Liaising with responsible jurisdictions/agencies to encourage the preparation and implementation of such plans in their areas of responsibility. Where mutual obligations exist the Australian Government will work cooperatively to prepare such plans

(g) monitoring the development and implementation of guidelines and cane toad management plans for designated high priority species and ecological communities

(h) monitoring the literature about the spread and impact of the cane toad and review/amend guidelines and develop new management plans as required

(i) establishing guidelines for humane management actions to control cane toads for VPC and Animal Welfare Committee endorsement

(j) distributing guidelines to all Australian Government agencies with land management responsibilities

(k) seek cooperative adoption of guidelines by states/territories including incorporation in state based regulations as appropriate.

(3) Communicating information about cane toads, their impacts and the TAP by:

(a) implementing a one-stop-shop webpage on the Department of Environment website with links to jurisdictional and stakeholder information on cane toads and including information on:

(i) the threat cane toads pose to biodiversity

(ii) management actions to limit this threat

(iii) guidelines for cane toad management

(iv) information to help identify cane toads from other amphibians

(v) codes of practice and standard operating procedures

(vi) management plans (as they are developed) for areas designated as high priority.

(b) encouraging monitoring, evaluation and reporting on cane toad management actions is maintained and communicated to stakeholders

(c) ensuring Australian Government fact sheets and other communications material on cane toads are current and reflect the strategy developed in this TAP.

Threat abatement plan for competition and land degradation by rabbits––2016

(1) The goal of this TAP is to minimise the impact of rabbit competition and land degradation on biodiversity in Australia and its territories by:

(2) protecting affected threatened species and ecological communities, and

(3) preventing further species and ecological communities from becoming threatened.

(4) To achieve this goal, the plan has four main objectives:

a) Strategically manage rabbits at the landscape scale and suppress rabbit populations to densities below threshold levels in identified priority areas

b) Improve knowledge and understanding of the impact of rabbits and their interactions with other species and ecological processes

c) Improve the effectiveness of rabbit control programs, and

d) Increase engagement of, and awareness by, the community of the environmental impacts of rabbits and the need for integrated control.

Conservation advices

Approved Conservation Advice for the Brigalow (*Acacia harpophylla* dominant and co-dominant) ecological community––2013

Research and monitoring priorities:

(1) Establish condition benchmarks across the range of the brigalow ecological community for each of the component vegetation communities.

(2) Survey and continue to monitor a representative set of sites in Qld and NSW to assess condition and to identify relevant threats.

(3) Identify, prioritise and map important areas for brigalow conservation in Qld and NSW.

(4) Investigate methods to assist advanced regrowth to attain the structural and floristic characteristics of remnant brigalow.

(5) Undertake monitoring to ensure and encourage compliance with legislation that protects the brigalow ecological community.

Priority recovery and threat abatement actions:

(1) Threat reduction/control

- (a) Protect and conserve remnant and regrowth areas of the ecological community. Prevent clearance of this endangered ecological community and of nearby native vegetation including buffer zones and connecting corridors.
- (b) Where further clearance is unavoidable:
  - (i) mitigate the severity of impacts (e.g. avoid higher quality areas, avoid dissection of patches, act to minimise hydrological disruption and the spread of weeds)
  - (ii) offsetting should consider the location and emulate qualities of affected patches.
- (c) Manage areas of the brigalow ecological community to reduce threats, including through:
  - (i) fire management that considers brigalow conservation, protection, and ecological heterogeneity
  - (ii) targeted weed and feral animal control with a particular focus on high biomass exotic grasses (buffel grass, Rhodes grass, green panic grass) and feral pigs.
- (d) Manage all weeds appropriately within and close to the brigalow ecological community; e.g.: spot application of herbicides, rather than aerial spraying; avoid fertiliser application; minimise tree thinning and soil disturbance.
- (e) Manage foxes and cats (as well as feral pigs) using a coordinated approach, preferably among groups of neighbours and across regions.
- (f) Help woodland birds to avoid aggression from noisy miners by: encouraging and protecting shrubby understorey; managing grazing pressure so that it does not degrade native vegetation; and retaining dense stands of trees and regrowth

(2) Land management

- (a) Encourage landholders to balance primary production and the conservation of native flora and fauna within and close to the ecological community. Examples of this are:
  - (i) managing stocking rates, paddock numbers/sizes, grazing practices and livestock camp sites to avoid damage to woodland understorey and ground cover – this may include adopting rotational or cell grazing regimes; or, excluding grazing entirely from intact stands of brigalow where appropriate (e.g. unless managing fuel loads through grazing)
  - (ii) leaving trees, or clumps of regrowth, in paddocks to maintain connections between patches of native flora and fauna habitat
  - (iii) connecting shade-lines to one another and keeping them as wide as possible (ideally more than 100 m)
  - (iv) avoiding the application of fertiliser, or the aerial / broad scale spraying of herbicides; and,
  - (v) leaving dead trees standing and allowing dead timber and leaf litter to rot where it falls on the ground.
- (b) Undertake regeneration of high value regrowth sites and revegetation of degraded sites.

(c) Increase the area of the brigalow ecological community managed for conservation, such as through the reservation of high quality/large areas of remnant or regrowth and by facilitating conservation agreements with landholders.

(d) Establish adequate buffer zones to protect remnants.

(e) Devise and implement water management, sediment erosion and pollution control and monitoring plans.

(3) Management for wildlife

(a) Undertake management actions that help to increase the diversity of species and their abundance; this requires thinking about habitat use at multiple scales. General management actions that benefit many fauna species include:

(i) retaining fallen timber and leaf litter for small mammals and reptiles

(ii) retaining standing dead trees or old trees with hollow limbs for nesting sites for birds, mammals and reptiles

(iii) re-introducing microhabitat features (e.g. rocks, logs and other woody debris) to sites disturbed during proposed works

(iv) discouraging species like noisy miners and introduced predators by maintaining large patches of woodland with complex structure

(v) avoiding clearing remnant vegetation; and retaining areas of brigalow regrowth.

(b) Encourage woodland regeneration close to areas of existing woodland.

(4) Develop and Propagate Conservation Information

(a) In consultation with land managers, local and state authorities and Indigenous groups:

(i) develop and propagate environmentally sustainable management guidelines and technical material to assist land managers, including measure to address inappropriate fire regimes, plant pathogens, invasive animal management, weed management and health and maintenance of the ecological community.

(ii) develop or support appropriate existing education programs, information products and signage to help the public recognise the presence and importance of the ecological community, and encourage compliance with their responsibilities under state and local regulations and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Approved Conservation Advice for *Rheodytes leukops* (Fitzroy Tortoise)––2008

Research priorities that would inform future regional and local priority action include:

(1) Undertake survey work in suitable habitat and potential habitat to locate any additional populations.

(2) Undertake research into developing appropriate protection methods to ensure higher survival of eggs and hatchlings.

(3) Develop and implement a monitoring program (including consideration of reproductive success).

(4) The following regional priority recovery and threat abatement actions can be done to support the recovery of *Rheodytes leukops*.

(5) Habitat Loss, Disturbance and Modification

(a) Identify populations of high conservation priority.

(b) Protect areas of riparian habitat where populations of *Rheodytes leukops* are known or have the potential to occur.

(c) Ensure mining operations and other infrastructure or development activities in areas where *Rheodytes leukops* occurs do not impact on known populations.

(d) Manage, in such a manner that there is no detrimental impact, any changes to hydrology that may result in changes to the water table levels, increased run-off, sedimentation or pollution, particularly from cotton/grazing production.

(e) Investigate formal conservation arrangements such as the use of covenants, conservation agreements or inclusion in reserve tenure.

(6) Trampling

(a) Develop and implement a stock management plan along riparian habitats and travelling stock routes.

(b) Animal Predation

(c) Develop a management plan to be implemented for the control and eradication of foxes, pigs, dingoes and cats around breeding colonies of the Fitzroy River turtle (Norris & Low, 2005).

(7) Conservation Information

(a) Raise awareness of Rheodytes leukops within the local community, particularly with boat owners to minimise boat strike (EPA, 2007).

(8) Enable Recovery of Additional Sites and/or Populations

(a) Improve recruitment of hatchling into the population.

(b) Maintain stream flow and the continuity of turtle populations between impoundments.

The following local priority recovery and threat abatement actions can be done to support the recovery of Rheodytes leukops:

(9) Habitat Loss, Disturbance and Modification

(a) Monitor known populations to identify key threats.

(b) Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

(c) Control access routes to suitably constrain public access to known sites on public land.

(d) Suitably control and manage access to nest sites on private land.

(e) Adequately consider the requirements and protection of this species in all proposals for impoundment developments.

(f) Minimise adverse impacts from land use at known sites.

(g) Protect populations of Rheodytes leukops through the development of conservation agreements and/or covenants.

(h) Maintain nesting banks used by the turtles and protect turtle nests from predation and disturbance.

(i) Improve water quality in the lower Fitzroy River catchment.

(j) Trampling

(k) Prevent trampling and riparian habitat damage by grazing animals at known sites on leased crown land through exclusion fencing or other barriers.

(10) Animal Predation

(a) Manage threats at known sites in reserve areas to control pigs, foxes and cats.

(b) Manage threats at known sites on private property to control pigs, foxes and cats.

(11) Enable recovery of additional sites and/or populations

(a) Develop ex situ breeding population.

(b) Evaluate the efficacy of removing eggs from the wild, hatching them in artificial sites, and returning hatchlings to the wild.

Approved conservation advice *Geophaps scripta scripta* squatter pigeon (southern)

(1) Conservation and Management Actions

a) Identify sub-populations of high conservation priority, especially in the southern part of the squatter pigeon's (southern) range.

b) Protect and rehabilitate areas of vegetation that support important sub-populations.

c) Protect sub-populations of the listed subspecies through the development of covenants, conservation agreements or inclusion in reserve tenure.

d) Develop and implement a stock management plan for key sites.

e) Develop and implement a management plan, or nominate an existing plan to be implemented, for the control and eradication of feral herbivores in areas inhabited by the squatter pigeon (southern).

f) Raise awareness of the squatter pigeon (southern) within the local community, particularly among land managers.

(2) Survey and Monitoring priorities

a) Monitor selected sub-populations throughout the distribution of the subspecies to identify rates of population change.

(3) Information and Research priorities

a) Identify preferred food plants, and the responses of these to fire and grazing regimes.

b) Determine patterns of dispersal or residency, and the factors that may determine these.

c) Assess reproductive success, and the factors that affect this.

d) Assess the species' status, and the impacts of mining, in central Queensland.

Approved Conservation Advice for Arthraxon hispidus (Hairy-joint Grass)

This list does not necessarily encompass all actions that may be of benefit to hairy-joint grass, but highlights those that are considered to be of highest priority at the time of preparing the conservation advice.

(1) Research priorities that would inform future regional and local priority actions include:

a) Design and implement a monitoring program or, if appropriate, support and enhance existing programs.

b) More precisely assess population size, distribution, ecological requirements and the relative impacts of threatening processes.

c) Undertake survey work in suitable habitat and potential habitat to locate any additional populations.

d) Undertake seed germination and/or vegetative propagation trials to determine the requirements for successful establishment.

e) Clarify the genetic relationship between local populations and non-Australian populations.

f) Research the life cycle of Hairy-joint Grass to determine whether the species is as annual, as suggested through observation, or a perennial species, as suggested in literature (DECC NSW, 2005).

(2) The following regional priority recovery and threat abatement actions can be done to support the recovery of Hairy-joint Grass:

a) Habitat Loss, Disturbance and Modification

i) Monitor known populations to identify key threats.

ii) Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

iii) Identify populations of high conservation priority.

iv) Investigate further formal conservation arrangements, management agreements and covenants on private land, and for crown and private land investigate inclusion in reserve tenure if possible.

b) Conservation Information

i) Raise awareness of Hairy-joint Grass within the local community.

c) Enable Recovery of Additional Sites and/or Populations

i) Undertake appropriate seed collection and storage.

ii) Investigate options for linking, enhancing or establishing additional populations.

iii) Implement national translocation protocols (Vallee et al., 2004) if establishing additional populations is considered necessary and feasible.

(3) The following local priority recovery and threat abatement actions can be done to support the recovery of Hairy-joint Grass:

a) Habitat Loss, Disturbance and Modification

i) Control access routes to suitably constrain public access to known sites on public land.

ii) Suitably control and manage access on private land.

iii) Minimise adverse impacts from land use at known sites.

iv) Avoid slashing or mowing around rainforest edges (DECC NSW, 2005).

v) Protect areas of rainforest, wet eucalypt forest and swamp from clearing and development (DECC NSW, 2005).

vi) Exclude from forest operations that may adversely affect this species (DECC NSW, 2007).

b) Invasive Weeds

i) Identify, remove, and prevent introduction of weeds in the local area, which could become a threat to Hairy-joint Grass, using appropriate methods.

ii) Control introduced grasses in areas with known populations (DECC NSW, 2005).

iii) Ensure chemicals or other mechanisms used to eradicate weeds do not have a significant adverse impact on Hairy-joint Grass.

c) Trampling, Browsing or Grazing

i) Ensure that livestock grazing, if it occurs in the area, uses an appropriate management regime and density that does not detrimentally affect this species.

ii) Where appropriate manage total grazing pressure at important/significant sites through exclusion fencing or other barriers.

d) Fire

i) Implement an appropriate fire management regime for local populations. Fire should be excluded from sites where this species occurs (NSW RFS, 2004).

ii) Protect habitat from frequent fire (DECC NSW, 2005).

iii) Provide maps of known occurrences to local and state Rural Fire Services and seek inclusion of mitigative measures in bush fire risk management plans, risk register and/or operation maps.

Appendix 7. Statement of Outstanding Universal Value—Great Barrier Reef

Brief synthesis

As the world's most extensive coral reef ecosystem, the GBR is a globally outstanding and significant entity. Practically the entire ecosystem was inscribed as World Heritage in 1981, covering an area of 348 000 km^2 and extending across a contiguous latitudinal range of 14° (10°S to 24°S). The GBR includes extensive cross-shelf diversity, stretching from the low water mark along the mainland coast up to 250 km offshore. This wide depth range includes vast shallow inshore areas, mid-shelf and outer reefs, and beyond the continental shelf to oceanic waters over 2000 m deep.

Within the GBR there are some 2500 individual reefs of varying sizes and shapes, and over 900 islands, ranging from small sandy cays and larger vegetated cays, to large rugged continental islands rising, in one instance, over 1100 m above sea level. Collectively these landscapes and seascapes provide some of the most spectacular maritime scenery in the world.

The latitudinal and cross-shelf diversity, combined with diversity through the depths of the water column, encompasses a globally unique array of ecological communities, habitats and species.

This diversity of species and habitats, and their interconnectivity, make the GBR one of the richest and most complex natural ecosystems on earth. There are over 1500 species of fish, about 400 species of coral, 4000 species of mollusc, and some 240 species of birds, plus a great diversity of sponges, anemones, marine worms, crustaceans, and other species. No other World Heritage property contains such biodiversity. This diversity, especially the endemic species, means the GBR is of enormous scientific and intrinsic importance, and it also contains a significant number of threatened species. At time of inscription, the IUCN evaluation stated "…if only one coral reef site in the world were to be chosen for the World Heritage List, the GBR is the site to be chosen".

Criterion (vii): The GBR is of superlative natural beauty above and below the water, and provides some of the most spectacular scenery on earth. It is one of a few living structures visible from space, appearing as a complex string of reefal structures along Australia's northeast coast.

From the air, the vast mosaic patterns of reefs, islands and coral cays produce an unparalleled aerial panorama of seascapes comprising diverse shapes and sizes. The Whitsunday Islands provide a magnificent vista of green vegetated islands and spectacular sandy beaches spread over azure waters. This contrasts with the vast mangrove forests in Hinchinbrook channel, and the rugged vegetated mountains and lush rainforest gullies that are periodically cloud-covered on Hinchinbrook Island.

On many of the cays there are spectacular and globally important breeding colonies of seabirds and marine turtles, and Raine Island is the world's largest green turtle breeding area. On some continental islands, large aggregations of over-wintering butterflies periodically occur.

Beneath the ocean surface, there is an abundance and diversity of shapes, sizes and colours; for example, spectacular coral assemblages of hard and soft corals, and thousands of species of reef fish provide a myriad of brilliant colours, shapes and sizes. The internationally renowned Cod Hole near Lizard Island is one of many significant tourist attractions. Other superlative natural phenomena include the annual coral spawning, migrating whales, nesting turtles, and significant spawning aggregations of many fish species.

Criterion (viii): The GBR, extending 2000 km along Queensland's coast, is a globally outstanding example of an ecosystem that has evolved over millennia. The area has been exposed and flooded by at least four glacial and interglacial cycles, and over the past 15 000 years reefs have grown on the continental shelf.

During glacial periods, sea levels dropped, exposing the reefs as flat-topped hills of eroded limestone. Large rivers meandered between these hills and the coastline extended further east.

During interglacial periods, rising sea levels caused the formation of continental islands, coral cays and new phases of coral growth. This environmental history can be seen in cores of old massive corals.

Today the GBR forms the world's largest coral reef ecosystem, ranging from inshore fringing reefs to mid-shelf reefs, and exposed outer reefs, including examples of all stages of reef development. The processes of geological and geomorphological evolution are well represented, linking continental islands, coral cays and reefs. The varied seascapes and landscapes that occur today have been moulded by changing climates and sea levels, and the erosive power of wind and water, over long time periods. One-third of the GBR lies beyond the seaward edge of the shallower reefs; this area comprises continental slope and deep oceanic waters and abyssal plains.

Criterion (ix): The globally significant diversity of reef and island morphologies reflects ongoing geomorphic, oceanographic and environmental processes. The complex cross-shelf, longshore and vertical connectivity is influenced by dynamic oceanic currents and ongoing ecological processes such as upwellings, larval dispersal and migration.

Ongoing erosion and accretion of coral reefs, sand banks and coral cays combine with similar processes along the coast and around continental islands. Extensive beds of halimeda algae represent active calcification and accretion over thousands of years.

Biologically the unique diversity of the GBR reflects the maturity of an ecosystem that has evolved over millennia; evidence exists for the evolution of hard corals and other fauna. Globally significant marine faunal groups include over 4000 species of molluscs, over 1500 species of fish, plus a great diversity of sponges, anemones, marine worms, crustaceans, and many others. The establishment of vegetation on the cays and

continental islands exemplifies the important role of birds, such as the Pied Imperial Pigeon, in processes such as seed dispersal and plant colonisation.

Human interaction with the natural environment is illustrated by strong ongoing links between Aboriginal and Torres Strait Islanders and their sea-country, and includes numerous shell deposits (middens) and fish traps, plus the application of story places and marine totems.

Criterion (x): The enormous size and diversity of the GBR means it is one of the richest and most complex natural ecosystems on earth, and one of the most significant for biodiversity conservation. The amazing diversity supports tens of thousands of marine and terrestrial species, many of which are of global conservation significance.

As the world's most complex expanse of coral reefs, the reefs contain some 400 species of corals in 60 genera. There are also large ecologically important inter-reefal areas. The shallower marine areas support half the world's diversity of mangroves and many seagrass species. The waters also provide major feeding grounds for one of the world's largest populations of the threatened dugong. At least 30 species of whales and dolphins occur here, and it is a significant area for humpback whale calving.

Six of the world's seven species of marine turtle occur in the GBR. As well as the world's largest green turtle breeding site at Raine Island, the GBR also includes many regionally important marine turtle rookeries.

Some 242 species of birds have been recorded in the GBR. Twenty-two seabird species breed on cays and some continental islands, and some of these breeding sites are globally significant; other seabird species also utilize the area. The continental islands support thousands of plant species, while the coral cays also have their own distinct flora and fauna.

Integrity

The ecological integrity of the GBR is enhanced by the unparalleled size and current good state of conservation across the property. At the time of inscription it was felt that to include virtually the entire Great Barrier Reef within the property was the only way to ensure the integrity of the coral reef ecosystems in all their diversity.

A number of natural pressures occur, including cyclones, crown-of-thorns starfish outbreaks, and sudden large influxes of freshwater from extreme weather events. As well there is a range of human uses such as tourism, shipping and coastal developments including ports. There are also some disturbances facing the GBR that are legacies of past actions prior to the inscription of the property on the World Heritage list.

At the scale of the GBR ecosystem, most habitats or species groups have the capacity to recover from disturbance or withstand ongoing pressures. The property is largely intact and includes the fullest possible representation of marine ecological, physical and chemical processes from the coast to the deep abyssal waters enabling the key interdependent elements to exist in their natural relationships.

Some of the key ecological, physical and chemical processes that are essential for the long-term conservation of the marine and island ecosystems and their associated

biodiversity occur outside the boundaries of the property and thus effective conservation programs are essential across the adjoining catchments, marine and coastal zones.

Protection and management requirements

The GBR covers approximately 348 000 km^2. Most of the property lies within the GBR Marine Park: at 344 400 km^2, this Federal Marine Park comprises approximately 99 per cent of the property. The GBR marine park's legal jurisdiction ends at low water mark along the mainland (with the exception of port areas) and around islands (with the exception of 70 Commonwealth managed islands which are part of the Marine Park). In addition the GBR also includes over 900 islands within the jurisdiction of Queensland, about half of which are declared as 'national parks', and the internal waters of Queensland that occur within the World Heritage boundary (including a number of long-established port areas).

The World Heritage property is and has always been managed as a multiple-use area. Uses include a range of commercial and recreational activities. The management of such a large and iconic world heritage property is made more complex due to the overlapping State and Federal jurisdictions. The Great Barrier Reef Marine Park Authority, an independent Australian Government agency, is responsible for protection and management of the GBR Marine Park. The Great Barrier Reef Marine Park Act 1975 was amended in 2007 and 2008, and now provides for "the long term protection and conservation … of the Great Barrier Reef Region" with specific mention of meeting"…Australia's responsibilities under the World Heritage Convention". Queensland is responsible for management of the Great Barrier Reef Coast Marine Park, established under the *Marine Parks Act 2004* (Qld). This is contiguous with the GBR Marine Park and covers the area between low and high water marks and many of the waters within the jurisdictional limits of Queensland. Queensland is also responsible for management of most of the islands.

The overlapping jurisdictional arrangements mean that the importance of complementary legislation and complementary management of islands and the surrounding waters is well recognised by both governments. Strong cooperative partnerships and formal agreements exist between the Australian Government and the Queensland Government. In addition, strong relationships have been built between governments and commercial and recreational industries, research institutions and universities. Collectively this provides a comprehensive management influence over a much wider context than just the marine areas and islands.

Development and land use activities in coastal and water catchments adjacent to the property also have a fundamental and critical influence on the values within the property. The Queensland Government is responsible for natural resource management and land use planning for the islands, coast and hinterland adjacent to the GBR. Other Queensland and Federal legislation also protects the property's Outstanding Universal Value addressing such matters as water quality, shipping management, sea dumping, fisheries management and environmental protection.

The EPBC Act provides an overarching mechanism for protecting the World Heritage values from inappropriate development, including actions taken inside or outside which could impact on its heritage values. This requires any development proposals to undergo rigorous environmental impact assessment processes, often including public consultation, after which the Federal Minister may decide, to approve, reject or approve under conditions designed to mitigate any significant impacts. A recent amendment to the EPBC Act makes the GBR Marine Park an additional 'trigger' for a matter of National Environmental Significance which provides additional protection for the values within the GBR.

The GBR Marine Park and the adjoining GBR Coast Marine Park are zoned to allow for a wide range of reasonable uses while ensuring overall protection, with conservation being the primary aim. The zoning spectrum provides for increasing levels of protection for the 'core conservation areas' which comprise the 115 000 km^2 of 'no-take' and 'no-entry' zones within the GBR.

While the Zoning Plan is the 'cornerstone' of management and provides a spatial basis for determining where many activities can occur, zoning is only one of many spatial management tools and policies applied to collectively protect the GBR. Some activities are better managed using other spatial and temporal management tools like Plans of Management, Special

Management Areas, Agreements with Traditional Owners and permits (often tied to specific zones or smaller areas within zones, but providing a detailed level of management not possible by zoning alone). These statutory instruments also protect the Outstanding Universal Value of the property.

Many Aboriginal and Torres Strait Island peoples undertake traditional use of marine resource activities to provide traditional food, practice their living maritime culture, and to educate younger generations about traditional and cultural rules and protocols. In the GBR these activities are managed under both Federal and Queensland legislation and policies including Traditional Use of Marine Resource Agreements (TUMRAs) and Indigenous Land Use Agreements (ILUAs). These currently cover some 30 per cent of the GBR inshore area, and support Traditional Owners to maintain cultural connections with their sea country.

Similarly non-statutory tools like site management and Industry Codes of Practice contribute to the protection of World Heritage values. Some spatial management tools are not permanently in place nor appear as part of the zoning, yet achieve effective protection for elements of biodiversity (e.g. the temporal closures that are legislated across the GBR prohibit all reef fishing during specific moon phases when reef fish are spawning).

Other key initiatives providing increased protection for the GBR include the comprehensive Great Barrier Reef Outlook Report (and its resulting 5-yearly reporting process); the Reef Water Quality Protection Plan; the GBR Climate Change Action Plan; and the Reef Guardians Stewardship Programs which involve building relationships and working closely with those who use and rely on the GBR or its catchment for their recreation or their business.

The 2009 Outlook Report identified the long-term challenges facing the GBR; these are dominated by climate change over the next few decades. The extent and persistence of damage to the GBR ecosystem will depend to a large degree on the amount of change in the world's climate and on the resilience of the GBR ecosystem to such change. This report also identified continued declining water quality from land-based sources, loss of coastal habitats from coastal development, and some impacts from fishing, illegal fishing and poaching as the other priority issues requiring management attention for the long-term protection of the GBR.

Emerging issues since the 2009 Outlook Report include proposed port expansions, increases in shipping activity, coastal development and intensification and changes in land use within the GBR catchment; population growth; the impacts from marine debris; illegal activities; and extreme weather events including floods and cyclones.

Further building the resilience of the GBR by improving water quality, reducing the loss of coastal habitats and increasing knowledge about fishing and its effects and encouraging modified practices, will give the GBR its best chance of adapting to and recovering from the threats ahead, including the impacts of a changing climate.

Acronyms and abbreviations

Acronym or term	Definition
ACH Act	*Aboriginal Cultural Heritage Act 2003*
AEIS	Additional information to the EIS
AEP	annual exceedance probability
AHD	Australian Height Datum
ALC	Agricultural land classification
AMTD	adopted middle thread distance
ANCOLD	Australian National Committee on Large Dams
BSC	Banana Shire Council
CEMP	construction environmental management plan
CID	community infrastructure designation
CMA	Commonwealth Marine Area
CQRWSS	Central Queensland Regional Water Supply Strategy
CSG	coal seam gas
DAF	Department of Agriculture and Fisheries
DATSIMA	Department of Aboriginal, Torres Strait Islander and Multicultural Affairs
DCCSDS	Department of Communities, Child Safety and Disability Services
DEE	Department of the Environment and Energy (Australian Government)
DEWS	Department of Energy and Water Supply
DHPW	Department of Housing and Public Works
DNRM	Department of Natural Resources and Mines
DSDIP	Department of State Development, Infrastructure and Planning
DVWSS	Dawson Valley Water Supply Scheme
EC	Ecological community
EFO	environmental flow objective
EHP	Department of Environment and Heritage and Protection
EIA	economic impact assessment
EIS	environmental impact statement
EMP	environmental management plan
EP Act	*Environmental Protection Act 1994*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
FSL	full supply level
GAB	Great Artesian Basin
GBRWHA	Great Barrier Reef World Heritage Area
GDEMP	groundwater-dependent ecosystem management plan

Acronym or term	Definition
GMMP	groundwater monitoring and management plan
GOC	government-owned corporation
GQAL	good quality agricultural land
ha	hectare
ICH	Indigenous cultural heritage
IECA	International Erosion Control Association
km	kilometre
L	litres
LGA	local government area
m	Metres
m^3	Cubic metre
ML	Megalitres
ML/a	Megalitres per annum
MNES	Matters of national environmental significance
MOV	minimum operating volume
MSES	Matters of state environmental significance
NC Act	*Nature Conservation Act 1992* (Qld)
OEMP	operational environmental management plan
PAA	priority agricultural areas
QH Act	*Queensland Heritage Act 1992*
QPS	Queensland Police Service
RE	regional ecosystem
ROL	resource operations licence
ROP	resource operations plan
RPI Act	*Regional Planning Interests Act 2014*
SARA	State Assessment and Referral Agency
SBICSDA	Surat Basin Infrastructure Corridor State Development Area
SCR	state-controlled roads
SDPWO Act	*State Development and Public Works Organisation Act 1971*
SIA	social impact assessment
SMP	species management programs under the NC Act
SPA	*Sustainable Planning Act 2009*
SPP	State Planning Policy
SPR	Sustainable Planning Regulation (2009)
TI Act	*Transport Infrastructure Act 1994*
TMR	Department of Transport and Main Roads
TOR	Terms of reference

Acronym or term	Definition
VM Act	*Vegetation Management Act 1999* (Qld)
W2G	Woleebee Creek to Glebe Weir pipeline
Water Act	*Water Act 2000*
WDRC	Western Downs Regional Council
WMP	Waste management plan
WPA	Wetland Protection Area
WQMP	water quality management plan
WSSR Act	*Water Supply (Safety Reliability) Act 2008.*

Glossary

Term	Definition
abutment	The part of a valley against which a dam is constructed. Right and left abutments are those on respective sides of an observer looking downstream.
allocated water	Water that a person or entity has been granted an entitlement to extract.
annual exceedance probability (AEP)	The probability of a specified magnitude of a natural event being exceeded in any year.
aquifer	A water-bearing stratum of permeable rock, sand, or gravel, able to transmit substantial quantities of water.
aquitard	A formation which contains groundwater but cannot transmit it rapidly enough to furnish a significant supply to a well or spring.
artesian bore	A bore drilled into a confined aquifer with enough hydraulic pressure for the water to flow to the surface without pumping (also called a flowing well).
assessment manager	For an application for a development approval, means the assessment manager under the *Sustainable Planning Act 2009* (Qld).
Australian Height Datum (AHD)	The datum used for determining elevations in Australia which uses a national network of bench marks and tide gauges, and has set mean seal level as zero elevation.
baseline assessment	Documents the pre-project environmental, social and economic conditions. This establishes benchmark data prior to any impact by the proponent.
bilateral agreement	The agreement between the Australian and Queensland governments that accredits the State of Queensland's EIS process. It allows the Commonwealth Environment Minister 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).
borrow pit	A small excavation providing earth to be used for construction material.
catchment	The area of land, which collects and transfers rainwater into a waterway.
concrete batching plant	Equipment that combines various ingredients to create concrete.
connectivity	Refers to the ease with which organisms move between particular landscape elements.
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).

‘Endangered’ regional ecosystem	A regional ecosystem is listed as endangered under the VM Act if remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares.
‘Least concern’ regional ecosystem	A regional ecosystem is listed as ‘Least Concern’ under the *Vegetation Management Act 1999* (Qld) if remnant vegetation is over 30 per cent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 hectares.
‘Of concern’ regional ecosystem	A regional ecosystem is listed as of concern under the *Vegetation Management Act 1999* (Qld) if remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion; or more than 30 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares.
controlling provision	The matters of national environmental significance, under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth), that the proposed action may have a significant impact on.
coordinated project	A project declared as a ' coordinated project' under section 26 of the SDPWO Act. Formerly referred to as a ‘significant project’.
Coordinator-General	The corporation sole constituted under section 8A of the *State Development and Public Works Organisation Act 1938* and preserved, continued in existence and constituted under section 8 of the SDPWO Act.
culvert	A covered channel that carries water, often be covered by a bridge or a road.
decommissioning	the removal of above-ground infrastructure, temporary buildings and structures, and then rehabilitation.
discharge spring	A spring supplied by underground water from an aquifer that in the vicinity of the spring is a confined aquifer.
dissolved oxygen	The amount of oxygen dissolved in water.
easement	An access right held by a third party to enter upon and make use of land belonging to another for a specified purpose.
edge effect	All changes at an ecosystem boundary and within adjacent ecosystems; the negative influence of a disturbed habitat edge on the interior conditions of a habitat, or on species that use the interior habitat.
effective charge mass per delay	The maximum quantity of explosive charge detonated on one interval within a blast.
endangered	A species is endangered if: • there have not been thorough searches conducted for the wildlife and the wildlife has not been seen in the wild over a period that is appropriate for the life cycle or form of the wildlife; or • the habitat or distribution of the wildlife has been reduced to an extent that the wildlife may be in danger of extinction; or • the population size of the wildlife has declined, or is likely to decline, to an extent that the wildlife may be in danger of extinction; or • the survival of the wildlife in the wild is unlikely if a threatening process continues.

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 flow	The flow of water that is required to maintain aquatic and riparian ecosystems in streams and rivers.
Environmental flow objective (EFO)	Performance indicators set out in the Water Resource (Fitzroy Basin) Plan 1999 for the measurement of the environmental performance of the Fitzroy Basin.
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).
erosion	The process by which sediments are removed from their original position to a different position by wind and water action.
essential habitat	Vegetation in which a species of wildlife is known to occur that is listed as endangered, vulnerable, near threatened under the Nature Conservation Act 1992 (Qld).
exotic species	Introduced species, not native to the area.
failure impact assessment (FIA)	An assessment carried out by a registered professional engineer who evaluates the number of people whose safety would be at risk if there was a dam failure. The assessment, if accepted by the chief executive of the Queensland Department of Natural Resources and Water, will result in the dam being given a failure impact rating according to the number of people at risk.
fauna	The collective animals of a given region.
flora	The collective plants growing in the geographic area.
flow regime	The variation in flow characteristics, such as volume, for a particular stream over time.
fluvial	The river system.
fragmentation	A process of landscape alteration in which natural areas are subdivided into smaller patches.
fugitive dust	Particulate matter (dust) suspended in the air from wind or human activities such as earthworks.
full supply level (FSL)	The maximum normal operating water surface level of a reservoir.
geomorphology	The form or shape of the landscape and the processes that modify and change it.
Great Artesian Basin (GAB)	An extensive sequences of laterally connected sedimentary rock aquifers extending across much of inland Queensland and certain areas of inland NSW, South Australia and the Northern Territory that encompass the include the geological entities of the Surat Basin, Eromanga Basin, Carpentaria Basin and part of the upper Bowen Basin.

ground level	The level of the natural ground, or, where the level of the natural ground has been changed, the level as lawfully changed.
groundwater	Water found underground in porous rock or soil strata.
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.
inundation area	The area that will be flooded with water above the existing water level, from raising of the dam.
landscape values	Areas protected under a regional plan and/or local government planning scheme, such as biodiversity networks, natural economic resource areas (including rural production), scenic amenity areas and landscape heritage areas.
listed species	A plant or animal included in a schedule of endangered, vulnerable, or near-threatened biota, such as the schedules in the EPBC Act (Cwlth) or the Nature Conservation (Wildlife) Regulation 2006 (Qld).
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).
overtopping	The process whereby the water level rises above the height of the dam wall.
pH	Measure of the acidity or alkalinity of a substance, with 1 being the most acidic, 7 being neutral and 14 being the most alkaline.
population	Occurrence of a species or ecological community in a particular area.
precipitation	A collective term for the moisture, either liquid or solid, that falls on the earth from the atmosphere. In North Queensland this is usually in the form of rain.
probable maximum flood (PMF)	The flood resulting from the worst flood-producing catchment conditions that can be realistically expected in the prevailing meteorological conditions.

properly made submission (for an EIS 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.
Ramsar wetland	Under the EPBC Act, a Ramsar wetland is either: • an Australian wetland on the List of Wetlands of International Importance kept under the Ramsar Convention; or • a wetland declared to be a Ramsar wetland by the Commonwealth Environment Minister.
recharge	The process involving the infiltration of water from the surface to groundwater.
recharge spring	A spring supplied by underground water from an aquifer or aquifers that in the vicinity of the spring are not confined aquifers. Recharge springs are found in areas where water enters and recharges the aquifers in the Basin.
recovery plan	A recovery plan is a document stating the research and management actions necessary to stop the decline, support the recovery and enhance the chance of long-term survival in the wild, of a stated species or community of protected wildlife.
regional ecosystem (RE)	Regional ecosystems were defined by Sattler and Williams (1999) as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.
rehabilitation	Making the land useful again after a disturbance. It may involve the recovery of ecosystem functions and processes in a degraded habitat.
remnant vegetation	Small remaining areas of naturally occurring vegetation in a landscape that has been altered by human activity such as agriculture. These remnants were once part of a continuously vegetated landscape.
riverine	Pertaining to rivers.
salinity	The concentration of any salt.
sediment	Any usually finely divided organic and/or mineral matter deposited by air or water in non-turbulent areas.
sedimentation pond	An artificial retention basin designed to trap suspended sediments carried in overland water flow before discharge into a water storage facility.
sensitive receptor	A place where noise (or dust, odour, light, smoke) is measured to investigate whether impacts are occurring.
sheet erosion	Erosion of thin layers of earth-surface material, more or less evenly, from extended areas of gently sloping land by broad continuous sheets of running water, without the formation of rills, gullies, or other channelised flow.

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’.
sodic	Refers to the dominance of sodium on the exchange complex of the soil. High levels of sodium can cause moisture infiltration problems and the accompanying, generally high soil pH, can cause nutrient disorders.
soil profile	The physical and chemical features of the soil imagined or seen in vertical section from the surface to the point at which the characteristics of the parent rock are not modified by surface weathering or soil processes.
species	A group of biological entities that (a) interbreed to produce fertile offspring; or (b) possess common characteristics derived from a common gene pool.
spring	The point where groundwater flows out of the ground, and is where the aquifer surface meets the ground surface.
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: a) development approval under the *Sustainable Planning Act 2009* b) proposed mining lease under the *Mineral Resources Act 1989* c) draft environmental authority (mining lease) under Chapter 5 of the *Environmental Protection Act 1994* (EPA) d) proposed petroleum lease, pipeline licence or petroleum facility licence under the *Petroleum and Gas (Production and Safety) Act 2004* e) non-code compliant environmental authority (petroleum activities) under Chapter 4A of the EPA.
sub-artesian bore	A bore drilled into an aquifer that does not have enough hydraulic pressure for the water to flow to the surface without pumping.
substrate	The underlying base to something e.g. the streambed.
Surat Basin	A geological entity which consists of a series of vertically layered formations and forms party of the Great Artesian Basin of Australia.
terrestrial	Pertaining to land, the continents or dry ground.
the project	Nathan Dam and Pipelines project
threatened	A collective term for native plants and animals which are presumed extinct, endangered and vulnerable.
Threatened species and ecological communities	Threatened species or ecological communities listed and protected under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).
topography	Description or representation of natural or artificial features of the landscape.
total dissolved solids (TDS)	A measure of the total amount of dissolved matter in the water, and indication of the total salinity of water.
translocation	The transfer of plants and animals from one area of habitat to another area of suitable habitat.

transmissivity	The rate at which groundwater can flow through an aquifer section of unit width under a unit hydraulic gradient. It is the average permeability of a section of the entire aquifer at a given location multiplied by the thickness of the formation.
turbidity	The clarity of the water, which depends on the concentration of particles that are suspended in the water column.
unallocated water	Water to which an entitlement to extract has not been granted.
unconfined aquifer	An aquifer containing water that is not under pressure. The water level measured in a bore drilled into an unconfined aquifer is the same as the water table outside the bore.
velocity	The rate of water movement with respect to time.
vulnerable	A species is vulnerable if: • its population is decreasing because of threatening processes; or • its population has been seriously depleted and its protection is not secured; or • its population, while abundant, is at risk because of threatening processes; or • its population is low or localised or depends on limited habitat that is at risk because of threatening processes.
Water Allocation Security Objective (WASO)	Means an objective that may be expressed as a performance indicator and is stated in a water resource plan for the protection of the probability of being able to obtain water in accordance with a water allocation.
weed	A plant that is considered undesirable because it threatens the persistence of native plants.
wetlands	Low-lying areas regularly inundated or permanently covered by shallow water. Usually important areas for birds and other wildlife.
wildlife corridor	A strip of habitat that facilitates fauna movement between otherwise isolated patches of habitat.
works	Defined under the SDPWO Act as the whole and every part of any work, project, service, utility, undertaking or function that: a) 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 b) 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 c) 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.
World Heritage property	Under the EPBC Act, a World Heritage property is either: • an Australian property on the World Heritage List kept under the World Heritage Convention; or • a property declared to be a World Heritage property by the Commonwealth Environment Minister.

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