CHAPTER 13

ENVIRONMENTAL ASSESSMENT

Nullinga Dam and Other Options Preliminary Business Case

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13 ENVIRONMENTAL ASSESSMENT

CHAPTER SUMMARY AND CONCLUSIONS

Base Case

- The preliminary environmental assessment is focused on the Tablelands Agricultural Area, defined as the boundaries of the Mareeba Shire Council and Tablelands Regional Council local government areas.
- The majority of the MDWSS area has been cleared for grazing and intensive agriculture. The area is noted for its productive soils and high rainfall.
- Surface water quality is moderate with elevated levels of nutrients and pesticides associated with irrigated agriculture identified. Areas of elevated groundwater and high salinity risk have been also been identified.
- Areas within the broader study area and the existing MDWSS are identified as containing non-remnant vegetation. A number of threatened ecological communities and flora and fauna species are mapped as occurring within the study area and may be impacted by the shortlisted options.

Option 2: Improve MDWSS rules and operation

- The key environmental issues associated with Option 2 relate to the potential for the increased operational performance of the scheme to result in a (marginal) expansion of land under irrigation.
- Key environmental issues associated with the marginal expansion of land under irrigation include:
  - Changes to surface water and groundwater level and quality due to minor increases in farm inputs, such as pesticides and fertilisers. The water quality in the Barron Basin already exceeds aquatic ecosystem guidelines for protection of freshwater systems.
  - Clearing of vegetation to facilitate new irrigation areas. Land surrounding the existing irrigation area is mapped as regulated vegetation and has the potential to contain threatened ecological communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Clearing in these areas could trigger State and Commonwealth approvals.

Option 3: Modernise MDWSS and convert losses

- The key environmental issues associated with Option 3 relate to the potential for the creation of new water allocations and the associated expansion of land under irrigation.
- Key environmental issues associated with Option 3, and increased irrigation, are the same as those for Option 2 but on a larger scale.

Option 4: Nullinga Dam for agricultural use

- The construction of Nullinga Dam would result in not only construction of a new impoundment on the Walsh River, but may also involve the development of a new irrigation area, noting that much of the unirrigated cropping land adjacent to the Walsh River would fall within the existing MDWSS area (as far west as the end of the Dimbulah area).
- To the extent that Option 4 results in increased irrigation within an existing irrigation area, key environmental issues associated with Option 4 relate to the potential for the creation of new water allocations and the associated increase in irrigation (in Area 10 of the MDWSS).

- Key environmental issues associated with increased irrigation are the same as those for Options 2 and 3 but again on a larger scale. Potential environmental issues associated with Option 4 (both the dam and increased irrigation) include:
  - Potential approval triggers at both State and Commonwealth level, resulting in a more complex and longer approvals process than would be required for Option 2 and 3.
  - Construction of the dam would require acquisition of land across a range of tenure types.
  - Modification to the Walsh River and the potential creation of a new irrigation area (or land use change on a greater scale than for Option 2 and 3) have the potential to impact water quality and flows downstream of the dam with consequential impacts on species composition.
  - Clearing of regulated vegetation will be required for both the dam inundation area and in parts of any new irrigation development. There are areas of land adjacent to the Walsh River (extending as far as the end of the Dimbulah area) that have been previously cleared and which are currently used for grazing and/or cropping
  - It is likely that essential habitat for threatened species listed at both the State and Commonwealth level will be impacted by the development.
  - Offsets for vegetation clearing under the *Environmental Offsets Act 2014* (Qld) may be required.
  - Clearing of threatened ecological communities (TEC) and threatened species listed under the EPBC Act is likely to trigger an EPBC Act referral to the Commonwealth Department for the Environment and Energy. If the project were declared to be a controlled action, offsets for vegetation clearing would be required.
  - Change in land use both at the dam site and in the new and existing irrigation areas will result in a change in visual amenity for the development areas.
  - Aboriginal cultural heritage has the potential to be disturbed as a result of the project. As the project is likely to trigger an environmental impact statement (EIS), an approved Cultural Heritage Management Plan will be required.

13.1 Purpose

The purpose of this chapter is to present the preliminary findings of environmental impacts arising from each of the short-listed options. The first part of this chapter provides a regional environmental profile to establish the operating context for each of the shortlisted options. Following this is the environmental assessment of the shortlisted options, including the potential environmental impacts.

13.2 Establishing the Environmental Context – Base Case

All three shortlisted options under examination will occur in the Tablelands Agricultural Area. Mareeba Shire Council and the Tablelands Regional Council local government areas define the boundary of the Tablelands Agricultural Area. Therefore, this environmental context setting includes information about each local government area.

There are a number of national parks within the region including Hann Tableland National Park, Barron Gorge National Park and Danbulla National Park. Additionally, approximately 25.5 per cent of the local government area for the Tablelands Regional Council also falls within the Wet Tropics World Heritage Area.

Major water resources in the area include the Barron River which flows to an estuary north of Cairns and the Walsh River which flows towards the Gulf of Carpentaria.

This environmental context setting provides information on the existing environment of planning and land use, topography, geology and soils, water quality, hydrology, flora and fauna, climate, noise and vibration, landscape and amenity and cultural heritage.

13.2.1 Planning and Land Use

The Tablelands Agricultural Area has a total area of 65,009 square kilometres. The local government area of Mareeba Shire Council makes up the majority of this area, with a total area of approximately 53,611 square kilometres.

Queensland Land Use Mapping identifies the majority of the region is used for grazing. Irrigated cropping areas are concentrated around the Walsh River, Barron River and Emerald Creek, which is the area of the existing MDWSS. There is also a small area of irrigation within the Upper Mitchell River sub-catchment.

The majority of the region is zoned rural under both relevant planning schemes; this includes the areas of the MDWSS.

13.2.2 Topography, Geology and Soils

The Barron Basin is a topographically variable area, ranging from approximately 800 metres above sea-level in the upper Barron Basin to approximately 400 metres around Mareeba and less than 100 metres toward the coast. Similar to the topography, the geology of the area varies throughout the basin. Parent materials are generally metamorphic and granite in the higher elevations of the upper Barron River catchment and the middle catchment around Mareeba and Kuranda. Basalt flows occur around the Atherton area and Mareeba, while alluvium underlies the coastal plain.

Soil type varies markedly from Atherton in the south to the Mareeba area in the north. Typically soil on the southern tablelands is red, structured, high-clay soil with an acid-neutral pH; it is well drained, has good fertility and is derived from basalt. In contrast, soil in the Mareeba-Dimbulah area is sandy loam to sandy clay loam over a red, structured, coarse sandy clay soil with a slightly acid pH; it is well drained, is derived from granite and has inherent low fertility.

Soils within the MDWSS vary from deep red and yellow friable basalt soils to the south-east of the scheme area to well drained deep red earths and red duplex soils on the upper slopes and mottled yellow duplex soils with deep pale sands and grey duplex soils on the lower slopes in the western scheme area. There are two large distinct alluvial areas found to the north and west of Mareeba. These areas are comprised primarily of grey cracking clays with minor areas of solodics. These alluvial areas are recognised as being a high risk area for salinization.

The geology of the Chillagoe district, to the west of the Barron Basin, is located along the western periphery of the Palaeozoic Tasman Geosyncline on the borders of the Precambrian basement. After being folded, the Palaeozoic sediments were intruded by Upper Permian granites and covered by concomitant volcanics. Chillagoe lies within a belt of limestone approximately 5 kilometres wide and 45 kilometres long, extending from south of Chillagoe and north-west to the Walsh River and beyond. The Chillagoe Karst Region contains the best examples of tropical limestone bluffs and towers in Australia. Soils within the Mitchell River catchment are generally poor quality, with better quality soils associated with floodplains and adjacent to rivers.

In 2002, DNRM identified that soil and crop suitability investigations indicated that potentially there are more than 50,000 hectares (ha) of soil suitable for irrigated cropping within the area, including the current

cropped area of 21,000 hectares. This suggests an additional 29,000 hectares is suitable for irrigation. However, the best lands served by the existing canals and pipelines have already been developed.

13.2.3 Water Quality

13.1.1.1 Surface Water

The 2014-15 Healthy Waterways report gave an overall water quality grade for the Barron Basin as moderate. These assessments use aquatic ecosystem guidelines for protection of freshwater systems and not load reduction targets for the marine environment. The score for Total Suspended Solids (TSS) indicated that the annual medians of TSS did not comply with the guideline values. Nutrients also scored moderate, meaning that nutrient values either equalled or were less than the guideline value. The Barron Basin is not monitored for contaminates and therefore no grade was provided for this parameter. Stakeholders within the MDWSS have however raised concerns in relation to the potential for heavy metals in sediments from historic mining activities in the upper catchment.

The Barron River and Trinity Inlet Water Quality Improvement Plan identified sediment and nutrient loads within the Barron River and Trinity Inlet. The plan includes both point sources (such as sewage treatment plants and urban development sites) and diffuse sources (such as natural forests in protected areas, sugarcane, grazing, plantation forestry, banana and mixed cropping horticulture; urban development zones). The plan identifies that the estimated annual pollutant loads delivered to receiving waters (including Tinaroo Falls Dam) was as follows:

- 1,600 tonnes of total nitrogen per year
- 250 tonnes of total phosphorus per year
- 78,000 tonnes of total suspended sediment per year.

Generally, the modelled average annual pollutant sources increased through the catchment, with the majority of pollutants originating in the lower sub-catchments. However, modelling carried out as part of the plan identified that a major source of elevated nitrogen (including nitrate, ammonia and particulate nitrogen) loss in the catchment is from urban sources (mainly in the lower catchment) and from cropping areas (located mainly in the upper and middle catchments). Elevated phosphorus loss in the catchment was from horticulture cropping areas and sewage treatment plants.

Grazing in the middle and lower catchments and cropping areas were identified as major sources of sediment loss in the catchment. Mud loggers rank the Barron River as the largest exporter of fine sediment per unit of catchment area in north Queensland.

Sources of herbicides detected in the catchment waterways were associated with land uses such as plantation horticulture and sugarcane cropping, with some contribution from urban areas. A wide range of other pesticide residues (e.g. ametryn, hexazinone, 2,4-D, MEMC) are also found in the Barron River. It should be noted that there have been some reductions in farm runoff, attributed to improved fertilizer and land management practices and the conversion of sewage treatment plants to tertiary treatment.

Environmental values, management goals and water quality objectives for the Barron Basin are set out in the *Barron River Basin Environmental Values and Water Quality Objectives Basin No. 110*. This document is made under the provisions of the *Environmental Protection (Water) Policy 2009*. Mapping identifies the MDWSS within the upland fresh water area. The MDWSS is not located within an area mapped as a high ecological value, slightly disturbed or moderately disturbed area. As such, the MDWSS is not required to ensure the water quality objectives are met; however, the water quality objectives provide a guide for management of water releases in the area.

Limited water quality is available for the upper Walsh and Mitchell catchments. The majority of watercourses in this area are ephemeral and changes in flow can impact water quality parameters. From the water quality data that is available, reduced water quality is generally associated with areas within the MDWSS, with these areas having high nutrient concentrations. High concentrations of phosphorus in some watercourses have been attributed to sewage treatment plants. Abandoned metal mines are scattered throughout the upper catchment and have been shown to be discharging metals and other contaminants, contaminating local stream waters and streambed sediments.

There are not currently any environmental values or water quality objectives established for surface water or groundwater within the Walsh and Mitchell catchments.

13.1.1.2 Groundwater

Within the Atherton Subartesian Area, water supplies from the Atherton Basalt are typically very good quality. Groundwater electrical conductivity ranges from 45 μScm^{-1} to 350 μScm^{-1}. However, there is limited data indicating that brackish/saline groundwater may be discharging to drainage features which may influence downstream water quality in the Barron River.

Groundwater monitoring bores within the MDWSS have shown trends of rising groundwater levels. Groundwater quality in Cattle Creek, Leadingham Creek and Biboohra has an impact on the surface water quality of the upper Walsh and Mitchell catchments. Groundwater within the Cattle Creek catchment has been rising and has the potential to result in increased salt concentrations in surface water. There are zones of significant salinity hazard located in the Biboohra area. Leadingham Creek is not considered to have a significant salinity hazard.

13.2.4 Hydrology

The Tablelands Agricultural Area comprises the water planning areas of Barron, Mitchell, Gulf and Wet Tropics catchments. Options 2 and 3 will primarily impact the catchment of the Barron Basin, while Option 4 will primarily have impact on the Walsh and Mitchell River catchment. The Barron River is the major watercourse within the basin. Major tributaries in the basin include Leslie Creek, Scrubby Creek, Rocky Creek, Tinaroo Creek, Emerald Creek, Granite Creek, Clohesy Creek, Flaggy Creek and Freshwater Creek.

Major impoundments within the Barron Basin include the Tinaroo Falls Dam on the Barron River and Copperlode Dam on Freshwater Creek (to the east of the MDWSS). The Barron River catchment downstream of the Tinaroo Falls Dam is a highly modified catchment.

There are three supplemented watercourses in the Walsh River catchment: the Walsh River, Murphy's Creek and Eureka Creek. In the Mitchell River system, the only supplemented watercourse is Two Mile Creek. The Walsh River extends upstream and downstream of the supplemented section of the MDWSS. Flow-related impacts both upstream and downstream of the supplemented sections are currently minor.

13.2.5 Flora and Fauna

Large areas of the existing MDWSS area are mapped as containing non-remnant vegetation. However, small pockets of remnant vegetation occur within the existing developed area and surrounding the existing developed area. Mapped regional ecosystems within the MDWSS are largely not of concern or, of concern to regional ecosystems. There are areas of endangered regional ecosystems to the north, east and south-west of Lake Tinaroo. These areas of remnant vegetation are mapped as regulated vegetation, category B.

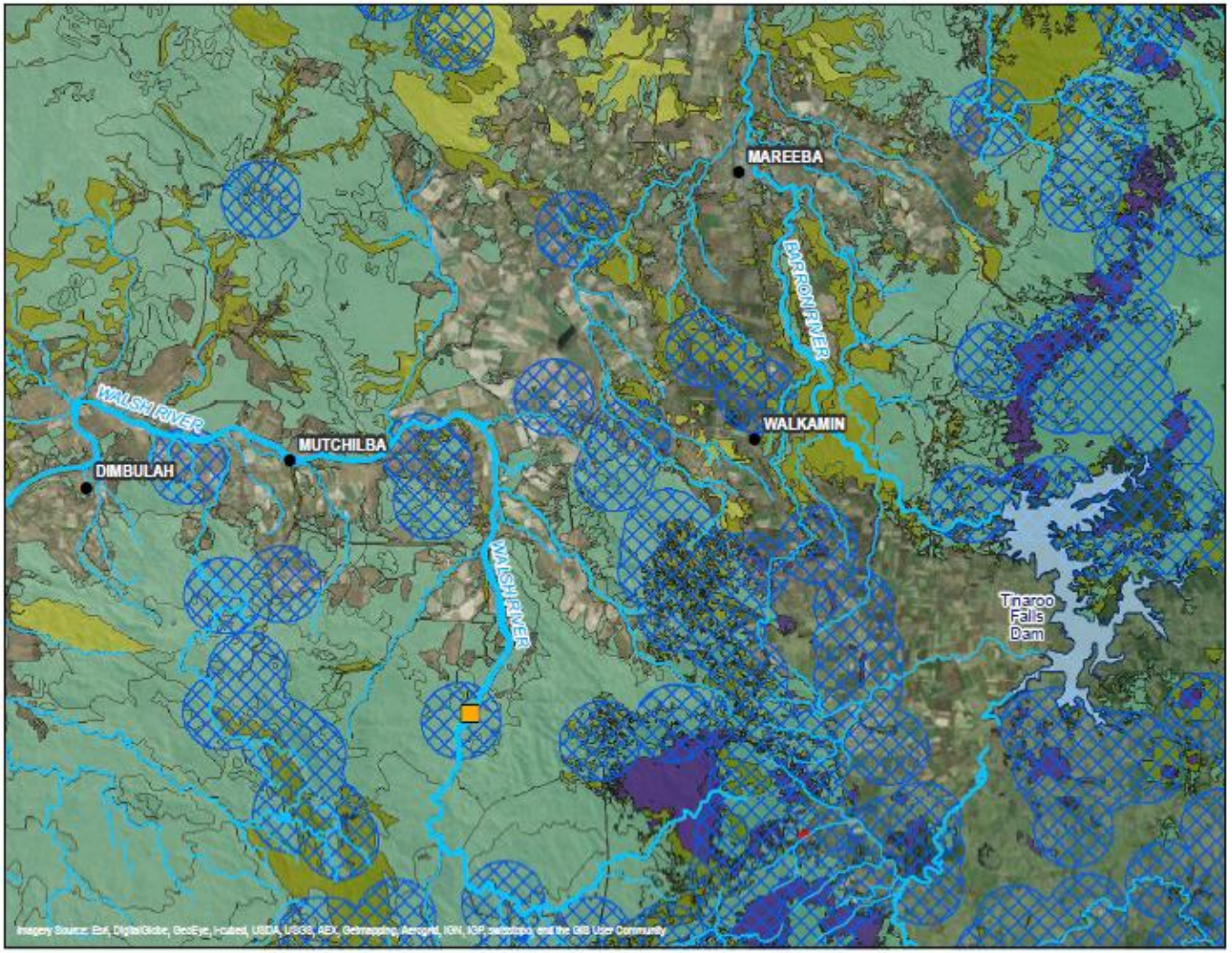
Four threatened ecological communities (TEC) listed under the EPBC Act have the potential to occur within the Tablelands Agricultural Area. These include:

- Broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland – listed as endangered
- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia – listed as critically endangered
- Mabi Forest (Complex Notophyll Vine Forest 5b) – listed as critically endangered
- The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin – listed as endangered

Regional ecosystem mapping indicates that one TEC, broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland, occurs to the south-west of the proposed Nullinga Dam site. Clearing within areas of TEC has potential to trigger assessment under the EPBC Act. If clearing will or is likely to have a significant impact on a TEC, referral and assessment of the clearing under the EPBC Act will be required.

A number of flora and fauna species protected under State and Commonwealth legislation also have the potential to occur within the study area, with essential habitat and high-risk flora areas mapped within the study area as follows (refer to Figures 1 and 2).

FIGURE 1: FLORA



LEGEND

- Town
- Collins Weir
- Watercourse
- Waterbody
- Flora Survey Trigger Area
- Broad Leaf Tea-Tree REs (TEC)

Regional Ecosystems (v10)

- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present

Data Sources:
Regional Ecosystems v10; Flora Survey Trigger v4.1; Weirs and Dams (Queensland State Government) Towns; Waterways; Waterbodies (Pitney Bowes Software StreetPro v4)

Geocentric Datum of Australia 1994

A4 1:300,000

N

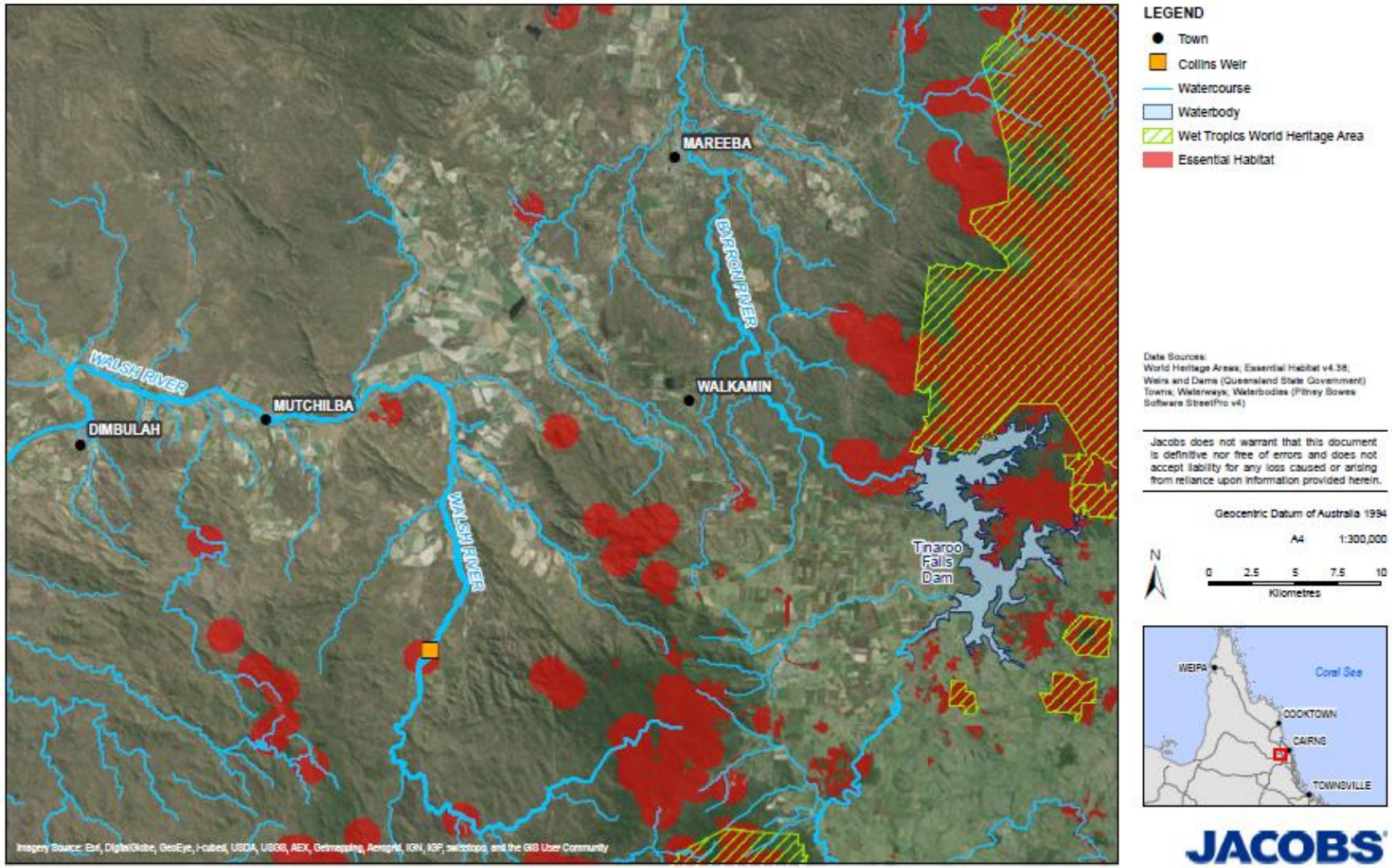
0 2.5 5 7.5 10
Kilometres

JACOBS

NULLINGA DAM

C:\Users\SMonro\Documents\Temp\Projects\170221_NullingaDam_IH110400_RPowell\Spatial\ArcGIS\Figures\IH110400_NullingaDam_Figure1_Flora.mxd Produced: 27/02/2017

FIGURE 2: FAUNA



NULLINGA DAM

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Subject to the location of potential irrigation development, approvals under State and Commonwealth legislation may also be required. These approvals would be dependent on the location of each individual proposal.

The Walsh and Mitchell catchments have high natural diversity of freshwater fish. The significance of the upper Walsh and Mitchell Rivers within a regional context is the high diversity of fishes found in the rivers and the contribution they make to the overall fish diversity of the region. Much of the fish fauna of the upper Walsh and Mitchell Rivers is evolutionarily and biogeographically distinct from that occurring in the easterly-flowing streams.

Groundwater dependent ecosystems (GDEs) are known to occur within the Barron Basin. The GDEs include:

- A cave and karstic ecosystem to the east of Mareeba
- Non-riverine wetlands considered to be GDEs located to the south of Yungaburra and along the coast near Yorkeys Knob
- Seventy-one regional ecosystems considered to be GDEs are located throughout the Barron Basin, but generally concentrated along the Mitchell River, Walsh River, and extending north of the Walsh River towards the Hann Tableland National Park. These regional ecosystems are generally associated with *Corymbia* and *Eucalyptus* species.

13.2.6 Climate

The climate of the area is predominantly humid subtropical with most rain falling in the summer. Wide variations in climate occur across the Tablelands Agricultural Area with changes in altitude and proximity to the Great Dividing Range being the major impacting factors.

Elevated areas in the east and south are generally wetter and cooler, whereas western and northern regions are hotter and drier. Average temperatures range from 18.2°C to 30.6°C and the average rainfall across the region is 1,090 millimetres each year. Table 1 summarises the climate aspects of key towns in the Tablelands.

Table 1 Climate of Key Tableland Towns

LOCALITY	ALTITUDE (M)	AVERAGE ANNUAL RAINFALL (MM)	AVERAGE TEMPERATURE RANGE (°C)	
			JANUARY	JULY
Kuranda	336	2,002	24-31	17-26
Mareeba	400	918	21-31	11-25
Dimbulah	407	783	22-34	11-27
Atherton	752	1,420	18-29	10-22
Malanda	738	1,565	17-28	5-22
Ravenshoe	930	842	16-31	3-23

Source DAF 2016

13.2.7 Noise and Vibration

Within the study area there are a range of land uses that generate noise. Noise sources are generally from agricultural uses and traffic. Within areas more remote from permanent man-made noise sources, the only ongoing noise present would be wind blowing over vegetation and noises from insects, birds and other local wildlife.

13.2.8 Landscape and Visual Amenity

The landscape within the Tableland Agricultural Area ranges from flat plains and river valleys, undulating hills and steep ranges. The general character is that of rural agricultural and grazing area. There are several towns, including Mareeba, Walkamin, Mutchilba and Dimbulah.

13.2.9 Cultural Heritage

No Commonwealth heritage properties are located within the study area. There are several State and local heritage places throughout the Tablelands Region.

There is potential for Indigenous cultural heritage to be associated with the following landscape features:

- Mature and/or remnant vegetation
- Rock outcrops
- Elevated plateaus
- Hills and mounds
- Water sources such as creeks, rivers, billabongs, lakes and springs.

13.3 Preliminary Environmental Assessment of Option 2: Improve MDWSS Rules and Operation

13.3.1 Environmental Issues Associated with Option 2

The key environmental issues associated with Option 2 relate to the potential for the increased operational performance of the scheme to result in a marginal expansion of land under irrigation. Key environmental issues associated with expansion of land under irrigation include:

- Changes to surface water and groundwater level and quality due to minor increases in farm inputs, such as pesticides and fertilisers. The water quality in the Barron Basin already exceeds aquatic ecosystem guidelines for protection of freshwater systems.
- Clearing of vegetation to facilitate new irrigation areas. Land surrounding the existing irrigation area is mapped as regulated vegetation and has the potential to contain TEC listed under the EPBC Act. Clearing in these areas could trigger State and Commonwealth approvals.

13.3.2 Legislation and Permit Requirements

To enable Option 2 minimal legislative changes are required. Option 2 would require a review and amendment of the existing Barron Resource Operations Plan (ROP) and Resource Operations Licence (ROL). The recent introduction of a new water planning framework under the *Water Act 2000* (Qld) (Water Act) (because of the *Water Reform and Other Legislation Amendment Act 2014*) requires new documents to replace the existing Water Plans and ROLs. These changes aim to deliver a water planning process that is more flexible and more efficient. This change in water planning framework may provide the opportunity to implement Option 2 as part of this process.

The new planning framework includes the following documents:

- *Water Regulation 2016*—replaces the *Water Regulation 2002* and takes a greater role in supporting the water planning process.
- Water plans—will replace water resource plans and will assess the size and nature of the resource to ensure that water is allocated within sustainable limits.

- Water entitlement notice—will replace the schedules in the ROPs and will be used to convert, grant, amend as well as refuse and cancel or repeal (in certain situations) entitlements.
- Water management protocols—will include operational matters such as water sharing and trading rules applicable to specific water management areas in a water plan area.
- ROLs and distribution operations licences—will detail the roles and responsibilities of scheme operators (supplemented water) to achieve the outcomes of the associated water plan.
- Operations manual—will include the day to day operation rules for the associated scheme and is approved by the chief executive.

The fact that the water resources plans and ROLs are changing means that there is a potential opportunity for the implementation of Option 2 with relatively low additional cost associated. The timeframe for implementation of the new planning framework for the Barron Water Plan area is unknown at this time, but depending on the priority of Barron catchment, this may delay the introduction of Option 2.

13.3.3 Planning and Land Use

A change to the availability and/or security of water for irrigation has the potential to change land use in the area of water availability. Within the rural zone, a change to, or intensification of, irrigated cropping (excluding mushroom farming and forestry for wood production) is self-assessable development under both the Mareeba Shire Council and the Tablelands Regional Council's planning schemes.

Expansion and or intensification of cropping within the rural zone because of Option 2 are consistent with the intent of the planning and land use within the area of the MDWSS.

13.3.4 Property Impacts

Option 2 provides an opportunity to increase water use through the existing irrigation system. Any additional infrastructure required to use the water would be associated with on-farm infrastructure and would be the responsibility of the individual land owner. No additional land would be required to implement this option. Property impacts are therefore negligible.

13.3.5 Water Quality Impacts

13.1.1.3 Surface Water

Intensification of production due to increased water availability may have a resultant effect of increased runoff and increased nutrients and pesticides entering the Barron, Walsh and Mitchell Rivers. This has the potential to further impact the existing water quality of the Barron, Walsh and Mitchell Rivers, as well as potential subsequent water quality impacts to the Great Barrier Reef and the Gulf of Carpentaria.

13.1.1.4 Groundwater

Groundwater monitoring bores within the MDWSS have shown trends of rising groundwater levels. Bores near the confluence of Leadingham Creek and the Walsh River have shown rising groundwater levels, with some bores rising approximately 3 metres between the mid 1990's to 2011-12. Bores along Callte Creek have also shown rising groundwater levels, with some bores rising between 1 metre and 4 metres over a similar period. Rising groundwater levels in bores can be an indicator of increasing salinity, which can result in lost agricultural production. Increased agricultural development has the potential to continue this trend and potentially increase salinity issues in the area.

Increased irrigation may also result in an increase in fertiliser and pesticides associated with crop management. Leaching of fertiliser and pesticides has the potential to impact groundwater quality. *Barron*

River Basin Environmental Values and Water Quality Objectives Basin No. 110 cover groundwater resources of the MDWSS. Under this document, where groundwater is in good condition, the existing water quality is to be maintained consistent with relevant water quality objectives.

13.3.6 Topography, Geology and Soils

Increasing water use through the existing irrigation system may provide some opportunity to expand irrigation into areas not currently irrigated. Increasing irrigation within the MDWSS has the potential to increase the risk of salinisation, particularly in the alluvial areas to the north and west of Mareeba. Increasing agricultural production within the MDWSS also has the potential to increase sediment loss, particularly within areas of sodic soils.

13.3.7 Hydrology

Changes implemented as part of Option 2 may result in hydrological changes in the Barron River catchment. The catchment is already highly modified and no additional dams or weirs are proposed to be constructed as a result of implementation of Option 2. However, changes to the transmission and operational allowances may result in hydrological changes. Further investigation into the potential impact on environmental flow objectives and water allocation security objectives will be required and assessment as to the associated environmental impacts of any hydrological change.

13.3.8 Flora and Fauna

Option 2 essentially requires amendments to existing statutory documents to increase operational performance of the scheme. While Option 2 itself does not require any on-ground works, it may result in increased water availability and may trigger individual land owners to expand irrigation areas. This expansion in irrigation areas has the potential to impact flora and fauna, however the extent of impact will be dependent upon the specific location of any expansion activities.

Expansion into areas mapped as regulated vegetation will trigger approval to clear native vegetation. Clearing for high-value agriculture is a relevant purpose under the *Vegetation Management Act 1999* (Qld) so it is possible to submit a development application to clear native vegetation that would be assessed against the relevant code.

Clearing within areas of TEC has the potential to trigger assessment under the EPBC Act. If clearing will have or is likely to have a significant impact on the TEC, referral and assessment of the clearing under the EPBC Act will be required.

A number of flora and fauna species protected under State and Commonwealth legislation also have the potential to occur within the MDWSS area. Depending on the location of potential irrigation development, approvals under State and Commonwealth legislation may also be required. These approvals would be dependent on the location of each individual proposal.

As previously described, Option 2 does not necessarily require any on-ground works. Therefore, the extent of impact to flora and fauna will be dependent upon the specific location of any expansion activities.

Groundwater dependent ecosystems (GDEs) are known to occur within the Barron Basin. The GDEs include:

- A cave and karstic ecosystem to the east of Mareeba
- Non-riverine wetlands considered to be GDEs located to the south of Yungaburra and along the coast near Yorkeys Knob
- Seventy-one regional ecosystems considered to be GDEs are located throughout the Barron Basin, but generally concentrated along the Mitchell River, Walsh River, and extending north of the Walsh River

towards the Hann Tableland National Park. These regional ecosystems are generally associated with *Corymbia* and *Eucalyptus* species.

Changes to groundwater, such as quality and depth, have the potential to impact GDEs. Increased take of groundwater or changes to groundwater quality with expansion of irrigation in the Barron Basin has the potential to impact these GDEs. Management measures can be established to minimise expansion of irrigation, including establishing minimum set back distances for groundwater pumping from known GDEs and establish minimum groundwater depth triggers and pumping rates in prescribed areas which relate to the GDE water requirements.

13.3.9 Climate and Air Quality

Option 2 has the potential to increase the irrigated area within the Barron Basin. Increasing the cropped area within the Barron Basin would potentially increase the exposed surfaces and result in an increase in dust generated in the area. The potential decrease in air quality due to dust emissions is not considered to be significant.

Seasonal variations currently influence the availability and take of water within the MDWSS. The implementation of Option 2 will not change the seasonal variation in water availability of the system, but may change the water use practices that may change the take of water in the system.

13.3.10 Climate Change and Emissions

Climate change has the potential to change the timing, frequency, magnitude and duration of stream-flows as well as reduce groundwater levels. Potential impacts may include an increase in frequency and severity of droughts. Increased agricultural activities may result in additional land clearing and increased use of fossil fuels which can contribute to carbon dioxide emissions.

13.3.11 Noise and Vibration

Option 2 includes a review of the ROP and ROL to increase operational performance of the existing scheme. Implementation of Option 2 will not directly result in changes to noise and vibration. Increased irrigation and associated agricultural machinery movements have the potential to increase noise and vibration. However, the area is already being used for irrigation purposes and the extent of potential increase in irrigation area is unlikely to result in significant to sensitive receivers such as residential dwellings or schools from noise and vibration.

13.3.12 Landscape and Visual Amenity

The MDWSS area is an existing irrigation area and the visual amenity is consistent with agricultural use. The implementation of Option 2 has the potential to increase the irrigation area. This expansion in irrigation area would be consistent with the existing use in the surrounding area and is unlikely to result in a change to visual amenity.

13.3.13 Cultural Heritage

The implementation of Option 2 is unlikely to impact State and local heritage places in the Barron Basin, as the majority of these sites are located within towns.

Aboriginal cultural heritage has the potential to be disturbed through the development of new irrigation areas. The *Aboriginal Cultural Heritage Act 2003* (Qld) requires that all persons must exercise due diligence and reasonable precaution before undertaking an activity that may harm Aboriginal cultural heritage. The *Aboriginal Cultural Heritage Act 2003 Duty of Care Guidelines* provides guidance in measures to ensure that activities are managed to avoid or minimise harm to Aboriginal cultural heritage. Any activities that may

cause ground disturbance that are associated with implementation of Option 2 will need to comply with the guidelines.

13.3.14 Waste Management

Option 2 includes a review of the ROP and ROL to increase operational performance of scheme. Implementation of Option 2 will not directly generate waste that will require management.

13.4 Preliminary Environmental Assessment of Option 3: Modernise MDWSS and Convert Losses

13.4.1 Key Environmental Issues Associated with Option 3

The key environmental issues associated with Option 3 relate to the potential for the creation of new water allocations and the associated increase in irrigation. Key environmental issues associated with increased irrigation are the same as those for Option 2 and are as follows:

- Changes to surface water and groundwater quality and groundwater levels due to increases in farm inputs, such as pesticides and fertilisers. The water quality in the Barron Basin already exceeds aquatic ecosystem guidelines for protection of freshwater systems.
- Clearing of vegetation to facilitate new areas under irrigation. Land surrounding the existing areas of irrigation is mapped as regulated vegetation and has the potential to contain TEC. Clearing in these areas could trigger State and Commonwealth approvals.

13.4.2 Legislation and Permit Requirements

No changes to legislation would be required to implement Option 3. There may be a requirement to obtain development approvals for operational works under either relevant planning schemes or the *Sustainable Planning Act 2009* (Qld)[1], or equivalent planning legislation. Works will need to be assessed against the planning scheme and Sustainable Planning Act to confirm if works trigger a development application.

13.4.3 Planning and Land Use

Planning and land use issues and requirements are the same as Option 2. Expansion and/or intensification of cropping within the rural zone as a result of Option 3 are consistent with the intent of the planning and land use within the area of the MDWSS.

13.4.4 Property Impacts

Planning and land use issues and requirements are the same as Option 2. Option 3 has the potential to provide additional water allocations through improvement in existing SunWater infrastructure. Any additional on-farm infrastructure required to use the water would be the responsibility of the individual land owner. Some additional small areas of land would be required to implement this option for facilities such as balancing storages. Property impacts are therefore considered low.

13.4.5 Water Quality

Issues and impacts associated water quality are considered to be the same as Option 2. Intensification of production due to increased water availability may have a resultant effect of increased runoff and increased nutrients and pesticides entering the Barron, Walsh and Mitchell Rivers. This has the potential to further impact the existing water quality of the Barron River, leading to potential subsequent water quality impacts in the Great Barrier Reef and the Gulf of Carpentaria. Increased agricultural development may impact on

[1] The *Planning Act 2016* will come into force in Queensland on 3 July 2017 and will supersede the *Sustainable Planning Act 2009*

groundwater levels and groundwater quality in the area. Leaching of fertiliser and pesticides has the potential to impact groundwater quality.

13.4.6 Topography, Geology and Soils

Issues and impacts associated with topography, geology and soils are considered to be the same as Option 2. Increasing the availability of water through converting bulk transmission and distribution losses may provide some opportunity to expand irrigation into areas not currently irrigated. Increasing irrigation within the MDWSS has the potential to increase the risk of salinisation, particularly in the alluvial areas to the north and west of Mareeba. Increasing agricultural production within the MDWSS also has the potential to increase sediment loss, particularly within areas of sodic soils.

13.4.7 Hydrology

Changes implemented as part of Option 3 are unlikely to result in hydrological changes in the Barron, Walsh and Mitchell River catchments. The catchment is already highly modified and no additional dams or weirs are proposed to be constructed as a result of implementation of Option 3.

13.4.8 Flora and Fauna

Option 3 involves improving existing infrastructure to reduce transmission and distribution losses. Implementation of Option 3 may require on-ground works to be carried out. These works would be restricted to existing areas of disturbance/infrastructure within the MDWSS. The MDWSS is largely located in areas mapped as non-remnant vegetation. However, small pockets of remnant vegetation do exist within the MDWSS area.

Similar to Option 2, implementation of Option 3 may create new water allocations that could facilitate expansion of the irrigation area. Regulated remnant vegetation is mapped in the area surrounding the existing irrigation area. Clearing of remnant vegetation for MDWSS infrastructure or for the expansion of irrigation area has the potential to impact flora and fauna.

As described in Section 14.2.5, mapped regional ecosystems within the MDWSS and surrounding area are largely not of concern or of concern to regional ecosystems. There are areas of endangered regional ecosystems to the north, east and south-west of Lake Tinaroo. Four TECs also have the potential to occur within the Tablelands Agricultural Area.

Clearing within areas mapped as regulated vegetation will trigger approval to clear native vegetation. Clearing for high-value agriculture is a relevant purpose under the *Vegetation Management Act 1999* (Qld) so it is possible to submit a development application to clear native vegetation which would be assessed against the relevant code.

Clearing within areas of TEC has the potential to trigger assessment under the EPBC Act. If clearing will have or is likely to have a significant impact on the TEC, referral and assessment of the clearing under the EPBC Act will be required.

A number of flora and fauna species protected under State and Commonwealth legislation also have the potential to occur within the MDWSS area. Depending on the location of the proposed works, approvals under State and Commonwealth legislation may also be required. Permit and approval requirements in relation to flora and fauna would be dependent on the location of the proposed works or irrigation development.

Changes to groundwater, such as quality and depth, as a result of Option 3 have the potential to impact GDEs known to occur within the Barron Basin. Increased take of groundwater or changes to groundwater

quality associated with intensification of use and/or expansion of irrigation in the Barron Basin has the potential to impact these GDEs. Management measures can be established to minimise expansion of irrigation, including establishing minimum set back distances for groundwater pumping from known GDEs and establish minimum groundwater depth triggers and pumping rates in prescribed areas which relate to the GDE water requirements.

As with Option 2, Option 3 has the potential to impact wetlands within and around the MDWSS through changes to flow regime and potential changes in water quality. Delivery of environmental flows to sustain wetlands could be implemented to minimise potential impacts.

13.4.9 Climate and Air Quality

Option 3 may create new water allocations, which could potentially increase the irrigated area within the Barron Basin. Increasing the cropped area within the Barron Basin would potentially increase the exposed surfaces and result in an increase in dust generated in the area. The potential decrease in air quality due to dust emissions is not considered to be significant.

Seasonal variations currently influence the availability and take of water within the MDWSS. The implementation of Option 3 will not change the seasonal variation in water availability of the system, but may change the water use practices that in turn may change the take of water in the system.

13.4.10 Climate Change and Emissions

Climate change has the potential to change the timing, frequency, magnitude and duration of stream-flows as well as reduce groundwater levels. Potential impacts may include an increase in frequency and severity of droughts. Increased agricultural activities may result in additional land clearing and increased use of fossil fuels which can contribute to carbon dioxide emissions.

13.4.11 Noise and Vibration

Option 3 involves improving existing infrastructure to reduce transmission and distribution losses. Noise and vibration may potentially increase during construction of infrastructure improvements; however, the works are proposed within an existing agricultural area and is unlikely to be significantly different to the existing noise and vibration associated with agricultural activities. Increased irrigation and associated agricultural machinery movements also have the potential to increase noise and vibration. As previously stated, the area is already being used for irrigation purposes and the extent of potential increase in irrigation area is unlikely to result in significant impacts to noise and vibration.

13.4.12 Landscape and Visual Amenity

The MDWSS area is an existing irrigation area and the visual amenity is consistent with agricultural use. The implementation of Option 3 has the potential to increase the irrigation area. This expansion in irrigation area would be consistent with the existing use in the surrounding area and is unlikely to result in a change to visual amenity.

13.4.13 Cultural Heritage

As detailed in Section 14.3.13, no Commonwealth heritage properties are located within the MDWSS and State and local heritage places are generally located within towns and are unlikely to be impacted by the implementation of Option 3.

Aboriginal cultural heritage has the potential to be disturbed during construction of infrastructure, as well as development of any new irrigation areas. The *Aboriginal Cultural Heritage Act 2003* Duty of Care Guidelines provides guidance in measures to ensure that activities are managed to avoid or minimise harm to Aboriginal

cultural heritage. Any activities that may cause ground disturbance that are associated with implementation of Option 3 will need to comply with the guidelines.

13.4.14 Waste Management

Option 3 involves improving existing infrastructure to reduce transmission and distribution losses to MP water. Waste potentially generated during construction includes domestic and industrial hazardous and non-hazardous wastes. Implementation of waste management practices during construction can manage potential impacts associated with waste generation.

13.5 Preliminary Environmental Assessment of Option 4: Nullinga Dam for Agricultural Use

13.5.1 Key Environmental Issues Associated with Option 4

The construction of Nullinga Dam would result in not only construction of a new impoundment on the Walsh River, but may also involve the development of a new irrigation area and an increase in the area of land within Area 10 of the MDWSS under irrigation. Key environmental issues associated with Option 4 include:

- Potential approval triggers at both State and Commonwealth level, resulting in a more complex and longer approval process to Option 2 and 3.
- Construction of the dam would require acquisition of land across a range of tenure types.
- Modification to the Walsh River and an increase in the area of land under irrigation (both in potential new irrigation and existing MDWSS) has the potential to impact water quality and flow downstream of the dam.
- Modification to the Walsh River will result in changes to the hydrological environment, both upstream and downstream of the dam, which may impact aquatic fauna.
- The dam wall will create a potential barrier to aquatic fauna which may impact species seasonal migration, spawning and preferred habitat and food resources.
- Clearing of regulated vegetation will be required for both the dam and new irrigation areas. Clearing of TEC and threatened species listed under the EPBC Act is likely to trigger an EPBC Act referral to the Commonwealth Department for Environment and Energy. Should the dam trigger an EIS at the State and/or Commonwealth level, offsets for vegetation clearing will be required.
- It is likely that essential habitat for threatened species listed at both the State and Commonwealth level will be impacted by the development.
- Change in land use both at the dam site and in the new irrigation will result in a change in visual amenity for the development areas.
- Aboriginal cultural heritage has the potential to be disturbed as a result of the project. As the project is likely to trigger an EIS, an approved Cultural Heritage Management Plan will be required.

13.5.2 Legislation and Permit Requirements

Due to the likely impact to matters of national environmental significance (MNES), Option 4 is likely to trigger the requirement for approval under the EPBC Act. At the State level, it is likely that the dam would meet the criteria for a significant project under the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act). Declaration of the project as a state significant project is likely to trigger the need for an EIS.

To minimise duplication of the assessment process, an assessment bilateral agreement between the State and Commonwealth is in place. To take advantage of this process, coordination of the initial referral of the project to the State and Commonwealth will be required.

Several additional approvals are likely to be required. Approvals under the following legislation are likely to be triggered:

- Native Title Act 1993 (C'th)
- SP Act (Qld) (or the *Planning Act 2016* when it comes into force in July 2017)
- Environmental Protection Act 1994 (Qld)
- Water Act 2000 (Qld)
- Vegetation Management Act 1999 (Qld)
- Nature Conservation Act 1992 (Qld).

As with Option 2, Option 4 will also require changes to the ROP. Section 14.3.2 details the changes to the water planning framework. However, Option 4 is likely to require substantial change to the existing water planning and is likely to take longer to incorporate Option 4 into the necessary water planning documents.

13.5.3 Planning and Land Use

The construction of the Nullinga Dam and compatibility with existing and future land use would be assessed as part of the EIS. The dam would result in a loss of agricultural land and resultant change in land use within the inundation area of the dam.

The Nullinga Dam would provide the opportunity to expand irrigated cropping into new areas of the MDWSS and potentially new irrigation areas outside of the MDWSS. Within the rural zone, a change to irrigated cropping (excluding forestry for wood production) is self-assessable development under the Mareeba Shire Council planning scheme. Expansion of cropping within the rural zone because of Option 4 is consistent with the intent of the planning and land use within the rural zone.

13.5.4 Property Impacts

Land within the footprint of the proposed inundation and buffer areas for Nullinga Dam will require acquisition to enable the development to proceed. Land tenure around the proposed dam site is a mix of freehold, lease hold land, reserves and State land. Under the SDPWO Act, the Coordinator-General has the power to resume or compulsorily acquire land on which large-scale infrastructure projects are to be built.

13.5.5 Water Quality

13.1.1.5 Surface Water

The implementation of Option 4 has the potential to result in a change to water quality within the Walsh and Mitchell river catchments. Reduced downstream flows due to the dam have the potential to greatly increase the impacts of runoff and nutrients on the Walsh River.

13.1.1.6 Groundwater

Groundwater pressure has the potential to change as a result of the dam. Change in groundwater pressure can increase groundwater levels in the vicinity of the dam. Further investigation into the potential hydrogeological change as a result of change in groundwater pressure would be further investigated as part of an EIS.

Implementation of Option 4 may result in a change in land use from rain-fed cropping and grazing to irrigated cropping. As was the case for Options 2 and 3, irrigation may result in an increase in fertiliser and pesticides applications associated with cropping.

13.5.6 Topography, Geology and Soils

The Nullinga Dam will result in inundation of agricultural and grazing land. The dam will permanently alienate this agricultural land from productive agricultural use. Change in land use due to irrigation has the potential to increase the risk of salinisation and may also result in erosion due to an increase in exposed surfaces. Development of the Nullinga Dam and associated irrigation area also has the potential to impact the Chillagoe-Mungana Caves due to changes in water quality and quantity of water.

13.5.7 Hydrology

Development of the Nullinga Dam is likely to result in significant flow-related impacts to the Walsh River. Changes to the low flow regime have the potential to impact flora and fauna, as well as existing downstream users and commercial industries in the Gulf of Carpentaria. Management of the low flow regime through environmental releases from Nullinga Dam may potentially reduce the impact to flora and fauna. The dam will also result in a change to flood regime, resulting in reduced floodplain process and flood-tolerance of the riverine ecosystem.

Reduction in high flows reduces the competitive advantage of flood-tolerant or dependent species. The dam will also impact sediment transport. The dam will act as a sink for sediment upstream and will reduce the sediment load downstream of the dam. This has the potential to cause erosion downstream. There is also potential of a slight reduction in sediment transport in the Mitchell River catchment, increasing the potential for weed encroachment and associated implications to instream biota.

13.5.8 Flora and Fauna

The implementation of Option 4 has potential for significant impacts to flora and fauna. Impacts will vary depending of the project stage, with impacts during construction generally short-term, with long-term impacts associated with dam operation. Potential short-term impacts during construction and impoundment filling include:

- Loss of riparian zone along the Walsh River and tributaries of Catherine, Pandanus and Middle creeks.
- Loss of terrestrial habitat due to construction of the dam wall, access roads and water supply infrastructure.
- Barrier to fish and turtle passage due to the dam wall, potentially dividing populations and disrupting migration and lifecycle stages of migratory or highly mobile species.
- Change in aquatic habitat due to alteration to flow and water quality.
- Increase in invasive and pest species through creation of conditions conducive to the introduction and maintenance of populations of pest species such as tilapia (*Tilapia mariae*), hymenachne (*Hymenachne amplexicaulis*) and gambusia (*Gambusia affinis*).
- Flooding of flora and fauna communities due to inundation by dam waters.

Potential long-term impacts associated with the dam operation include:

- Changes to downstream morphology of riverbed and banks that has the potential to change the in-stream habitat and provide habitat favourable to invasive flora and fauna.

- Impact on benthic substrates and their dependent macroinvertebrate communities due to changes in sediment loads.
- Change to flood regime, resulting in reduced floodplain process and flood-tolerance of the riverine ecosystem and reduction in the competitive advantage of flood-tolerant or dependent species.
- Long term alteration below impoundment area impacting the abundance and diversity of fauna populations.
- Long term opportunities for pest species through the creation of conditions favourable for establishment and survival.
- Loss of terrestrial habitat due to clearing associated with establishment of new irrigation area.

13.5.9 Climate and Air Quality

Option 4 will result in development of a new irrigation area within the Walsh River and Mitchell River catchments. Increasing the cropped area would potentially increase the exposed surfaces and result in an increase in dust generated in the area. The potential decrease in air quality due to dust emissions is not considered to be significant.

13.5.10 Climate Change and Emissions

Climate change has the potential to change the timing, frequency, magnitude and duration of stream-flows as well as reduce groundwater levels. Potential impacts may include an increase in frequency and severity of droughts. Increased agricultural activities will result in additional land clearing and increased use of fossil fuels which can contribute to carbon dioxide emissions.

13.5.11 Noise and Vibration

Option 4 involves the construction and operation of the Nullinga Dam. Noise and vibration is likely to increase during construction of the dam. Potential impact of construction related noise and vibration at sensitive receptors will be required to be assessed as part of the EIS process. It is unlikely that noise and vibration associated with operation of the dam will have a significant impact to sensitive receptors.

13.5.12 Landscape and Visual Amenity

With the exception of the existing MDWSS area on the Walsh River, the landscape is dominated by grazing and natural areas. The development of the dam and associated irrigation area will change the visual amenity of these areas. In relation to the new irrigation area, visual amenity impact may be limited as the development is within an existing agricultural area and sensitive receptors may not sensitive to the change in visual amenity. The dam will result in a significant change in visual amenity of the area.

13.5.13 Cultural Heritage

In the area of the Nullinga Dam site through to Chillagoe there are no Commonwealth heritage properties. State heritage places within the area are upstream of the proposed dam site and to the north west of Dimbulah. It is unlikely that the implementation of Option 4 will impact these sites. Local heritage places are located within towns and are unlikely to be impacted by the implementation of Option 4.

As it is highly likely that Option 4 will trigger the requirement for an EIS, the Aboriginal Cultural Heritage Act requires that a cultural heritage management plan (CHMP) is developed and approved for the project. The CHMP is an agreement between the proponent and the Traditional Owners and details how land use activities can be managed to avoid or minimise harm to Aboriginal cultural heritage.

13.5.14 Waste Management

Option 4 involves construction of a new dam. During construction of the dam, waste potentially generated includes domestic and industrial hazardous and non-hazardous wastes. Waste disposal will be required to keep the construction area tidy and safe, but also to prevent land and water contamination. Implementation of waste management practices during construction can manage potential impacts associated with waste generation.

13.6 Conclusion

The legislative and permitting requirements to implement Options 2 or 3 are significantly less than those required for Option 4.

The implementation of Option 2 would require amendment of existing water resource planning documents. Recent legislative changes have resulted in the introduction of a new water-planning framework. This means that there is a potential for Option 2 to be implemented with relatively low additional cost.

Option 3 requires limited permitting requirements, simply development approvals for operational works under either relevant planning schemes, the SPA, or equivalent planning legislation.

Option 4 is likely to meet the requirements to be declared a controlled action under the EPBC Act and meet the criteria for a significant project under the SDPWO Act. This would trigger the need for an EIS to be approved prior to construction of the dam. The EIS process is a more complex and longer approval process than that required for implementation of Option 2 or 3.

All three options have the potential to increase the area of land under irrigation, with Option 4 providing the largest potential for increased irrigation. Environmental impacts associated with increased irrigation are likely to reflect the scale of impact, but may include:

- Reduction in habitat as a result of vegetation clearing.
- Changes in surface water and groundwater level and quality due to increases in farm inputs.
- Changes to the hydrological regime resulting in potential impacts to aquatic flora and fauna.

In addition to increased irrigation area, Option 4 includes the construction of Nullinga Dam. This will result in inundation of land currently used for agricultural purposes and a number of environmental impacts. The potential environmental impacts associated with the dam include:

- Loss of riparian zone and terrestrial habitat and changes in aquatic habitat due to inundation, alteration to flow and/or water quality.
- Barrier to the movement of aquatic fauna due to the dam wall.
- Changes to downstream morphology of riverbed and banks which has the potential to change the in-stream habitat and provide habitat favorable to invasive flora and fauna.
- Impact on benthic substrates and their dependent macroinvertebrate communities due to changes in sediment loads.
- Change to flood regime, resulting in reduced floodplain process and flood-tolerance of the riverine ecosystem and reduction in the competitive advantage of flood-tolerant or dependent species.
- Impact to cultural heritage within the inundation area.