

**REFERRAL UNDER THE
ENVIRONMENTAL
PROTECTION ACT 2019 (NT)**

Manton Dam Return to Service



August 2023

DOCUMENT CONTROL RECORD

Job	EZ22117
Power and Water ID	230000
EcOz Document ID	216541
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DOCUMENT HISTORY

Rev	Reviewed by	Approved by	Issued to	Date
1	Kylie Welch	Kylie Welch	Power and Water	4 August 2023
2	Kylie Welch	Kylie Welch	Power and Water	17 August 2023

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EXECUTIVE SUMMARY

This Referral report was prepared to inform the Northern Territory Environment Protection Authority (NT EPA) of the proposal by Power and Water Corporation (Power and Water) for the Manton Dam Return to Service Project (Manton Dam RTS).

Project overview

The Manton Dam RTS Project is part of the *Darwin Region Water Supply Infrastructure Program (DRWSIP)*, an initiative of the Northern Territory Government (NTG) in conjunction with Power and Water. The scope of the project involves construction of a new pump station and infrastructure upgrades near the existing dam wall, construction of a new water pipeline in existing utility easements along the Stuart Highway and construction and operation of a Water Treatment Plant (WTP) at Strauss¹. The location of the Project is shown in Figure 1-1.

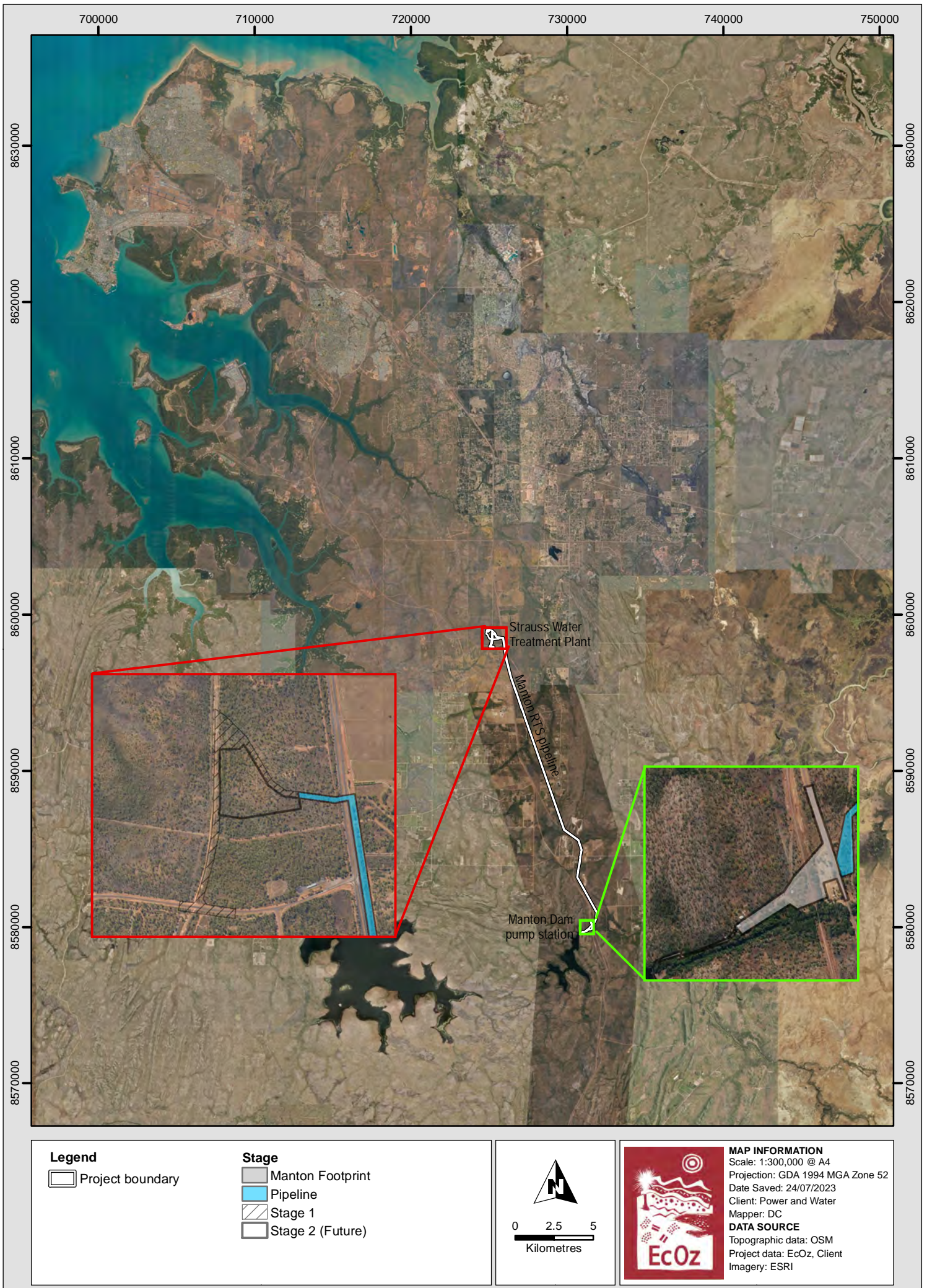
Manton Dam will continue to be operated as a recreation area. The Strauss WTP will provide for treatment of water to potable water standards.

The Project comprises three key components as summarised in text and shown on the map below.

Brief description of Project components

	Manton Dam infrastructure	Water main pipeline and fibre optic cable	Strauss WTP
Description	The existing dam at Manton Dam with modifications to infrastructure including the existing inlet tower and a new pump station and associated ancillary works	A pipeline from Manton Dam to transport water in an existing easement, Crown Land licences and the Stuart Highway Road reserve to the proposed Strauss WTP. A fibre optic cable will also be installed in the existing easement.	A WTP at Strauss, including new intersection on Cox Peninsula Road for access to the WTP. The WTP will be developed in two stages as described below.
Street address	4680, 4760 Stuart Highway	Various – See Appendix A	Corner of Stuart Highway and Cox Peninsula Road
Lot/Section number	NT Portion 3837, 4002	Various – See Appendix A	Part Lot 418, Part Lot 2929, Part Lot 2930
Town/Hundred	Darwin River Dam	Acacia Hills, Manton, Hughes, Noonamah Hundreds of Cavenagh, Colton, Strangways	Noonamah Hundred of Strangways
Tenure	Freehold (Power and Water) and Crown lease	Existing utilities easement through multiple freehold lots, Vacant Crown Land and Road Reserve	Vacant Crown Land Road reserve
Nearest residential community/town	4.5km east from Acacia Larrakia Community	<100m away from Rural blocks in Hughes and Livingstone	500m away from Rural blocks in Livingstone south of Cox Peninsula Rd; approx. 4km south of Noonamah Tavern
Ownership of land	Power and Water	Private NT Government	NT Government

¹ The completion of the Strauss WTP will be a staged approach. Only Stage 1 of the WTP will be constructed as part of the Manton RTS Project. The location has been selected to allow for future expansion of the plant to treat water from Darwin River Dam and the future AROWS. Any future stages of the Strauss WTP will be constructed under approvals associated with those projects and therefore are not considered in detail in this referral.



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Figure 1-1. Map showing the project within a regional context

Consultation

Key issues raised through the consultation process and the outcomes are summarised below. Further details of consultation to date is provided in Section 3.2 of the referral report.

Key issues raised	Outcome
Appropriate water quality for consumption if recreational use continues.	Design response to ensure water quality standards are met even with continued recreational use.
Recreational use of Manton Dam	Commitment by NTG to maintain recreational use of Manton Dam. Formal media announcement by NTG in March 2022.
Further engagement with impacted stakeholders required	NTG to continue to work with the NLC to ensure Aboriginal land and interests are appropriately considered as part of the project development process. NTG is committed to meaningful engagement with Aboriginal communities and stakeholders in line with the NTG's <i>Remote Engagement and Coordination Strategy</i> and <i>Best Practice Guide for Remote Engagement and Coordination</i> .
Need for strong assessment and approvals process for ensuring sustainable water consumption.	Ongoing consultation with Environment Centre NT throughout Project lifecycle. Power and Water agree demand management and sustainable water consumption initiatives are required.
Demand management, overuse of groundwater and high-water consumption are critical issues that need to be considered across all sectors throughout the Territory.	Consideration that the Strategic Territory Water Plan (released June 2023) could consider the oversubscription of groundwater networks in more detail, and potential solutions at a Territory level to ensure there is sufficient water to promote and sustain growth and development.
Heritage values	Engagement with Heritage Branch to inform heritage values information and expectations in the referral. Archaeological survey conducted prior to submission of this referral.
Cease of controlled discharge from Manton Dam into Manton River	Power and Water committed to maintain controlled discharge flow of 30 L/s during dry season into Manton River, in agreement with downstream property owners.

Assessment of potential impacts

Pre-referral screening of the Project undertaken by EcOz Environmental Consultants (EcOz) determined that the Project has potential to impact five of the NT EPA's 14 environmental factors. For each of the five relevant factors, surveys and assessments were undertaken to identify environmental values. Where important values were identified, work was undertaken by Power and Water to identify measures that could be implemented to avoid and minimise impacts. These measures are documented in the referral report and were taken into consideration when assessing the residual impacts to each factor. The outcomes of the impact assessment are summarised in the table below.

Summary of factors relevant to the Project, potential impacts and residual impacts

Factor	Environmental value	Potential impacts and benefits	Residual impact
Terrestrial ecosystems Section 5.2	<ul style="list-style-type: none"> • Vegetation and habitat • Old-growth forest • Riparian vegetation • Threatened species 	<ul style="list-style-type: none"> • Direct loss and degradation of vegetation and habitat • Direct loss of significant vegetation • Loss of threatened species habitat • Direct mortality of threatened fauna 	Moderate
Hydrological processes Section 5.3	<ul style="list-style-type: none"> • Surface water drainage • Surface water flows downstream of Manton Dam 	<ul style="list-style-type: none"> • Alteration of surface water drainage • Alteration of surface water availability downstream • Surface water drawdown 	Moderate
Aquatic ecosystems Section 5.4	<ul style="list-style-type: none"> • No-threatened aquatic fauna • Riparian vegetation and habitat • Aquatic biodiversity 	<ul style="list-style-type: none"> • Direct mortality of aquatic fauna • Habitat degradation and fragmentation from reduction of surface water flows in Manton River downstream of Manton Dam • Habitat degradation and fragmentation from increased drawdown in Manton Dam 	Low
Community & economy Section 5.5	<ul style="list-style-type: none"> • Recreational use of Manton Dam • Downstream water users on Manton River • Rural residential properties near project footprint • Security of water supply 	<ul style="list-style-type: none"> • Restrictions on recreational use during the late dry season in low water years • Reduced flows in Manton River • Amenity impacts during construction • Improved water security for the Darwin region 	Moderate
Culture and Heritage Section 5.6	<ul style="list-style-type: none"> • Aboriginal sacred sites • European heritage features (WWII) 	<ul style="list-style-type: none"> • Loss or damage to known or unknown archaeological sites • Loss or damage to known or unknown sacred sites 	Low

Conclusion

The results of studies and impact assessment presented in the referral report indicate that with appropriate avoidance and mitigation measures, the Project is unlikely to result in significant impacts to the environment.

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ACRONYMS

AAPA	Aboriginal Areas Protection Authority
AFANT	Amateur Fishing Associated Northern Territory
ANCOLD	Australian National Committee on Large Dams
AROWS	Adelaide River Off Water Storage
BOM	Bureau of Meteorology
CEMP	Construction Environment Management Plan
DAAF	Dissolved air flotation and filtration
DBC	Detailed business case
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
DEPWS	Department of Environment, Parks and Water Security (Northern Territory) – formerly DLRM
DIPL	Department of Infrastructure Planning and Logistics
DITT	Department of Industry Tourism and Trade
DRWSIP	Darwin Region Water Supply Infrastructure Program
EcOz	EcOz Environmental Consultants
EP Act	<i>Environment Protection Act 2019 (NT)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act (1999) (Commonwealth)</i>
ESCP	Erosion and Sediment Control Plan
MCA	Multi-criteria assessment
Manton Dam RTS	Manton Dam Return to Service
MNES	Matters of National Environmental Significant
NAR	Northern Australia Railway
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
NTG	Northern Territory Government
NWGA	National Water Grid Authority
Power and Water	Power and Water Corporation
PwC	PwC Australia (formerly PriceWaterhouseCoopers)
PWG	Project working group
TERC	Territory Economic Reconstruction
TPWC Act	<i>Territory Parks and Wildlife Conservation Act (Northern Territory)</i>
WTP	Water treatment plant

PUBLICATION STATEMENT

This Referral has been prepared by EcOz Environmental Consultants (EcOz) on behalf of Power and Water Corporation (Power and Water). A listing of the key consultants, their qualifications and experience in the environmental field are provided below.

Key consultant	Qualifications	Experience
Jeff Richardson	Bachelor of Science (Hons)	20+ years
Kylie Welch	Bachelor of Science (Hons); Master of Social Science	25+ years
Glen Ewers	Bachelor of Science; Bachelor of Law (Environment) Diploma of Arts (Environmental Studies); Graduate Certificate in Ornithology	15+ years
Cameron Jones	Bachelor of Environmental Management	4+ years
Alice Nicholl	Bachelor of Science Master of Science (BioScience)	3+ years
Britanny Crescentino	Bachelor of Science	4+ years

Inputs from relevant technical consultants have been provided throughout the development of this Referral. A listing of the key technical consultants, their qualifications and experience in the environmental field are provided below.

Key technical specialist	Specialist area	Qualifications	Experience
Silvano Jung	Archaeology	Doctor of Philosophy Bachelor and Master of Arts	20+ years
Ben Keys	Archaeology	Batchelor of Archaeology (Hons)	20+ years
Steve Hart	Greenhouse gas emissions	Bachelor of Science; Practitioner Institute of Environmental Management and Assessment	15+ years

1 INTRODUCTION

This Referral has been prepared to inform the Northern Territory Environment Protection Authority (NT EPA) of the Project by Power and Water Corporation (Power and Water) to return the existing Manton Dam reservoir to service as a water supply reservoir for the greater Darwin region. The Project is referred to as the Manton Dam Return to Service Project (Manton Dam RTS).

The Project is being referred to the NT EPA to determine whether formal assessment is required pursuant to the NT *Environment Protection Act 2019 (EP Act)*. This Referral also considers whether the Project should be referred for assessment under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*.

1.1 Project overview

The Manton Dam RTS Project is part of the *Darwin Region Water Supply Infrastructure Program (DRWSIP)*, an initiative of the Northern Territory Government (NTG) in conjunction with Power and Water. The Project is fully funded by the Australian Government through the National Water Grid Authority (NWGA). Power Water is the Project Proponent² responsible for delivering the works required to return Manton Dam to service and for ongoing operation and maintenance of the water supply infrastructure.

The scope of the Manton Dam RTS project involves construction of a new pump station and infrastructure upgrades near the existing dam wall, construction of a new water pipeline in existing utility easements along the Stuart Highway and construction and operation of a Water Treatment Plant (WTP) at Strauss³. The location of the Project is shown in Figure 1-1.

Manton Dam will continue to be operated as a recreation area. The Strauss WTP will provide for treatment of water to potable water standards.

1.2 Background

Sustainable access to potable water is crucial in supporting both economic growth and the health and livelihoods of the NT population. The NTG has set an ambitious goal to become a \$40 billion economy by 2030 by increasing private sector investment through the growth of key industries, jobs and creation of sustainable business (TERC 2020). Given the anticipated economic and population growth in the region, a solution is required to ensure a sustainable and cost-effective source of safe drinking water is available. This has resulted in the development of the DRWSIP.

Currently, the greater Darwin region's water is predominantly supplied from the Darwin River Dam which is operating above its sustainable yield and is supplemented with groundwater resources. Even in the absence of substantial increase in economic activity, the economic prosperity and long running economic contribution of Darwin is compromised by the existing available water supply (PwC Australia 2022). By 2050, it is forecast that an additional supply of 11,000 ML/year is required to supply forecast population growth in the Darwin region, 17,000 megalitres per year (ML/year) is required to provide for agriculture growth and 26,700 ML/year is required for industry growth. The demand profile is shown in Figure 1-3 (PwC Australia 2022).

To meet the water supply requirements for the forecasted population and economic growth, augmentation of the existing water supply is required. The DRWSIP outlines that this can be achieved through a mix of

² Power and Water is a government-owned corporation, responsible for generating and distributing electricity and retail gas, and providing water supply and sewerage services across the Northern Territory (NT).

³ Only Stage 1 of the WTP will be constructed as part of the Manton RTS Project. The location has been selected to allow for future expansion of the plant to treat water from Darwin River Dam and the future AROWS. Any future stages of the Strauss WTP will be constructed under approvals associated with those projects and therefore are not considered in detail in this referral.

approaches, including increasing the use of groundwater up to the current licenced allocation, returning Manton Dam to service, and constructing a new reservoir on the Adelaide River (AROWS).

Power and Water propose Manton Dam RTS as the first construction component in the DRWSIP based on an extensive options assessment process described further in Section 2.4. The DRWSIP also includes the Adelaide River Off Water Storage (AROWS) Project, the Horticulture Supply Project and Middle Arm Industrial Supply Project (see Figure 1-2).

To align with the DRWSIP it is proposed the Strauss WTP site will be developed over two stages.

- Stage 1 (Subject of this referral) - Development of the Strauss WTP to treat 20 ML/day from Manton Dam
- Stage 2 – (Future works) – Development of an additional 236 ML/day WTP to treat water from Darwin River Dam and the future AROWS project

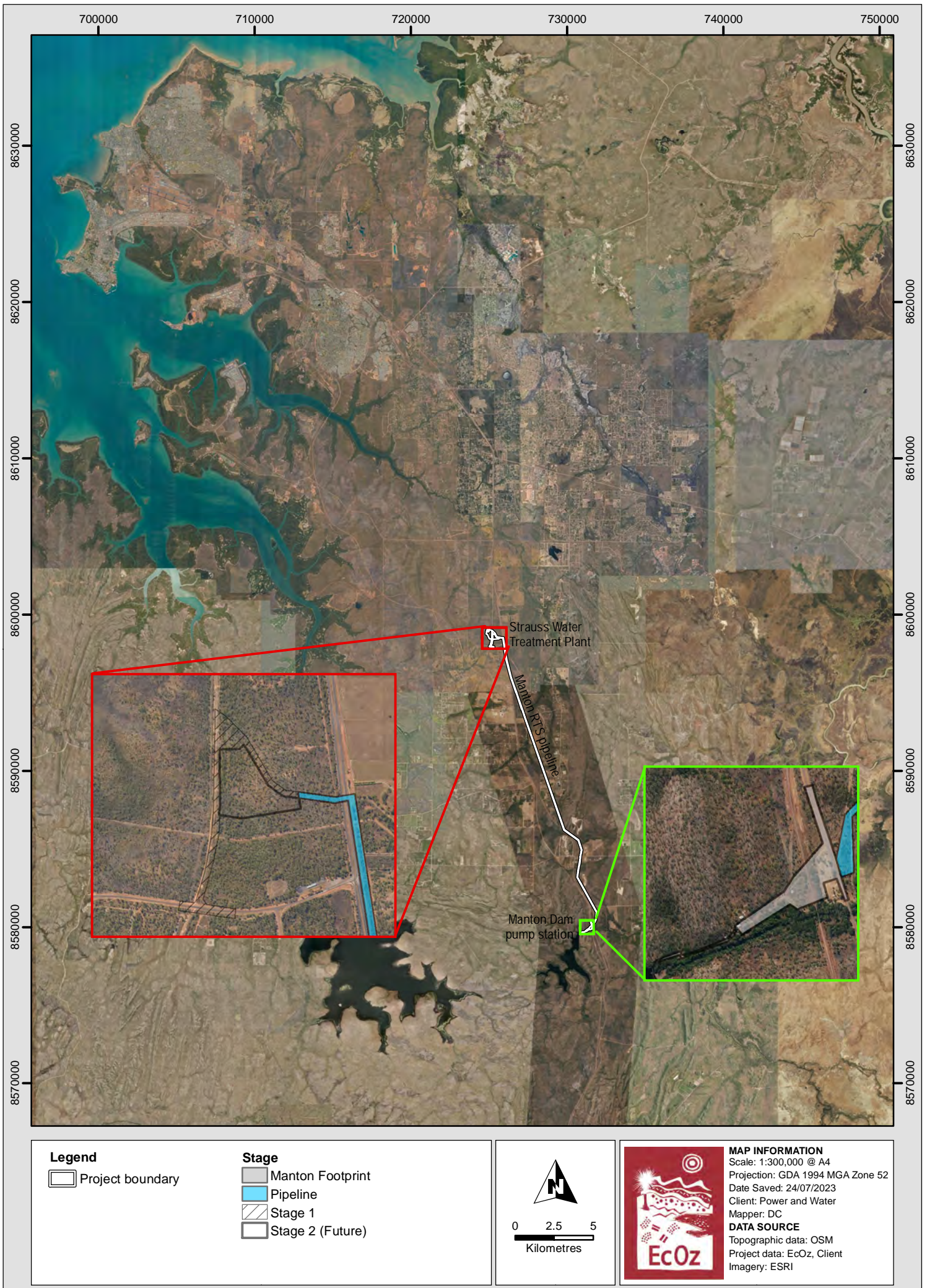
Stage 2 (subject to future referral and environmental assessment process) allows for expansion of the treatment of water from Darwin River Dam and the AROWS project i.e., 2 x 125 ML/day. It is estimated that this will be required by 2031. Stage 2 will require the Strauss WTP development footprint to expand from the footprint requested as part of this referral, 7.64 ha to 16.64 ha to accommodate the additional infrastructure required to treat a larger quantity of water.

The proposed schedule for the water supply augmentation program is shown in Figure 1-4. The Manton Dam's RTS project is scheduled to commence supply from 2026.

1.3 Studies undertaken to inform this Referral

The following studies have been undertaken to inform this Referral:

- Archaeological heritage surveys completed by Silvano Jung (2017 and 2023)
- Ecological Assessment – Manton Dam Return to Service completed by EcOz (2023)
- Greenhouse Gas Assessment completed by EcOz (2023).
- Power and Water (2023b) internal hydrological modelling of the effect of returning the dam to operation (extraction of 7.3Gl/year)



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Figure 1-1. Map showing the project within a regional context

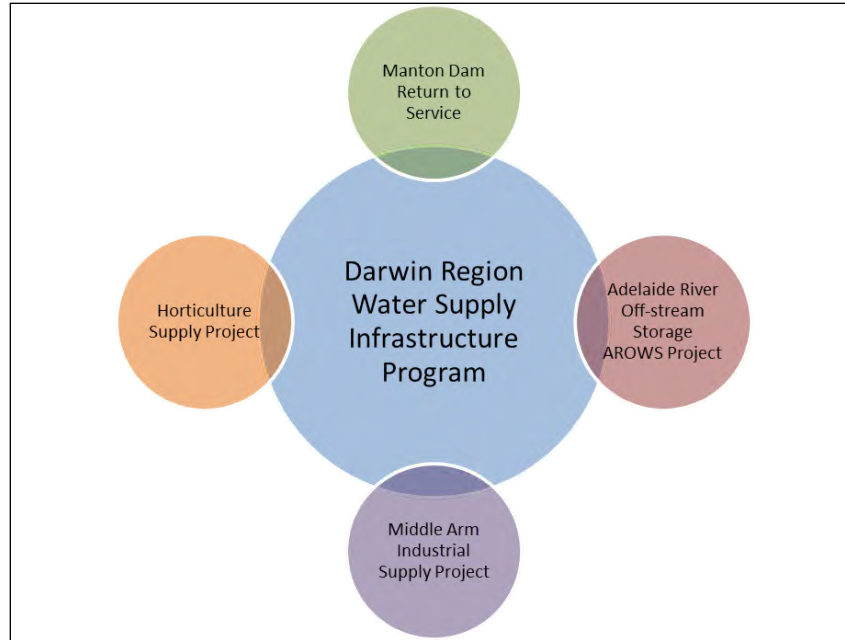


Figure 1-2. DRWSIP Projects

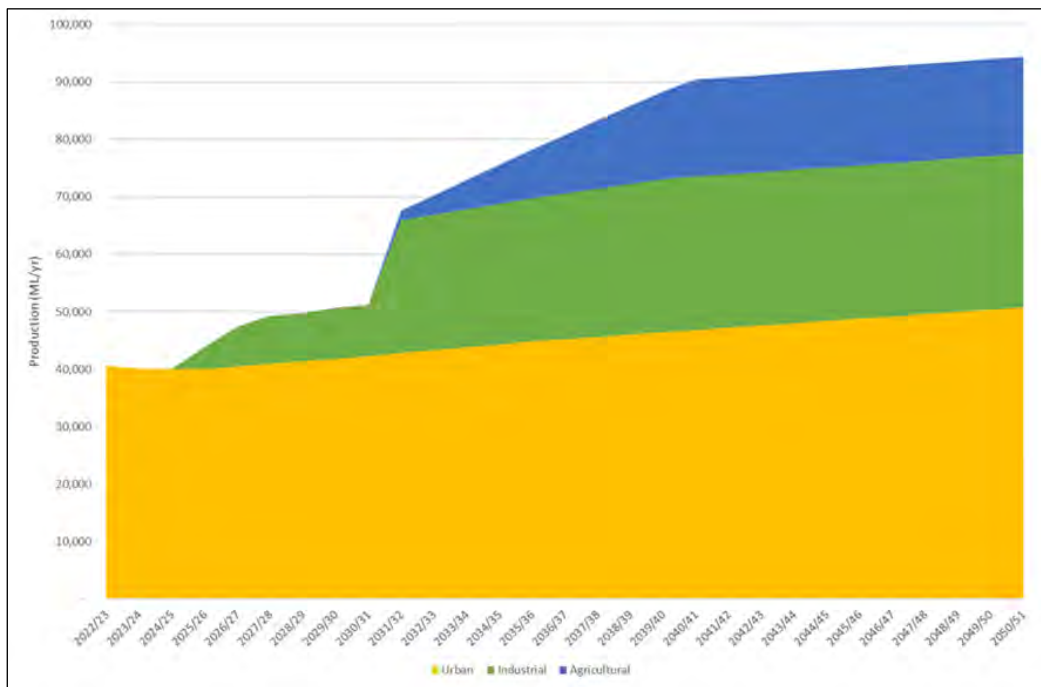


Figure 1-3. Potential water demand profile for the Darwin region from 2023-2050

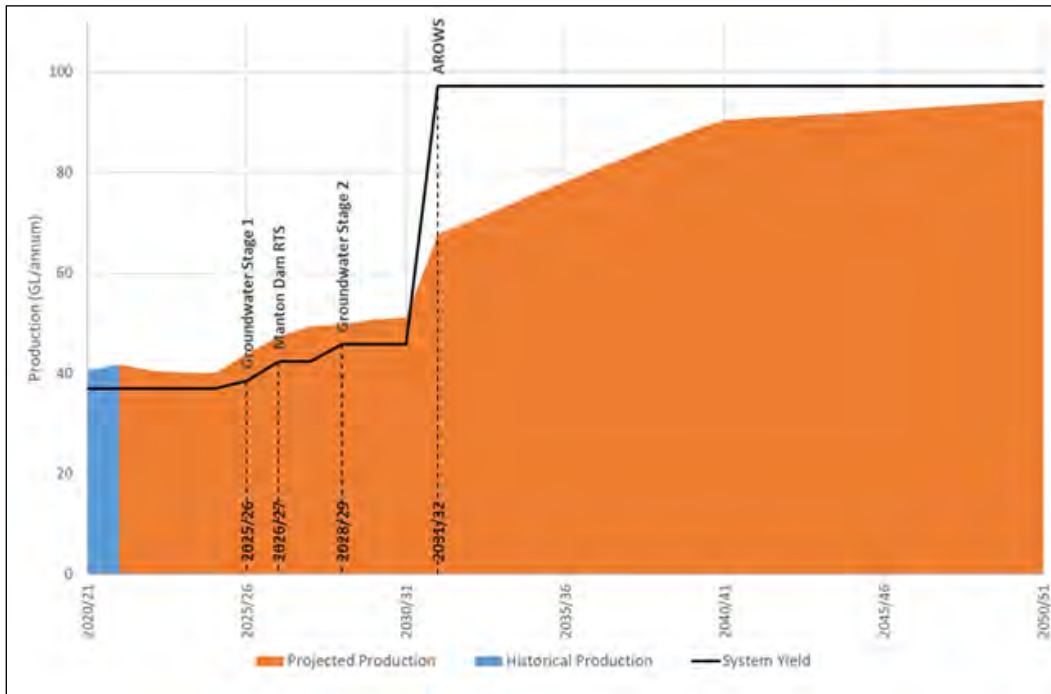


Figure 1-4. Darwin region water source development program

2 PROJECT DESCRIPTION

This section provides details of the Project location and describes the key physical and operational components of the Project and their purpose.

2.1 Location and land regional context

2.1.1 Location

The existing Manton Dam reservoir is approximately 70 km south of Darwin and the proposed Strauss WTP site is approximately 50 km south of Darwin, near the Cox Peninsula Road intersection. The proposed water main pipeline connecting the two components will run for approximately 21 km adjacent to or nearby the Stuart Highway between Manton Dam and the proposed Strauss WTP, in either existing easements, the Stuart Highway Road reserve, or areas of Vacant Crown Land. Figure 2-4 shows the location of each component.

2.1.2 Land information

Table 2-1 summarises the location and land information for each Project component. Details of each land parcel within the Project footprint are provided at Appendix A.

Table 2-1. Location and land information for each project component

	Manton Dam infrastructure	Water main pipeline	Strauss Water Treatment Plant
Latitude	-12.670°S	NA – linear infrastructure	-12.839°S
Longitude	131.077 °E	NA – linear infrastructure	131.129°E
Street address	4680, 4760 Stuart Highway	Various – See Appendix A	Corner of Stuart Highway and Cox Peninsula Road
Lot/Section number	NT Portion 3837, 4002	Various – See Appendix A	Part Lot 418, Part Lot 2929, Part Lot 2930
Town/Hundred	Darwin River Dam	Acacia Hills, Manton, Hughes, Noonamah Hundreds of Cavenagh, Colton, Strangways	Noonamah Hundred of Strangways
Zoning	Unzoned	Rural (R); Main Road (M); Multi Zone (MZ)	Multi Zone (MZ)
Tenure	Freehold (Power and Water) and Crown lease	Existing utilities easement through multiple freehold lots, Vacant Crown Land and Road Reserve	Vacant Crown Land Road reserve
Nearest residential community/town	4.5km east from Acacia Larrakia Community	<100m away from Rural blocks in Hughes and Livingstone	500m away from Rural blocks in Livingstone south of Cox Peninsula Rd; approx. 4km south of Noonamah Tavern
Ownership of land	Power and Water	Private NT Government	NT Government

2.1.3 Land use

Overview

Most of the Project area is a modified environment where existing land uses have involved clearing of native vegetation. As is typical of the modified environments through the Darwin rural area, there is minor localised occurrences of erosion and weed infestations present as described in EcOz (2023) at Appendix B. There are no contaminated sites registered under the *Waste Management and Pollution Control Act 1998*; however, it is noted that the area around the existing infrastructure at Manton Dam could have hydrocarbon contaminated soils (from fuel storages, generators and pumps) and asbestos present. The surrounding land use is dominated by major transport infrastructure, including the Stuart Highway and the Darwin-Adelaide Railway line, various rural residential properties and agricultural properties.

Manton Dam

Manton Dam Reservoir was constructed in the 1940s and was the main water source for the Darwin region until 1972 when Darwin River Dam was fully commissioned. Manton Dam has been maintained as a potential emergency water supply source and used as a recreational dam for activities such as water skiing and fishing. The dam is a popular freshwater recreation destination for the community, with a boat ramp allowing the access by motorised boats. Most of the catchment is Freehold land owned by Power and Water that is managed by Parks and Wildlife but is undeveloped and has restricted public access. An updated Catchment Protection Plan is currently being developed and will be implemented by Power and Water, and the recreational aspects of Manton Dam will be managed by Parks and Wildlife.

Water pipeline and fibre optic cable corridor

The corridor is in an existing easement that has existing high voltage powerlines and water pipeline infrastructure and is subject to ongoing maintenance activities by Power and Water. The natural environment has been heavily modified as illustrated in the images presented in Figure 2-1.

Throughout the majority of the easement east of the Stuart Highway, there is a cleared corridor with dirt vehicle track to support maintenance of the current infrastructure. This cleared corridor is generally devoid of trees – with temporary regrowth occurring in some areas – and has high infestation by weed species. Bordering this cleared corridor is a mix of cleared land for agriculture, infrastructure and private rural residential blocks, as well as sections of remnant vegetation. There is an extensive (~7.5 ha) man-made ponded waterbody adjacent to the easement at Coulton Park Farm, Acacia Hills.

The section of easement west of the Stuart Highway near Manton Dam Wall is heavily disturbed with the current Adelaide-Darwin railway line crossing the site and much of the remainder currently being used as the Manton Dam Wall Picnic Area – including bitumen roads, mowed lawns and historical infrastructure / information (Figure 2-2). Some remnant vegetation is present adjacent to Manton River, including riparian vegetation. There is heavy weed infestation spreading from an unmaintained patch of land adjacent to the railway line.



Figure 2-1. Images taken along the corridor east of the Stuart Highway



Figure 2-2. Images taken along the corridor between Manton Dam wall and the Stuart Highway

Strauss Water Treatment Plant

The Strauss WTP site is vacant land alongside the Stuart Highway and Cox Peninsula Road that mostly consists of remnant woodland that is further described in Section 5.2. The greatest disturbance to the site is a north-south corridor through the centre used for utilities. Various other disturbances are scattered throughout, with many likely to be from WWII activities associated with Strauss WWII Airstrip to the north. The site is exposed to regular fire. Few weeds were encountered, with the majority of these located in the disturbed corridor.



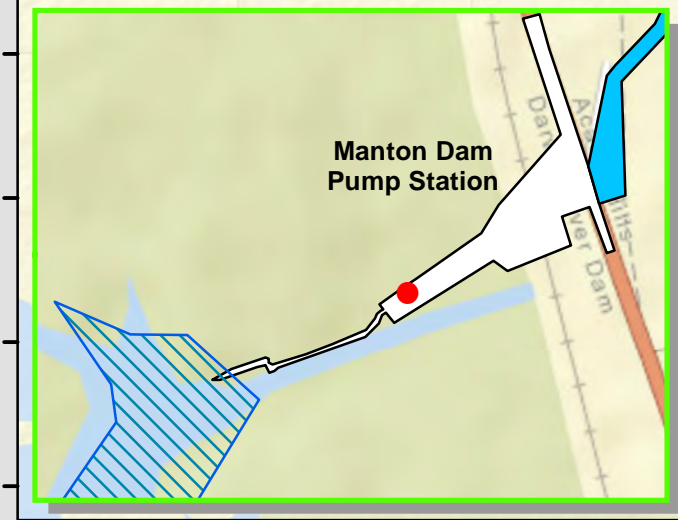
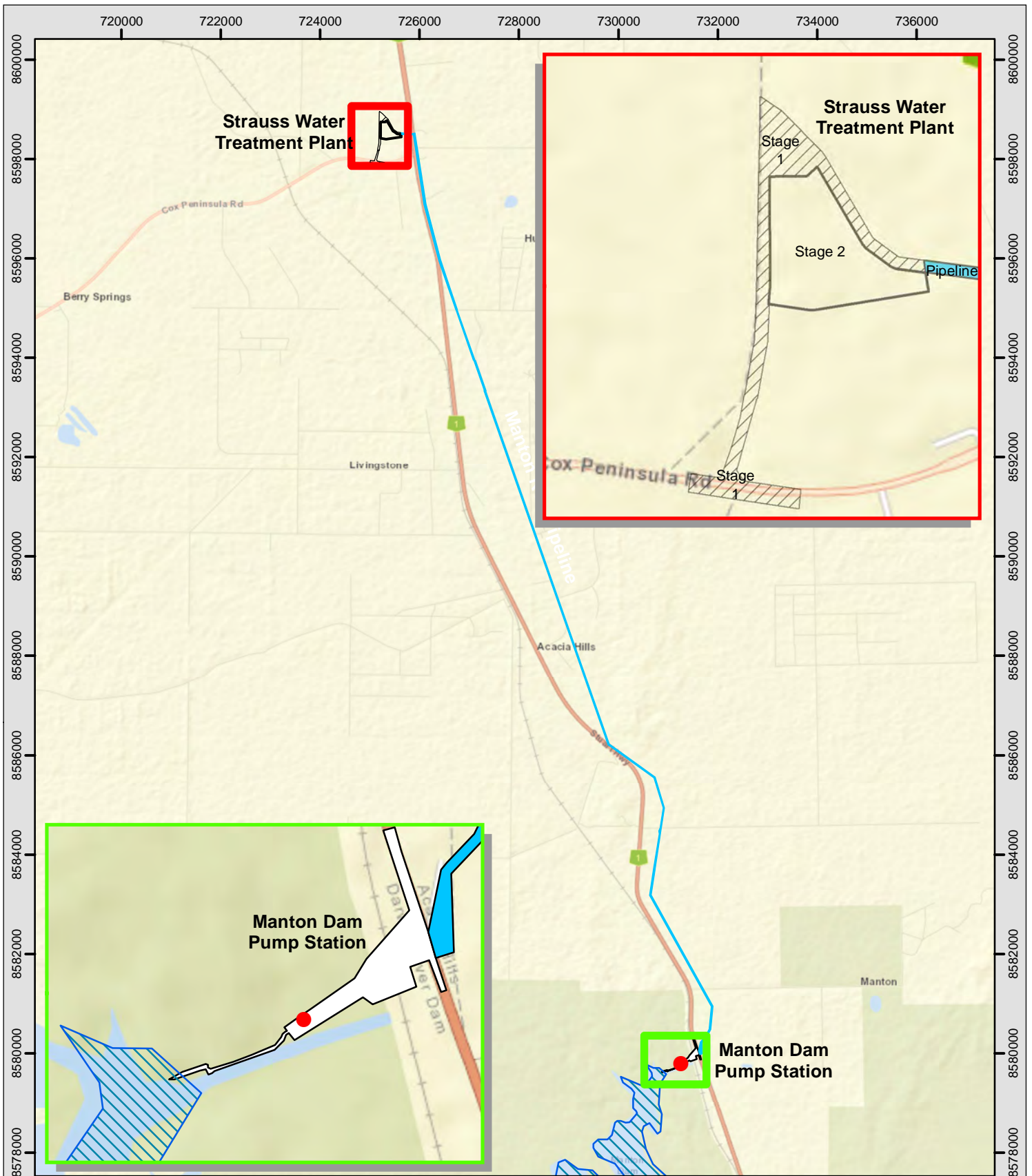
Figure 2-3. Image of utilities corridor running through the Strauss WTP site

2.2 Key components

Table 2-2 below summaries the key physical components of the Project and their purpose/function. The project footprints and layout are shown in Figure 2-4. The subsequent sections then provide details of activities associated with construction and operation each component.

Table 2-2. Summary of key components and footprint

Component	Description	Footprint (ha)
Manton Dam infrastructure	<ul style="list-style-type: none"> • New pump station with capacity to pump 20 ML/day • Upgrade existing inlet tower • Upgrade existing inlet tower access road (to reduce flooding) – road is approx. 310 m in length and minimum 4m wide • Upgrade of existing site access road from the Stuart Highway (minimum 5 m wide) • Upgrade existing carparking including disabled parking • Upgrade existing power substation • Backup diesel power generators • Diesel fuel storage • Street lighting and security fencing at site boundary and pump station compound 	6 ha - existing disturbed area
Water main pipeline and fibre optic cable	<ul style="list-style-type: none"> • Underground 600 mm diameter water main pipeline from Manton Dam to Strauss WTP • Corridor is approx. 20.4 km x 32 m wide • Fibre Optic cable to be installed either in existing aerial electrical infrastructure or buried alongside pipeline. 	65 ha - existing disturbed area; some localised clearing to remove regrowth and achieve corridor width
Strauss WTP	<ul style="list-style-type: none"> • Stage 1 of the Strauss WTP will be constructed as part of the (DRWIP) • To treat 20 ML/day – footprint approx. 4.85 ha • Access road from Cox Peninsula Highway • Backup diesel power generators • Hazardous materials storage areas for diesel fuel and chlorine • Waste storage areas • Security fencing 	7.64 ha – mostly remnant vegetation with some prior disturbance
Total footprint		78.64



- Legend**
- Manton Dam pump station
 - ▨ Manton Dam
- Stage**
- Manton Footprint
 - ▬ Pipeline
 - ▨ Stage 1
 - ▭ Stage 2



0 0.5 1 2
Kilometres



MAP INFORMATION
 Scale: 1:105,000 @ A4
 Projection: GDA 1994 MGA Zone 52
 Date Saved: 1/08/2023
 Client: Power and Water
 Mapper: DC

DATA SOURCE
 Topographic data: OSM, BOM
 Project data: EcOz
 Imagery: ESRI

Figure 2-4. Map of Project components

2.3 Key project features and activities

The sections below and Table 2-3 summarise the activities that will occur during construction and operation that were considered in conducting the environmental impact assessment presented in this Referral.

2.3.1 Manton Dam construction activities

Various infrastructure works are required at Manton Dam, some existing infrastructure requires upgrades, while some new infrastructure will need to be installed.

Demolition of redundant infrastructure

Existing old infrastructure will be demolished and removed from site. The demolition plan is shown in Figure 2-5. The demolition plan includes a diesel tank and some of the infrastructure may contain asbestos. Soil contamination and asbestos will be managed in accordance with current accepted standards and guidelines to ensure the site is safe, stable and non-polluting. Engagement with Heritage Branch has confirmed that none of the infrastructure in the demolition plan has heritage significance. Historical structures identified during engagement with Heritage Branch as of heritage value are remaining (i.e. Caretaker residence, Pump house No 1 and No. 2 and Stilling pond at base of the dam).

Construction of new pump station

A new pump station will replace existing pump stations. The new pump station will be constructed on previously disturbed land. Works include, but are not limited to:

- site preparation and levelling
- compound civil works including driveways and pavements, footpaths, anti-climb fencing, gates
- laying concrete slabs
- construction of the pump station building and mechanical components
- drainage and erosion and sediment control works are required
- construction of septic disposal system for small ablution in building

Upgrade existing intake tower

The existing intake tower adjacent to the dam wall requires upgrades. Works include, but are not limited to:

- installation of new valves and actuators
- construction of new fibre optic communications (above ground) from the new pump station to the intake tower
- upgrades and improvements to intake tower access including a new platform with handrails, jib crane, trash screens and access bridge.

Upgrading existing walkway

The existing walkway from the old diesel pump station to the dam wall will be upgraded including pavement and handrail upgrades, Whilst the whole site will be closed to the public, access may be provided to limited groups on application or through planned open to the public for viewing days.

Access roads and site security

Access roads and site security will be upgraded, including, but not limited to:

- repair of potholes and resealing of Manton Dam site access road from Stuart Highway to the new pump station

- upgrade to Stuart Highway intersection line marking
- new site boundary and pump station compound security fence
- upgrades to car parking including new pavements, line marking and signage.

Upgrade existing stilling pond

An existing stilling pond is located at the base of the Manton Dam wall. The purpose of the pond is to dissipate flow velocity when the dam wall overflows to the downstream environment. During the wet season, fish from the dam can overflow into the pond, and travel upstream, from the river to the pond. In the dry season, water in the pond evaporates and any fish trapped in the pond may perish.

Power and Water will engage with structural and hydraulic engineers to investigate the feasibility of upgrading the stilling pond to create an egress (i.e., channel or pipeline) from the pond to the downstream environment for the fish to be released prior to the evaporation of the pond. The investigation will consider the function of the stilling pond in reducing velocity of flows to the environment.

2.3.2 Manton Dam operations and maintenance activities

Extraction of water

Approximately 20 ML/day of water will be extracted from Manton Dam and pumped via the new water main pipeline for treatment to potable standard at the Strauss WTP, before being distributed for use in the Darwin region via existing pipelines. Power and Water has an existing surface water extraction licence in place under the *Water Act* that allows for extraction of up to 7,300 ML/year.

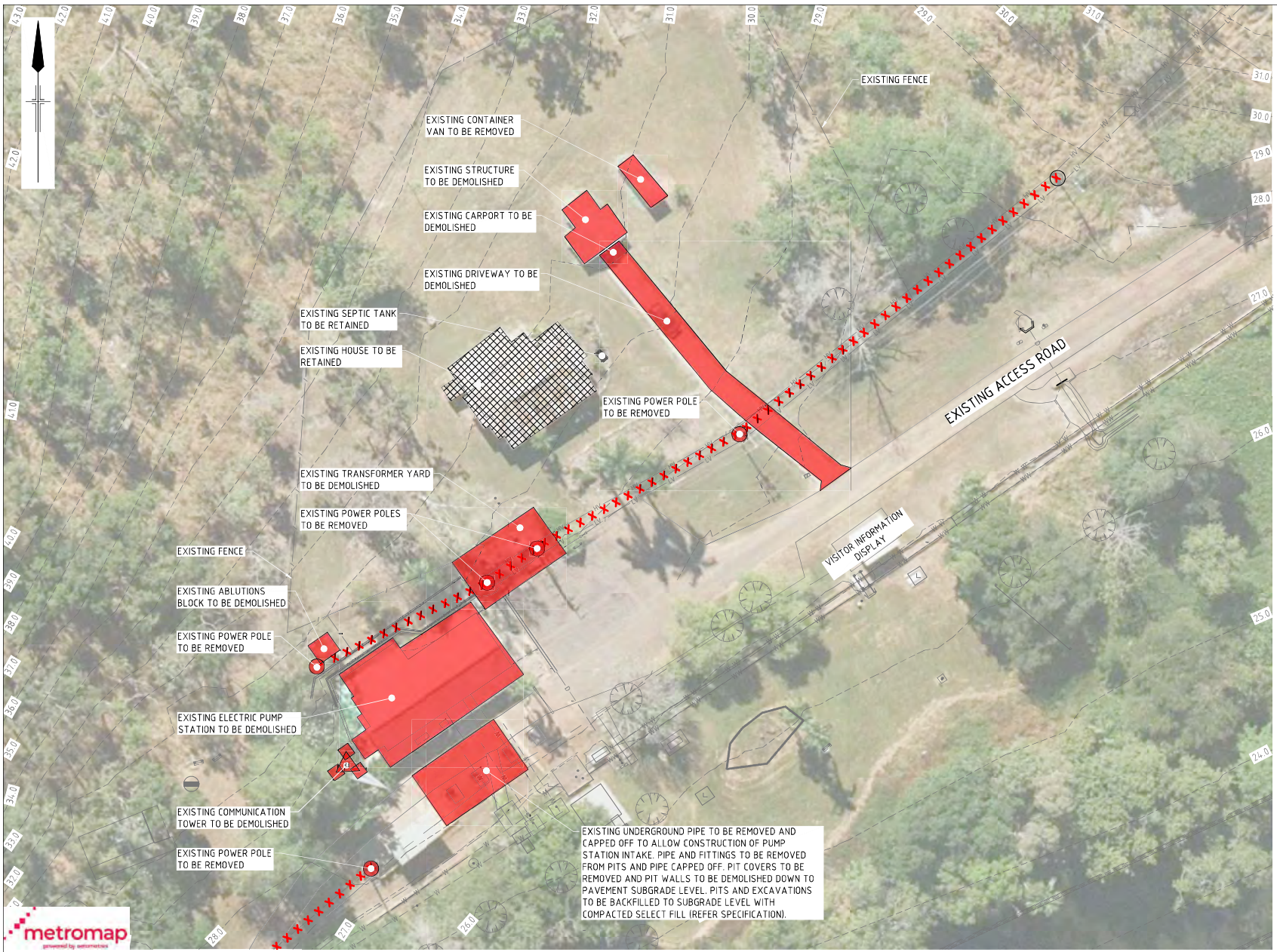
Maintenance

Power and Water will undertake routine operations, inspections, and maintenance of the dam infrastructure. Activities will include monitoring of infrastructure, minor works and repairs.

2.3.3 Ongoing recreational use and management

Recreational use of the dam will continue, including for boating and fishing, and will be managed by Parks and Wildlife (as it currently is). Recreational boating activities will be possible for most of the time, excepting when the dam water levels drop below the bottom of the boat ramp. Modelling of dam water levels indicates that access may not be possible during the late dry season in some years (refer Section 5.5.2). Requirements for upgrade of the public car parking area and boat ramp is under review as part of the Recreation Management Plan under development in conjunction with Parks and Wildlife, who will be responsible for implementation of the Plan.

The operational area at the dam wall and pump station will be closed to the public. It is proposed that open days will be made available for the public to gain access to heritage areas in a controlled manner. Refer Section 5.6 for further details about heritage values and impacts.



LEGEND:
EXISTING:

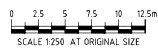
- W—W—W— WATERLINE
- HV—HV— HV ELECTRICAL LINE (HIGH VOLTAGE)
- LV—LV— LV ELECTRICAL LINE (LOW VOLTAGE)
- / — / — FENCE
- D—D—D— DRAINAGE
- 30.0 MAJOR CONTOUR
- PLANTATION
- GATE
- ELECTRIC POLE
- TREE

PROPOSED WORK:

- STRUCTURE TO BE DEMOLISHED/REMOVED
- STRUCTURE TO BE RETAINED
- DECOMMISSION SERVICE LINE

NOTE:

1. EXISTING OVERHEAD POWER FROM CHLORINATION CONTAINER TO THE OLD DIESEL PUMP STATION TO BE REMOVED.



SCALE 1:250

R THIS DRAWING INCLUDES COLOURED INFORMATION
G COPIES OF THIS DRAWING MUST BE PRODUCED IN COLOUR
B

	Level 7, 24 Mitchell Street Darwin NT 0800 Australia PO Box 351 Darwin NT 0801 T 61 8 8982 0100 F 61 8 8981 1075 E darwin@ghd.com W www.ghd.com	
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NO	DESCRIPTION	DRN	DATE	CKD	APPD	DRG NO	TITLE		
AMENDMENTS							ASSOCIATED DRAWINGS		

Figure 2.5. Manton Dam RTS demolition plans⁴
⁴Pump House no 2 and Pump House no 1 are to be retained as they have been identified to have heritage value. The existing diesel tank is to be demolished and area checked for possible contamination and remediated if required.

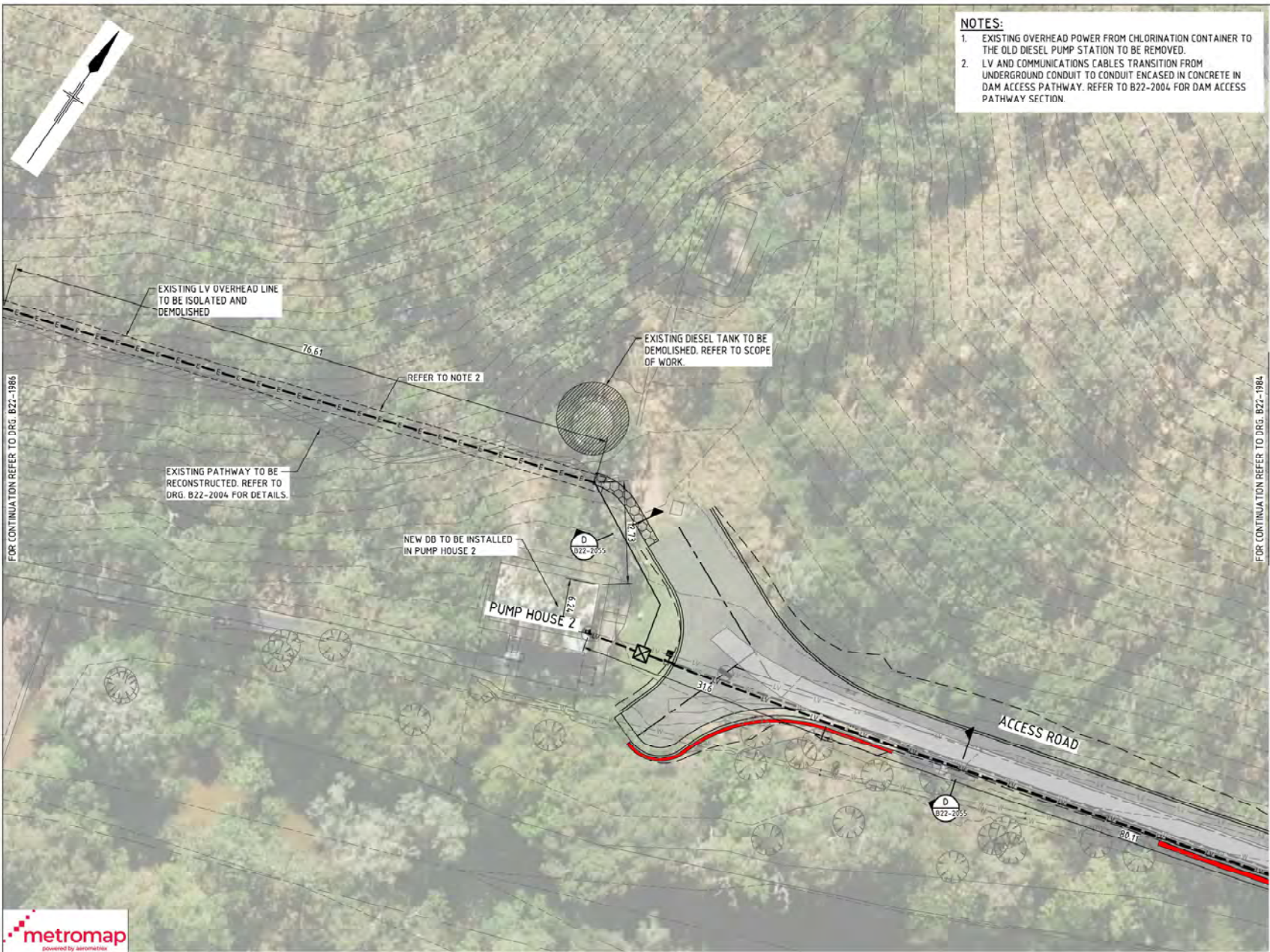


DES	J. NOYNAV
DRN	M. BLUMOTAD
CKD	S. MCINTYRE
APPD	T. LAYMAN
SCALE	AS SHOWN
ISSUED -	
ALL DIM. IN	mm
DRAFTING STANDARD TO	A.S.1100

NORTHERN REGION – DARWIN
MANTON DAM SITE WORKS
MANTON DAM RETURN TO SERVICE
DEMOLITION PLAN

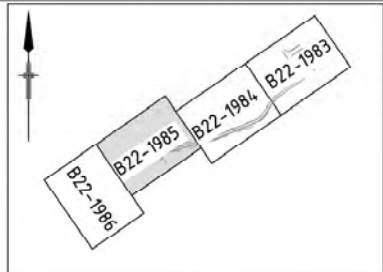
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NOTES:

- EXISTING OVERHEAD POWER FROM CHLORINATION CONTAINER TO THE OLD DIESEL PUMP STATION TO BE REMOVED.
- LV AND COMMUNICATIONS CABLES TRANSITION FROM UNDERGROUND CONDUIT TO CONDUIT ENCASED IN CONCRETE IN DAM ACCESS PATHWAY. REFER TO B22-2004 FOR DAM ACCESS PATHWAY SECTION



- LEGEND:**
- EXISTING:**
- W — W — EXISTING WATER LINE
 - HV — HV — EXISTING OVERHEAD LINE HIGH VOLTAGE
 - LV — LV — EXISTING OVERHEAD CABLE LOW VOLTAGE
 - LV — LV — EXISTING UNDERGROUND CABLE LOW VOLTAGE
 - / — / — EXISTING FENCE
 - D — D — EXISTING DRAINAGE LINE
 - ▨ PLANTATION
 - ▬ EXISTING PATHWAY
 - G — EXISTING GATE
 - ⊙ EXISTING POLE
- PROPOSED WORK:**
- HV — HV — ELECTRICAL HIGH VOLTAGE OVERHEAD LINE
 - LV — LV — ELECTRICAL LOW VOLTAGE OVERHEAD LINE
 - LV — LV — ELECTRICAL LOW VOLTAGE UNDERGROUND CABLE
 - HV — HV — ELECTRICAL HIGH VOLTAGE UNDERGROUND CABLE
 - F — F — LV SERVICE MOUNTED TO STAIR HAND RAIL
 - ⊙ OVERHEAD/UNDERGROUND TERMINATION POLE
 - ⊗ CABLE PIT
 - W — W — WATER ALIGNMENT
 - WS — WS — WATER SERVICE
 - / — / — NEW FENCE
 - C — C — COMMUNICATION CONDUIT
 - ▬ RETAINING WALL
 - ▨ PARKING
 - ▨ CONCRETE WALKWAY
 - ⊙ DIESEL TANK TO BE DEMOLISHED

KEY PLAN
NTS

PROPOSED WORK:

THIS DRAWING INCLUDES COLOURED INFORMATION
COPIES OF THIS DRAWING MUST BE PRODUCED IN COLOUR

SITE LAYOUT PLAN - SHEET 3 OF 4
SCALE 1:250



NO	DESCRIPTION	DRN	DATE	CKD	APPD	DRG NO	TITLE
0	ISSUED FOR TENDER		14.10.22	AS			
AMENDMENTS							ASSOCIATED DRAWINGS

Figure 4.6. Manton Dam RTTS construction plan at dam wall and access improvements.
1. Refer to all applicable existing and/or construction drawings.



DES	M. LEE
DRN	M. BLUMSTAD
CHKD	M. ELLIOTT
APPD	T. LAYMAN
SCALE	AS SHOWN
ISSUED	-
ALL DIM.	IN mm
DRAFTING STANDARD	TO A.S.1100

NORTHERN REGION - DARWIN
MANTON DAM SITE WORKS
MANTON DAM RETURN TO SERVICE
SITE LAYOUT - SHEET 3 OF 4

DRAWING NUMBER - B22-1985

CAD PRODUCT - DO NOT AMEND MANUALLY





Figure 2-7. Location of stilling pond at Manton Dam wall and potential channel/pipeline route

2.3.4 Water main pipeline

The water main pipeline will be installed by open trench methods along most of its length. The trench will be excavated in sections with soils stockpiled to one side. Work methods will require separate stockpiling of topsoil and subsoils so that they can be used in backfilling and reinstating the trench and corridor. The pipeline will be laid and tested, prior to backfilling with the stockpiled materials.

The water main pipeline will be installed with a trenchless construction methodology under the Stuart Highway (two crossing points) and the Alice Springs to Darwin Railway corridor (one crossing point). The pipeline will transverse several local roads (7) under the jurisdiction of Litchfield Shire Council. These sections are proposed to be constructed under traffic and will be subject to approval by the Shire.

There a number of creek crossings along the alignment of the pipeline (one considered moderate four considered minor). The current 90% detailed design of the pipeline provides appropriate protection to the creek crossings including:

- type 2B foundation material in trench base where foundation is soft ground
- bedding material fully encased
- trench backfill cement stabilised to eliminate erosion
- 150 mm dumped rock up to the base of the creek
- extended rock protection upstream and downstream of the crossing
- all works will be documented in the final design and sediment and erosion control plan.

The pipeline will transverse six local property accesses in current road reserves. Property owners will be contacted prior to construction, in accordance with the Stakeholder Engagement and Communications Plan

provided at Appendix C . The proposed contract for the pipeline requires the contractor to have a stakeholder engagement plan that is aligned with the Power and Water stakeholder engagement plan and approved by Power and Water. The plan is to cover consultation with affected property owners and a requirement to provide all temporary works to maintain access to properties and reinstatement with new property access.

2.3.5 Fibre optic cable

A fibre optic cable will be installed in the pipeline corridor easement. The cable will be either:

- strung from existing aerial electrical infrastructure, or
- direct buried adjacent existing electrical infrastructure.

The design of the optic fibre will involve checking of existing power poles outreaches and structural capacity of existing infrastructure. Modification will be undertaken to ensure cables can be supported.

2.3.6 Strauss WTP construction

The Stage 1 Strauss WTP will be designed to process 20 ML/day from Manton Dam and is planned for completion by Q1 2026. It will be constructed in the northern portion of an existing 'Utilities' zoned future development site. An access road and intersection – approximately 30 m wide - will be constructed to the WTP from the Cox Peninsula Road. The pipeline from Manton Dam will be constructed from the eastern boundary of Lot 418 to the new WTP (approximately 500 m). An example of an existing 20 ML/day WTP layout and the current concept design are provided at Figure 2-8.

Power to the WTP will be supplied by connection to the existing mains supply that runs past the site. Backup diesel power generators will be installed on site.

Vegetation across the site footprint will be cleared and mulched for use in site reinstatement, landscaping and erosion and sediment control. The ground surface will be cleared and levelled to create a suitable foundation for construction. Works include, but are not limited to:

- site preparation and levelling
- compound civil works including driveways and pavements, footpaths, anti-climb fencing, gates
- laying concrete slabs
- construction of the buildings and treatment plant components
- drainage and erosion and sediment control works are required.



Figure 2-8. Example 20 ML per day WTP layout

2.3.7 Strauss WTP operations

Water treatment process

Manton Dam under the *Australian Drinking Water Guidelines (ADWG)* is classified as a Category 3 Water Source, which means the treatment process requires consideration that the dam will be used for recreational purposes. Category 3 requires *Full conventional filtration (filtration that has a sedimentation or a floating process between the coagulant dosing and filtration steps) or membrane filtration following a sedimentation process, followed by a single disinfection barrier.*

The conceptual treatment process selected is a dissolved air flotation and filtration (DAFF) treatment system, chlorination with the addition of Ultraviolet (UV) treatment as the additional disinfection barrier against the risks to water from recreational activities. A flow diagram of the concept treatment process is shown in Figure 2.9. The detailed treatment process will be confirmed in the detailed design phase of the Project, which will be subject to Power and Water approval prior to commencement of works. A detailed option assessment was undertaken for the concept treatment process for the WTP, further information is provided in Section 2.4.

Post treatment the potable water will be delivered into the existing Darwin River Dam transmission pipeline that passes through the site, by way of a new pump station.

Waste streams

The tender for Strauss WTP is a Design and Construct contract with consideration of alternative designs. Power and Water has asked specific questions of potential tenderers regarding proposed waste streams, any proposed design will produce and provision details of the following:

- proposed treatment process and waste stream generated including quantity of liquid and solid waste
- minimisation of waste stream
- reduction in operational costs in managing waste stream.

Power and Water have engaged an independent consultant to assess the designs provided by tenderers.

The DAFF treatment process selected during the concept design will produce a sludge, that will pass through a centrifuge to minimise liquid waste and the final liquid waste sludge passed to the head of the WTP. It is anticipated that the sludge produced will be in the order of 1,610 kg/day (approximately 1.3 m³/day). It is

proposed that this waste be stored under cover on-site and periodically removed from site by heavy vehicle for disposal at an appropriate licenced facility (confirmation of disposal site is currently under investigation).

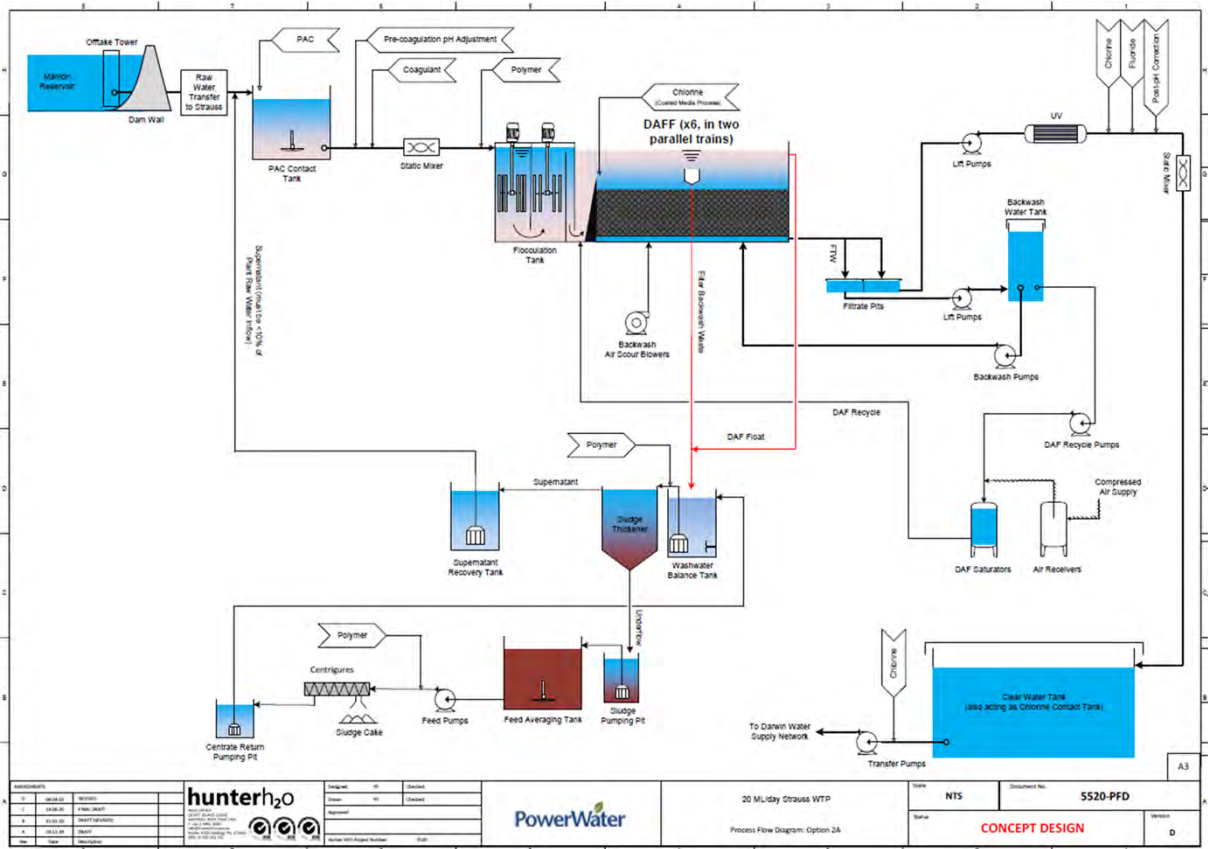


Figure 2-9. Concept design of adopted water treatment option at Strauss WTP

Table 2-3. Key Project features information

Project element	Project phase	Details
Schedule	Construction	<ul style="list-style-type: none"> • 24-month construction period • Start February 2024 – Completion February 2026 – Commissioning completed March 2026 • NOTE: Contractor will operate facility for a minimum of 10 months post commissioning
	Operation	<ul style="list-style-type: none"> • 50 years
Workforce	Construction	<ul style="list-style-type: none"> • 250 people (peak)
	Operation	<ul style="list-style-type: none"> • 3 full time employees (on rotation) at Strauss WTP; 0.5 full time employees at Manton Dam pump station
Transport	Construction	<ul style="list-style-type: none"> • Workers to be based in Darwin and are expected to travel using light vehicles
	Operation	<ul style="list-style-type: none"> • Construction materials will be transported via road predominately from Darwin and Adelaide
Water source	Construction	<ul style="list-style-type: none"> • Water for construction is available from Power and Water potable water mains via existing standpipes in the Manton and Strauss areas. • Water for the pipeline and Strauss WTP will be sourced via existing Power and Water stand pipes.
	Operation	<ul style="list-style-type: none"> • 20 ML / day to be pumped from Manton Dam to the Strauss WTP for treatment. • The treated water will be connected into existing water mains for use in the Darwin region.
Energy source	Construction	<ul style="list-style-type: none"> • Construction plant and transportation will utilise Diesel. • For the Manton Site works, power is available from the existing overhead powerlines at both the pump station site and the inlet tower. Initial construction site office and crib rooms at Manton will utilise on site diesel generators until upgrade of existing supply is completed. • The power supply for the Strauss WTP site will be supplied by the existing 22kVa power line adjacent the site with an appropriate step down transformer. • Along the pipeline it is anticipated the contractor will establish two intermittent sites for crib rooms and ablutions. These will be supplied by on-site generators with self-bunded diesel fuel tanks.
	Operation	<ul style="list-style-type: none"> • The Strauss WTP and the pump station at Manton Dam will be powered from the main electrical grid • Strauss WTP: approximately 2,500,000 kWh p.a. • Pump station: approximately 1,500,000 kWh p.a.
Emissions	Construction	<p>Construction contributes 22,000 T CO₂e over the 2-year construction period comprising of scope 1 emissions (includes land clearing and operation of diesel-powered vehicles and equipment). Emissions during the 1st year are proposed 10,000 T CO₂e/yr and 12,000 T CO₂e/yr during the 2nd year of construction (refer to GHG assessment provided as Appendix D).</p>

Project element	Project phase	Details
	Operation	<p>Operations contributes a total of ~2.0 MT CO₂e over the 50-year operating life or approximately 41,000T CO₂e per year during operations. Annual emissions are made up of 2,000 T CO₂e /yr from electricity use and 39,000 TCO₂e /yr from the other sources. The largest source of emissions for Manton Dam RTS is the existing methane emissions from the anoxic breakdown of organic material in the dam that account for ~93% of project emissions 38,000T CO₂e/yr (refer to GHG assessment provided as Appendix D). Additionally, Power and Water will install EV chargers to enable the use of EV vehicles at the sites.</p>
Waste	Construction	<ul style="list-style-type: none"> • Portable ablution blocks will be utilised for the construction workforce and will be serviced by a licenced waste contractor as per the <i>Waste Management and Pollution Control Act 1998</i> (NT). • Contaminated soils and asbestos containing materials will be identified and quantified as part of preparing the demolition plan. All hazardous wastes will be managed in accordance with accepted standards and guidelines by a licenced waste contractor as per the <i>Waste Management and Pollution Control Act 1998</i> (NT). Disposal of the small volumes that are expected to occur can be accommodated at existing waste facilities in the Darwin region. • Construction and putrescible waste generated through works will be stored in appropriate containers for disposal at a licenced waste management facility. • Waste generation through construction is anticipated to be minimal due to the nature of the works.
	Operation	<ul style="list-style-type: none"> • Operational and putrescible waste generated through works will be stored in appropriate containers for disposal at a licenced waste management facility. • Operations of the Strauss WTP will generate a waste stream from the treatment process, the waste will be treated through a centrifuge to assist in removal of liquid. It is anticipated that the sludge produced will be in the order of 1,610 kg/day (approximately 1.3 m³ /day). It is proposed that this waste be stored under cover on-site and periodically removed from site by heavy vehicle for disposal (confirmation of disposal site is currently under investigation). Current concept design is to dispose waste to landfill.
Hazardous substances	Construction	<ul style="list-style-type: none"> • Diesel, oils, lubricants, paints, solvents and other substances relevant to general building construction. It is not expected that any bulk quantities of materials will be stored on-site, and refuelling will occur off-site at appropriate facilities. • Construction contractors will maintain a hazardous substance register for the site, including storage location, summary of hazardous/dangerous goods status and links to Safety Data Sheets (SDSs). • All hazardous substances, dangerous goods and other chemical products will be stored, used and managed in accordance with their SDSs (including appropriate bunding requirements).
	Operation	<ul style="list-style-type: none"> • Diesel fuel storage will be provided at both sites for power backup through backup generators. • Hazardous materials from the Strauss WTP will include Chlorine (Polyaluminum Chlorine – PAC). This material will be stored to industry standard under the <i>Dangerous Goods Act 1998</i> and maintained as required.

Project element	Project phase	Details
Decommissioning and rehabilitation		<ul style="list-style-type: none"> <li data-bbox="719 228 2047 347">• The contractor will be responsible for rehabilitation of the site when construction works are complete. This will include reseeding and fertilising all unpaved and disturbed areas in accordance with the DIPL Standard Specification for Roadworks Section 16. All waste, temporary works, site facilities, demobilisation plant and equipment will be removed from site. <li data-bbox="719 355 2047 414">• At completion of the useable life of infrastructure the site will be decommissioned OR upgraded to maintain supply to the Darwin region

2.4 Alternatives

This section examines the various alternative sites, layouts and approaches that were considered by Power and Water prior to deciding upon the Project presented in this Referral.

2.4.1 Preliminary assessment options

Both infrastructure and non-infrastructure options were considered to manage the required supply of water for the Darwin region. These are discussed below.

Infrastructure options

As part of the Detailed Business Case (DBC), nine options were subject to a multi-criteria assessment (MCA) to determine the best option to provide the required water supply capacity of the Darwin region, to support economic and population growth. These options are presented in Table 2-4. Of the nine options presented in Table 2-4, five were then subject to a rapid cost-benefit analysis, and the two best options were then carried through to the DBC (PwC Australia 2022). These two were:

- Option 3 – Do minimum and disaggregated supply, and
- Option 9 – Manton Dam RTS and AROWS 3.

The DBC determined Option 9 – Manton Dam RT and AROWS 3 is the best option to meet the Darwin region's water requirements in the short, medium and long term. It was found to outperform the alternative option – Option 3 – due to:

- Better yield of water – almost 400% as much water as Option 3 for a 45% increased capital cost
- Lower operational costs – resulting in lower levelised cost of water and lower consumer costs
- Similar potential for environmental impact – i.e. one option did not have a lesser impact than the other, as Option 3 required land clearing and discharge of brine into Darwin Harbour

Although the preferred option in the DBC includes both Manton Dam RTS and AROWS, these projects are considered separate. One does not rely on the other being realised, and each provide benefits on their own. The AROWS project, while important in the long term, requires extensive planning and consultation that is currently ongoing.

Therefore, the preferred option is to disassociate the two projects, and progress them independently in separate environmental assessment processes. This allows for the Manton Dam RTS (the subject of this Referral) to progress, regardless of the outcomes of the AROWS project.

Table 2-4. Consideration of alternative options (PwC Australia 2022)

Option	Description	Consideration
Option 1 – Do minimum	The do minimum scenario included a range of non-infrastructure and low-cost initiatives which could be implemented to reduce water consumption across both the reticulated supply and groundwater e.g. demand management strategies, improved management of groundwater applications, water tanks etc.	The option will only result in a relatively small increase in water availability over the long-term and does not provide sufficient water to ensure long-term urban water security or enable either industrial or agricultural / horticultural development. The option could be bundled with an infrastructure option to provide an integrated response positively influencing both water demand and water supply to ensure the greatest impact from any capital investment.
Option 2 – Recycled water	The primary opportunity is a 5,000 ML p.a expansion at the Palmerston Waste Stabilisation Ponds.	Given its location, the Palmerston Waste Stabilisation Ponds has the potential to provide raw water to industrial users at Middle Arm but would be limited in its ability to provide raw water to other potential users. Recycled water is lower quality than potable water and therefore there may be concerns for some industrial users that require high quality water for use in their operations. Recycled water is typically also substantially more expensive than potable water.
Option 3 – Do minimum and disaggregated supply	This option combines the low cost ‘Do Minimum’ Option 1 with a combination of disaggregated water supply options, including the recycled water infrastructure from Option 2 and a small-scale desalination plant to provide water for industrial use.	This option represents a lower cost initiative relative to larger-scale infrastructure options. Recycled water and desalination facilities can be developed in a relatively short time frame, providing a more immediate supply option to satisfy short-term supply constraints while more comprehensive long term supply options are developed. While this option could support some industrial development, it does not provide sufficient supply to meet the identified long-term requirements for industrial and agricultural / horticultural growth more broadly.
Option 4 – Manton Dam RTS and AROWS 1a	This option includes the Manton Dam RTS Project and the smallest AROWS development (1a). This option could provide approximately 17,500 ML p.a.	This option would only service forecast population growth over the short to medium term and does not provide additional water supply to unlock opportunities for either industrial or agricultural / horticultural development.
Option 5 – Manton Dam RTS and AROWS 1c	Similar to Option 4, this option includes the delivery of both Manton Dam RTS and the AROWS project. Under this option however, the AROWS Stage 1c provides for an additional 30,700 ML p.a. This option provides a total of 38,000 ML p.a	This option would service forecast population growth over the short to medium-term and has the ability to support some industry. However, it does not provide additional water supply to unlock significant opportunities in either industrial or agricultural / horticultural development.

Option	Description	Consideration
Option 6 – Desalination	The majority of desalination plants in Australia are reverse osmosis desalination plants, and for the purposes of this assessment, a 60,000 ML p.a reverse osmosis-style plant has been assumed. A plant this size is consistent with the fully developed AROWS options, and at this scale, the desalination plant would be able to provide sufficient water to meet future urban water security, industrial and agricultural / horticultural water requirements.	Desalination offers a climate-resilient water supply source that has a relatively short-term delivery timeframe relative to other large infrastructure options. Additionally, there is more flexibility in the location and staging of a desalination plant depending on demand requirements. Desalination plants have both high operating and capital cost and require large amounts of energy to operate. This results in a very high cost of water that would likely be cost prohibitive for many users if charged at a cost recovery rate.
Option 7 – AROWS 3	This option represents the AROWS project sized to provide sufficient water for urban, industrial and agricultural / horticultural users. AROWS 3 can supply around 60,200 ML p.a. Unlike the other AROWS options, this option does not include the Manton Dam RTS and instead seeks to accelerate the AROWS project to avoid the need for the Manton project.	This option enables sufficient yield to provide long-term urban water security for the greater Darwin region and provide water for both industrial and agricultural / horticultural development. Given the scale of the AROWS 3 project, and the likely approvals and development timeframe, there is a risk that it could not be delivered within the five year timeframe, to be operational by 2025/26, when additional water supply for urban water security is forecast to be required.
Option 8 – In-stream dams	A number of in-stream dams have been suggested and investigated to differing extents over the last 20 years and most recently reviewed in the CSIRO 2018 report Water Resource Assessment for the Darwin Catchments. These potential in-stream dams include Marrakai Dam, Mount Bennett Dam and Upper Adelaide River Dam.	The dam options are all located large distances from the greater Darwin region and will require significant investment in pipe networks and high ongoing water transport costs. All three dam sites will also have long development times given the likely approvals requirements and high environmental and cultural impact risks.
Option 9 – Manton Dam RTS (the current Project) and AROWS 3	This option represents the maximum sized AROWS project which could provide sufficient water for urban, industrial and agricultural / horticultural users and alleviate near-term water security risks. In total, this option can provide 67,500 ML p.a.	The inclusion of Manton Dam RTS, and its shorter delivery timeframe, means that immediate water security can be provided for. The major cost drivers for the AROWS project, such as the spillway and other core infrastructure, are consistent across the various sizes of the AROWS projects. Incremental cost increases occur largely through increased pumping and piping required. Therefore, achieving significant increases in yields can be achieved at relatively low cost for the larger AROWS options and represent significant economies of scale.

Non-infrastructure options

Non-infrastructure options were explored in the DBC in addition to the infrastructure options described above (PwC Australia 2022). Although demand management options were investigated as part of the options analysis, the assessment found these were not a long-term solution in isolation and required the support of infrastructure options to meet the forecast demand needs.

Demand management will be required in addition to infrastructure options to manage water demand in the long-term, to ensure water is being consumed in a sustainable manner. This includes sustainable use of water across all sectors – residential, industrial and government – and appropriate consideration of re-use requirements for industry. Demand management and education surrounding water use was also identified as a theme through stakeholder engagement and focus groups held for the Project, indicating the general public are supportive of a combined approach to supply and management of water in the Darwin region (Have your say survey results DITT 2021).

Demand management and water efficiency is a major policy issue that needs to be addressed at a Territory wide level, and the NTG released a strategic Territory Water Plan in June 2023. The plan responds to a two year consultation community feedback process on water security challenges and opportunities for the future. Power and Water's Living Water Smart initiative (<https://www.livingwatersmart.com.au/>) will be an important ongoing program to ensure the continued focus on water efficiency across all sectors.

2.4.2 Design

Given Manton Dam is an existing dam that has previously been used to service the Darwin region, there are limited design alternatives to consider. A discussion for each key Project components is provided below.

Staged development

A staged development with a temporary 10 ML/day WTP at Manton itself, utilising the existing distribution system, deferring the requirement to construct a new pipeline. The second stage at Strauss to service a greater demand. Due to the desire of the NTG to fast track the project to service impending forecast demand growth, this option was not preferred.

Destratification

Destratification at the Dam close to the inlet tower was considered but discounted on a preliminary cost, benefit risk basis.

Inlet tower

Options for modification to the inlet tower were considered including new suction line next to the tower, a new tower or refurbishment of the existing tower. The refurbishment of the existing tower was considered the best option from a CAPEX and OPEX perspective.

Manton Dam

Manton Dam is subject to ongoing maintenance therefore only minor infrastructure installation and upgrades are required. There are no alternatives to these upgrades therefore there is not considered to be any alternative design considerations for Manton Dam itself. Power and Water have undertaken an assessment of the existing dam in accordance with industry standards (ANCOLD). This assessment is being finalised by SMEC with preliminary findings confirming the Dam has sound structural integrity in accordance with current standards (SMEC 2023). Additional modelling and finite element analysis is currently being undertaken by Stantec Pty Ltd with a final report to be released in October 2023.

Pipeline and fibre optic cable corridor

Alternative routes for the water pipeline and fibre optic cable from Manton Dam to the Strauss WTP were not considered. The selected route runs within an existing Power and Water easement along the Stuart Highway in an area that has been previously disturbed and is therefore the option with the least impact.

Strauss WTP

A detailed option assessment was undertaken for the design of the Strauss WTP treatment process, and this assessment ended with the option of constructing a WTP to treat 20 ML/day via a DAFF treatment process. The assessment methodology used to select the preferred option, ranged from coarse screening and identification of treatment options, to shortlisting, and final assessment. This process is outlined in Figure 2-10.

Power and Water previously looked at the option of staging the treatment plant however this was not suitable due to the NTG requiring the project to be fast tracked to support development of Middle Arm. Note that a multiple barrier approach through the water supply system provides the least pathogen risk to the consumer whilst enabling recreational use on the reservoir to continue.

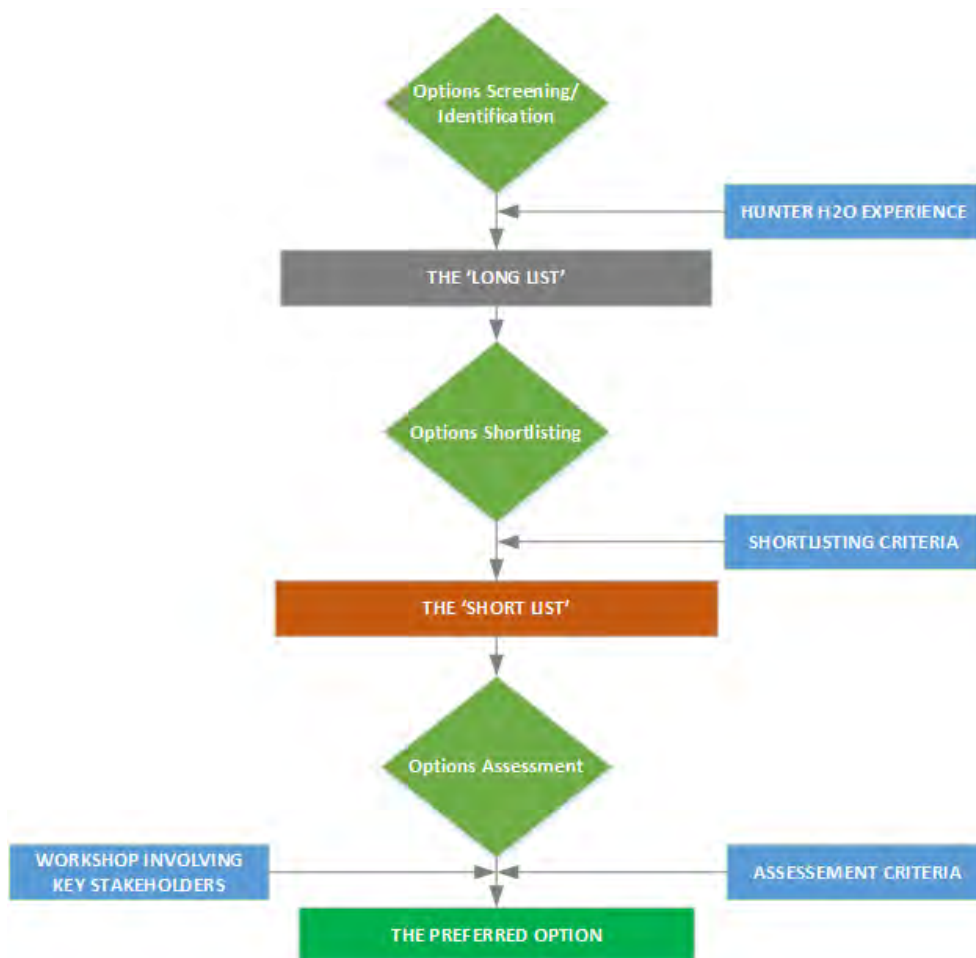


Figure 2-10. Option assessment process used to determine design options

To assist with the options shortlisting, the ‘long list’ established was first transformed/grouped into candidate treatment options in terms of key unit processes, as follows:

- options for Clarification
- options for Filtration
- options for Disinfection
- options for Fe and Mn Removal
- options for Algal Metabolites Removal

Processes common to all options include:

- Raw water supply
- Chemical storage and dosing
- Fluoridation
- Clearwater storage
- Residuals handling
- Power
- Control
- Buildings
- Site services

An MCA including non-financial criteria was undertaken in conjunction with Power and Water and a final recommended option was selected for all aspects of the treatment products and processes, as provided in Section 2.3.6.

2.4.3 Recreational use

The ongoing recreational use of Manton Dam once it is returned to service has been considered extensively since the inception of the Project. Initially, the Project for the Manton Dam RTS included prohibiting recreational use. This was due to increased water quality risks to consumers. However, after ongoing stakeholder engagement and assessment of the social impact associated with restricting recreational use of the Dam, it was determined that the recreational use was important to stakeholders and would be maintained with additional treatment measures to ensure water meets stringent drinking water quality standards. This option has been selected as it has a lesser social impact to recreational users of the Dam than the alternative.

A Recreation Management Plan and Water Source and Catchment Protection Plan are currently being developed by consultants for Power and Water. The implementation of the Recreation Management Plan will be undertaken by Parks and Wildlife.

2.5 Application of the principles of environmental protection and management

The referral guidance requests that Power and Water discusses how the principles of environment protection and management (Part 2 of the *EP Act*) and the general duty of proponents provided for under Section 43 of the *EP Act* have been applied to the design and subsequent feasibility phases of the Project. Part 2 of the Act provides Principles of Environmental Protection and Management that decision-makers (i.e., NT EPA) and proponents must take into account when making decisions about actions that could affect the environment. Section 43 prescribes the General Duty of Proponents when undertaking an Environmental Impact Statement process. The specific sections required for consideration at the referral level are listed below:

- Part 2 Principles of Environmental Protection and Management
 - Division 1: Principles of Ecologically Sustainable Development
 - Division 2 Management Hierarchies
 - Section 26 Environmental Decision-Making Hierarchy
 - Section 27 Waste Management Hierarchy
- Part 4 Environmental Impact Assessment Process
 - Division 1 Purpose of Environmental Impact Assessment Process
 - Section 43 General Duty of Proponents

Table 2-5 below summarises how each of the sections of the *EP Act* have been applied.

Table 2-5. Checklist of the EP Act Section 42 and 43 requirements

Specific sections	Comment
<i>Have the following principles of ecologically sustainable development been taken into consideration in the design of the proposed action?</i>	
<ul style="list-style-type: none"> • Decision-making principle 	<p>Yes – the Project has considered both short- and long-term impacts and benefits, as is outlined in the Section 2.4. There has been ongoing stakeholder consultation in regard to this Project.</p>
<ul style="list-style-type: none"> • Precautionary principle 	<p>Yes – this assessment is based on both existing information and studies undertaken specifically for the Project and undertaken by suitably qualified professionals. As a precaution, studies were undertaken early in the planning process to provide the necessary confidence to assess potential risks and impacts.</p>
<ul style="list-style-type: none"> • Principle of evidence-based decision-making 	<p>Yes – this assessment is based on both existing information and studies undertaken specifically for the Project and undertaken by suitably qualified professionals.</p>
<ul style="list-style-type: none"> • Principle of intergenerational and intergenerational equity 	<p>Yes – this project aims to benefit and improve water security for the community and maintain the social and recreational uses associated with Manton Dam for future generations. Additionally, by utilising the existing Manton Dam this reduces the potential environmental impacts associated with developing a new dam or new water source option.</p>
<ul style="list-style-type: none"> • Principle of sustainable use 	<p>Yes –Power and Water will operate within its extraction licence. Power and Water also has a water efficiency program “Living Water Smart”.</p>
<ul style="list-style-type: none"> • Principle of conservation of biological diversity and ecological integrity 	<p>Yes – The majority of the project footprint is in previously disturbed areas, which minimises further loss of native vegetation. Ecological assessments have been undertaken for the Project to inform design and development. To inform consideration of potential offsite and cumulative impacts associated with future expansions of the Strauss WTP site, ecological survey efforts covered a much larger area surrounding the Stage 1 and 2 proposed footprint extents. The surveys identified 2 individuals of the threatened plant species <i>Typhonium praetermissum</i> in the Stage 1 footprint; however, a large patch of the species was found nearby to the north west. Following this record, Power and Water undertook work to confirm that future stages of the WTP could be accommodated without impacting on the Typhonium population.</p>
<ul style="list-style-type: none"> • Principle of improved valuation, pricing and incentive mechanisms 	<p>Yes – Environmental outcomes are considered by Power and Water when comparing design options for infrastructure.</p> <p>Waste during construction will be the responsibility of the construction company but they will be obligated, through a Construction Environmental Management Plan (CEMP), to manage waste appropriately and in compliance with relevant legislation. During operations waste, principally from the Strauss WTP will be the responsibility of Power and Water.</p>
<i>Have the following management hierarchies been taken into consideration in the design of the proposed action?</i>	
<ul style="list-style-type: none"> • Environmental decision-making hierarchy 	<p>Yes – the Project has applied the environmental decision-making hierarchy through the design and location of the Manton Dam RTS project, based on consultation and environmental assessments. Infrastructure is being designed to minimize impacts where they are unavoidable, as demonstrated within this Referral.</p>

Specific sections	Comment
<ul style="list-style-type: none"> Waste management hierarchy 	<p>Yes – construction and putrescible waste generated through works will be stored in appropriate containers for disposal at a licenced waste management facility.</p> <p>Construction contractors are incentivised to make sustainability commitments, including recycling and waste management (in line with the waste hierarchy), as part of their respective submissions.</p> <p>The waste management post construction will be developed as part of the design and construct contract. Potential tenderers are to propose a design that minimises both solid and liquid waste. Designs will be assessed by independent consultant and final design with regard to waste management approved by Power and Water and NT EPA</p>
<p><i>Other Section 43 considerations</i></p>	
<ul style="list-style-type: none"> Have communities that may be affected by the proposed action been provided with information and opportunities for consultation? 	<p>Yes – through the various mechanisms identified in the Stakeholder Engagement Plan. Consultation with downstream property owners that may be affected by a reduction in dry season flows is ongoing. Letters have been sent to landowners requesting detail on current use of water from the river. No downstream property owners have an extraction licence from the river.</p> <p>In addition, there is an indigenous owned portion of land further downstream consultation with these owners is being facilitated through the Northern Land Council (NLC) and DIPL.</p> <p>Refer to the Stakeholder Engagement Register attached to the Stakeholder Engagement and Communications Plan provided as Appendix C.</p> <p>Letters have been sent to downstream property owners and a meeting held with interested parties on-site. Concerns were raised about flows in the river. Power and Water set the discharge to 30 L/s and undertook an additional inspection with landowners to ensure they are informed of the planned dry season discharge regime in the future.</p>
<ul style="list-style-type: none"> Has consultation with affected communities, including Aboriginal communities' been undertaken in a culturally appropriate manner? 	<p>Yes – in part through the Aboriginal Areas Protection Authority (AAPA) and NLC processes discussed above. An archaeological assessment has been completed for the project area and Traditional Owner representatives were present during the assessment, and any relevant concerns incorporated into the assessment (See Appendix E).</p> <p>Noting that a sacred site has been listed downstream of the dam on the Manton River. Whilst this site is well outside the area of infrastructure works, Power and Water is currently engaging with AAPA on the matter.</p>
<ul style="list-style-type: none"> Has community knowledge and understanding (including scientific and traditional knowledge and understanding) of the natural and cultural values of areas that may be impacted by the proposed action been sought and documented? 	<p>Yes – through the process of</p> <ul style="list-style-type: none"> Updating the Water Source and Catchment Protection Plan Developing a Recreation Management Plan (Both to have draft complete August 2023). <p>Community engagement sessions have been held including:</p> <ul style="list-style-type: none"> Landowners presentation at Lake Bennett Open day at Darwin River Dam Community stand at Fred's Pass show <p>Section 3.2 provides further details of stakeholder engagement undertaken to date.</p>
<ul style="list-style-type: none"> Have Aboriginal values and the rights and interests of Aboriginal communities' been addressed in relation to areas that may be impacted by the proposed action? 	<p>Yes – Aboriginal values have been recognised through adherence and reinforcement of AAPA certification processes and compliance with the <i>Aboriginal Sacred Sites Act 1989</i>. NLC processes, as well as the cultural heritage assessment have addressed Aboriginal values.</p>

3 CONSULTATION

The *EP Act 2019* requires proponents to engage with stakeholders who may be affected by their Project and to support these communities and the public to understand the potential impacts and benefits of a proposed action. The *NT EPA's Stakeholder Engagement and Consultation Guidance for Proponents* (DEPWS 2021a) recognises that stakeholder consultation is an important component of social, cultural and health impact assessments, over and above formal opportunities for feedback on documents placed on public exhibition.

Power and Water first identified Manton Dam RTS and AROWS as a solution to future water supply challenges in their *Darwin Region Water Supply Strategy 2013* (Power and Water 2013). For the past decade, Power and Water has been laying the groundwork for the Infrastructure Program, completing a significant body of preliminary work to inform the design and delivery of both projects.

A summary of objectives and outcomes of consultation to date are provided in Sections 3.1 and 3.2. A description of future engagement is provided in Section 3.3.2 and the endorsed Power and Water Stakeholder Engagement and Communications Plan and Stakeholder Engagement Register to date included in Appendix C. Noting the register provides the stakeholders Power and Water have engaged with independent of the engagement that has been undertaken by third party consultants on Power and Water's behalf.

3.1 Key objectives of stakeholder engagement

The Project as is presented in this Referral has been developed and shaped by ongoing stakeholder engagement across almost a decade. Various stakeholder engagement plans have been prepared and used to guide engagement, outlining the targeted audience, stakeholders, actions, engagement objective and the timeline to engage identified stakeholders.

Power and Water's objectives and approach to stakeholder engagement, guided by the NT EPA's *Stakeholder Engagement and Consultation Guidance for Proponents* (DEPWS 2021a), were/are to:

- Increase awareness and understanding of the Infrastructure Program, its current planning phase, potential risks and impacts, and the next steps
- Understand community sentiment surrounding the Project
- Collaborate with relevant NT Government agencies and key stakeholders to develop and deliver consistent messaging for the Project, through an interagency working group
- Consult with recreational user groups and other relevant stakeholders on the future of recreational activities at Manton Dam (Including the NT Water Ski Association and AFANT)
- Engage with relevant NTG agencies and key stakeholders over the continued recreational use at Manton Dam and the development of a recreational management plan. Noting a Recreational Management Plan is currently being developed in conjunction with Parks and Wildlife
- Engage with key stakeholders to develop and implement a Heritage Management Plan for Manton Dam. Consultations are ongoing with East Point Military Museum for relocation of some redundant infrastructure (such as major valves) to the museum
- Inform key stakeholders and community about the processes, potential impacts and project timelines
- Inform recreational users of Manton Dam about if and when access to the Dam will be closed or restricted due to Project development and maintenance activities
- Inform neighbouring landowners of the project and potential impacts

These objectives were captured in various stakeholder engagement plans prepared across the past decade, which formed – and continues to form – the basis for ongoing engagement and consultation activities.

Consultation has, and will continue to, be undertaken in accordance with Section 43 *EP Act General Duty of Proponents*.

3.2 Overview of stakeholder engagement

The Proponent recognises the importance of stakeholder engagement throughout all Project stages and has sought to engage appropriately and effectively since the Project was introduced to the public. Views and knowledge of a variety of stakeholder groups have been crucial in developing the Project to date. Overall, stakeholders are supportive of the Project and have been active in engagement to date.

Engagement for the Project commenced in 2013 and has been ongoing since. The Manton Dam RTS was initially outlined to the public in the *Darwin Region Water Supply Strategy 2013* (Power and Water 2013), with the project to be completed by 2025/26. After this, engagement has been undertaken through focus groups run by market research agency Colmar Brunton in 2019, through the DITT ‘Have Your Say’ process in 2021, through the DBC process lead by PwC between 2019 and 2020 (PwC 2022), and most recently in 2022 via the current engagement effort led by the Proponent, as presented in Figure 3-1.

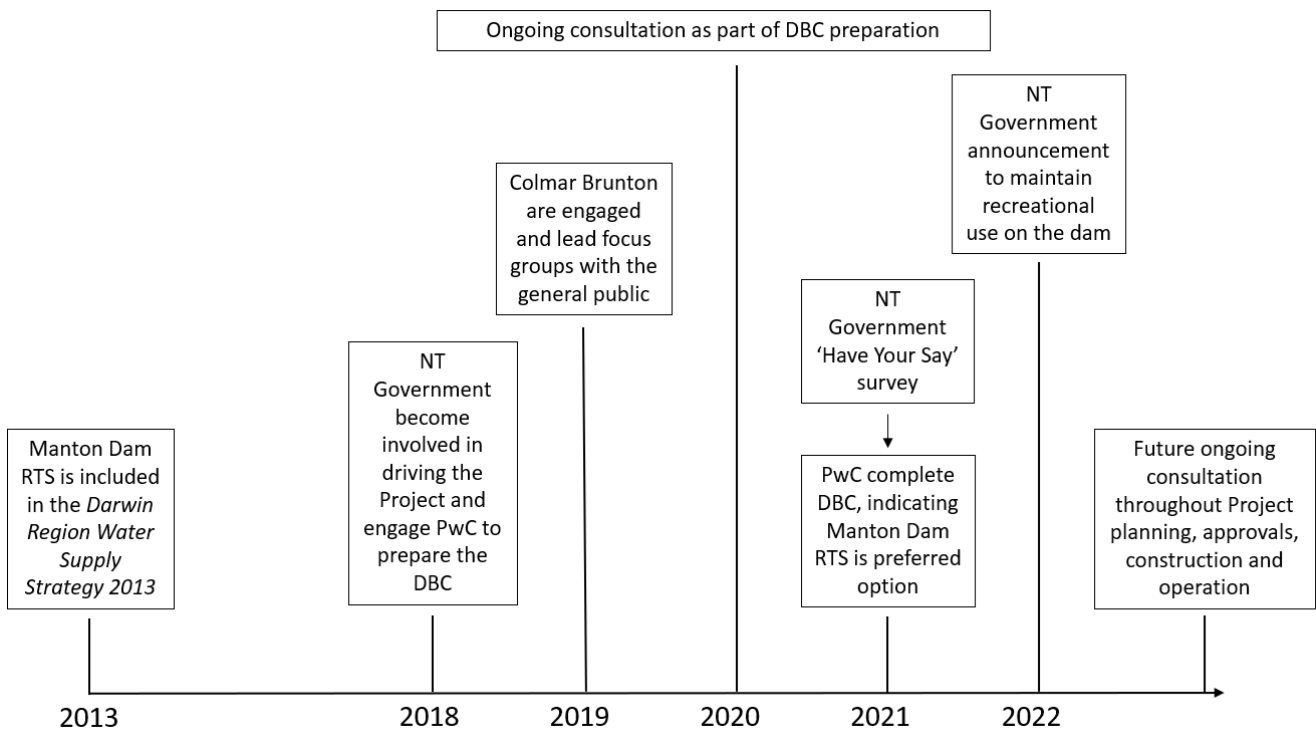


Figure 3-1. Timeline of consultation activities for the Project

Generally, members of the public involved in the 2019 focus groups run by Colmar Brunton were supportive of the Project, however there were concerns raised regarding potentially closing Manton Dam off to recreational users during operations. Discontinuing recreational use of Manton Dam was identified as a potentially significant social impact, however conversely, non-recreational users raised concerns regarding water quality should recreation be allowed to continue. In response, further consultation and planning requirements were identified by Power and Water to explore ways to maintain recreational use while ensuring water could be treated sufficiently to meet stringent water quality standards.

The NTG became involved in driving the Project in 2018, engaging PwC to prepare the DBC, and undertaking more targeted engagement regarding the issue of recreational use. Direct engagement was undertaken with the Amateur Fishing Associated Northern Territory (AFANT) to resolve issues regarding ongoing recreational use of the Dam. AFANT strongly supported ongoing recreational use, citing the benefits this would bring and

raising concerns regarding social impacts should the dam be closed to recreational users. During consultation AFANT highlighted the fish kill at the end of the wet season associated with the evaporation of water in the stilling pond. Power and Water have committed to undertaking an investigation to provide a solution for the fish kills as discussed in Section 2.3.

Other groups consulted with during the DBC process were generally supportive of the Project in principle (PwC 2022). A summary is provided in Table 3-1. The stakeholder engagement register is provided in Appendix C.

Power and Water is currently engaging with downstream property owners to gain an understanding of current usage of the river downstream. This includes consultation with downstream property owners, Traditional Owners (TOs) and custodians through the Northern Land Council (NLC) and Aboriginal Areas Protection Authority (AAPA).

Table 3-1. Summary of consultation from the DBC (PwC 2022)

Stakeholder / stakeholder group	Engagement method	Issues raised	Outcome
General public – non recreational user	<ul style="list-style-type: none"> • Focus group • ‘Have Your Say’ survey 	<ul style="list-style-type: none"> • General support for Manton Dam RTS. • Concerns raised regarding water quality if recreational use continues. 	<ul style="list-style-type: none"> • Design response to ensure water quality standards are met even with continued recreational use.
General public – recreational user		<ul style="list-style-type: none"> • Serious concerns raised over potential of discontinued recreational use. • Only supportive of Manton Dam RTS if recreation is maintained. 	<ul style="list-style-type: none"> • Announcement by NTG that recreational use will be maintained. • Design response to ensure water quality standards are met.
Northern Land Council (NLC)	<ul style="list-style-type: none"> • Email and phone • Briefings where required 	<ul style="list-style-type: none"> • Engagement to date has not raised any significant concerns relating to the options proposed. • However, the NLC flagged the need to conduct further engagement with impacted stakeholders as the Project progresses. • The NLC suggested the NTG ensures that appropriate messaging is developed for Aboriginal stakeholders that can clearly define the project and timing for development. 	<ul style="list-style-type: none"> • NTG to continue to work with the NLC to ensure Aboriginal land and interests are appropriately considered as part of the project development process. • NTG is committed to meaningful engagement with Aboriginal communities and stakeholders in line with the NTG’s <i>Remote Engagement and Coordination Strategy</i> and <i>Best Practice Guide for Remote Engagement and Coordination</i>.
Environment Centre NT	<ul style="list-style-type: none"> • Briefing 	<ul style="list-style-type: none"> • Overall, the engagement process to date did not raise any significant concerns or fatal flaws with the options considered as responses to the identified opportunities and constraints. • Highlighted need for strong assessment and approvals process for ensuring sustainable water consumption. 	<ul style="list-style-type: none"> • Ongoing consultation with Environment Centre NT throughout Project lifecycle. • Power and Water agree demand management and sustainable water consumption initiatives are required.
AFANT	<ul style="list-style-type: none"> • Briefing 	<ul style="list-style-type: none"> • Overall, the engagement did not raise any significant concerns or fatal flaws, other than advocating for continued recreation use. 	<ul style="list-style-type: none"> • Announcement by NTG that recreational use will be maintained. • Design response to ensure water quality standards are met.

Stakeholder / stakeholder group	Engagement method	Issues raised	Outcome
		<ul style="list-style-type: none"> • AFANT strongly believed that if Manton Dam RTS proceeds, recreation should be maintained, including motorised craft. • AFANT consider surface water storages as assets that can generate value beyond just storage and provide a diversified economic benefit to the community to justify the substantial investment required. 	
Local Government Association of the Northern Territory (LGANT)		<ul style="list-style-type: none"> • Demand management, overuse of groundwater and high-water consumption are critical issues that need to be considered across all sectors throughout the Territory. • A greater level of detail is needed to be provided on the shortlisted options to allow for a more considered assessment of the options. 	<ul style="list-style-type: none"> • A public release version of the DBC was made available, allowing additional detailed information developed in the DBC to be provided to the community. • The environmental approvals process requires an extensive community engagement and consultation program which will enable additional detail and information to be shared and ensure that impacts across all users are considered. • Consideration that the Strategic Territory Water Plan (released June 2023) could consider the oversubscription of groundwater networks in more detail, and potential solutions at a Territory level to ensure there is sufficient water to promote and sustain growth and development.

Stakeholder / stakeholder group	Engagement method	Issues raised	Outcome
Contractor market participants (key proponents and industry body representatives in the NT and Australian contractor market)	<ul style="list-style-type: none"> Market sounding interviews via videoconference 	<ul style="list-style-type: none"> Purpose was to engage with the contractor market to validate assumptions made in the DBC, understand the market's interest in the Project, and gain the market's perspective on the Project's challenges, risks and opportunities. All participants were supportive of the delivery of new water supply infrastructure in the region. The capability exists in the NT and across the broader Australia market to deliver the various infrastructure elements, however contractors are constrained in the near future (from 2021) Supportive of early market engagement to allow contractors time to strategize and plan their resources. 	<ul style="list-style-type: none"> The outcomes and findings of the contractor market sounding have informed the delivery model assessment in the DBC.
Government departments and agencies	<ul style="list-style-type: none"> Undertaken through formal governance structures as well as engagement across departments at the Executive and Officer level 	<ul style="list-style-type: none"> Various input and advice to Power and Water to inform Project development. Heritage values 	<ul style="list-style-type: none"> Engagement was used to inform the DBC process to ensure relevant departments and portfolios had opportunity to engage in Project development early in the process. Engagement was used to inform heritage values information and requirements in the referral.

Further consultation supported the sentiment that generally the Project would be largely supported if recreational use could continue. An NTG ‘Have Your Say’ survey for Manton Dam RTS was undertaken in 2021 found of the 207 completed surveys, 50 per cent of respondents supported Manton Dam RTS as a concept, however only nine per cent of this supported the Project if recreation was maintained. Additionally, 28 per cent of people were not supportive, however most of these respondents cited discontinued recreational use as the main driver behind their lack of support. Additionally, demand management activities through education regarding water use, minimising environmental impacts, supporting economic growth and costs to the taxpayer were all important issues raised during this consultation process.

A decision was made to maintain recreational use of Manton Dam as a direct response of stakeholder engagement and was publicly announced in March 2022 (NTG 2022). Power and Water have designed its water quality monitoring and treatment regime to account for that outcome and are working with Parks and Wildlife to develop a Recreation Management Plan, recognising the future dual use of Manton Dam.

Power and Water has worked extensively with NTG agencies and departments to ensure future demand scenarios are realistic and all relevant factors were considered when developing the Project scope. These departments and agencies include:

- Department of Environment, Parks and Water Security (DEPWS)
- Department of Infrastructure, Planning and Logistics (DIPL)
- Department of the Chief Minister and Cabinet (DCMC)
- Department of Industry, Tourism and Trade (DITT)
- Department of Treasury and Finance (DTF)
- Department of Health
- Department of Territory Families, Housing and Communities (DTFHC)
- Land Development Corporation
- NT Land Corporation.

Consultation to date has generally highlighted support for the Project, and where concerns have been raised, these have directly influenced design and decision-making in subsequent Project development phases. Additionally, advice and themes raised during consultation will continue to inform ongoing engagement activities. Concerns regarding discontinued recreational use of Manton Dam led to the decision to allow continued recreational use. Modifications regarding water treatment have been required based on this decision, and concerns raised regarding water quality should recreation continue. Ongoing consultation is progressing including the following:

- A Community Reference Group has been in operation since November 2022 and meets quarterly
- Information videos have been developed and will be posted on the Manton Dam webpage on the Power and Water website
- A generic email has been developed that the public can ask questions regarding the project
- At relevant stages of the project an updated fact sheet is to be posted to the website to inform the public of progress on the project
- Recent public forums have been held at Fred’s Pass Show, Lake Bennett and these information sessions will become more frequent as construction draws closer
- Signage has been installed adjacent the two main sites for the project informing the public of the future works (including the Manton Dam page on the Power and Water website)
- A media release has been issued and a communications program is being developed by Power and Water for ongoing communications and future media releases
- Consultation with downstream property owners to understand how the property owners interact with Manton River and discuss maintaining discharge flow from the dam wall, has occurred through letter correspondence and multiple onsite meetings. The owners use the river as a source of domestic and stock water supply. Over the years discharge flows have fluctuated in excess of

250 L/s as Power and Water lowered the dam water level to simulate 20 ML/day extraction. Initially owners expressed concerns that flows would be retained at 30 ML/s. The owners understand the requirement to retain the 30 ML/s flow and upon trialling the flow rate during the dry season are satisfied with the retained flow rate. Agreement between Power and Water and downstream owners determined that the current flow of 30 L/s will be maintained during the dry season and will not be reduced.

Future stages of consultation will be guided by advice provided during previous consultation – for example engagement with Aboriginal stakeholders will be guided by the advice provided by NLC. Future engagement is discussed below in Section 3.3.

3.3 Future engagement

Engagement to date has informed key design and operational details for the Project, including the decision to maintain ongoing recreational use of Manton Dam, and types and standards of water treatment processes required to meet drinking water standards. Power and Water recognises the importance of ongoing engagement and has developed plans for engagement throughout the Project lifecycle. A stakeholder engagement strategy has been prepared by the NTG for the *Darwin Region Water Infrastructure Program*, which the Project is being delivered as part of. This strategy identifies Power and Water as being responsible for ongoing engagement regarding the Project.

Power and Water has prepared a project specific detailed and endorsed Stakeholder Engagement and Communication Plan to inform and guide future Project engagement (Appendix C). In addition, Power and Water have stipulated in the proposed construction tender contract that the primary contractor for the project develop a construction Stakeholder Management Plan and this is to be submitted to Power and Water for approval, prior to commencement of works. This plan will deal directly with Stakeholders affected by construction activities.

3.3.1 Key ongoing stakeholders

A variety of stakeholders have been identified and engaged to date through previous engagement activities. Some of these stakeholders will continue to be engaged in future, and others who have not previously been engaged have been identified as relevant to future Project processes. Stakeholders to be engaged and how they will be engaged is described in Table 3-2.

Table 3-2. Stakeholders to be engaged through future engagement

Stakeholder	Methods of engagement
General overall key stakeholders	
CEO Steering Committee	<ul style="list-style-type: none"> • Direct Engagement • PWG
NTG Program Working Group (PWG)	<ul style="list-style-type: none"> • Direct Engagement • Fact Sheet
DITT (historic Project Administrator)	<ul style="list-style-type: none"> • CEO Steering Committee • PWG • Direct Engagement
DIPL (Project Administrator as of 01 July 2023)	
DEPWS	
Coomalie Community Government Council	<ul style="list-style-type: none"> • Direct Engagement
Litchfield Shire Council	
AAPA	
NLC	<ul style="list-style-type: none"> • Direct Engagement • Project Fact Sheets

Stakeholder	Methods of engagement
Downstream Property Owners	<ul style="list-style-type: none"> • Correspondence • Letter Drop • Site Meetings in Person • Website • Fact Sheet
Property Owners for pipeline alignment	
Property owners property access affected	
General public affected by roadworks construction	<ul style="list-style-type: none"> • Signage • Website • NT Media
NT Media	<ul style="list-style-type: none"> • Website • Fact Sheet • Direct Engagement
General Public	<ul style="list-style-type: none"> • Website • Open Day • Fact Sheet • NT Media • Signage
Heritage stakeholders	
Darwin Defence Museum	<ul style="list-style-type: none"> • Heritage Management Plan • Direct Engagement • Fact Sheet
Heritage NT	
Minister for Tourism and Hospitality	<ul style="list-style-type: none"> • PWG • Media Release
General Public	<ul style="list-style-type: none"> • Website • Fact Sheet • Signage • Direct Engagement
NT Media	
Recreational area stakeholders	
Minister for Essential Services	<ul style="list-style-type: none"> • Fact Sheet • Signage
Minister for Parks and Rangers	
Minister for Tourism and Hospitality	
Minister for Agribusiness and Aquaculture	
Department of Environment, Parks and Water Security	
Local Members – Darwin and rural areas	<ul style="list-style-type: none"> • Direct Engagement • Website • Fact Sheet • Signage
NT Water Ski Association	
AFANT	
General public	
NT Media	

3.3.2 Overview of future engagement

Future engagement will be guided by the Power and Water's Stakeholder Engagement and Communication plan. Methods of consultation and engagement will be guided by the stakeholder and the stage of the Project.

Planning and approvals phase – engagement regarding the NT EP Act Referral

Power and Water are currently engaging with relevant stakeholders and will consult on the outcomes of this Referral Report. Landowners whose property the water transmission pipeline will pass through have been sent a letter and will be followed up with about the construction program and access requirements to ensure they are made aware of potential impacts to them.

A notice will be posted on the Power and Water website informing the general public the Referral is available online for consultation and providing guidance on how to make a submission.

Construction

A formal website for the Project has been developed that provides a project contact and status updates, to inform members of the public – i.e. traffic impacts during construction – and who to contact if they have questions or complaints. Additionally, landowners who will be directly impacted by construction will be contacted and Power and Water will liaise with them to ensure impacts are minimised.

General project information has been posted to the Project website [[Available here](#)], and when available, information on the Recreation Management Plan will be posted there too.

Operation

Stakeholders can contact Power and Water through the 'Contact Us' page of the Power and Water website (<https://www.powerwater.com.au/contact-us>). The Recreation Management Plan being prepared by consultants for Power and Water will detail how recreational use of the dam will be managed by Parks and Wildlife. There are periods currently when recreational use of the dam is closed for maintenance and other reasons (e.g., crocodile sightings). When the dam is periodically closed to recreational users Parks and Wildlife will notify the public by posting a notice on their website and social media as is current practice.

4 STRATEGIC AND STATUTORY CONTEXT

There are both Territory and Commonwealth legislation and regulations that apply to projects in the NT. The Project will adhere to all relevant NT and Commonwealth environment and heritage legislation and will be required to obtain all associated permits and approvals. The NT EPA will assess the information in this Referral to determine if the Project requires assessment under the *EP Act*. Relevant primary legislation is described in Table 4-1. An approvals register documenting all required permits and approvals is provided in Appendix F.

Table 4-1. Relevant primary legislation

Legislation	Relevance
Commonwealth	
<i>Environment Protection and Biodiversity Conservation (EPBC) Act 1999</i>	The Project will be assessed for impacts to Matters of National Environmental Significance (MNES). It is unlikely the Manton Dam Return to Service project will require referral or approval under the <i>EPBC Act</i> , as it is not expected to have a significant impact on any MNES.
<i>National Greenhouse and Energy Reporting (NGER) Act 2007</i>	<p>A GHG emissions estimate has been prepared and indicates that the project scope 1 and scope 2 emissions are well below the threshold in the Large Emitters Policy</p> <ul style="list-style-type: none"> • Scope 1 emissions sources include land clearing and operation of diesel-powered vehicles and equipment. • Scope 2 emissions will be produced from the Strauss WTP which will be connected to the Darwin Katherine Interconnected grid System. <p>The bulk of project emissions come from the existing anoxic breakdown of material within Manton Dam, which would occur regardless of the project progressing and are not required to be accounted for.</p>
Northern Territory	
<i>Bushfires Management Act 2016</i>	The project is located within the Vernon Arafura Fire Management Zone, permits and conditions apply under this Act, such as installation of firebreak, permits to burn, adhering to fire bans etc.
<i>EP Act (NT)</i>	<p>The <i>Environment Protection Act 2019 (NT) (EP Act)</i> replaced the <i>Environment Assessment Act 1982 (NT)</i>. The <i>EP Act</i> and associated <i>Environment Protection Regulations 2020</i> sets out referral triggers, which require the proponent of a project to refer the project to the NT EPA for assessment. Referral can also be triggered if the project is likely to result in a significant impact. This is informed by the environmental objectives, declared by the NT Minister.</p> <p>Pre-referral screening of the Project determined it has potential to impact 5 environmental factors and is therefore being referred to the NT EPA to determine if approval under the <i>EP Act</i> is required (Appendix G).</p>
<i>Heritage Act 2011</i>	<p>All sites on the NT Heritage Register and Aboriginal and Macassan archaeological sites are protected under this Act. Archaeological surveys by Ellengowen Enterprises (2017 and 2023) over the Strauss WTP and pipeline easement identified several WWII archaeological sites and two aboriginal sites. Two WWII archaeological sites occur in the Strauss WTP footprint, a number of sites can be avoided. Consultation with the Heritage Branch has occurred prior to submission of this referral and will be ongoing for the duration of the project (refer to Section 5.6.1).</p> <p>Heritage values are known at Manton Dam and consultation with Heritage Branch has commenced (refer to Section 5.6.1).</p>

Legislation	Relevance
<p><i>Territory Parks and Wildlife Conservation Act 2014 (TPWC Act) (NT)</i></p>	<p>The Act provides for the establishment of territory parks, other parks and reserves, and for the study, protection and conservation of wildlife in the NT.</p> <p>A permit is required to take or interfere with wildlife. The Project would require a permit for example if there was a plan to relocate flora or fauna from the site prior to land clearing.</p> <p>The Act allows for declaration of feral animal control areas and areas of essential habitat. There are no such declarations in or near the Project area.</p> <p>The Project area is not located in or near a national park or reserve declared under the Act.</p>
<p><i>Water Act 1992</i></p>	<p>The <i>Water Act</i> is the primary tool for managing and protecting the Territory's water resources. Under the reform agenda the application of the <i>Water Act</i> to mining activities took effect as of January 2018.</p> <p>The extraction of surface water from Manton Dam is current authorised under licence 461, for 7,300 ML/year for the purpose of public water supply. The licensee is Power and Water, and the licence expires 30/05/2051.</p>
<p><i>Weeds Management Act 2001 (NT)</i></p>	<p>Landholders and occupiers have statutory obligations to manage declared weeds under the Act. Gamba Grass (<i>Andropogon gayanus</i>) and Hymenachne (<i>Hymenachne sp.</i>) were commonly observed at the Strauss WTP by EcOz (2023) during ecological surveys. Additional to Gamba Grass, Hyptis (<i>Mesosphaerum suaveolens</i>), Annual Mission Grass (<i>Cenchrus pedicellatus</i>) and Calopo (<i>Calopogonium mucunoides</i>) were commonly found along the easement during surveys. Weed Management will be required in the CEMP.</p>

5 ENVIRONMENTAL FACTORS

5.1 Overview

The NT EPA has developed a framework for the assessment of environmental impact. The framework uses 14 environmental factors to provide a systematic approach to organising environmental information and to establish environmental objectives against which Projects will be assessed. Pre-referral screening of the Project undertaken by EcOz Environmental Consultants (EcOz) determined that the Project has potential to impact five of the 14 environmental factors. The following factors were selected for further assessment either because the environmental values associated with the factor may be significantly impacted, or because there is insufficient information to conclude that they will not be:

- Terrestrial ecosystems
- Hydrological processes
- Aquatic ecosystems
- Community and economy
- Culture and heritage.

A copy of the pre-referral screening report is presented in Appendix G.

Table 5-3 provides details of the factors that were excluded from further assessment because there is a high level of confidence that environmental values associated with that factor will not be significantly impacted.

For each of the five factors selected for further assessment, the following approach was taken to identify and assess environmental impacts from the Project:

- **Identification and characterisation of environmental values:** A combination of desktop and field assessments were undertaken to identify and characterise the existing environment that occurs within the Project area and surrounding areas. Valued components of the environment were then selected for further assessment on the basis that they are ecologically, socially, culturally and/or economically important, and are either likely to be impacted by the Project, or people are highly concerned that they could be impacted.
- **Identification of potential impacts:** Consideration was given to how the activities associated with implementing the Project (described in Section 2) could impact each of the valued components. Potential direct and indirect impacts were identified.
- **Environmental protection and management:** For each impact, measures that will be implemented to avoid and mitigate those impacts were identified.
- **Residual impact:** Each valued component was then assessed considering the context and intensity of the impact, and the scale, duration and magnitude (degree of change) of the residual impact.

The criteria used to rate residual impacts is shown in Table 5-1.

The outcomes of the impact assessment process are summarised in Table 5-2 and discussed further in subsequent sections of this Referral Report.

Table 5-1. Residual impact ratings

High	Moderate	Low
<p>A high impact generally has two or more of the following characteristics:</p> <p>Scale: Regional/ Widespread Magnitude: Moderate/Major Duration: Long-term/Permanent</p> <p>There are sensitive values or receptors present.</p> <p>Impacts are difficult or impracticable to avoid or mitigate, or there is a high degree of uncertainty.</p> <p>A high residual impact has potential to be significant.</p>	<p>A moderate impact generally has two or more of the following characteristics:</p> <p>Scale: Localised/Regional Magnitude: Moderate Duration: Medium-term/Long-term</p> <p>There are sensitive values or receptors present, but impacts can be effectively avoided or mitigated with a high degree of certainty.</p> <p>A moderate residual impact is unlikely to be significant subject to effective mitigation.</p>	<p>A low impact generally has two or more of the following characteristics:</p> <p>Scale: Limited/Localised Magnitude: Negligible/Minor Duration: Short-term/ Medium-term/Reversible.</p> <p>There are not sensitive values or receptors present.</p> <p>There is a high degree of certainty, and the impact is managed using routine measures that are proven effective.</p> <p>The impact is not significant.</p>

Table 5-2. Summary of potential impacts and avoidance/mitigation measures

Factor	Environmental value	Potential impacts and benefits	Avoidance and mitigation	Residual impact
LAND				
Terrestrial ecosystems Section 5.2	<ul style="list-style-type: none"> Vegetation and habitat Sensitive vegetation types including riparian and old-growth forest Threatened species 	<ul style="list-style-type: none"> Direct loss and degradation of vegetation and habitat downstream Direct loss of significant vegetation Loss of threatened species habitat and direct mortality of threatened fauna 	<ul style="list-style-type: none"> Clearing Plan and pre-clearance survey Use of a fauna spotter-catcher within the WTP footprint for vegetation clearing works Weed Management Plan implemented Retention of downstream pre-development water flows of 30 L/s 	Moderate
WATER				
Hydrological processes Section 5.3	<ul style="list-style-type: none"> Surface water drainage Surface water flows downstream of Manton Dam 	<ul style="list-style-type: none"> Alteration of surface water drainage Alteration of surface water availability downstream Surface water drawdown 	<ul style="list-style-type: none"> All major and minor surface water features have been avoided during site selection Detailed designs of pipeline include engineering controls for pipeline intersection of creek crossings in existing utilities easement corridor. Completion of works during the dry season where possible and the implementation of Erosion and Sediment Control Plan's (ESCPs) to minimise the impacts of surface water flow changes Extraction controlled by an existing extraction licence which includes a reporting requirement to ensure no exceedance Stormwater detailed design at Strauss WTP will be prepared by a qualified engineer to manage internal stormwater flows Retention of downstream pre-development water flows of 30 L/s 	Moderate
Aquatic ecosystems Section 5.4	<ul style="list-style-type: none"> No-threatened aquatic fauna Riparian vegetation and habitat Aquatic biodiversity 	<ul style="list-style-type: none"> Direct mortality of aquatic fauna Habitat degradation and fragmentation from reduction of surface water flows in Manton River downstream of Manton Dam due to extraction. Habitat degradation and fragmentation from increased drawdown in Manton Dam due to extraction. 	<ul style="list-style-type: none"> Extraction controlled by an existing extraction licence which includes a reporting requirement to ensure no exceedance Stilling pond upgrade investigation (current issue) Retention of controlled downstream pre-development water flows of 30 L/s Monitoring of riparian vegetation health 	Low
PEOPLE & COMMUNITIES				
Community & economy Section 5.5	<ul style="list-style-type: none"> Refer to Section 5.5.2 	Refer to Section 5.5.2	Refer to Section 5.5.2	Moderate
Culture and Heritage Section 5.6	<ul style="list-style-type: none"> Aboriginal sacred sites European heritage features (WWII) 	<ul style="list-style-type: none"> Loss or damage to known or unknown archaeological sites Loss or damage to known or unknown sacred sites 	<ul style="list-style-type: none"> Authority Certificate from AAPA (redacted for public exhibition) (Appendix H) Clearing Plan and pre-clearing survey to identify archaeological values to avoid Consultation with the NT Heritage Branch Manton Dam Heritage Management Plan CEMP to include an unexpected find procedure Consultation with TO's Monitoring of riparian vegetation health 	Low

Table 5-3. Environmental factors not assessed

Theme	Factor	Reasons why not assessed
Land	Landforms	No distinct natural landforms are present in the Project area.
	Terrestrial environmental quality	<p>Project activities are in previously disturbed areas, and not in areas of high erosion risk.</p> <p>Potential contamination has been discussed in the Pre-referral checklist at Appendix G, a summary is provided below.</p> <p>The contamination investigation footprint is small (350 m²) and restricted to the historical operational activities in the Manton Dam area, which ceased in 1972. The potential contaminations of concern are hydrocarbons and asbestos sources associated with infrastructure being demolished as part of this referral. Potential hydrocarbon sources include:</p> <ul style="list-style-type: none"> • Redundant empty diesel tank (~90,000 L capacity and empty) • Redundant transformer yard • Generator fill points • Electric pump house • Engine servicing areas <p>The concrete permeable foundations that the infrastructure are located will be demolished and disposed of.</p> <p>Potential asbestos sources footprint is small (~260 m²) and include:</p> <ul style="list-style-type: none"> • Garage • Electric pumphouse <p>Contamination investigation and remediation works will occur as part of infrastructure removal works in the event of contamination. An unexpected finds procedure will be included in the demolition CEMP.</p> <p>If required, the Remediation Plan will include remediation requirements for soil applicable for future use. No other known soil contaminating activities have occurred across the area.</p>
Water	Inland water environmental quality	<p>Construction:</p> <p>No minor or major watercourses are present at the Strauss WTP, and land clearing activities will be managed through an ESCP in accordance with the IECA BPESC Guidelines.</p> <p>Contamination risk from minor storages of fuels and other hazardous chemicals used during construction will be managed through a Construction EMP.</p> <p>Operations:</p> <p>Recreational use of Manton Dam is set to continue during operations, water will be treated and monitored at the Strauss WTP to ensure adequate standards for human consumption are met.</p> <p>Chemicals required for operation of the WWTP will be stored and handled as per accepted standards and legislative requirements.</p> <p>Waste from the water treatment process will be managed by a licenced waste contractor.</p>
Sea	Coastal processes	The Project will not interact with or impact any of the Sea themed factors due to its geographical location.
	Marine environmental quality	
	Marine ecosystems	

Theme	Factor	Reasons why not assessed
Air	Air quality	<p>Closest sensitive receptor to the Strauss WTP are residential properties approximately 500 m to the south and east. Besides the Strauss WTP the majority of the existing easements and Manton Dam are highly modified and/or cleared.</p> <p>Minor levels of dust will be generated during construction, particularly during stages of vegetation clearance, and can be managed through air quality, erosion and sediment control measures in ESCP and CEMP. Dust during construction can be managed through air quality, erosion and sediment control measures in ESCP and MMP.</p>
	Atmospheric processes	<p>Atmospheric Processes was not identified for further consideration in this Referral. EcOz completed a Greenhouse Gas (GHG) Emission report for the project (Appendix D). The report summarised that the Project does not trigger thresholds for scope 1 or scope 2 emissions noting the above policies, therefore no formal abatement plan is required as part of NT EPA referral submission.</p>
People	Human health	<p>Human health impacts are inherently unlikely given the nature of the project. When water levels drop below a safe level Recreational access will be restricted using signage in certain areas. Biting insect habitats are not expected to be increased. Water from the dam will be treated so that it will be suitable for human consumption in accordance with ANZECC (2000) Australia Drinking Water Guidelines (ADWG).</p>

5.2 Terrestrial ecosystems

The NT EPA's objective for Terrestrial ecosystems is to:

Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

The sections below identify the terrestrial ecosystem values that occur within and surrounding the Project area and assess the potential impacts of the Project on these values and the NT EPA's objective.

5.2.1 Environmental values

An Ecological Assessment (EcOz 2023) was prepared using desktop spatial databases maintained by the NTG and field studies (Appendix B). Field studies consisted of:

- Land unit and habitat mapping
- Threatened flora surveys
- Camera trapping targeting threatened fauna species.

Appendix B provides additional details about the survey methods and sites.

Vegetation and habitats

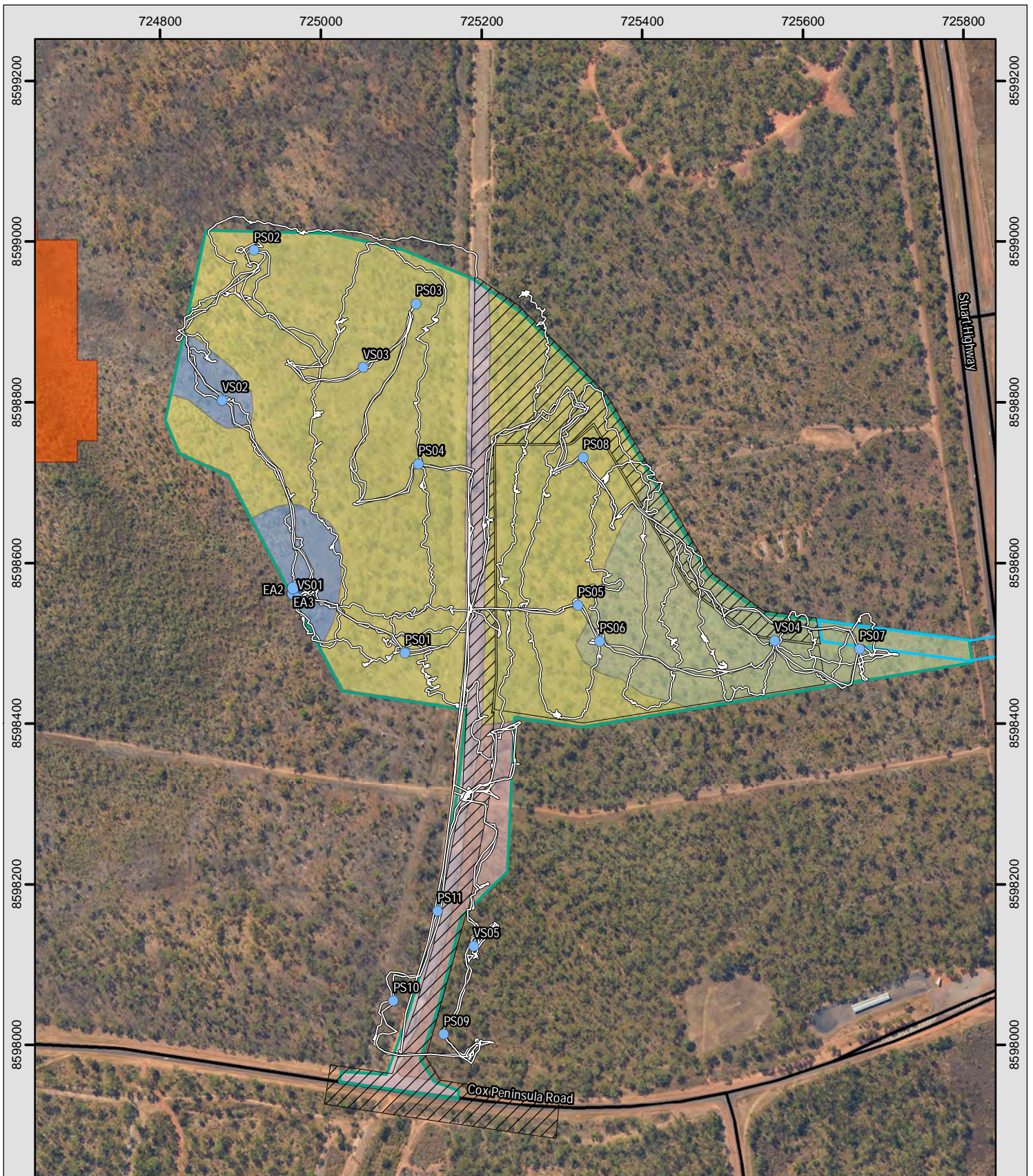
At the Strauss WTP site, the vegetation is predominately intact, except for a north-south corridor through the centre which has been significantly disturbed. The remainder is remnant native vegetation. Figure 5-3 shows the verified land units and location of transects and survey sites used in the ecological surveys. Land unit details are provided in Table 5-4.

Vegetation along the water mains pipeline easement was heavily disturbed, bordered by a mix of cleared land for agriculture, infrastructure and private residential blocks, as well as sections of remnant vegetation.

At Manton Dam, the vegetation along the pipeline easement – i.e. west of the Stuart Highway – was also heavily disturbed, with much of the remainder being used as the Manton Dam Wall Picnic Area. Some remnant vegetation is present adjacent to Manton River, including riparian vegetation (see below).

Table 5-4. Field verified land units and vegetation within the Strauss WTP Stage 1 project area

No.	Landform	Soil	Vegetation
3a	Gentle sloping plain <1 % west-south-west aspect	Red-brown clay loam sand with sparse gravel	<i>Eucalyptus</i> and <i>Erythrophleum</i> (Ironwood) woodland over a diverse sparse shrubland and open grassland
3c – open woodland	Side slope <2 % west aspect	Grey-brown sandy clay loam with surface gravel	<i>Eucalyptus</i> open woodland over sparse shrubland and open grassland
Disturbed	Flattened ground with long parallel raised mounds	Varied – including road fill brought from other locations	Regularly slashed of vegetation with some peripheral shrubs remaining

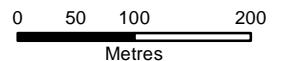


Legend

- Survey sites
- Survey effort
- Pipeline
- ▨ Stage 1
- ▭ Stage 2
- ▭ Survey extent
- High likelihood sandsheet heath

Land Units

- 3a
- 3c-open woodland
- 3c-woodland
- 6b
- Disturbed
- Road



MAP INFORMATION
 Scale: 1:6,500 @ A4
 Projection: GDA 1994 MGA Zone 52
 Date Saved: 24/07/2023
 Client: Power and Water
 Mapper: DC

DATA SOURCE
 Topographic data: OSM, BOM
 Project data: EcOz
 Imagery: NTLIS

Figure 5-1. Map of field-verified land units at the Strauss WTP with survey effort extent

Sensitive vegetation communities

In the NT, significant vegetation types are included for consideration in the *Land Clearing Guidelines* (DEPWS 2021a) due to their vulnerability to impacts by adjacent land uses, limited distribution and/or inherently high biodiversity values. The following is the list of sensitive vegetation communities within the Project area/potential impact area:

- Rainforest – alongside Manton River
- Riparian vegetation – alongside Manton River
- Old-growth forest containing large trees with hollows suitable for fauna – in Strauss WTP only

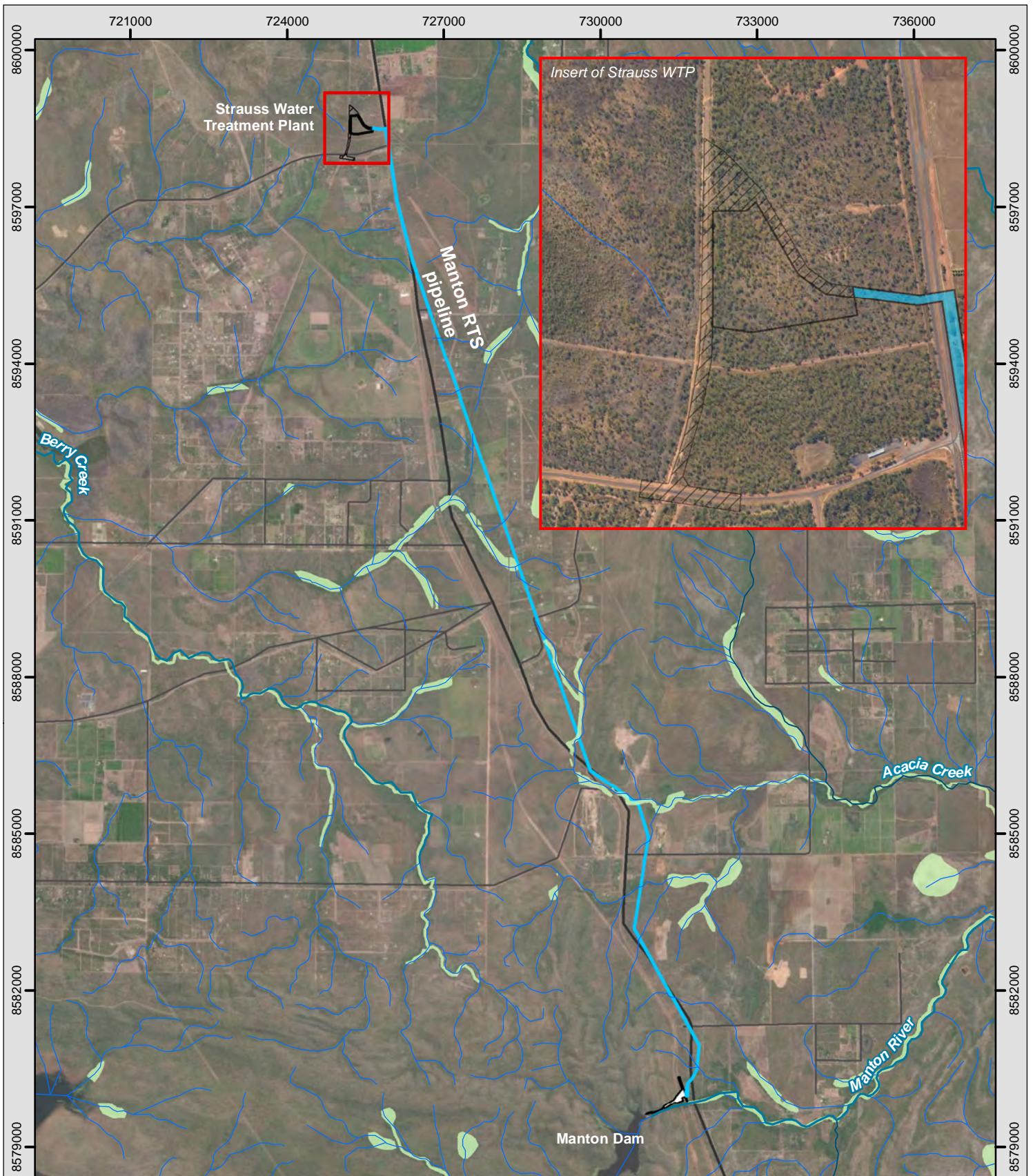
Rainforest/riparian vegetation

The project intersects numerous watercourses (Figure 5-2). Those along the easement have had their vegetation cleared, consequently there is no extant riparian vegetation. At the Strauss WTP, there is an area of drainage alongside the watercourse (Stream Order 1) on the south of the site dominated by *Melaleuca* species.

The easement between the Manton Dam wall and the Stuart Highway runs adjacent to Manton River which hosts riparian vegetation along its banks. The proposed Project area encompasses a small area (~0.4 ha) of this riparian vegetation. Downstream of Manton River – outside of the Project area – there are some large areas of riparian vegetation, some of which may be rainforest (Figure 5-2).

Old-growth forest

Large, hollow-bearing trees only occur at the Strauss WTP, where they were documented at seven assessment sites. Most of these trees occur as a scattering of one to three individuals. However, one area in the north of the WTP meets the *Land Clearing Guidelines* definition of old-growth forest due to presence of more than five trees with stems greater than 50 cm diameter at breast height per hectare. The locations of the large hollow-bearing trees are provided on an ecological constraints map for the Strauss WTP, provided as Figure 5-3.



Legend		Stage	
	Major Drainage		Manton Footprint
	Minor Drainage		Pipeline
	Streams		Stage 1
	Major road		Stage 2
	Minor road		
	Riparian area		

MAP INFORMATION
 Scale: 1:100,000 @ A4
 Projection: GDA 1994 MGA Zone 52
 Date Saved: 1/08/2023
 Client: Power and Water
 Mapper: DC

DATA SOURCE
 Topographic data: OSM, BOM
 Project data: EcOz
 Imagery: ESRI

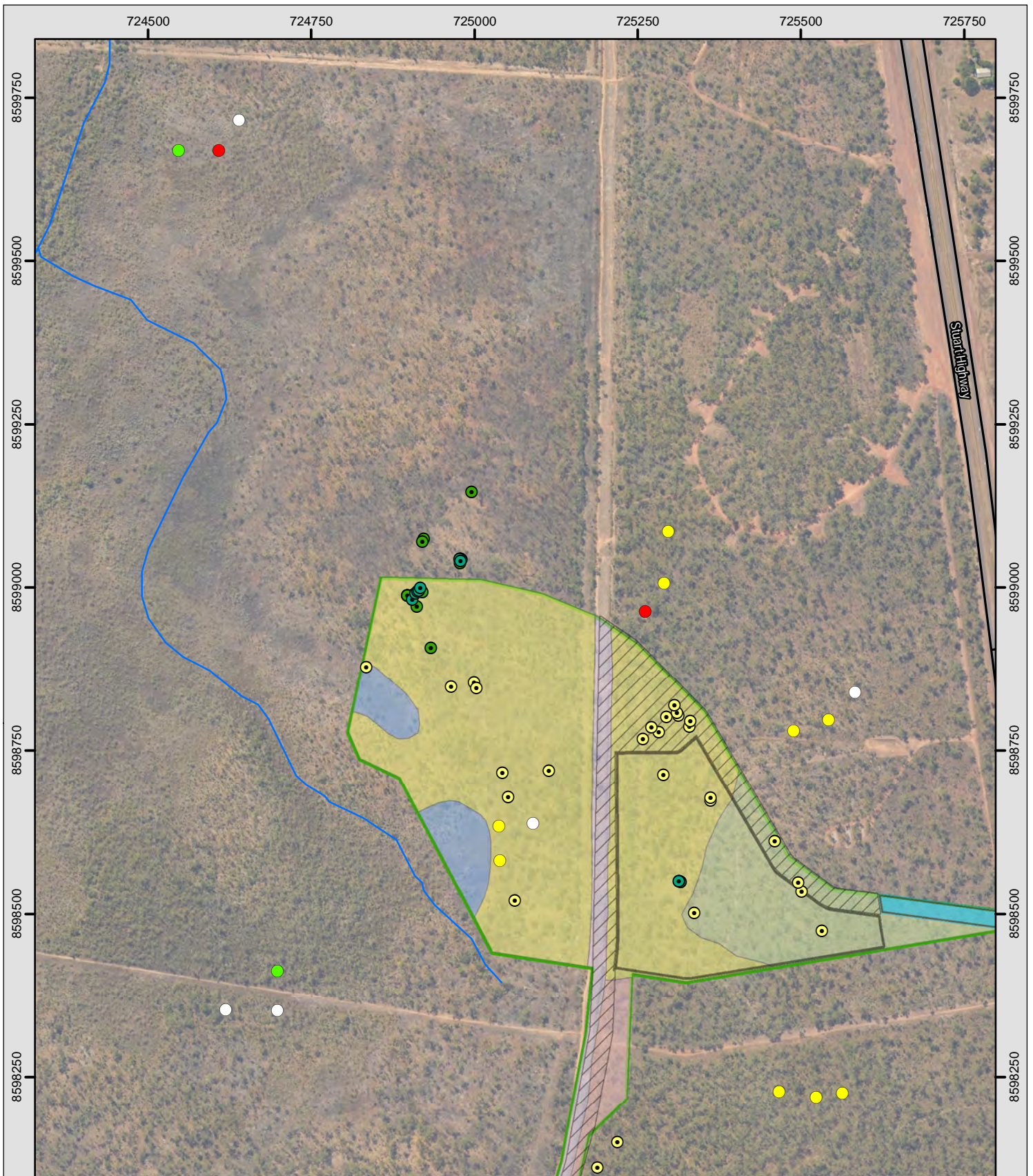
Figure 5-2. Map of riparian vegetation and watercourses

Threatened species

Results of the desktop ecological assessment (Appendix B) identified 16 threatened flora and fauna species with a high or medium likelihood of occurring within the Project area. These species and/or their habitats were considered only likely to occur at the Strauss WTP site, which was then targeted during field surveys. Following the surveys it was concluded that there are eight threatened species with a medium or high likelihood of occurring in the project area – see Table 5-5. For the locations of species records see Figure 5-3.

Table 5-5. Threatened species with a reasonable likelihood of occurrence within the Project area

Likelihood	Species	Status		Class	Comment on occurrence
		EPBC	TPWC		
HIGH	Northern Brushtail Possum (<i>Trichosurus vulpecula arnhemensis</i>)	VU	-	Mammal	Recorded in the 2022 survey immediately to the west of the Strauss WTP boundary
	Pale Field-rat (<i>Rattus tunneyi</i>)	-	VU	Mammal	Not recorded in the 2022 survey within the Strauss WTP boundary, but recorded adjacent to the north and west
	Darwin Cycad (<i>Cycas armstrongii</i>)	-	VU	Plant	Present in low densities across the Project area
	a herb (<i>Typhonium praetermissum</i>)	-	VU	Plant	Detected in the Strauss WTP – a central-south patch of two plants, with 23 plants in a north-west patch outside the Project area
	Mertens' Water Monitor (<i>Varanus mertensi</i>)	Currently under assessment	VU	Reptile	Assumed to occur in suitable habitat along Manton River and vegetated watercourses of the Project area
MEDIUM	Partridge Pigeon (eastern subspecies) (<i>Geophaps smithii smithii</i>)	VU	VU	Bird	May occur on occasion within the woodland habitats of the Project area, but unlikely to be resident
	Bare-rumped Sheathtail Bat (<i>Saccolaimus saccolaimus nudicluniatus</i>)	VU	-	Mammal	
	Floodplain Monitor (<i>Varanus panoptes</i>)	-	VU	Reptile	



Legend		Stage
Watercourse		Pipeline
Survey extent		Stage 1
Camera trap survey results		Stage 2
Northern Brushtail Possum		Land Units
Pale Field Rat and Northern Brushtail Possum		3a
Pale Field Rat		3c-open woodland
Neither		3c-woodland
Other ecological constraints		6b
<i>Typhonium praetermissum</i> record		Disturbed
Large trees		

MAP INFORMATION
 Scale: 1:8,000 @ A4
 Projection: GDA 1994 MGA Zone 52
 Date Saved: 1/08/2023
 Client: Power and Water
 Mapper: DC

DATA SOURCE
 Topographic data: OSM, BOM
 Project data: EcOz
 Imagery: NTLIS

Figure 5-3. Map showing location of ecological constraints relevant to the Strauss WTP footprint

5.2.2 Potential impacts

The potential impacts to vegetation and habitat, terrestrial flora, significant vegetation (riparian vegetation and tree hollows) and to threatened fauna from the Project activities are:

- direct loss of vegetation and habitat
- degradation of vegetation and habitat
- direct loss of significant vegetation
- loss of threatened species habitat
- direct mortality of threatened fauna.

Of these potential impacts, the ecological values potentially most at risk are threatened species. Impacts to other values are not likely to constrain development because the impacts can either be avoided or mitigated using routine measures commonly adopted on land development and construction projects.

Vegetation and habitat

The primary potential impact to vegetation and habitat in the Project area is direct loss of native bushland through land clearing at the Strauss WTP site, where approximately 7.64 ha of native vegetation will be cleared. The infrastructure at Manton Dam and the pipeline easement have been located in previously disturbed areas, thereby avoiding any impacts on terrestrial ecosystems at these sites.

Given the extensive area of intact vegetation and habitat to the north-west (i.e. in Weddell), the loss of vegetation within the Project area is only likely to be considered significant where it provides habitat for threatened species (refer below).

The other potential impact to vegetation and habitat within the Project area is reduced habitat quality caused by the introduction and spread of weeds. The mitigation measures presented in Section 5.2.3 are industry-standard and will reduce the potential for introduction and spread of weeds as far as practicable. However, it is noted that existing easements and disturbed areas have extensive weed infestations, and this situation is likely to remain, irrespective of the project activities.

Significant vegetation

Riparian and rainforest vegetation occurs downstream of Manton Dam in the Manton River and in patches along the banks of the Manton Dam waterbody. It is expected that the existing extent and quality of riparian and rainforest vegetation downstream of Manton Dam has been modified from its natural condition by the long-term presence of the dam; however, there is no record of what the vegetation was like prior to development of the dam for comparison. Anecdotally it is considered likely that the watercourse currently receives more water through the dry season than under natural conditions due to intermittent release of water that occurs, and this could contribute to persistence of small waterholes and more dense riparian vegetation.

Riparian and rainforest vegetation is highly variable in extent along the banks of Manton Dam and is a result of the availability of the permanent water source (Reynolds 2013). Currently the dam experiences an annual surface water drawdown of 3.7% (refer to Appendix I). Proposed reductions in the volume of water flow downstream of the Manton Dam and in Manton Dam itself associated with this Project could negatively impact the extent and habitat quality of the vegetation (see Section 5.4 for more detail).

Land clearing will result in the loss of a patch of old-growth forest within the Strauss WTP site. That patch could provide roosting habitat for the local occurrence of the Northern Brushtail Possum, and/or other non-threatened fauna species, and is discussed further below.

No waterbodies or major drainage lines occur in the Project area. The water main pipeline crosses several minor drainage lines where there has been previous clearing and disturbance. Section 2.3.4 describes the construction methods that will be used at these crossings to further minimise impacts to riparian vegetation.

Threatened species

Eight threatened species were found, or are likely to occur, in the Project area. Of these, only Mertens' Water Monitor is likely in the Manton Dam footprint, and no threatened species are likely within the water main pipeline easement. Seven threatened species are relevant to the Strauss WTP footprint. The significance of the occurrence of those species differs when the regional context is considered below.

Land clearing will result in the loss of habitat for the three medium likelihood species –. However, for these habitat-generalists for whom the Project area does not constitute important or critical habitat, the clearance of such a small area is unlikely to have a significant impact.

The occurrence within the Project area of the threatened plant species *Typhonium praetermissum* is significant because the next nearest occurrences are 5 km to the east and south, meaning that this occurrence is considered a unique sub-population. Stage 1 of the Strauss WTP has been located such that land clearing will result in the loss of only two *Typhonium praetermissum* plants, which does not constitute a significant impact. It is noted that a larger patch of *Typhonium* occurs to the west in an area that could be used for further expansion of the Strauss WTP; however, Power and Water has confirmed that the expansion footprint could be accommodated without impacting the population.

The **Darwin Cycad** is abundant in the savanna woodlands of the greater Darwin region, such that conservation efforts are focussed on high density stands of 400+ individuals per hectare (as per recent approval conditions for the Holtze Development Area). The species does not occur in high densities within the Project area and so the loss of individuals because of land clearing is unlikely to have a significant impact on this species.

If **Mertens' Water Monitors** are present in Manton River, impacts to that species are unlikely providing changes to flows into Manton River do not significantly affect downstream riverine habitat as discussed in Section 5.3.

The **Pale Field-rat** was detected in the fauna survey for this Project in drainage habitat to the south-west of the Project area, as well as in open woodland immediately north of the Project area. These records are significant because this species has been rarely recorded in the Darwin region in recent years, despite substantial survey effort. The occurrence of this species in the south-west corner of the project area is therefore likely to be considered an important population. Table 5-7 assesses whether Project activities are likely to have a significant impact upon this Vulnerable species (as defined in *EPBC Significant Impact Guidelines 1.1*). The conclusion is that the small proportion of habitat that will be cleared compared with that available in the surrounding area means it is unlikely that Project activities will have a significant impact upon the Pale Field-rat.

Table 5-6. Significant impact assessment table for Pale Field-rat

Criterion	Summary of impacts
<p>Lead to a long-term decrease in the size of an important population</p>	<p>An important population of the Pale Field-rat has been recorded in the area surrounding the Strauss WTP Project area, and so is highly likely to be present within that Project area. All land clearing activities associated with this project will include pre- and post-clearing inspections by qualified fauna spotter-catchers to minimise mortality of Pale Field-rat that occur in the area. Experience in the Top End is that with such precautions, mortality of fauna species during land-clearing is very rare.</p> <p>The development will require clearing of Pale Field-rat habitat. As discussed below, the small area that will be cleared means it is unlikely that will have a significant impact on this species.</p>
<p>Reduce the area of occupancy (AOO) of an important population</p>	<p>The AOO of the Pale Field-rat estimated to be 1,720 km² but is probably significantly greater (Woinarski et al. 2014). It was calculated using a 2 x 2 km grid cell method. The loss of vegetation associated with the project will not result in a 2 x 2 km grid cell being completely depauperate of habitat for this species, meaning that the development will not reduce the area of occupancy.</p>

Criterion	Summary of impacts
Fragment an existing important population into two or more populations	Post-development, the Project area will be surrounded by remnant vegetation that is Pale Field-rat habitat, and only the very northern tip of the developed area passes between the two sites within which the species was recorded. Consequently, connectivity will be maintained between remaining habitat and so land clearing is unlikely to result in fragmentation of the population of this species.
Adversely affect habitat critical to the survival of the species	Critical habitat for the Pale Field-rat has not been formally defined. No habitat can be clearly circumscribed as being critical to the survival of this species because it occurred extensively across a breadth of habitats that are extremely wide-ranging and because its survival appears to be more likely dependent upon the management of (hitherto poorly-understood) threats within a habitat, rather than retention of a defined habitat.
Disrupt the breeding cycle of an important population	Land clearing activities for this project could disrupt the breeding cycle for individual Pale Field-rat if a burrow used for breeding is damaged or destroyed. The significance of this impact will be low if a fauna spotter-catcher is employed during initial land clearing.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Land clearing will lead to a net loss in habitat for this species. The Project area occurs on the edge of Weddell – more than 10,000 ha of remnant bushland that is almost entirely suitable habitat for the Pale Field-rat. The clearing of less than 0.5% of that habitat for this Project is unlikely to affect the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species' habitat	Feral Cats (as predators) and possibly invasive grasses such as Gamba Grass (with large biomasses that increase fire intensity) are invasive species that may be harmful to the Pale Field-rat. Feral Cats are common in the region and so are highly likely to already be established in the project area. As noted in the Ecological Assessment (Appendix B), invasive grasses are present in disturbed areas within the project area. The Project will need to have strict weed hygiene and control measures in place to minimise the introduction of invasive grasses and ensure any existing occurrence do not proliferate.
Introduce disease that may cause the species to decline	Disease is not listed as a threatening process for the Pale Field-rat. The author is not aware of any literature on diseases that could be introduced by the project and that would detrimentally affect this species.
Interfere with the recovery of the species	There is no recovery plan for the Pale Field-rat. In the interim, priorities for the recovery of this species are to conduct research to define cause(s) of decline and to continue long-term monitoring programs (DEPWS 2021c). This Project will not interfere with either of those priorities.

The **Northern Brushtail Possum** was recorded in woodland immediately to the north, south and west of the Project area in the fauna survey undertaken for this Project. This species was recently listed as Vulnerable because it has undergone a broadscale decline in population size and range, such that its once extensive distribution is now patchy (TSSC 2021). The majority of recent Northern Brushtail Possum records in the NT are from the Darwin rural area, where it is posited that the species is protected from the higher rates of burning that are occurring across much of the species' range. Consequently, the occurrence of this species within the project area is considered a key source population for breeding or dispersal, and therefore an 'important population' as per the *EPBC Significant Impact Guidelines 1.1* (DoE 2013). Table 5-7 assesses whether project activities are likely to have a significant impact upon this Vulnerable species (as defined in *EPBC Significant Impact Guidelines 1.1*). The conclusion is that the small proportion of habitat that will be cleared compared with that available in the surrounding area means it is unlikely that Project activities will have a significant impact upon the Northern Brushtail Possum.

Table 5-7. Significant impact assessment table for Northern Brushtail Possum

Criterion	Summary of impacts
<p>Lead to a long-term decrease in the size of an important population</p>	<p>An important population of the Northern Brushtail Possum has been recorded in the area surrounding the Strauss WTP Project area, and so is highly likely to be present within that Project area. All land clearing activities associated with this project will include pre- and post-clearing inspections by qualified fauna spotter-catchers to minimise mortality of Northern Brushtail Possums that occur in the area. Experience in the Top End is that with such precautions, mortality of this species during land-clearing is very rare.</p> <p>The development will require clearing of Northern Brushtail Possum habitat. As discussed below, the small area that will be cleared means it is unlikely that will have a significant impact on this species.</p>
<p>Reduce the area of occupancy (AOO) of an important population</p>	<p>The AOO of the Northern Brushtail Possum estimated to be 1,392 km², but is probably significantly greater (TSSC 2021). It was calculated using a 2 x 2 km grid cell method. The loss of vegetation associated with the project will not result in a 2 x 2 km grid cell being completely depauperate of habitat for this species, meaning that the development will not reduce the area of occupancy.</p>
<p>Fragment an existing important population into two or more populations</p>	<p>Post-development, the Project area will be surrounded by remnant vegetation that is Northern Brushtail Possum habitat. Consequently, connectivity will be maintained between remaining habitat and so land clearing is unlikely to result in fragmentation of the population of this highly-mobile species.</p>
<p>Adversely affect habitat critical to the survival of the species</p>	<p>Critical habitat for the Northern Brushtail Possum has not been formally defined. No habitat can be clearly circumscribed as being critical to the survival of this species because it occurred extensively across a breadth of habitats that are extremely wide-ranging (tropical Eucalypt open forests) and because its survival appears to be more likely dependent upon the management of (hitherto poorly-understood) threats within a habitat, rather than retention of a defined habitat.</p>
<p>Disrupt the breeding cycle of an important population</p>	<p>Land clearing activities for this project could disrupt the breeding cycle for individual Northern Brushtail Possums if their breeding trees are removed. The significance of this impact will be low if a fauna spotter-catcher is employed during initial land clearing.</p>
<p>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p>	<p>Land clearing will lead to a net loss in habitat for this species. The Project area occurs on the edge of Weddell – more than 10,000 ha of remnant bushland that is almost entirely suitable habitat for the Northern Brushtail Possum. The clearing of less than 0.5% of that habitat for this Project is unlikely to affect the availability or quality of habitat to the extent that the species is likely to decline.</p>
<p>Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species' habitat</p>	<p>Feral Cats (as predators), Black Rats (as disease vectors) and invasive grasses such as Gamba Grass (with large biomasses that increase fire intensity) are all recognised in the Conservation Advice (TSSC 2021) as invasive species that are harmful to the Northern Brushtail Possum. Feral Cats and Black Rats are common in the region, and so are highly likely to already be established in the project area. As noted in the Ecological Assessment (Appendix B), invasive grasses are present in disturbed areas within the project area. The Project will need to have strict weed hygiene and control measures in place to minimise the introduction of invasive grasses, and ensure any existing occurrence do not proliferate.</p>
<p>Introduce disease that may cause the species to decline</p>	<p>Diseases carried by Black Rats are considered a potential threat factor to the Northern Brushtail Possum in the Conservation Advice (TSSC 2021). However, as mentioned above, Black Rats are already common in the region, and so this Project is unlikely to lead to introduction of disease that may cause the decline of the species.</p>

Criterion	Summary of impacts
Interfere with the recovery of the species	There is no recovery plan for the Northern Brushtail Possum. Instead, the Conservation Advice for the species is considered to provide sufficient direction to implement priority actions, mitigate against key threats and enable recovery of the species (TSSC 2021). One of the four primary conservation actions is to ‘identify and protect important habitat for the Northern Brushtail Possum from habitat loss, degradation and fragmentation.’ The habitat loss associated with the Project is minimal and the small area that will be cleared is unlikely to interfere with the recovery of this species.

5.2.3 Environmental protection and management

The following measures will be implemented to mitigate impacts to terrestrial ecosystems.

Clearing Plan and Pre-clearing surveys

Majority of land clearing will occur at the Strauss WTP project area. A Clearing Plan and pre-clearance survey will be conducted prior to the clearing and development by a qualified ecologist to identify any potential habitat for threatened fauna and the relocation of any threatened fauna identified. The purpose of the pre-clearing inspection is to undertake a comprehensive site check prior to clearing activities to identify potential fauna species and/or habitat (i.e. hollows, nests, large trees) present at the site that need to be ‘cleared with care’ to minimise mortality or injury to native fauna. Such features will be flagged and communicated to land-clearing equipment operators. Tree hollows and habitat logs deemed suitable for salvage should be relocated to retained vegetation during the clearing process. These hollows provide critical refuge to displaced fauna.

Weed management

During construction, the introduction and/or spread of weeds will be managed through a Weed Management Plan within the CEMP, prepared in accordance with relevant guidance documents. This plan will include hygiene and quarantine measures to prevent the introduction of new species to the site, prevent the spread of weeds within the site, and will detail control measures for existing weed infestations. Weed management will be in line with the *Weeds Management Act 2001*.

Ongoing maintenance of the habitat values will be critical to minimising the impact of the Project on all the threatened species considered likely to be present. This will include weed and fire management and minimising access to the site. Power and Water will develop a management regime based on standard management practices.

Riparian vegetation

The Project has sought to minimise impacts by ensuring any changes to flows downstream of Manton Dam do not impact on riparian vegetation. Water flow downstream of the Manton Dam will remain consistent at approximately 30 L/s after consultation with downstream property owners. This continuation of flows will assist in minimising the impacts of returning the storage to service on the downstream riparian vegetation.

At Manton Dam the extraction of surface water is controlled by an existing surface water extraction licence, limiting the allowable surface water to be extracted to 7,300 ML/year. Modelling indicates that Manton Dam will continue to spill in most years though the frequency may reduce (from an estimated 98% of years to 84% of years - based on a 1,000 year simulation). The volume of spill from Manton Dam will also reduce once the storage is operational as shown in Figure 5-5. The drawdown of the storage may increase, with modelling showing that the minimum annual storage level may drop by an average of 2 m (as indicated in Figure 5-6 and Table 5-9). Further details of the hydrological modelling is provided at Appendix I. It is unlikely this reduction of surface water flows from wet season spills will negatively impact the riparian vegetation, as approximately two thirds of the Manton River catchment is downstream from the dam and remains unimpeded.

Section 5.4.3 discusses the monitoring that will be undertaken of riparian vegetation in the Manton River and at Manton Dam, and the adaptive management measures that will be undertaken based on the results of the monitoring.

5.2.4 Residual impact

Assuming effective implementation of the above mitigation measures, it is concluded that the Project is unlikely to have a significant impact on the terrestrial ecosystems and the NT EPA's objective will be met.

The Project is likely to have a moderate level of residual impact to terrestrial ecosystems. The land clearing at Strauss WTP will result in the loss of two *Typhonium praetermissum* plants and individuals of the threatened plant species *Cycas armstrongii*. The land clearing will impact a small area of Eucalyptus woodland old-growth forest that could be utilised by several threatened fauna species, in particular the Northern Brushtail Possum and Pale Field-rat that were recorded in habitat proximate to the Project area. The assessment of potential impacts undertaken in accordance with the *EPBC Significant Impact Guidelines 1.1* (DoE 2013) concluded that the impacts from the Project are unlikely to be significant due to the small area of land clearing involved.

Section 5.4.4 discusses the residual impacts to riparian vegetation in Manton River and Manton Dam.

5.3 Hydrological processes

The NT EPA's objective for Hydrological processes is to:

Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.

The sections below identify the hydrological process values that occur within and surrounding the Project area and assess the potential impacts of the Project on these values and the NT EPA's objective. The environmental values, environmental protection and management measures and potential impacts focus on surface water flows in the project area and downstream. The surface water drawdown of Manton Dam is discussed in the aquatic ecosystems factor as the potential impact assessed is on riparian vegetation located on the banks of Manton Dam (Section 5.4).

5.3.1 Environmental values

The information for this section was sourced from historical information provided by Power and Water, desktop satellite imagery and NTG NR maps surface water data ([available here](#)). The discussion is limited to surface water in the Manton Dam reservoir and Manton River downstream of the dam. There are no major or minor surface water drainage features located within the easement or Strauss WTP area (refer to Figure 5-2), with only minor streams crossed by the existing easements. The majority of these streams are located within residential/rural locations and are heavily modified. Water movement across the Project area would be comprised entirely of sheet flow during heavy rain events, with no concentrated flow expected within the Project area.

Groundwater values are not discussed because the likelihood of impacts to groundwater is inherently low. Groundwater extraction is not planned, and it is not expected that extraction of Manton Dam will create a groundwater drawdown as the dam will contain water all year round.

Manton Dam reservoir

The Manton Dam reservoir makes up approximately 1/3 of the Manton Dam catchment as shown in Figure 5-4. The total catchment area of Manton River is approximately 81 km² (Hill 2004). It is noted that the majority of the catchment runoff to Manton River is maintained.

Manton River

Manton River is an ephemeral Stream Order 4 watercourse, located downstream of the Manton Dam wall. The river extends approximately 13 km connecting to a number of minor Stream Order watercourses (1 to 3) before connecting to the Adelaide River. Satellite imagery indicates two waterbodies retain water and vegetation during the Dry season, one small waterbody approximately 2 km downstream of the dam wall and one large waterbody approximately 11 km downstream and then approximately 2 km upstream from Adelaide River. The tidal influence of Adelaide River and surrounding catchment flows into this waterbody is uncertain, as at the mouth of this waterbody connects to Acacia Creek (Stream Order 3 watercourse).

Before construction of the dam there would have been little or no flows in the river during the late dry season. Since the construction of the dam wall in the 1940s, the river has had a highly variable release of dry season discharge from the dam, with a steady 30-50 L/s released in more recent times (last decade). This has likely influenced the nature of the watercourse to have more water flow over the dry than it may have had before the dam was constructed, suggesting that the watercourse has been modified from its natural state. Flows downstream have been increased for short periods to enable maintenance of the dam wall.

Existing users

Power and Water have consulted with downstream property owners and other stakeholders to understand expectations for dry season discharge in the long term. There are currently no extraction licences for the Manton River downstream of the dam wall.

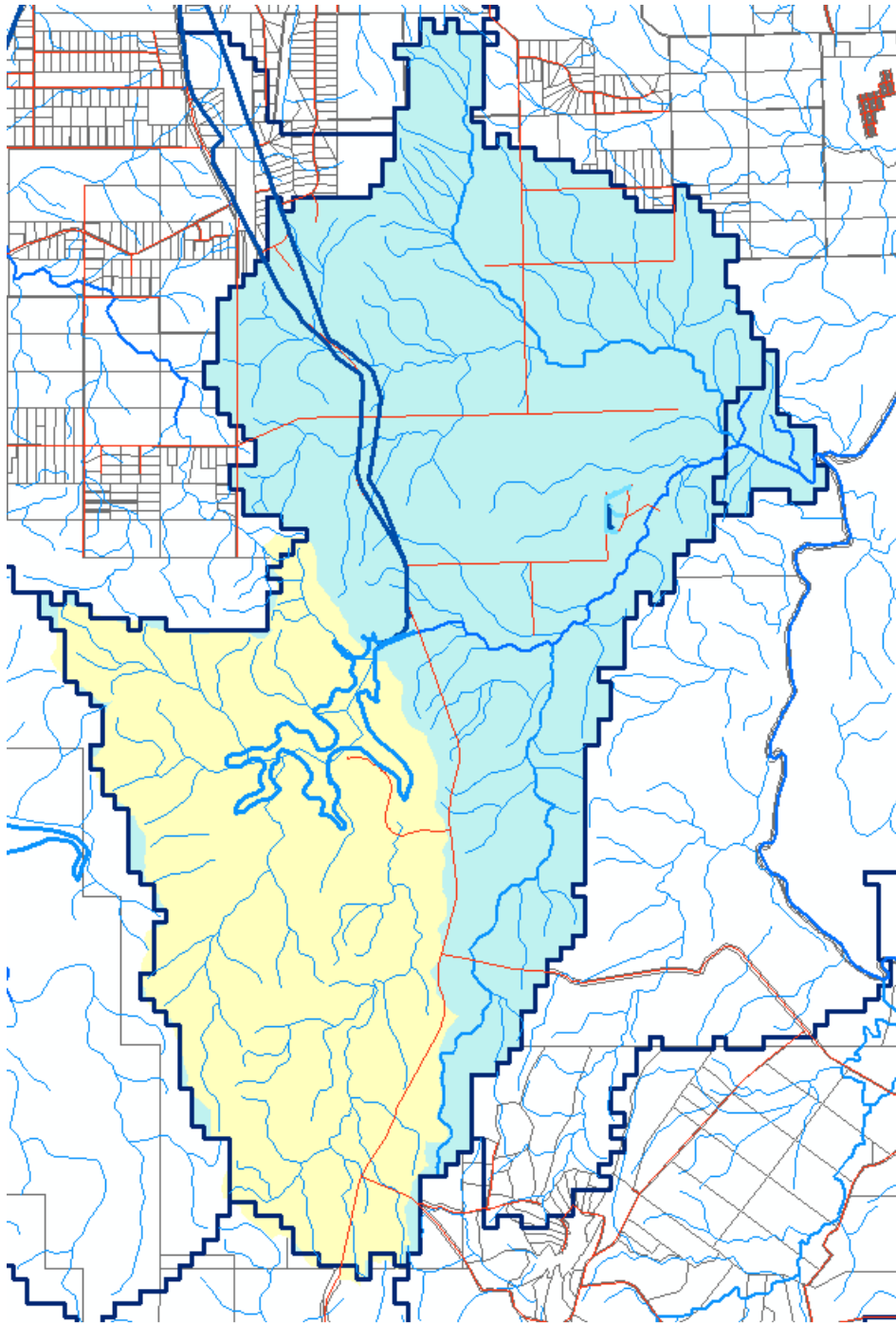


Figure 5-4. Manton River catchment (dark blue outline) with 1/3 Manton Dam reservoir catchment (yellow) (provided by Power and Water internal hydrological modelling)

5.3.2 Potential impacts

Power and Water has utilised its Darwin water supply model (a water balance model that includes simulated catchment inflows to Manton Dam, rainfall, evaporation losses and water supply) to assess the impact of extracting 20 ML/day on storage levels and spill volumes. Further details of the hydrological modelling is provided at Appendix I.

Alteration to surface water drainage

During construction land impacted along the pipeline and fibre optic cable easements and at Manton Dam is small and temporary. At the Strauss WTP there is a larger amount of vegetation clearing though there are no nearby watercourses thus flow impact will be limited to alteration of surface water shedding and will be minimal. The detailed designs presented in Section 5.3.3 are industry-standard and when implemented are effective to ensure management of Project surface water flows during rainfall events.

Alteration to surface water availability downstream

Surface water availability to riparian vegetation in the Manton River could be impacted by the Project. Current flow rates from uncontrolled spills during the wet season and controlled discharge in the dry season⁶ will be reduced. Majority of the spills occur during the wet season when rainfall occurs naturally over the Manton area, with limited to no spills during the dry season. Modelling of current uncontrolled spill conditions and the uncontrolled spills during the proposed extraction scenario (20 ML/day) indicate the percentage of years that water from Manton Dam will spill into Manton River during the wet season will reduce by 14%, from 98% to 84% (Table 5-8).

Table 5-8. Percent years Manton Dam will spill under current and proposed extraction scenarios

Extraction scenario	Average annual spill (ML/year)	Spill years*
0 ML (current scenario)	23,020	98%
20 ML/day	16,027	84%
% reduction	30%	14%

* Modelling was done by Power and Water using current climate, a 1000 yr stochastic dataset was used.

Section 5.4.3 discusses the monitoring that will be undertaken of riparian vegetation in the Manton River and at Manton Dam, and the adaptive management measures that will be undertaken based on the results of the monitoring.

⁶ Controlled discharge rate of 30 L/s has been determined during consultation with downstream land users (July 2023). This will allow 30 L/s to continue to be discharged into the river during the dry season.

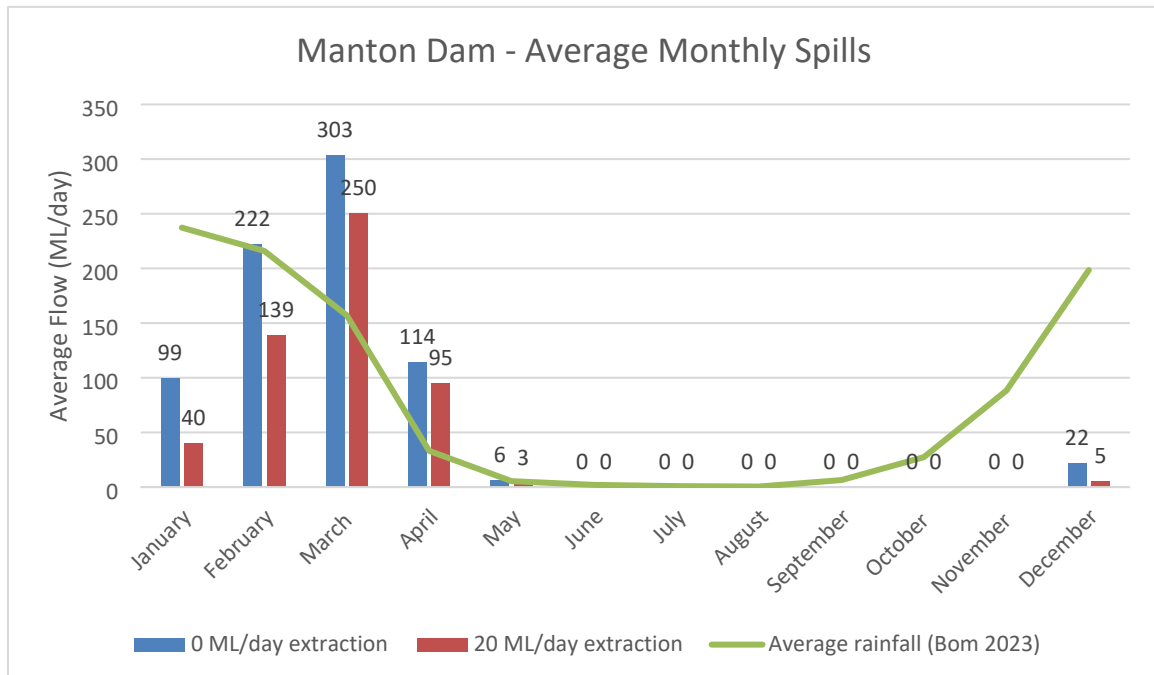


Figure 5-5. Comparison of dam wall overflow volume with and without proposed extraction

Surface water drawdown in the dam

The purpose of returning Manton Dam to service is to provide a treatable water source to supply potable water to the Darwin region. Surface water level modelling using the 20 ML/day extraction rate indicates that average annual minimum storage level will reduce to 35.20 mAHD compared to 37.41 mAHD with no extraction. A summary of the surface water level modelling is shown in Table 5-9.

Table 5-9. Comparison of surface water drawdown at Manton Dam of current levels and proposed extraction scenario (Power and Water modelling 2023)

Storage Level	No extraction	20 ML/day extraction
Full Supply level	38.17 m AHD	
Average annual drawdown level (simulated)	37.41 m AHD	35.20 mAHD
Dead Storage ⁷	28.00 mAHD	

A current surface water extraction licence will control the quantity of surface water to be extracted, limiting annual extraction to 7,300 ML/year.

⁷ Dead storage refers to the volume of water stored below the level of the lowest outlet (the minimum supply level). This water cannot be access under normal operating conditions.

5.3.3 Environmental protection and management

The following measures will be implemented to mitigate potential impacts to Hydrological processes.

Surface water extraction licence

Extraction of surface water from Manton Dam will be controlled by an existing extraction licence (No. 461) under the *Water Act*, with a maximum extraction limit of 7,300 ML/year. The licence has a requirement to provide an annual extraction report to the NTG, to maintain compliance.

Detailed designs

Detailed designs for the Strauss WTP stormwater management system and pipeline installation will be prepared by a qualified engineer and approved by Power and Water prior to the commencement of works.

Erosion and sediment control plan

An ESCP that aligns with the Best Practice Erosion and Sediment Control Guidelines (IECA, 2008) will be prepared by a Certified Practitioner as part of the CEMP. Works are to be completed mostly in the dry season to minimise impacts on water flow run off from the Strauss WTP footprint and demolition/construction upgrade areas at Manton Dam. If works are not to be completed prior to wet season, all ESCP controls to be implemented by the contractor prior to 01 October each year of construction.

Controlled discharge from Manton Dam to Manton River

Water flow downstream of the Manton Dam wall will be sustained at 30 L/s as per consultation with downstream land users. Initial vegetation mapping as discussed in Section 5.4.3 and vegetation and surface water monitoring of downstream impact will be undertaken to identify any potential changes, and adaptive management measures undertaken based on the results of the monitoring.

5.3.4 Residual impact

Assuming effective implementation of the above mitigation measures, it is concluded that the Project is unlikely to have a significant impact on the hydrological processes and the NT EPA's objective will be met.

The Project is predicted to have a moderate to low level of residual impact to surface water flows in the Project area due to compliance with the surface water extraction licence requirements, consideration of stormwater management in detailed designs of the Strauss WTP, and effective implementation of an ESCP. Controlled discharges from Manton Dam will continue at a rate of 30 L/s during the dry season and monitoring and adaptive management measures will be applied to understand and limit impacts to downstream ecosystems if required.

The potential impact of reducing surface water flows on aquatic ecosystems downstream of Manton Dam are discussed in Section 5.4.

5.4 Aquatic ecosystems

The NT EPA's objective for Aquatic Ecosystems is to:

Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

The sections below identify the aquatic ecosystems that occur within and surrounding the Project area and assess the potential impacts of the Project on these values and the NT EPA's objective.

5.4.1 Environmental values

The information for this section was sourced from the Ecological Assessment (EcOz 2023 provided as Appendix B), research paper *Habitat associations of birds at Manton Dam, Northern Territory* (Reynolds 2013) and desktop spatial database maintained by the NTG NR Maps ([available here](#)).

Threatened aquatic fauna – Manton River

Manton River is an ephemeral meandering watercourse (Stream Order 4) which flows from below Manton Dam into the Adelaide River during the wet season. The Manton River would support aquatic species typically found in ephemeral streams across the region. There are two waterholes along the river that are likely to provide refugia habitat for aquatic species during the dry season. The ecological assessment undertaken for this Project reported that there are five threatened fish within the region but concluded that there was no suitable habitat within Manton River for these species (refer to the Threatened Species Likelihood of Occurrence Analysis Table in Appendix B).

Riparian vegetation and habitat – Manton River

From aerial imagery, it is evident that along Manton River there is a small and large area of riparian vegetation – some of it likely to be rainforest – downstream of the Project area. As explained in Section 5.4.3, prior to commencement of the development, the extent and health of that vegetation will be described and mapped as a baseline to inform ongoing monitoring. Based on the assessment of threatened species' likelihood of occurrence presented in Appendix B, it can be concluded that the habitats present in the downstream riparian habitats are unlikely to support any threatened species apart from Mertens' Water Monitor (discussed in Section 5.2.1).

Aquatic biodiversity – Manton Dam

No sensitive communities or threatened species are known to occur in Manton Dam, and specifically in the water edge habitats. Manton Dam is an artificial ecosystem, the aquatic habitats include open water, water edge which includes shallow water habitats through water level alteration and riparian monsoon forest. (Reynolds 2013). The dam is used by a low abundance of waterbird species in comparison to other wetland habitats in Northern Australia (Reynolds 2013). The low abundance of species may be due to lack of suitable shallow foraging areas. The waters edge, shallow margins and embayment's of 2-3m depth, contain sub-surface, emergent and surface aquatic plants that are exposed in the dry season and become muddy flats impacted by feral pigs (Reynolds 2013). Around the extent of the dam banks riparian monsoon forests occur in various compositions, with terrestrial bird species known to use these habitats (Reynolds 2013).

The dam contains Barramundi and Saratoga for recreational fishing use, annually the NTG release Barramundi fingerlings into the dam as part of the restocking program, which began in 2004 (DITT 2023). Barramundi require saltwater to breed, and therefore cannot breed in Manton Dam as it is a freshwater source. Modelling of the current annual drawdown of surface water from intermittent releases and evaporation shows that the dam surface water level reduces on average from 38.17m AHD to 37.41 AHD.

As explained in 2.3.1, at the base of Manton Dam wall is a stilling pond, during overspill a quantity of fish from Manton Dam may spill from the dam in the Manton River.

5.4.2 Potential impacts

This section assesses potential impacts to aquatic ecosystems in Manton Dam and downstream in Manton River.

Direct mortality of aquatic fauna

Direct mortality of aquatic fauna is unlikely to occur in Manton Dam, as modelling indicates the predicted drawdown of the storage may increase, with modelling showing that the minimum annual storage level may drop by an average of 2 m (as indicated in Figure 5-6 and Table 5-9). Manton Dam will continue to contain water all year round. No threatened or significant aquatic fauna have been identified as being associated with Manton Dam or specifically the water edge habitats.

Modelling of spills from Manton Dam estimates that average annual spill volumes will be reduced by 30% due to extraction activities. This will result in less water overflowing into the stilling pond at the base of Manton Dam. It is uncertain if this will increase or reduce the quantity of fish being killed as the current fish mortality rate has not been quantified. As the dam is artificially stocked, these fish deaths from over the dam wall will not affect the natural fish populations downstream.

Habitat degradation and fragmentation

Power and Water has modelled the current annual draw down levels and extraction of 20 ML/day on surface water drawdown level in Manton Dam. As discussed above, extraction of 20 ML/day will increase the drawdown of the storage level each year, which will expose the water edge habitats for longer periods (presented in Table 5-9). Aquatic fauna associated with water edge habitats may be impacted by the additional 2 m reduction of surface water levels (note that this is based on average annual simulated drawdown levels and this will vary from year to year depending on climate conditions). The impact to water edge habitats containing aquatic plants is unlikely to be significant, as these habitats currently experience fluctuations of surface water levels during the dry season, and there are no aquatic species present that are likely to be restricted to these habitats.

Construction of the water main pipeline will require some disturbance of riparian vegetation and the stream bed and banks at several drainage lines. Section 2.3.4 describes the construction methods that will be adopted to minimise disturbance. These measures are routine for linear infrastructure projects and are expected to be effective in limiting impacts to instream habitats and water quality.

Habitat degradation and fragmentation downstream riparian vegetation

The existing extent and quality of riparian and rainforest vegetation in the Manton River is a result of highly variable rates (0 L/s – 400 L/s, with a base flow of 30-50 L/s) discharged year-round from Manton Dam. Proposed reductions in the volume of water flow downstream of the Manton Dam associated with this Project could negatively impact the extent and habitat quality of that vegetation.

5.4.3 Environmental protection and management

Surface water extraction licence

Extraction of surface water from Manton Dam will be controlled by an existing extraction licence (No. 461) under the *Water Act*, with a maximum extraction limit of 7,300 ML/year. The licence has a requirement to provide an annual extraction report to the NTG, to maintain compliance. Manton Dam will contain surface water all-year round.

Stilling pond upgrade investigation

Power and Water will engage with structural and hydraulic engineers to investigate the feasibility of upgrading the stilling pond to create an egress (i.e., channel or pipeline) from the pond to the downstream environment for the fish to be released prior to the evaporation of the pond. The investigation will consider the function of the stilling pond in reducing velocity of flows to the environment. Construction of an egress from the pond to Manton River will remove an existing impact from fish trapped in the stilling pond.

Controlled discharge from Manton Dam into Manton River

It is proposed that water flow downstream of the Manton Dam wall will be maintained at 30 L/s based on initial consultation with downstream land users, details on consultation is provided in Section 3.2. Vegetation and surface water monitoring of downstream impact will be undertaken to identify any potential changes, and adaptive management measures undertaken based on the results of the monitoring.

Monitoring of downstream riparian vegetation health

To minimise the impact of altered hydrology within Manton River to downstream riparian vegetation, the extent, diversity and health of that vegetation will be monitored using aerial / drone imagery combined with surveys of established monitoring sites. The baseline assessment will be undertaken prior to any Project works. Such impact monitoring is being undertaken for other projects in the greater Darwin region. For this Project, the objective would be to identify potential impacts as soon as possible and then adjust water discharges in response. Power and Water is committed to undertake further studies as required by the NT EPA.

5.4.4 Residual impact

It is concluded that the Project is unlikely to have a significant impact on aquatic ecosystems and the NT EPA's objective will be met. The Project is predicted to have a low level of residual impact to aquatic ecosystems. The Manton Dam is a man-made water body, and whilst it supports aquatic ecosystems, they are not particularly unique or sensitive. The dam will permanently hold water and will continue to sustain aquatic species. Due to the ephemeral characteristics of the Manton River under natural conditions, it is unlikely that the aquatic ecosystems will be significantly affected from the reduction of water flows from spills over from Manton Dam. There is currently uncertainty on the potential impact to riparian vegetation from reduction of surface water flows, which is proposed to be addressed through monitoring and adaptive management.

5.5 Community and economy

The NT EPA's objective for Community and Economy is to:

Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.

The factor was identified for further consideration in this Referral due to the Project:

- Contributing as a water source for the Darwin regional community,
- Current community recreational usage of Manton Dam
- Location of the Project to surrounding communities

5.5.1 Environmental values

The Project, approximately 75 km from Darwin at the furthest point, is largely within the Litchfield Shire municipality with the exception of Manton Dam which is in the Coomalie Shire. The Litchfield Shire incorporates large areas of dispersed rural residential, rural living and agricultural land holdings, as well as land around Ironstone and Knuckey Lagoon on the urban fringe of Darwin, Robertson Army Barracks, activity centres around Howard Springs, Coolalinga, Humpty Doo, Berry Springs and Mandorah. Within the Litchfield Shire, the Project is within the Weddell region.

The closest community to the Project is the Acacia Larrakia Community, home to approximately 32 people approximately 4.5 km east of Manton Dam, situated on the Manton River (BushTel 2022). There are a number of residential properties to the south and east of the proposed Strauss WTP, the closest approximately 500 m away.

Manton Dam is a popular recreational site for activities including boating, water sports and fishing. Recreational users of Manton Dam include a large variety of people. In March 2022, the NTG announced that future recreational activities will continue once the dam is returned to service as a drinking supply water source. Access to Manton Dam for recreational use will be restricted intermittently when the dam returns to service, refer to Section 5.5.2 for further information.

The pipeline and fibre optic easements traverse a route that intersects a number of freehold properties and is less than 100 m from several residential and commercial properties along the route, however largely the easement is surrounded by native bushland. The easements cross the Stuart Highway and Alice Springs Darwin Railway at differing locations. Both are the major north-south routes through Australia and are major transport corridors servicing tourism and freight movements, as well as private commuter and commercial vehicles.

5.5.2 Potential impacts

A screening level assessment of potential social impacts (positive and negative) was undertaken using the screening tool and guidance provided in the New South Wales *Social Impact Assessment Guideline for State Significant Projects* (2021). The purpose of the screening assessment is to identify those impacts that are potentially significant, and therefore will require further assessment to be undertaken to ensure they are avoided and mitigated to an acceptable level, or in the case of positive impacts, work is undertaken to ensure the benefits are realised by the local community.

The following assumptions apply to this assessment:

- The project will be constructed and operated in accordance with all relevant regulatory guidelines, including those for the management of noise, dust and safety
- Stakeholders have honestly communicated any concerns based on information presented to them during consultation
- Mitigation measures identified will be implemented and effective

The potential impacts described in Table 5-10 were identified considering the issues raised during consultation, and professional judgement of the assessors informed by knowledge and experience of the social impacts that have occurred with other similar projects in the NT. The social impacts screening level assessment is provided as Appendix J.

Seven positive impacts to way of life, livelihoods and surrounds were identified with operations of Manton Dam and the Strauss WTP as a future water source.

13 negative impacts were identified, one as potentially significant, access to Manton Dam by the boat ramp for recreational activities due to its importance to the community. NTG have committed to continuing recreational activities on the dam, however modelling indicates that the extraction of water will result in the boat ramp being unusable for extended time periods in the late dry season. This is discussed further below.

Access to Manton Dam

Modelling of Manton Dam with extraction of 20 ML/day indicates that the boat ramp may not be accessible during 1 in 5 years (noting that this would likely only occur for a short duration at the end of the dry season). When assessing the impact to the number of days that the boat ramp could still be accessed, it is estimated that recreation could still occur 94% percent of the time once the storage is operational.

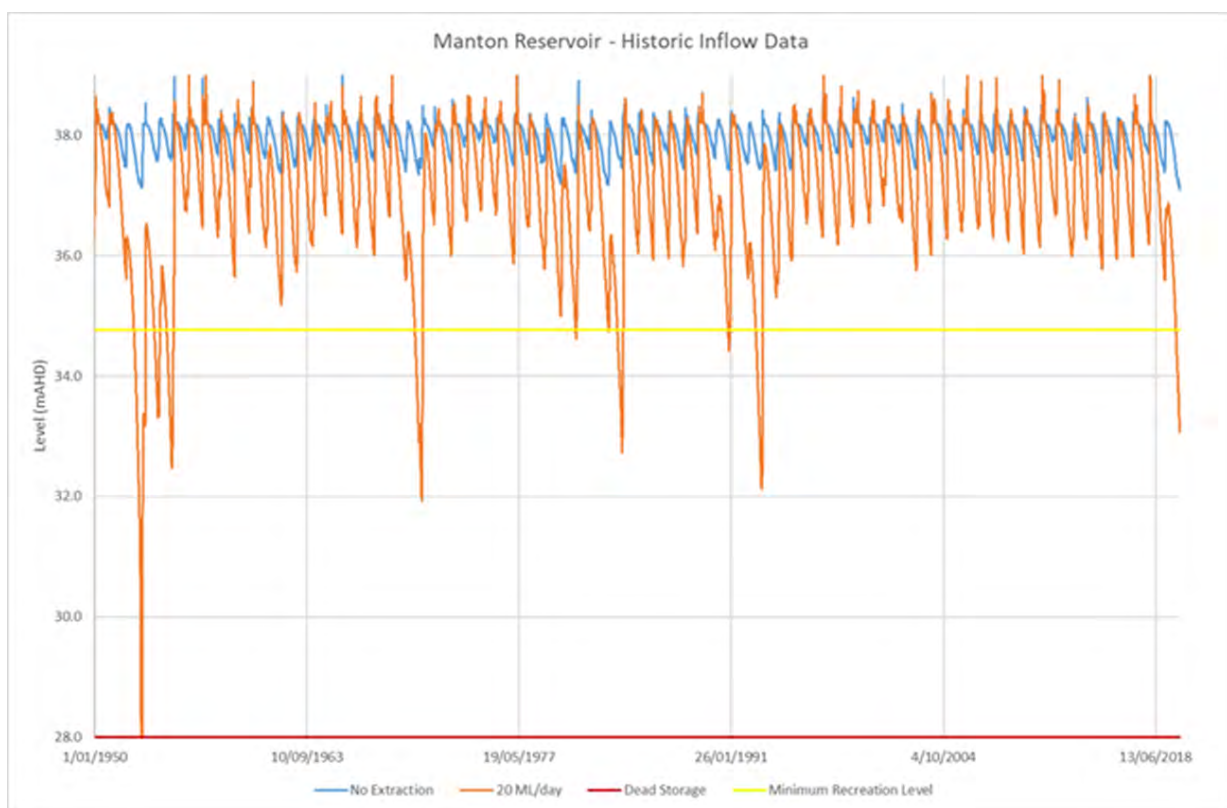


Figure 5-6. Simulated Manton Dam storage levels with and without 20 ML/day extraction (Power and Water 2023b).

Table 5-10. Potential community and economy impacts

Project activity	Description of potential impact	Category	Positive or negative	Potentially significant impact ⁸	Mitigation/enhancement measures
Construction					
Project components	Disruption to access of Manton Dam for recreational users	Way of life	Negative	No	<ul style="list-style-type: none"> • Construction Stakeholder engagement and Communication Plan • Recreational Management Plan
	Restricted access of Manton Dam heritage sites, carpark and picnic area for recreational and tourism users				
	Amenity impacts (noise and dust) to nearby residents during construction/installation of pipeline and fibre optic cable	Surroundings			<ul style="list-style-type: none"> • Construction Environmental Management Plan (CEMP), including dust suppression methods and construction noise monitoring. • Traffic Management Plan • Construction Stakeholder Engagement and Communication Plan. • Baseline noise assessment (Appendix K)
	Amenity impacts (noise and dust) to nearby residents during construction/installation and Strauss WTP				
	Local impacts to property owners as property access at seven locations will require temporary access and reinstatement of driveways				
Along the pipeline alignment private property owners will have minor inconvenience due to construction of pipeline	Access	<ul style="list-style-type: none"> • Construction Stakeholder Engagement and Communication Plan. • Access to properties will be always maintained using detours where necessary. 			

⁸ as defined by NT EPA Act 2019

Project activity	Description of potential impact	Category	Positive or negative	Potentially significant impact ⁸	Mitigation/enhancement measures
	Interaction with sacred sites and Aboriginal archaeological sites	Culture			<ul style="list-style-type: none"> CEMP include unexpected finds 'stop work' procedure Ongoing consultation Indigenous stakeholders AAPA Authority Certificate obtained (C2010/151) Archaeological assessment has been undertaken by archaeologist – recommendations provided – refer to Section 5.6
	Disturbance of WWII archaeology and heritage				<ul style="list-style-type: none"> Works Permit under the Heritage Act to move NAR infrastructure and bottles at Strauss WTP. Consultation and preliminary advice has been sought with NT Heritage Branch, refer to Appendix L Future discussions with Heritage Branch on sites to remain and sites that can be removed, as part of the Heritage Management Plan for Manton Dam being developed by Power and Water. CEMP include unexpected finds 'stop work' procedure. Archaeological assessment has been undertaken by archaeologist – recommendations provided – refer to Section 5.6
	Biting insects impact to construction workers at Manton Dam	Health and wellbeing			<ul style="list-style-type: none"> CEMP include Biting Insect Management Plan, including both site-wide management and personal protective equipment
	Increased employment opportunities	Livelihoods	Positive	No	<ul style="list-style-type: none"> Preparation of a local procurement strategy to maximise local benefits.
Operation					
	Lowering of dam levels from extraction making the boat ramp in accessible for short periods in the late dry season in some years	Way of life	Negative	No	<ul style="list-style-type: none"> Implementation of a Recreational Management Plan, including notification of boat ramp inaccessibility procedure

Project activity	Description of potential impact	Category	Positive or negative	Potentially significant impact ⁸	Mitigation/enhancement measures
	Exposure of objects in Manton Dam increasing risk of collision with objects	Way of life	Negative	No	<ul style="list-style-type: none"> Recreational Management Plan will outline the requirement to notify recreational users when water levels have dropped below safe and accessible levels in parts of the dam. The potential exposed objects have been surveyed and will be detailed in the management plan. Signage has been historically used to alert recreational users and will continue to be used.
	Restricted access of Manton Dam heritage sites, carpark and picnic area for recreational and tourism users	Community	Negative	No	<ul style="list-style-type: none"> Consultation with recreational users to inform the restricted public access to the area during operations will be undertaken through Stakeholder Engagement and Communication Plan and identified in the Recreational Management Plan. Planning is in place to secure and preserve the heritage assets and in the future make them available to the public through potential initiatives including periodic public open days and guided tours.
	Quality of water for drinking with recreational use continuing	Health and wellbeing	Negative	No	<ul style="list-style-type: none"> The Strauss WTP will be operated in accordance with all relevant regulatory guidelines and abide by the <i>Australian Drinking Water Guidelines</i>.
	Amenity impacts - higher noise levels affecting residences nearby to the Strauss WTP	Surroundings	Negative	No	<ul style="list-style-type: none"> Noise management via an Operational Noise Management Plan will be implemented as part of the Operations Environmental Management Plan for the Strauss WTP. Power and Water have an online general enquires, complaints and feedback platform for processing of complaints from the community. "
	Provision of drinking water as part of the <i>Darwin Region Water Supply Strategy 2013</i> (Power and Water 2013)	Way of life	Positive	No	<ul style="list-style-type: none"> Project aligns with the <i>Territory Water Plan</i> and <i>Darwin Region Water Supply Strategy 2013</i> as the first stage in long-term water supply for urban users
	Promotes economic development and diversification in the region	Livelihoods	Positive	No	<ul style="list-style-type: none"> None considered
	Increased employment opportunities	Livelihoods	Positive	No	<ul style="list-style-type: none"> Preparation of a local procurement strategy to maximise local benefits.

Project activity	Description of potential impact	Category	Positive or negative	Potentially significant impact ⁸	Mitigation/enhancement measures
	Continuation of tourism and recreation opportunities	Livelihoods	Positive	No	<ul style="list-style-type: none"> • Planning is in place to secure and preserve the heritage assets and in the future make them available to the public through potential initiatives including periodic public open days and guided tours.
	Improved environmental, regional social and economic resilience	Surroundings	Positive	No	<ul style="list-style-type: none"> • None considered
	Increased water accessibility for use in improving/increasing agricultural output	Livelihoods	Positive	No	<ul style="list-style-type: none"> • The Northern Territory Agribusiness Strategy 2030 considers the growth of agriculture in the NT, which are highly dependent on water.

5.5.3 Environmental protection and management

The following measures will be implemented to mitigate potential impacts to the Community and economy, to as low as reasonably practicable.

Site selection

Site selection has avoided many impacts on community and economy by locating the project in a low-density area with minimal nearby residences. Utilising existing infrastructure areas at Manton Dam and the pipeline easement avoids potential impacts associated with new construction and changes to land use.

Stakeholder engagement and communication plan

A Stakeholder Engagement and Communication Plan has been produced by Power and Water to guide engagement and consultation through future stages, the Plan is provided as Appendix C. The plan will include guidance and structure regarding engagement with all stakeholders, including local residents downstream and surrounding the Project, Government departments and authorities, and relevant private corporations. Liaison with recreational groups regarding times when the dam will be closed for recreation use and any potential safety concerns will also be managed with this plan and in conjunction with the Recreational Management Plan once Manton Dam is RTS. Regular reviews of the plan will occur, and amendments actioned and approved by Power and Water.

Prior to construction commencing contractors are required to produce a Stakeholder Engagement Plan for approval by Power and Water for construction related activities.

Recreation management plan

A Recreation Management Plan is currently being developed that will outline in detail the methods to minimise the impacts to recreational users of Manton Dam. This plan is being prepared by Power and Water in conjunction with DEPWS, with DEPWS managing recreation into the future. The plan will include a set of trigger levels in order to provide recreational users with advanced warning should access to the dam be impacted. Further details on the rationale of trigger levels are provided in Appendix I. Power and Water will remain responsible for the management of the Manton River catchment.

The current management at Manton Dam for ensuring there are no collisions with objects by recreational users includes identifying and placing marker signage above or around potential hazards (which at times will be submerged), and alerting recreational users using signage located at the boat ramp. These procedures will continue to be utilised, with marker signage to be permanently installed at hazards.

Heritage Management Plan

A Heritage Management Plan for Manton Dam is being developed by Power and Water in conjunction with consultation with the Heritage Branch, further details are provided in Section 5.6.3.

Construction environment management plan

A CEMP will be prepared to mitigate potential construction-related impacts. This management plan will include provision for the following:

- Construction noise level monitoring to ensure construction activities occur in accordance with NT EPA *Noise Management Framework Guideline 2018*
- Dust suppression management
- Unexpected finds procedure for heritage values (Aboriginal and non-Aboriginal)
- AAPA authority certificate to manage and avoid impacts to Aboriginal sacred sites
- Stakeholder engagement during construction stage
- Biting insects management plan to manage impact of biting insects during works at Manton Dam

Operational Noise Management

The noise created by the proposed Strauss WTP is negligible. The loudest equipment in the plant will be the pump station that includes three pumps. The noise generated at this location is the same as several other pump stations that are located across the urban area in Darwin.

The proposed pumps will be fully encapsulated in their own building to minimise noise. It is noted the pump house will be similar (or smaller than those pump stations such as that at McMinns that are located within urban areas throughout Darwin and these pumps stations produce no noticeable noise in the area they are situated. Power and Water have received no noise complaints associated with existing pump stations in urban areas.

5.5.4 Residual impact

Assuming effective implementation of the above mitigation measures, it is concluded that the Project is unlikely to have a significant impact on the Community and Economy and the NT EPA's objective will be met.

The Project is predicted to have a moderate level of residual impact on the Community and Economy considering the effective implementation of the mitigation measures described above. The Darwin community will benefit from the Project as it will provide security around a safe drinking water source to support future needs of the region, and current recreational use of Manton Dam will be maintained.

..

5.6 Culture and Heritage

The NT EPA's objective for culture and heritage is to:

Protect culture and heritage

The sections below identify the culture and heritage values that occur within and surrounding the Project area and assess the potential impacts of the Project on these values and the NT EPA's objective.

5.6.1 Environmental values

An Archaeological Assessment (Ellengowan Enterprises 2023) was prepared using historic archaeological surveys conducted over the project area (Appendix E). The historic archaeological surveys include:

- Two surveys over the proposed Strauss WTP in 2017 and 2022 (Ellengowan Enterprises 2017 and 2023)
- A pre-disturbance assessment of the easement between Manton Dam and the Cox Peninsula Road in 2009 (Crassweller 2009)
- Two surveys of the proposed pipeline easement between Manton and the proposed Strauss WTP in November 2022 and February 2023 (Ellengowan Enterprises 2023).

An AAPA certificate, advice from consultation with the Heritage Branch and a *Cultural Heritage Management Plan for Manton Dam* (Ellengowan Enterprises 2022) has provided additional information on Aboriginal heritage and European heritage values (mainly WWII).

Aboriginal heritage features

The AAPA certificate - issued January 2023 - did not identify within the Project area or nearby any restricted works areas or sacred sites (Appendix H – redacted for Public Exhibition). Archaeological surveys undertaken have identified one low significance Aboriginal heritage value (shown as Site 3 in Figure 5-10), a stone artefact scatter, in the pipeline corridor easement, no Aboriginal heritage values were identified in the Project footprints of Manton Dam or Strauss WTP (Ellengowan Enterprises 2023).

A sacred site is known to occur downstream of Manton Dam in a large waterbody in the Manton River.

European heritage features

The European heritage features identified in archaeological surveys are WWII heritage values. The region is known for heritage values associated with WWII with the Strauss WTP surrounded by five declared sites under the *Heritage Act*. The Strauss WTP and easement do not intersect any of the declared heritage sites, as shown on Figure 5-9.

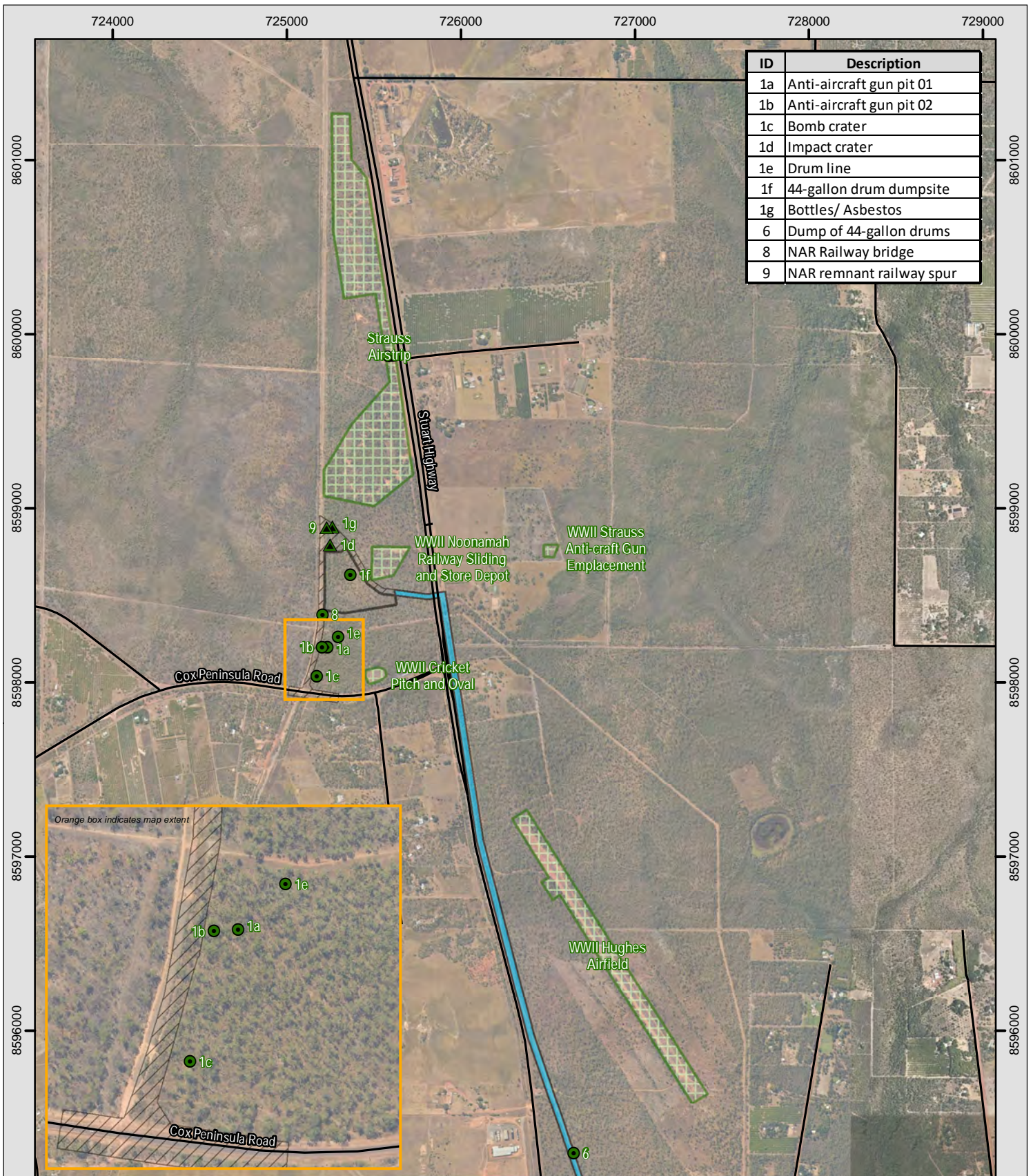
Two WWII heritage values were identified inside the Strauss WTP footprint, an impact crater potentially associated with an UXO and remnants of a Northern Australia Railway (NAR) spur (see Figure 5-7). Adjacent to the access road is a NAR bridge, which will be avoided by the development as per consultations with Heritage Branch (see Figure 5-8). Consultation with Heritage Branch identified the impact crater as a potential UXO concern, not a heritage concern. NAR infrastructure is considered an important value for the region as other NAR infrastructure are known in the surrounding environment and are connected to the surrounding declared heritage sites (Heritage Branch pers. comms., 5 July 2023).



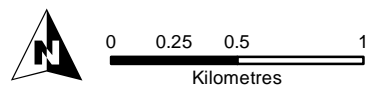
Figure 5-7. Photo of remnant NAR Spur (ID 3 in Figure 5-9)



Figure 5-8. Photos of NAR Railway Bridge (ID 8 in Figure 5-9)



- Legend**
- ▲ Heritage values
 - Heritage values - Avoided
 - ▨ Declared Heritage Areas
- Stage**
- ▬ Pipeline
 - ▨ Stage 1
 - ▭ Stage 2



MAP INFORMATION
 Scale: 1:30,000 @ A4
 Projection: GDA 1994 MGA Zone 52
 Date Saved: 15/08/2023
 Client: Power and Water
 Mapper: DC

DATA SOURCE
 Topographic data: OSM, BOM
 Project data: EcOz
 Imagery: NTLIS


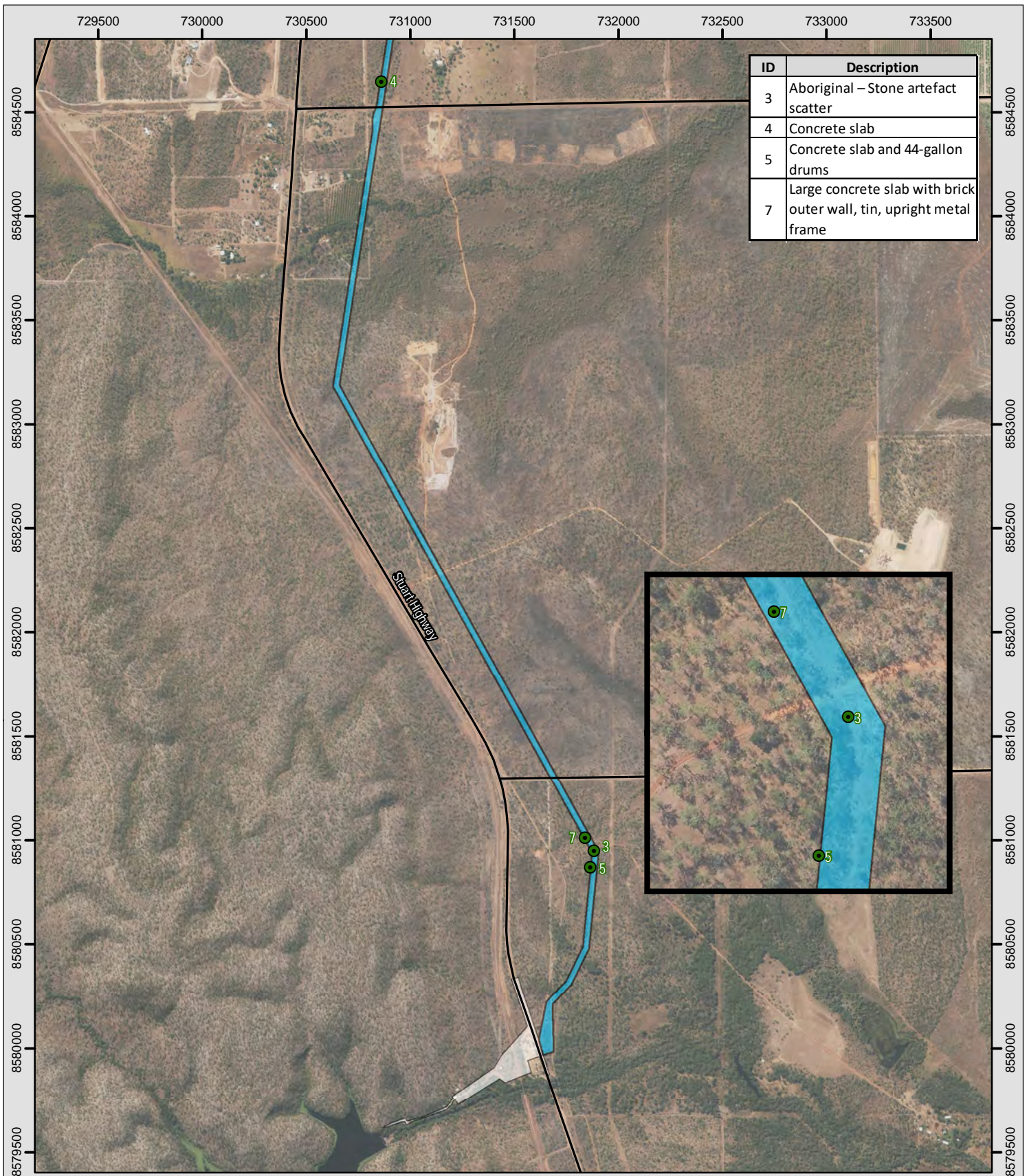


Figure 5-9. Map of heritage values at Strauss WTP



Legend

- Heritage values - Avoided

Stage

- Manton Footprint
- Pipeline

MAP INFORMATION

Scale: 1:25,000 @ A4
 Projection: GDA 1994 MGA Zone 52
 Date Saved: 15/08/2023
 Client: Power and Water
 Mapper: DC

DATA SOURCE

Topographic data: OSM, BOM
 Project data: EcOz
 Imagery: NTLIS




Figure 5-10 Map of heritage values along pipeline easement

Manton Dam heritage area

Preliminary advice by the Heritage Branch (Appendix L) suggests the Manton Dam area has culturally significant values, and *any decisions made about the future of the place should take into account the principles of the Burra Charter* (Conservation principle). Essentially there should be no removal or dramatic alteration of the Manton Dam infrastructure with heritage value, this includes the existing caretakers housing infrastructure, Pump house no.1 and no. 2 and the Stilling Pond at base of the dam. The current designs for the demolition works include the removal of low potential value assets (i.e. Caretakers garage, fuel tank) and do not interfere with any high potential heritage values identified by the Heritage Branch. Anything identified within the report as having high interpretive value will be retained and maintained.

A Manton Dam Heritage Management Plan is currently being developed for Power and Water that will ensure that high value heritage assets will be maintained.

5.6.2 Potential impacts

This section assesses potential impacts to cultural and heritage values in the Project area and downstream in Manton River. Heritage values may be impacted by the following Project actions:

- Works around the Manton Dam wall where there is an existing heritage value
- Damage to previously unrecorded archaeological objects (unexpected finds)
- During surface water extraction operations reduced surface water flows downstream where there is a sacred site.

Loss or damage to known or unknown Aboriginal sacred sites

Loss or damage to sacred sites could arise during construction, in the Strauss WTP and easement. The key pathways for this to occur are due to vegetation removal, ground disturbance and reduction of surface water flows downstream.

There is potential for construction to impact both known and unknown cultural value sites, through unintended damage or destruction of archaeological sites or objects, heritage places or cultural features. This includes both tangible heritage, such as the known features identified above, and intangible heritage, through potential impacts to connections held between the local Indigenous people and country.

Loss or damage to known or unknown archaeological sites

Loss or damage to archaeological sites could arise during construction, in the Strauss WTP and easement. The key pathways for this to occur are through vegetation removal and ground disturbance. Localised WWII heritage values are well known in the surrounding environment.

There is potential for construction to impact both known and unknown archaeological sites, through unintended damage or destruction of archaeological values, heritage places or features.

5.6.3 Environmental protection and management

The following measures will be implemented to mitigate impacts to culture and heritage values.

Authority Certificate

An AAPA certificate (C2023/044) has been obtained by Power and Water for the proposed works in the Project area. No registered sacred sites are identified in the site boundaries. Engagement with AAPA will continue throughout the Project.

Clearing plan and Pre-clearing surveys

Cultural and heritage values occur in the Project area and in the surrounding environment.

A Clearing Plan and pre-clearing survey will be conducted prior to clearing and development to clearly identify archaeological values. Such values will be flagged, fenced (if applicable) and communicated to contractors to ensure they are not accidentally disturbed. Avoidance was recommended for all cultural and heritage value sites where it was appropriate for the Project. Most sites identified on Figure 5-9 and Figure 5-10 can be avoided during vegetation and land clearing works. The NAR railway bridge located east of the access road to Strauss WTP (ID no. 8 on Figure 5-9) will be avoided and Power and Water will signpost and maintain the heritage value item into the future.

The section below discusses the heritage values that cannot be avoided that will require an application to carry out works on a heritage place or object submission to the Heritage Branch.

Consultation with the NT Heritage Branch

Consultation with the Heritage Branch has occurred pre-submission of this referral report, to introduce the Project, discuss the archaeological surveys to date and provide positive communication around the Heritage Branch's expectations and importance of the area from a heritage perspective. Further consultation will occur between Power and Water and the Heritage Branch to ensure heritage values are protected. An application to carry out works on a heritage place or object will be submitted to the Heritage Branch prior for the removal of the remnant NAR spur located inside the Strauss WTP Project area. In the event that other heritage values are identified during construction, works will cease and consultation will occur with the Heritage Branch. Additional applications may be submitted to the Heritage Branch prior to re-commencement works.

Consultation with Traditional Owners

A sacred site downstream of Manton Dam wall in a large waterbody in Manton River has been identified. Power and Water are currently undertaking consultations AAPA to ensure the nominated site is not affected by proposed changes to the downstream discharge. Ongoing consultation will occur for the duration of the Project development.

Construction Environmental Management Plan

A CEMP will be prepared prior to the commencement of vegetation clearing and construction. The CEMP will provide all heritage values to be avoided and maintained. An unexpected finds procedure will be in place in the event of identification of potential heritage or cultural values. In the event that an unexpected find is uncovered all works in the immediate area will cease and adaptive management measures that will be undertaken based on consultation with the relevant regulator (i.e., Heritage Branch, AAPA etc).

Manton Dam Heritage Management Plan

A site-specific Heritage Management Plan is being prepared by GHD to identify high value heritage assets for Power and Water. The purpose of the Heritage Management Plan is to manage the assets and provide a process on how to maintain the values into the future. The assets will be viewed by the public on selected public open days.

Downstream riparian vegetation monitoring

As discussed in Section 5.4.3 the Project has sought to minimise impacts by ensuring any changes to flows downstream of Manton Dam do not impact on any riparian vegetation, including the vegetation present at the known sacred site. Water flows downstream of the Manton Dam wall will remain consistent at approximately 30 L/s after consultation with downstream property owners. Retainment of flows allows water flow downstream to continue and will assist in minimising the impacts on the downstream riparian vegetation. It is assumed that the riparian vegetation is important to the TO's in retaining the value of the sacred site.

Section 5.4.3 discusses the monitoring that will be undertaken of riparian vegetation in the Manton River and at Manton Dam, and the adaptive management measures that will be undertaken based on the results of the monitoring. Adaptive management will include consultation with TO's if required.

5.6.4 Residual impact

Assuming effective implementation of the above mitigation measures, it is concluded that the Project is unlikely to have a significant impact on the culture and heritage and the NT EPA's objective will be met.

Considering implementation of the above mentioned mitigation and avoidance measures, the Project is likely to have a low level of residual impact on culture and heritage values in the Project area and the connection of the values in the surrounding environment. During construction, transparent communication to regulatory bodies and construction contractors, clear identification and avoidance of known cultural and heritage values and the implementation of an unexpected finds procedure reduces the likelihood of potential impacts to cultural and heritage values.

During operations the implementation of a Heritage Management Plan at Manton Dam will allow heritage values at Manton Dam specifically to be protected and maintained during operations. As for the potential impacts downstream of Manton Dam at the known sacred site, these will be monitored through riparian vegetation monitoring and adaptive management measure will be undertaken based on the results of the monitoring. The adaptive management will include consultation with TO's if required.

6 CUMULATIVE IMPACTS

Cumulative impacts, as defined by the NT EPA (2021) are:

“impacts that can accumulate as a result of additive or interactive processes and actions, interactions among multiple management measures (past, present and future), a combination of multiple minor impacts over time, and activities conducted over a wider area than the proposed action, such as the activities of multiple projects operating in a region.”

The purpose of considering cumulative impacts is to determine whether environmental values could be at risk from impacts from multiple past, present, and future projects/activities, that are not apparent when the impact of the Manton RTS project are considered in isolation.

6.1 Environmental factors

It is relevant to consider cumulative impacts for those factors predicted to experience a moderate or high level of residual impact from the Manton RTS Project. As documented in Table 5-2, these are:

- Terrestrial ecosystems
- Hydrological processes
- Community and economy.

All other factors are predicted to experience a low level of residual impact from the Manton RTS project, and therefore cumulative impacts were not further considered.

6.2 Relevant projects

For each of the above factors, existing or planned projects that could contribute to cumulative impacts were identified from publicly available information.

For the Terrestrial ecosystems factor it is relevant to consider the future stages of the Strauss WTP, the Adelaide River Off stream Water Storage (AROWS) and other projects that will involve land clearing in the greater Darwin region.

For the Hydrological processes factor it is relevant to consider the AROWS Project as it is in the same catchment as the Manton Dam RTS Project, the Adelaide River catchment.

For the community and economy factor, there were no other projects identified that are likely to contribute to cumulative impacts. The residual impacts to this factor from the Manton RTS Project are associated with the potential for periodic restrictions on the recreational use of Manton Dam due to lowering of water levels in the late dry season in some years. There are no other projects that would exacerbate this impact and therefore cumulative impacts to the Community and economy factor are not further assessed.

6.2.1 Adelaide River Off-stream Water Storage

Manton Dam RTS is part of a larger long-term water supply initiative by the NTG, including the development of the AROWS project, as discussed in Section 1.2. The AROWS Project involves construction of an off-stream reservoir (AROWS reservoir) located to the west of the Adelaide River approximately 45 km downstream of the Adelaide River township and 25 km upstream from the Arnhem Highway. The AROWS reservoir would be located about 5 km north of Lake Bennett, next to the Adelaide River on Wulna Country, and is approximately 4 km east of Manton Dam. The AROWS reservoir will be filled by pumping water from an intake on the Adelaide River during the wet season and transferring the water to the reservoir.

The AROWS Project is relevant to consideration of cumulative impacts because:

- The Project will require construction of Stage 2 of the Strauss WTP, which will further reduce the availability of habitat for threatened species that utilise the area.
- The Project will involve habitat loss associated with flooding the reservoir and construction of pumping infrastructure and pipelines.
- Both AROWS and the Manton Dam RTS involve extraction of surface water in the Adelaide River catchment.

6.2.2 Other projects in the Greater Darwin region

There are numerous projects proposed in the Greater Darwin region that will involve significant land clearing. These include the Middle Arm Sustainable Development Precinct, Australia-Asia Power-Link Project, several solar farms, new residential areas, and roads. These projects will cumulatively reduce habitat availability for threatened species that are already under pressure from habitat loss due to the proximity to Darwin.

6.3 Assessment of potential impacts

The sections below describe potential cumulative impacts to Terrestrial ecosystems and Hydrological processes from the Manton Dam RTS Project, AROWS and other projects combined.

Terrestrial ecosystems

The Manton RTS Project will result in loss of a small area of Eucalyptus woodland old-growth vegetation that is likely to be used by threatened species. Whilst this localised loss is considered unlikely to have a significant impact on any species, the above-mentioned projects will further contribute to loss and fragmentation of these habitat types. These habitat types are still widespread in the Darwin region but are declining as the city expands because they generally occur on land that is also most suitable for development. Cumulative impacts to threatened species from development across the Greater Darwin region have potential to be significant; however, the contribution of the Manton Dam RTS Project to this impact is minimal as the Project is mainly located in previously disturbed areas.

The Manton RTS Project involves construction of Stage 1 of the Strauss WTP, which will impact individuals of the threatened plant species *Typhonium praetermissum* and *Cycas armstrongii*. These impacts to individual plants are not considered significant; however, it is noted that further losses could occur when Stage 2 of the Strauss WTP is built as part of the AROWS Project. Cumulative impacts to *Cycas armstrongii* are unlikely to be significant as the plants are scattered, and no high-density patches were recorded. Surveys undertaken in the Stage 2 footprint did identify a population of *Typhonium praetermissum*; however, Power and Water have confirmed that there is sufficient land area available to expand the WTP without impacting the population.

The impact of cumulative habitat loss in the Greater Darwin region is an issue that is being worked on by the Department of Environment, Parks, and Water Security (DEPAWS).

Hydrological processes

Pumping water from Manton Dam is predicted to reduce downstream flows in the Manton River during the wet season by 30% over current conditions, noting that these conditions are already altered from natural conditions by the presence of the dam. The Manton River is part of the Adelaide River catchment and flows into the Adelaide River approximately 13 km downstream of Manton Dam. The mouth of Manton River is downstream of the proposed AROWS reservoir and therefore, both projects will contribute to reducing flows in the Adelaide River.

The potential for cumulative impacts to the river have been recognised and the NT Government is preparing a Water Allocation Plan (WAP) under the *Water Act*. The WAP will take into consideration the existing Manton Dam extraction licence when assessing the available water for the AROWS project.

7 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

There are nine Matters of National Environmental Significance protected under the *EPBC Act*:

- World Heritage properties
- National Heritage places
- Wetlands of international importance (listed under the Ramsar Convention)
- Listed threatened species and ecological communities
- Migratory species protected under international agreements
- Commonwealth Marine Areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mines)
- A water resource, in relation to coal seam gas development and large coal mining development.

The only MNES relevant to this Project is listed threatened species. The ecological assessment for this project (Appendix B) performed a likelihood of occurrence for threatened species and concluded that:

- For federally listed aquatic species there was no suitable habitat across the Project
- For federally listed terrestrial species there was the possibility of two currently listed species (the Northern Brushtail Possum and the Partridge Pigeon) and one species currently under assessment to occur within the Project Area (Mertens' Water Monitor). Field surveys found one of these species immediately to the west of the Strauss WTP boundary, the Northern Brushtail Possum but concluded that the other species may also use the area even temporarily.

The Mertens' Water Monitor has the likelihood to occur downstream of the Project area in riparian vegetation in the Manton River. The potential impacts are unlikely providing changes to flows into Manton River do not significantly affect downstream riverine habitat. Downstream monitoring of riparian vegetation and adaptive management measures are discussed in Section 5.4.3.

It is unlikely that the project will have a significant impact on threatened species under the *EPBC Act*. The Project is likely to have a low level of residual impact due to the small scale localised clearing subject to the Project area and the assumption that the implementation of mitigation, avoidance and adaptive management measures discussed in Section 5.2.3 will be effective.

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APPENDIX A PROJECT LOCATION PROPERTY INFORMATION

*R = Rural; MZ = Multi Zone

Project component	Address	Suburb	Division	Parcel number	Owner category	Tenure	Town planning zone*
Manton Dam	4680 Stuart Highway	Darwin River Dam	NT Portion	NT Por 3837	Private	Freehold	No Zone
Manton Dam	4760 Stuart Highway	Darwin River Dam	NT Portion	NT Por 4002	Private	Crown Lease Term	No Zone
Pipeline	110 Acacia Gap Road	Acacia Hills	Hundred of Colton	Sec. 1579	Northern Territory Government	Vacant Crown Land	R
Pipeline	295 Colton Road	Acacia Hills	Hundred of Cavenagh	Sec. 1514	Private	Freehold	R
Pipeline	65 Byers Road	Manton	Hundred of Colton	Sec. 1003	Northern Territory Government	Vacant Crown Land	R
Pipeline	3785 Stuart Highway	Acacia Hills	Hundred of Colton	Lot 6	Private	Freehold	R
Pipeline	3735 Stuart Highway	Acacia Hills	Hundred of Colton	Lot 8	Private	Freehold	R
Pipeline	3595 Stuart Highway	Acacia Hills	Hundred of Colton	Sec. 242	Northern Territory Government	Vacant Crown Land	R
Pipeline	60 Colton Road	Acacia Hills	Hundred of Colton	Sec. 1520	Private	Freehold	R
Pipeline	2150 Stuart Highway	Noonamah	Hundred of Strangways	Sec. 418	Northern Territory Government	Vacant Crown Land	MZ
Pipeline	2245 Stuart Highway	Hughes	Hundred of Strangways	Sec. 4578	Private	Freehold	MZ
Pipeline	42 Townend Road	Acacia Hills	Hundred of Strangways	Sec. 4806	Private	Freehold	R
Pipeline	89 Affleck Road	Acacia Hills	Hundred of Strangways	Sec. 4809	Private	Freehold	R
Pipeline	159 Affleck Road	Acacia Hills	Hundred of Strangways	Sec. 4812	Private	Freehold	R
Pipeline	60 Byers Road	Manton	Hundred of Colton	Sec. 204	Private	Freehold	R

Project component	Address	Suburb	Division	Parcel number	Owner category	Tenure	Town planning zone*
Pipeline	195 Leonino Road	Acacia Hills	Hundred of Colton	Sec. 1595	Private	Freehold	R
Pipeline	80 Colton Road	Acacia Hills	Hundred of Colton	Sec. 1546	Northern Territory Government	Reserve	R
Pipeline	0 Walter Road	Acacia Hills	Hundred of Colton	Sec. 1767	Private	Freehold	R
Pipeline	139 Affleck Road	Acacia Hills	Hundred of Strangways	Sec. 4811	Private	Freehold	R
Pipeline	63 Affleck Road	Acacia Hills	Hundred of Strangways	Sec. 4808	Private	Freehold	R
Pipeline	115 Affleck Road	Acacia Hills	Hundred of Strangways	Sec. 4810	Private	Freehold	R
Pipeline	2645 Stuart Highway	Acacia Hills	Hundred of Strangways	Sec. 2900	Northern Territory Government	Vacant Crown Land	R
Pipeline	5 Byers Road	Acacia Hills	Hundred of Colton	Sec. 1004	Northern Territory Government	Vacant Crown Land	R
Pipeline	2815 Stuart Highway	Acacia Hills	Hundred of Cavenagh	Sec. 2354	Private	Freehold	R
Pipeline	70 Acacia Gap Road	Acacia Hills	Hundred of Colton	Sec. 219	Northern Territory Government	Vacant Crown Land	R
Pipeline	75 Acacia Gap Road	Acacia Hills	Hundred of Colton	Sec. 230	Private	Freehold	R
Pipeline	3405 Stuart Highway	Acacia Hills	Hundred of Colton	Sec. 1703	Local Government Council - Litchfield	Freehold	R
Pipeline	3765 Stuart Highway	Acacia Hills	Hundred of Colton	Lot 7	Private	Freehold	R
Strauss WTP	2150 Stuart Highway	Noonamah	Hundred of Strangways	Sec. 418	Northern Territory Government	Vacant Crown Land	MZ
Strauss WTP	1910 Stuart Highway	Noonamah	Hundred of Strangways	Sec. 2929	Northern Territory Government	Vacant Crown Land	MZ
Strauss WTP	83 Cox Peninsula Road	Berry Springs	Hundred of Strangways	Sec. 2930	Northern Territory Government	Vacant Crown Land	MZ

APPENDIX B ECOLOGICAL ASSESSMENT

APPENDIX C STAKEHOLDER ENGAGEMENT AND COMMUNICATIONS PLAN

APPENDIX D GHG ASSESSMENT

APPENDIX E ARCHAEOLOGICAL ASSESSMENT REPORT

APPENDIX F REGULATORY REQUIREMENTS AND APPROVALS REGISTER

APPENDIX G PRE-REFERRAL SCREENING OUTCOMES

APPENDIX H AAPA CERTIFICATE (C2010/151) (REDACTED)

APPENDIX I HYDROLOGICAL MODELLING REPORT (POWER AND WATER 2023B)

APPENDIX J SOCIAL IMPACT SCREENING TOOL

APPENDIX K BASELINE NOISE ASSESSMENT

APPENDIX L PRELIMINARY ADVICE FROM HERITAGE BRANCH