Toorale Water Infrastructure Project – Phase 1

Review of Environmental Factors

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Abbreviations

Abbreviation	Description
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
Alluvium	Alluvium Pty Ltd
BAM	Biodiversity Assessment Methodology
BC Act	Biodiversity Conservation Act 2016
Biosis	Biosis Pty Ltd
BoM	Bureau of Meteorology
Bourke LEP	Bourke Local Environmental Plan 2012
Biosecurity Act	Biosecurity Act 2015
CEMP	Construction Environmental Management Plan
CEWO	Commonwealth Environmental Water Office
CEWH	Commonwealth Environmental Water Holder
CLM Act	Contaminated Land Management Act 1997
CNVMP	Construction Noise and Vibration Management Plan
DAWR	Department of Agriculture and Water Resources
DPI	Department of Primary Industries
ECM	Environmental Control Maps
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
ELA	Eco Logical Australia
EPA	NSW Environment Protection Authority
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Reg	Environmental Planning and Assessment Regulation 2000
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EPL	Environment Protection Licence
ESCP	Erosion and Sediment Control Plan
FM Act	Fisheries Management Act 1994
Heritage Act	Heritage Act 1977
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
JMAC	Joint Management Advisory Committee

Abbreviation	Description
JMC	Joint Management Committee
KFH	Key Fish Habitat
LEP	Local Environment Plan
LLS	Local Land Services
LTIM Project	Long-Term Intervention Monitoring Project
MDBA	Murray Darling Basin Authority
MNES	Matters of National Environmental Significance
Native Title Act	Commonwealth Native Title Act 1993
NPW Act	NSW National Parks and Wildlife Act 1974
NPW Reg	National Parks and Wildlife Regulation 2009
NPW	National Parks and Wildlife
NPWS	National Parks and Wildlife Service
NSW	New South Wales
NTAP	Nature Tourism Action Plan
OEH	New South Wales Office of Environment and Heritage
OOW	NSW Office of Water
PASS	Potential Acid Sulfate Soils
PCT	Plant Community Type
POEO Act	Protection of the Environment and Operations Act 1997
PoM	Plan of Management
RAPs	Registered Aboriginal Parties
REF	Review of Environmental Factors
RSWMP	Regional Strategic Weed Management Plan
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
SHR	State Heritage Register
Toorale	Toorale National Park and State Conservation Area
TSC Act	Threatened Species Conservation Act 1995
WALs	Water Access Licences
WM Act	Water Management Act 2000

Executive Summary

This Review of Environmental Factors (REF) has been prepared for the New South Wales (NSW) Office of Environment and Heritage (OEH) to satisfy environmental assessment and approval requirements to modify two dams at Toorale National Park and State Conservation Area (Toorale), within the Warrego River Catchment. Toorale is located approximately 65 km southwest of Bourke in north western NSW and is managed by OEH, National Parks and Wildlife Service (NPWS).

Toorale contains various water infrastructure, including dams across the Warrego River, that were initially installed as part of property improvements during the late 19th century primarily to increase floodplain watering and grazing capacity at Toorale. Since construction, the environment has naturalised in response to the water resources provided. Water management structures and practices have evolved over time to meet changing agricultural, and more recently, conservation outcomes.

Toorale water entitlements include irrigation licences, stock water entitlements and domestic water entitlements. Upon the purchase of Toorale by the NSW government, water access licences were transferred to the Commonwealth Environmental Water Holder (CEWH) including three separate licences to extract a total of 8,106 ML from the Warrego River and a high-flow area-based licences to irrigate 1,620 hectares, which was subsequently converted to a licence to extract 9,720 ML from the Warrego River at Boera Dam. The CEWH's use of its water entitlements is guided by its *Strategy for utilising Toorale Warrego River Commonwealth environmental water.*

The water entitlements are significant to Toorale because the Western Floodplain is regionally significant, supporting a range of wetland habitats, and as such a range of animals. The waterholes provided by the dams along the Warrego River within Toorale provide refuges that persist for much longer than other areas of the lower Warrego River.

An agreement between NSW and Commonwealth governments requires the NSW government to modify the infrastructure currently used for water management at Toorale to increase capacity to discharge up to 900 ML/day down the Warrego River during periods when delivery of flows to the Darling River is required to be maximised.

The Toorale Water Infrastructure Project involves modifications to four dams that have been previously constructed across the Warrego River to support former agricultural practices associated with Toorale. Phase 1 of the project proposes the following modifications to existing infrastructure:

- Reconstruct the embankment at the site of the existing breach at Homestead Dam.
- Remove the existing instream structure of Peebles Dam.

This REF is one of two REF documents that shall be prepared for the purposes of the Toorale Water Infrastructure Project.

The proponent of the project is the NSW Government acting through OEH. Under section 110 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), certain government entities are deemed to be a determining authority and it is assumed that this project shall be assessed under Part 5 of the EP&A Act. The project activities are permissible without consent under the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP).

This document identifies environmental risks associated with the project and highlights key areas where mitigation measures and/or ongoing management is required to manage these risks. Where additional approvals and permits are necessary, these have been identified.

Impact assessment concludes that there is unlikely to be a significant impact to EPBC listed MNES, and that referral is not recommended. Potential impacts against factors listed under Clause 228(2) of the EP&A Regulation are summarised below.

Water resources

The proposed modifications have a net improvement to environmental flows from the Warrego River to the Darling River. All construction works associated with the proposed modifications would have short-term impacts on the environment and would be rehabilitated following completion of construction activities. The long-term effects on water flow through the Warrego will benefit from the proposed works by providing improved connectivity along the lower end of system and with Darling River.

Impacts to longitudinal connectivity and fish passage at Homestead Dam are short term. The long term Toorale Water Infrastructure Project will remove some of the impacts created by the short-term proposal.

Amenity

Short term and minimal adverse impacts to air quality, traffic and water resources would be limited to the construction stage and would be managed through the preparation and implementation of a Construction Environmental Management Plan (CEMP) and environmental safeguards.

There would be minor aesthetic impacts during construction. These impacts would be temporary for the duration of the works. The proposed modifications will not have any long-term impacts that reduce an aesthetic, recreational, scientific or other environmental quality or value of the locality.

Risks of pollution to the environment would be minimal. The potential for water pollution, erosion and contamination to land exist but would be minimal and avoided with the safeguards and mitigation measures in the REF and CEMP.

Biodiversity

The proposed works would not result in the endangering of any species of animal, plant or other form of life, nor result in any significant adverse impacts on the ecosystem of the locality.

The proposed modifications at Peebles Dam will result in some insignificant impacts to local vegetation within the development footprint, however, will improve the delivery of environmental flows and fish passage, hence provide benefits to the ecosystem within the Warrego and Darling Rivers.

Changes to flooding patterns may result in decreased inundation within Ross Billabong, however, these changes will represent a more natural flooding regime and enable improved connection between Ross Billabong and the Darling River.

Increased retention of water at Homestead Dam is likely to provide increased instream habitat and drought refugia relative to the currently breached arrangement, however, fish passage will be temporarily reduced relative to current conditions. This will be further rectified following implementation of Phase 2 of the Toorale Water Infrastructure Project which will incorporate a fishway in the works.

There are no significant negative impacts on habitat for protected fauna. Rather, the proposed works at Homestead Dam will result in improved habitat/refugia conditions for aquatic and terrestrial fauna.

In addition, the removal of Peebles Dam shall allow for improved longitudinal connectivity and fish migration between the Warrego River and the Darling River.

If any impacts are identified during the construction phase, these can be readily managed through the implementation of the mitigation measures.

Heritage

Adoption and implementation of the mitigation measures will allow for any impacts to Aboriginal heritage items to be managed.

No direct impacts from the proposed modifications to non-indigenous heritage are anticipated at Homestead Dam.

Indirect outcomes include:

- Improved cultural outcomes for the Aboriginal community that wish to see the dam reinstated
- Enhanced environmental and aesthetic outcomes that are consistent with historic values at the Homestead Precinct;

The proposed development involves direct impacts to Peebles Dam however these impacts will be minimised by appropriate mitigation measures.

Waste

Infrastructure at Peebles Dam will be reused by NPWS staff and embankment material from Peebles Dam will be reused on Homestead Dam and/or returned to original borrow pits. Any additional waste generated during construction will be disposed of at a licenced waste facility. Where possible waste generated would be reused and recycled.

All materials required for the proposed works are available and are not currently or likely to be in short supply.

Cumulative Impacts

Cumulative impacts of the current proposal are anticipated to be minor but positive. The impacts associated with the proposed dam works would be short term during the construction phase.

Mitigation measures as detailed in the REF will ameliorate or minimise any expected impacts to acceptable levels.

The REF concludes that construction and operation of Phase 1 works are unlikely to result in a significant adverse environmental impact. The proposed development does not result in negative permanent change to the environment. Any low or medium impacts are short term in nature (during the construction stage) and long-term arrangements of the two dams are considered to provide a net positive impact upon the environment. The proposed development is unlikely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the BC Act or FM Act and therefore a SIS or EIS is not required. Furthermore, the proposed development is unlikely to affect Commonwealth land or have an impact on MNES and does not require referral to the Federal Minister for the Environment.

1 Introduction

1.1 Project overview

1.1.1 Toorale Water Infrastructure Project

As part of an existing agreement between the NSW and Commonwealth governments, the Toorale Water Infrastructure Project proposes to decommission and modify existing water management infrastructure within the Toorale National Park and State Conservation Area (Toorale) which is located to the south-west of Bourke in north-western NSW (Figure 1). The purpose of this project is to enable greater water flow capacity through the lower reaches of the Warrego River and into the Darling River for downstream environmental and cultural benefits, while at the same time protecting and maintaining the environmental values currently present at Toorale.

Toorale was purchased by the New South Wales (NSW) and Commonwealth governments in 2008 to secure the water entitlements held by the property (14 GL) and ensure protection and ongoing management of the significant environmental, Aboriginal and historical cultural values associated with the property. Day to day management of Toorale is undertaken by the NSW National Parks and Wildlife Service (NPWS). Water entitlements for Toorale were transferred to the Commonwealth government and are now administered by the Commonwealth Environmental Water Holder (CEWH) in consultation with NPWS.

The Toorale Water Infrastructure Project involves modifications to four dams that have been previously constructed across the Warrego River to support former agricultural practices associated with Toorale. These dams were initially installed as part of property improvements during the late 19th century primarily to increase floodplain watering and grazing capacity at Toorale. Since construction the environment has naturalised in response to the water resources provided. Water management structures and practices have evolved over time to meet changing agricultural, and more recently, conservation outcomes.

1.1.2 Phase 1 Works

The NSW Office of Environment and Heritage (OEH) is managing the Toorale Water Infrastructure Project on behalf of the Commonwealth government to achieve outcomes sought by both the NSW and Commonwealth governments. Within the broader Toorale Water Infrastructure Project, decommissioning works at Peebles Dam and maintenance/repair work at Homestead Dam (Phase 1 works) have been prioritised and form the basis of this Review of Environmental Factors (REF).

The works at Homestead Dam involve the partial re-instatement of the previously breached structure consistent with an existing works approval for the structure. These proposed works are an interim measure pending the full implementation of the Toorale Water Infrastructure Project. The proposed decommissioning works at Peebles Dam are in full accordance with the outcomes of Toorale Water Infrastructure Project.

This REF has been prepared to allow OEH, as the proponent and determining authority, to evaluate potential environmental impacts and provide statutory approval for Phase 1 Works. The works proposed under this REF are described in Section 2 of this REF.

1.2 Project location

Toorale is located on the junction of the Warrego and Darling Rivers, approximately 60 km south-west of Bourke, in the Western Division of NSW (Figure 1). Toorale encompasses a combined area of approximately 85,251 ha. According to the Köeppen climate classification system, which uses native

vegetation cover as a representation of local climate, Toorale experiences a Grassland (semi-arid) climate (BoM, 2016). Typical conditions are hot summers and cold to mild winters with relatively uniform rainfall across the year, with drier months occurring between August and October (BoM, 2016; Alluvium, 2016).

The closest automatic weather station (AWS) with full climate statistics available is Bourke Airport AWS (station 048245) approximately 60 kilometres north east of Toorale. Bourke has an annual average rainfall of 305.6 mm, an average maximum temperature of 28.2°C, and an average minimum temperature of 13.4°C (BoM 2018a). Mean daily evaporation (mm) is not available at Bourke Airport AWS, however data from Cobar Meteorological Office has been included (BoM, 2018b). High summer temperatures, over 40°C, are regularly experienced in the area. Other weather stations that collect rainfall data only indicate that the average annual rainfall for the area is between 282.5 mm and 338 mm (Fords Bridge and Louth) (BoM, 2018c; BoM, 2018d).

Summary climate statistics for Bourke Airport AWS are provided in Table 1.

Table 1: Summary climate statistics for Bourke Airport AWS (BoM, 2018a; BoM, 2018b)

Month	Mean Temp		Mean monthly rainfall (mm)	Mean number of days of rain (>1 mm)	Mean Wind Speed		Mean Daily Evaporation (mm)[#]
	Min	Max			9 am	3 pm	
January	22.4	37.3	31.1	3.1	19.3	16.4	11.4
February	21.8	35.8	31.4	3	18.1	16.5	10
March	18.6	32.8	38.2	3.2	16.6	15.6	8
April	13.3	28	23.2	2.1	15.3	14.5	5.3
May	8.4	22.8	25	2.6	12.1	13.6	3.1
June	6.1	18.8	32.9	4	11.8	14.2	2.1
July	4.2	18.5	13.6	2	11.2	14.1	2.3
August	5	21.3	12.4	1.9	14	16.3	3.4
September	9.3	25.7	18.6	2.3	17.1	16.2	5.4
October	13.8	29.8	23.7	3	17.9	17.4	7.5
November	17.4	32.8	38.3	4.1	18.3	17.3	9.4
December	20.4	35.4	36.1	2.9	18.6	17.1	11.1
Annual	13.4	28.2	305.6	34.2	15.9	15.8	6.6

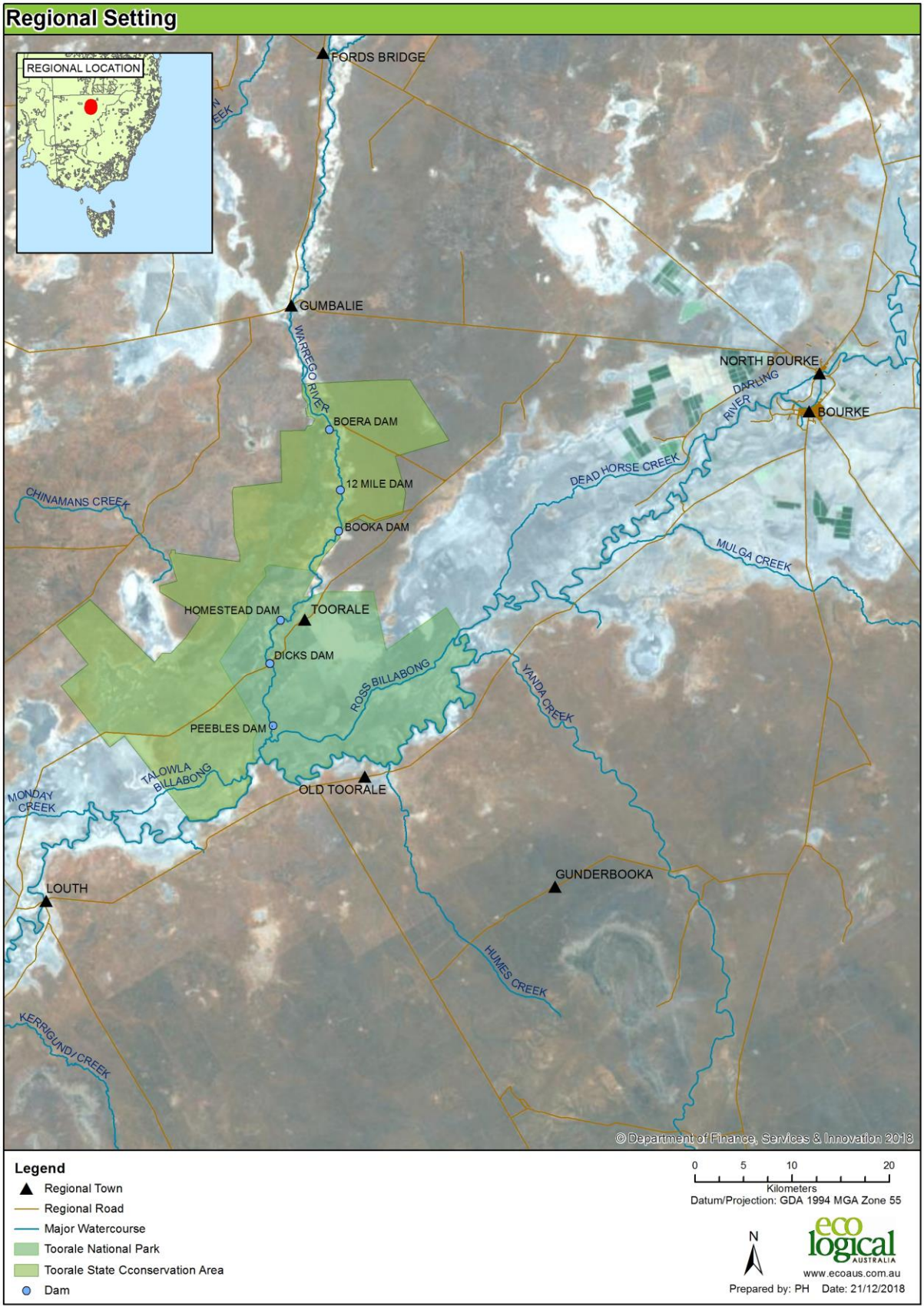

Figure 1: Regional setting

1.3 Land use and ownership

Toorale is owned by the NSW Government and managed by NPWS. Toorale is managed in accordance with the draft Plan of Management (PoM; OEH 2018a), which is implemented in accordance with the NSW *National Parks and Wildlife Act 1974* (NPW Act).

Prior to the NSW Government purchasing the property in 2008, Toorale was owned by Clyde Agriculture. The NSW Government was able to purchase the property with financial support from the Commonwealth Government. The property was purchased because of its outstanding natural and cultural values, the unique contribution Toorale would make to the national Reserve System, and to secure the property's extensive water entitlements, which were at the time tied to land ownership (OEH, 2018a).

1.4 Water Management

At the time of purchase, in addition to the existing water management infrastructure that allowed water to be diverted from the Warrego River onto the Western Floodplain for enhanced pasture production, Toorale also held approvals and infrastructure to irrigate 2,064 ha of cropped land from water entitlements held for both the Darling and Warrego Rivers.

Since its addition to the NSW reserve system, the now Commonwealth-held water is used to achieve environmental benefits both on and downstream of Toorale. Management of water entitlements held for the Darling River is relatively straightforward, however, the infrastructure used to harvest water from the Warrego River is more complex and includes management of embankments constructed across the Warrego River to capture and divert flow. These embankments (referred to as dams) were initially installed during the 1880s and have been the subject of numerous modifications, failures, rebuilds and upgrades.

These historic embankments (dams) remain largely in place across the Warrego River and impact on the flow of water through the Warrego River system and into the Darling River, which has resulted in the establishment of water bodies and floodplain wetlands with important ecological, cultural and social values. The location of the existing dam embankments within the Warrego River is provided in Figure 2.

In 2016, a business case for the Toorale Water Infrastructure Project was developed by Alluvium Consulting Pty Ltd (Alluvium) which identified and assessed options to modify the existing water infrastructure at Toorale with the objective to protect and maintain its environmental values, while enabling greater capacity to divert flow through the Warrego River to the Darling River (Alluvium, 2016). The business case included:

- Technical investigations, field studies and on-site consultation;
- Identification of ecological, social and cultural values, fish passage requirements, and water delivery requirements to be protected and/or enhanced through the project;
- Infrastructure modifications required to support the integrated delivery of environmental water to achieve desired objectives, improved fish passage and the passing of water through the site (including conceptual designs); and
- An estimate of the costs necessary to implement the project, including for regulatory planning assessment and approval, detailed design, construction, operation and maintenance, including an appropriate contingency.

As part of the business case, consultation regarding objectives and development options has been undertaken with key government agencies, the Toorale Joint Management Committee (JMC; representing the Aboriginal co-management of Toorale) and community stakeholders, as described in Section 3.

More recently, Alluvium were engaged by NSW OEH to complete the Survey and Design component of this project. This work has three main phases:

- Site investigations and survey;
- Functional design; and
- Detailed design.

Site investigation and survey for the design phase was undertaken between February – March 2018 and included site inspections (20-22 February 2018), geotechnical sampling and assessment and topographical survey. A Project Design Working Group met on four occasions during 2018 to develop and refine functional designs for the four dam sites. The functional design has formed the basis of this environmental assessment.

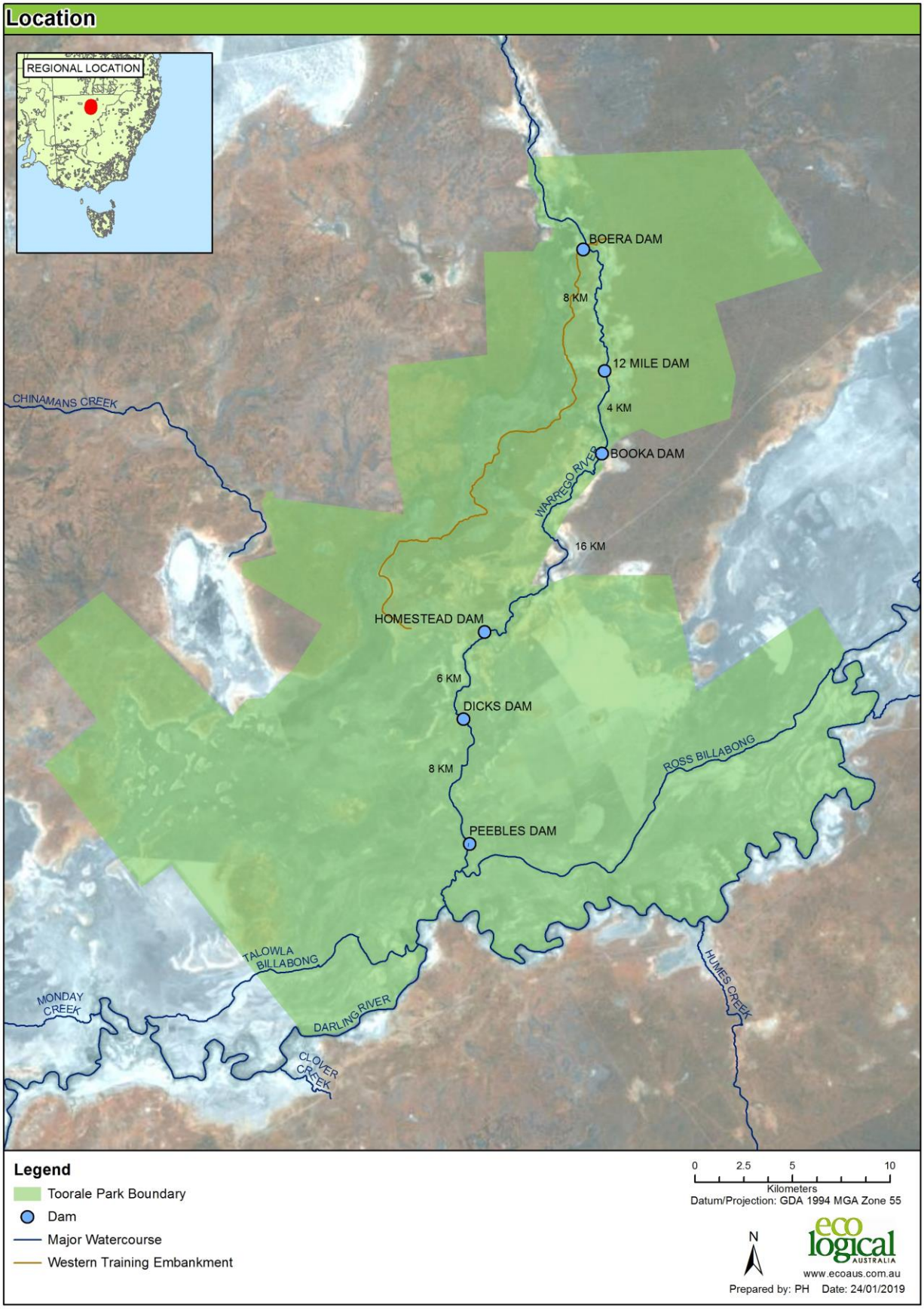

Figure 2: Existing water infrastructure and distance (km) between each

1.4.1 Existing Infrastructure

Toorale water management infrastructure has been developed historically (dating back to the 1880s) primarily to facilitate floodplain irrigation and pasture development across the property. This infrastructure has been modified in an ongoing manner since this time in response to agricultural growth as well as in response to structural failures during flood events (Jill Sheppard Heritage Consultants, 2013).

Major water management infrastructure at Toorale includes:

- Boera Dam: An embankment across the Warrego River that distributes flow to the Western Floodplain and serves as a Stock and Domestic water supply for Toorale and adjoining properties;
- 12 Mile Dam: An embankment across the Warrego River between Boera and Booka dams, currently breached;
- Booka Dam: An embankment across the Warrego River near Booka Station, historically providing Stock and Domestic supplies for Toorale and Booka Station;
- Homestead Dam: An embankment across the Warrego River providing Stock and Domestic water supply for the Toorale Homestead. Homestead Dam is currently breached;
- Dicks Dam: A causeway on the public Toorale-Louth Road across the Warrego River that bisects the Toorale National Park;
- Peebles Dam including Duncan's Wall and Darling River levees: An embankment across the Warrego River with accompanying infrastructure and storage (Ross Billabong) that was used to divert and store water for irrigation sourced from both the Darling and Warrego Rivers.
- Irrigation water supply infrastructure: Embankments and channels constructed across the floodplain to distribute water to the agricultural areas.
- Western floodplain training embankment: This structure comprises a low-lying embankment that distributes flows bywashing from Boera Dam when it overflows, and was originally constructed to prevent water on the Western Floodplain from returning to the Warrego River. The structure includes a number of subsequently-constructed pipe regulators that could be opened and closed to allow controlled releases from the Western Floodplain to the Warrego River. The pipes are no longer functional, and flow frequently breaches the embankment and returns to the Warrego River.

Structures subject to Phase 1 of the Project are further described below.

Homestead Dam

Homestead Dam was constructed in 1876 to provide stock water and amenity for domestic purposes (Jill Sheppard Heritage Consultants, 2013). A levee runs along the high-water level to protect the historic Toorale Homestead and outbuildings from elevated water levels caused by the main embankment. This levee is currently reinforced by sandbags in several locations. A bywash is located on the eastern side of the dam. Two 1200 mm diameter regulator pipes have been installed through the embankment, not far from the breach site, at the original river bed level.

The dam was breached 100 m west of the regulator pipes during a flood event during 2012. The breach has significantly reduced the storage capacity of Homestead Dam and subsequently decreased historic, cultural, ecological and visitor amenity at the site. Prior to this breach, the full supply level of Homestead Dam was 99.5 m Australian Hight Datum (AHD), with an estimated volume of 665 ML.

Currently a small body of water is retained within the storage controlled by an existing low-level road causeway located downstream of the original dam wall, with a crest level of 97.5 m AHD.

Peebles Dam

Peebles Dam is the southernmost dam on the Warrego River, located approximately 45 km downstream of Boera Dam (Figure 2). A low-level version of the dam was constructed in the 1870s to divert water into Ross Billabong to augment water supplies at the Toorale woolshed and wool scour (Jill Sheppard Heritage Consultants, 2013).

An enhanced version of the dam was constructed in 1983 as part of Duncan's Wall, a 2840 m long embankment. The enhanced storage area provided water supplies to the former station's main irrigation area. A 750 mm diameter regulator pipe was installed in a smaller channel off the main Warrego River channel, and a further two 1200 mm regulator pipes were installed in the main channel in 2002 (Jill Sheppard Heritage Consultants, 2013). A bywash is located at the eastern end of Duncan's Wall.

Over time, Peebles Dam has undergone several failures and rebuilds, and is currently in a failed state, with a breach in Duncan's Wall that affects the storage capacity of the weir pool at Peebles Dam. Peebles Dam, Duncan's Wall and the Darling River levee also constrain large flows in the Darling River from moving upstream into the Warrego, so these structures operate in both directions.

1.4.2 Water Access, Licences and Approvals

Water access and sharing within the NSW-section of the Warrego River is set out in the NSW Water Sharing Plan (WSP) for the Intersecting Steams Unregulated and Alluvial Water Sources (NOW, 2011), under the *Water Management Act 2000* (WM Act).

Two types of approvals for the management of water and the works in a river apply at Toorale:

- water supply works approvals; and
- water access licences.

The water supply works approvals allow the construction of water supply infrastructure such as water pumps and dams to take water from a river. They also include conditions under which the infrastructure must be operated. Homestead Dam has a single works approval for the bywash dam for stock and domestic water conservation. Peebles Dam has two works approvals, one for stock water conservation and augmentation of the bywash dam and the other for four 760 mm pumps (not installed).

Toorale's water access licences (WALs) were transferred to the CEWH and include three separate licences to extract a total of 8,106 ML from the Warrego River (from above Boera Dam, Boera Dam and Peebles Dam), and a high-flow area-based licence to irrigate 1,620 hectares, which was subsequently converted to a licence to extract 9,720 ML from the Warrego River at Boera Dam.

A summary of relevant water entitlements for storages associated with Phase 1 of the Toorale Water Infrastructure Project is provided in Table 2.

Table 2: Existing water licences

Dam	Water Entitlements	Works Approval
Homestead Dam	nil	Conservation of stock and domestic supply. Held by the Minister administering the NPW Act (85SL022041)
Peebles Dam	6,000 ML entitlement. Held by CEWH (WAL27552/85SL044557)	Conservation of stock and domestic supply. Held by the Minister administering the NPW Act (85SL043727)

Dam	Water Entitlements	Works Approval
	Stock water entitlement of 9 ML. Held by the Minister administering the NPW Act. (WAL27551/85SL044557)	

1.4.3 Structural Arrangements and Operations

The current infrastructure on Toorale allows for the release of up to approximately 600 ML/d through the control gates on Boera Dam. To meet licence requirements, if sustained inflows are entering Boera Dam, the gates must be opened to let water flow through to the Darling River. Depending on flow conditions within the Darling River, the gates can then be closed to allow levels to build in Boera and flow onto the Western Floodplain, or they can be left open to provide a longer duration flow to the lower Warrego River (e.g. if the CEWO wishes to pass their entitlement to the Darling River). The gates at Boera are hand operated by NPWS staff, and once they are opened, the gates at Booka Dam are accordingly adjusted within half a day. Once the gates are closed at Boera Dam following a flow event, they are left closed until the next flow event comes down the Warrego River.

Homestead Dam WAL licence conditions require that up to the capacity of the pipes to be passed until the Warrego River flow enters the Darling River, or until flows at Louth on the Daring River exceed 330 ML/d. They can then be closed until the next inflow, impounding water within Homestead Dam. The gates on these two pipes are manually operated but have not been used since the dam breached in 2012.

Peebles Dam is currently breached and NPWS leaves these pipes open at all times.

1.5 Justification and Alternatives Considered

This REF is of one of two REF documents that shall be prepared for the Toorale Water Management Project. Approval is being sought within this REF for the reconstruction of Homestead Dam and the removal of Peebles Dam.

Justification

The CEWH purchased the water entitlements attached to Toorale to improve the benefits from the delivery of these flows to environmental assets on-park and within the Darling River downstream. However, the existing water infrastructure has been established to maximise water retention and use for irrigation and agricultural purposes on Toorale, and constrains CEWH's ability to manage its entitlements to generate desired improvements in both the Warrego and Darling Rivers.

An agreement between the State and Commonwealth governments at the time of its purchase requires the NSW government to demolish, modify, remove or decommission the water infrastructure on Toorale to improve water flows for environmental purposes. The NSW Office of Environment and Heritage commenced the Toorale Water Infrastructure Project in 2016. The Project is being funded by the Commonwealth government under the Toorale Water Infrastructure Project Agreement.

The proposal is consistent with the draft PoM prepared for Toorale (OEH, 2018) which includes a summary of the issues that have been considered during planning and design of the proposed activity. Those that are specifically relevant to the proposed activity are:

- Improvement of flows downstream of Toorale needs to be balanced with the maintenance of key natural and cultural values present at Toorale. The design and operation of in-stream structures must ensure:

  - the maintenance of vegetation, including wetland condition on the western floodplain to conserve habitat and food availability for both terrestrial and aquatic species;
  - the health and viability of important wetland communities and the species they support, including vulnerable blue-billed ducks (*Oxyura australis*) and brolgas (*Grus rubicunda*) and migratory species such as eastern great egrets (*Ardea modesta*), glossy ibis (*Plegadis falcinellus*) and oriental pratincoles (*Glareola maldivarum*). This includes in-stream refugia and other habitat values;
  - the heritage values of the Boera Dam and Toorale Floodwaters Scheme and the Toorale Homestead Precinct are conserved;
  - access is available for visitor opportunities and the maintenance and protection of cultural and heritage values.
- Ongoing maintenance and operation of in-stream regulating structures retained for the delivery of Commonwealth water or the maintenance of park values;
- The need for intervention to prevent the continual erosion of the Homestead Dam bank during periods of high flow;
- That existing in-stream and floodplain structures are barriers to fish passage during low flows and some medium flows;
- That there is an ongoing requirement for water to be supplied to the park through stock and domestic entitlements.

The proposed works seek to ensure that the following desired outcomes in the draft PoM are met, or make significant contributions to achieving these outcomes:

- Water in the park is managed to maintain or improve the park's natural and cultural values (in particular, water-dependent ecosystems), and facilitate effective land management operations and amenity for visitors.
- Development, modifications and other works associated with in-stream structures have a net environmental benefit for natural and cultural values. Environmental and cultural impact assessments are conducted prior to any works or modifications.
- Water supply to the park for management purposes, including visitor facilities, is maintained.
- Cooperative relationships are maintained with water management authorities, neighbours and stakeholders.
- The importance of flooding and drying events to maintain key ecological processes is communicated to stakeholders, including authorities, neighbours and the community.
- The impacts of riverbank subsidence and sedimentation are minimised.
- Where possible, significant cultural values are protected from flooding.
- Fish passage is improved.

The Proposed Activity and Alternatives Considered

In 2016, OEH contracted Alluvium to undertake a business case to investigate options to deliver the project objectives and requirements. A range of options were considered following consultation with key stakeholders, field inspections and review of technical data (Alluvium, 2016). A preferred arrangement of works was recommended for the water infrastructure on Toorale. The Toorale Project Steering Committee subsequently endorsed a preferred package of works to be undertaken at Boera, Booka, Homestead and Peebles Dams.

Several modifications to the proposal have been made since completion of the business case based on further consultation with stakeholders and additional information gained from associated studies. These

changes mostly relate to works proposed for Boera Dam, and the fishways proposed at Booka and Homestead Dams.

The proposal to remove Peebles Dam and to reinstate Homestead Dam, i.e. the activity that is the subject of this REF, forms part of the larger project to modify the water infrastructure on Toorale. Key points in regard to this proposal are as follows:

- The effect of repeated changes to the project proposal has been that the initial delivery date of June 2019 for the Project cannot be achieved. Although discussions are in progress to secure funding to complete the Project after this date, the full project currently ends in June 2019. However, finances are available to progress removal of Peebles Dam and reinstatement of Homestead Dam within 2018/19.
- The proposed removal of Peebles Dam has been unchanged since first recommended in the Toorale Business Case. Its removal is supported by all stakeholders consulted, as well as the Toorale Design Working Group.
- Reconstruction of Homestead Dam as proposed is an interim measure until funding is available to complete works as proposed in the preferred package. The rationale for constructing a temporary structure is:
    - The Toorale JMC has indicated support for the project on the basis that works at Homestead Dam are undertaken first[1] in recognition of its value to the Kurnu-Barkandji people and their aspirations for the site. Reinstating a dam wall delivers on a commitment made to the JMC to start work at Homestead Dam, if possible.
    - Reinstatement of the embankment will improve access over the Warrego River to the western side of the park from the existing situation with the breached wall until more permanent arrangements can be constructed.
    - Earthen material removed from the Peebles Dam can be used to reform the bank at Homestead Dam. It is expected that there will be some efficiencies from minimising double-handling of this material, as well as reducing the potential for impacts from alternative borrow sites for Homestead.
    - It is understood the reconstruction is possible under the existing works approval as a maintenance activity as long as the structure continues to be operated in accordance with the licence conditions.
    - If and when the full Toorale Water Infrastructure Project goes ahead, the temporary replacement bank at Homestead Dam will be replaced by a fill-and-spill crested weir with a rock-ramp fishway.

The current status quo of the water management infrastructure at Toorale (the “do-nothing approach”), including that for Homestead Dam and Peebles Dam, does not address the issues or achieve the desired outcomes as defined by the draft PoM. The following impacts are identified as being likely to occur, or continue to occur:

- Reduction in control over the water levels in storages
- No improvement in maintaining historic, cultural and visitor values
- Continued adverse impact on park access at Homestead Dam
- Ongoing potential for failure, repair and cost associated with these at Peebles Dam

[1] However, the JMC does not support the interim option and indicated that they want all work to hold off until the full project can be implemented.

The current proposal outlined within this REF and associated designs to repair and upgrade Homestead Dam and decommission Peebles Dam have been considered by the key stakeholders and the Project Design Working Group to meet the requirements for management within the draft PoM. The proposed activity was selected for implementation as it would:

- be cost effective
- meet flow delivery requirements and objectives
- be consistent with existing Water Management Act approvals
- improve fish passage (Peebles Dam)
- protect and maintain environmental, heritage and cultural values
- improve amenity for park visitors
- facilitate improved NPWS access.

2 Proposed Activity

2.1 The Proponent

The proponent is the NSW Office of Environment and Heritage (OEH), 92 Macquarie Street, Dubbo, NSW 2830.

The OEH cares for and protects NSW's environment and heritage, which includes the natural environment, Aboriginal country, culture and heritage, and built heritage. OEH supports the community, business and government in protecting, strengthening and making the most of a healthy environment and economy in NSW.

2.2 Objectives

The key objective of the Toorale Water Infrastructure Project is to increase the capacity to deliver flows to the lower Warrego River from 600 ML/day to 900 ML/day. Within this overarching objective are a myriad of aims and actions at selected sites. Those relevant to Phase 1 are described below

Homestead Dam

The aim of Phase 1 is to reinstate the existing dam to meet the intent of the existing works approval conditions and to provide for discharge of up to 600 ML/day in the Warrego River for release into the Darling River. This is a proposed interim measure pending approval of the whole Toorale Water Infrastructure Project.

The design objectives for the proposed works at Homestead Dam are listed in Table 3.

Table 3: Interim design objectives for Homestead Dam

Element	Criteria
Hydrology	Meet the intent of the existing works approval conditions Provide for discharge of up to 600 ML/day in Warrego River for release to the Darling River
Ecological values	Minimise impacts on existing in-stream ecological values Protect intact and established values as required under relevant legislation
Cultural heritage values	Avoid and minimise site and functional level heritage impacts Manage cultural values in accordance with heritage values, legislation and policy Have regard to values and concerns of Aboriginal community as represented by Toorale JMC
National Park operation and maintenance	Limit adverse impacts on park access Provision of safe, all-weather access across the Warrego River to the western side of the park at Toorale Homestead for NPWS staff Not increase the maintenance and operation liabilities at the site Consider Park recreational and aesthetic values

Peebles Dam

The intent of removing the Peebles Dam portion of the embankment is to allow Warrego River flows to pass through to the Darling River and to allow for high flow events in the Darling River to back up into the Warrego River. The new profile of Peebles Dam will accommodate flows moving through Ross Billabong (possibly up to 5,000 ML/day when the Darling River flow is around 40-60,000 ML/day).

The objectives of the design of the Peebles Dam are listed in Table 4.

Table 4: Design objectives for Peebles Dam

Element	Criteria
Hydrology	Meet the intent of the existing works approval conditions Provide for discharge of up to 900 ML/d in Warrego River for release to the Darling River
Fish passage	Provide fish habitat and passage through Warrego River and improve connection with Darling River for small to large bodied native fish (Golden Perch, Silver Perch, Spangled Perch, Murray Cod, Eel-Tailed Catfish, Hyrtl's Tandan, Bony Bream, Carp Gudgeon, Un-specked Hardyhead, Australian Smelt, Murray-Darling Rainbow Fish, Desert Rainbowfish, and Olive Perchlet). Meet regulatory requirements for fish passage in any modification to existing structures and in particular to satisfy section 218 of the NSW *Fisheries Management Act 1994* (FM Act).
Cultural heritage values	Avoid and minimise site and functional level heritage impacts Manage cultural values in accordance with heritage values, legislation and policy Have regard to values and concerns of Aboriginal community as represented by Toorale JMC
National Park operation and maintenance	Limit adverse impact on park access Not increase the maintenance and operation liabilities at the site Consider park recreational and aesthetic values

2.3 Description of the Activity

The proposed activity seeks to reinstate Homestead Dam and to decommission Peebles Dam as given in Table 5.

Table 5: Proposed activity

Homestead Dam	Peebles Dam
Dam embankment to be rebuilt at the site of existing breach at Homestead Dam: • Spillway crest 98.50 m AHD • Recommission existing outlet pipes • New full supply level of Homestead Dam to be 98.50 m AHD	Dam to be decommissioned by removing embankment at main Warrego River channel location • Width of embankment removed around 300 m to return to pre-development flow conveyance • Embankment to be removed to existing waterway bed level

• Crest width of 6 m to allow single vehicle access over the dam.	

2.4 Description of the proposed works

The proposed works seek to repair Homestead Dam and decommission Peebles Dam. A summary is provided below.

Homestead Dam

The temporary reinstatement of an earthen embankment is proposed for Homestead Dam at the site of the existing breach. This is to be of a similar design to the previous embankment under the existing works approval. The spillway elevation will be reinstated at 98.5 m AHD and the existing outlet pipes will be recommissioned to allow the passing of up to 600 ML/day. A structure with a crest width of 6 m is proposed and will be constructed of either local material or imported material from the Peebles Dam site.

Peebles Dam

Peebles Dam is to be decommissioned by removing the embankment at the main Warrego River channel location (Appendix A). A 300 m portion of the embankment is proposed to be removed, to return to pre-development flow conveyance. A 300 m breach length has been decided following conservative hydrological analyses by Alluvium (2018).

The embankment will be removed to the existing waterway bed level, to allow the Warrego River flows to pass through to the Darling River and to allow high flow events in the Darling River to back up into the Warrego River. Some spoil may be transported and used in the construction of the proposed works at Homestead Dam. Any additional spoil will be deposited within existing borrow pits close to the site (Figure 3). For a breach length of 300 m, the amount of material to be removed from the site is approximately 22,000 m^3.

The operating conditions under the existing WAL require Peebles Dam to have two 1200 mm pipes remaining open while there is ever any inflow. Under the proposed arrangements, the embankment will be removed completely which will then require the licence to be cancelled. Existing infrastructure at Peebles Dam will be relocated and reused by NPWS Bourke Area (pipes, gates and operating platform). However, an exact future purpose has not yet been determined and infrastructure will be stored at Toorale. No wastage of materials will occur, only the reuse of them for alternate purposes.

2.5 Works stages

This section discusses the works methodology, timing, materials and materials management (collection and storage), machinery, equipment, hours of operation and working hours, as well as access and ancillary works that are relevant to each stage of the proposed project.

2.5.1 Pre-construction

Access to the dams will be via existing roads and management trails within Toorale. No additional access tracks are proposed.

Trees currently growing on the section of embankment to be removed at Peebles Dam will be cut down by local NPWS staff and relocated for future use as firewood or access barriers.

2.5.2 Construction

Construction is expected to begin between April and June 2019. Considering their location, the Proponent is mindful that the works will be dependent on weather conditions and flows in the Warrego River at the time. If flows are passing through, then works will be rescheduled to reduce the environmental impacts on the park and the Warrego River, and to ensure safe working conditions.

Spoil from Peebles Dam will be deposited in existing borrow pits in the vicinity of the works, from which the material was originally sourced (Figure 3). Should construction works proceed concurrently at Homestead Dam, a portion of this spoil may be reused for the construction of the Homestead Dam embankment. Where possible other infrastructure (pipes, gates and operating platform) will be reused or recycled by NPWS in the Bourke area. However, an exact future purpose has not yet been determined and infrastructure will be stored at Toorale. No wastage of materials will occur, only the reuse of them for alternate purposes.

For Homestead Dam, fill is required to partially reinstate the earthen embankment. If found to be suitable, the material will be sourced from the decommissioned Peebles Dam wall. Fill material will be transported the approximate 26 km between the two sites in tipper trucks traveling on Toorale Road to transport the material to Homestead Dam (Figure 3).

It is estimated that approximately 1,500 m^3 of material will be required to be transported, increasing the traffic load on these routes to a minimal degree and only within the hours of 7am and 6pm during weekdays. The scheduled amount of days expected to use these roads to transport the material is about seven working days. Trucks will be road registered and comply with all relevant legislation.

Construction equipment that will be used for the proposed works include tipper trucks for transporting embankment material, excavators and Moxies to remove, place and shape embankments, dozers for stockpile management and cutting and filling of dam wall and graders for trimming the dam wall. This plant and other relevant equipment shall be stored within the demarcated project footprint at each site for the duration of the works.

Construction work will occur during normal working hours, being between 7am and 6pm on weekdays only.

2.5.3 Operation

Once reconstructed, operation of Homestead Dam will return to that undertaken prior to the breach, i.e. operating pipes in accordance with the licence conditions and CEWO watering requirements. This will require periodic site visits to manually set and/or reset the gates.

There will be no operational activities associated with Peebles Dam.

2.5.4 Future Works

Phase 2 of the Toorale Water Infrastructure Project involves more permanent planned upgrades to the Homestead Dam, including a new dam crest, fishway and access arrangements. Potential environmental impacts associated with these works will be assessed as part of a separate REF for Phase 2 of the project.

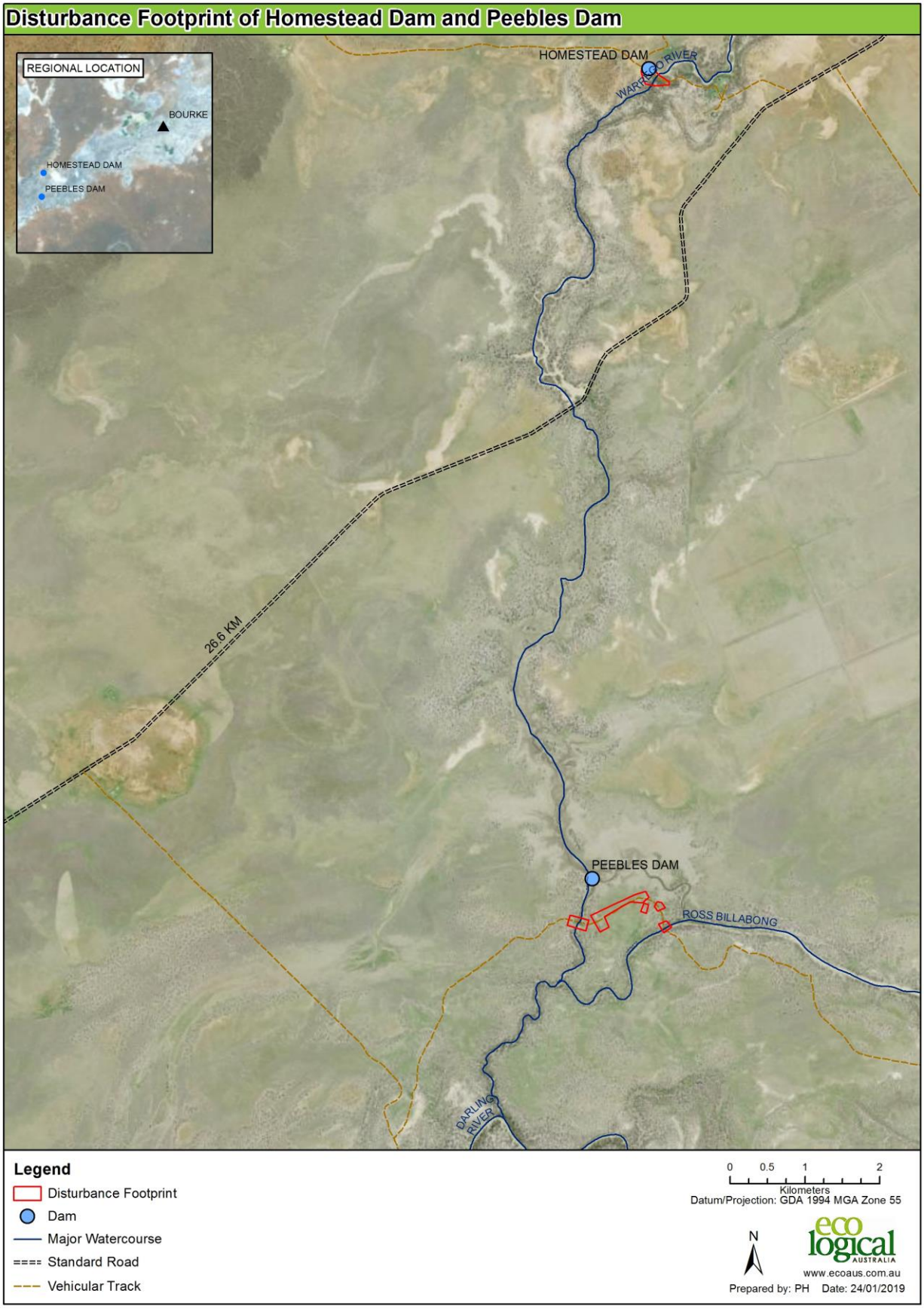

Figure 3: Potential disturbance footprint for both sites including access tracks

3 Consultation

3.1 Consultation During Project Planning and Design

Consultation regarding the proposed works has been undertaken over the duration of the Toorale Water Infrastructure Project to ensure that appropriate environmental and cultural outcomes have been identified and agreed upon by all relevant stakeholders and are likely to occur as a result of the proposed works. Consultation activities have been undertaken in accordance with the requirements outlined under Division 1 of Part 2 of the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) for development carried out by or on behalf of a public authority.

In 2016, OEH contracted Alluvium Australia to undertake a business case to investigate options to deliver the project objectives and requirements (Alluvium, 2016). Stakeholders were consulted several times during preparation of the business case to provide input on values of Toorale and then environment important to them, and what they wished addressed in planning an option to achieve the project requirements. Stakeholders consulted included:

- National Parks and Wildlife Service
- Bourke Shire Council
- NSW Fisheries
- Department of Industry – Water
- Commonwealth Environmental Water Holder
- Toorale Joint Management Committee
- Park neighbours

The Project Manager has continued to consult with these stakeholders as the project has progressed, and the project has been substantially modified in response to their input. The outcome of this approach has been the development of a proposal that is generally supported by the above groups.

National Parks and Wildlife Service

NPWS Bourke Area manages Toorale NP and SCA and has been closely involved with all aspects of the planning for and design of the project since its inception. The Project Manager has also liaised with the NPWS Planning and Assessment Team to ensure consistency with the draft Toorale PoM.

NPWS has no concerns with the proposed works at Peebles and Homestead Dams. The Homestead Dam interim proposal satisfies the access and visitor issues raised by NPWS. Mitigation works proposed will avoid or minimise impacts to the environmental, historic and cultural values of the park.

Bourke Shire Council

Bourke Shire Council was consulted during preparation of the business case and provided with subsequent updates on project progress.

Council raised road maintenance and access, as well as impacts to neighbours, as potential issues of concern.

Council has not been directly consulted about the interim Peebles and Homestead works.

NSW Fisheries

NSW Fisheries was consulted during preparation of the business case and subsequently through the concept design stage.

NSW Fisheries supports the removal of Peebles Dam but does not support the interim reinstatement of Homestead Dam on the grounds that it reinstates a barrier to fish movement in the Warrego River.

Department of Industry (DoI) - Water

DoI Water was consulted during preparation of the business case and again early in the concept design stage.

DoI Water has advised that options proposed for the Toorale Water Infrastructure Project should not result in a reduction in delivery of water to the Darling River from that currently provided for in existing licences and approvals.

Commonwealth Environmental Water Holder

The CEWH has been closely engaged in project planning and design since its inception.

CEWH supports the removal of Peebles Dam and has no objection to the interim reinstatement of Homestead Dam as proposed.

Aboriginal consultation

Consultation with the Aboriginal community has primarily been through the Toorale Joint Management Committee, as representatives of the Kurnu-Baakandji traditional owners.

A range of options were considered following consultation with key stakeholders, field inspections and review of technical data (Alluvium, 2016). A preferred arrangement of works was recommended for the water infrastructure on Toorale. The Toorale Project Steering Committee subsequently endorsed a preferred package of works to be undertaken at Boera, Booka, Homestead and Peebles Dams.

During 2017 and 2018, comprehensive assessment of Aboriginal cultural heritage in the area to be impacted by the project was undertaken by Biosis Pty Ltd (Biosis 2018a). This assessment included consultation with the Toorale Joint Management Committee. Consultation with Registered Aboriginal Parties was also undertaken in support of two Aboriginal Heritage Impact Permit Applications (C0003079 and C0004300). Records of consultation undertaken during the development of the AHIP applications are provided in Biosis 2018a.

The Toorale JMC has been actively engaged in the planning stage of the project, which has been modified several times in response to concerns expressed and suggestions they have made (see Appendix B for a log of consultation with the JMC). The JMC requirements that have been incorporated into the project planning and design made to the project that are of particular relevance to this REF include:

- Reinstatement of the storage at Homestead Dam
- Commencement of work at Homestead Dam as a priority
- Avoid and minimise harm to Aboriginal Cultural Heritage unless absolutely necessary

At its October 2018 meeting, the JMC indicated that it was satisfied with the project as proposed and presented at that point in time. However, the JMC did not support commencement of works at Peebles and Homestead prior to implementation of the full project, i.e. works proposed at all four dam sites.

Park Neighbours

Park neighbours were contacted and invited to provide input to the business case (Alluvium, 2016), and have been updated by letter/email since (available on request). A face-to-face meeting with the owners of Talowla and Yandaroo between OEH Project Manager and Eco Logical Australia was held in May 2018. Contact has also been made with downstream landholders between Toorale and Louth.

No neighbours have a boundary with either Homestead or Peebles Dam and are not affected by the proposed activity. Downstream landholders have indicated support for the removal of Peebles Dam, but have not been consulted on the interim proposal to reinstate Homestead Dam.

3.2 Consultation on Environmental Assessment Requirements

While no formal consultation has been undertaken, the following agencies were contacted for their environmental assessment requirements for the project:

Office of Environment and Heritage

The Regional Operations North West Branch provided guidance on the matters to be considered in the environmental assessment and the template to be used for the report.

National Parks and Wildlife Service

The Park Programs Branch provided advice on the requirements for assessment of non-Aboriginal heritage, and referred to the guidelines "*NPWS Guidelines for historic heritage approvals. How to seek approvals for activities and work at historic heritage places within national parks and other reserves".*

The Partnerships, Planning and Heritage Branch provided advice on public exhibition requirements from the "*OEH Guidelines for determining a Review of Environmental Factors*" and referred the assessment to the "*OEH/NPWS Construction Assessment Procedures*".

Department of Industry – Water

In May 2018, the Water Regulation Group advised the Project Manager of assessment requirements for new or modified works approvals. No new works or modifications are proposed that are inconsistent with the existing approvals.

NSW Fisheries

NSW Fisheries has not been consulted on requirements for this REF since *Fisheries Management Act* approval requirements are considered not to be triggered. Note comments above in 3.1

Environmental Protection Authority

EPA Central West Operations advised its assessment requirements in December 2017 (Appendix C)

Bourke Shire Council

Councils assessment requirements were sought in March 2017. Bourke Shire Council did not respond with any requirements.

Department of Environment

Early contact was made in December 2015 in broad terms about the project and approvals process.

Documentation related to the above consultation can be provided on request.

4 Statutory Framework

This Review of Environmental Factors (REF) has been prepared to enable assessment of the proposed activities under Part 5 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). This report addresses the requirements of s228 of the EP&A Reg 2000.

This REF addresses potential impacts to Matters of National Environmental Significance (MNES) in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

4.1 Commonwealth legislation

4.1.1 *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)

The EPBC Act protects MNES, such as threatened species and ecological communities, migratory species (protected under international agreements), and National Heritage places (among others).

Any actions that will, or are likely to, have a significant impact on MNES require referral and approval from the Australian Government Environment Minister. Significant impacts are defined by the Commonwealth (DoEEa, 2018) for MNES. Under the environmental assessment provisions of the EPBC Act, the following MNES and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Department of the Environment and Energy (DotEE). Table 6 addresses the MNES for the project.

Table 6: EPBC factors for consideration and likely impact

Factor	Likely impact
a. *Any impact on a World Heritage property?* The proposal would not impact any World Heritage property	Nil
b. *Any impact on a National Heritage place?* The proposal would not impact any National Heritage place	Nil
c. *Any impact on a wetland of international importance?* The proposal would not impact any wetland of international importance	Nil
d. *Any impact on a listed threatened species or communities?* Flora and Fauna assessments undertaken to support this REF indicate that the proposed activity is unlikely to impact on EPBC listed threatened species and communities	Unlikely
e. *Any impacts on listed migratory species?* The proposal would not impact any Commonwealth-listed migratory species	Nil
f. *Any impact on a Commonwealth marine area?* The proposal would not impact any Commonwealth marine area	Nil
g. *Does the proposal involve a nuclear action (including uranium mining)?* The proposal does not involve a nuclear action	Nil
h. *Additionally, any impact (direct or indirect) on Commonwealth land?* No Commonwealth land would be impacted by the proposal	Nil

Evaluating the significance of the impacts associated with the proposed activity has been considered by determining how extensive the impacts are, how adverse the impacts are on environmentally sensitive areas and how acceptable the impacts are, in accordance with the guidelines for preparing a REF (OEH, 2016). It is concluded that a significant impact is not likely to result and therefore a referral to the Commonwealth Department of Environment is not recommended.

4.1.2 Native Title Act 1993

The Commonwealth *Native Title Act 1993* (Native Title Act) was introduced following the High Court Mabo judgment and significantly amended following the High Court's Wik decision. The Native Title Act does four major things of relevance to the proposed development:

- recognises native title rights exist in Australia where those rights have not been extinguished (e.g. by the grant of a freehold title)
- validates certain past actions carried out by governments
- includes a 'future act regime' that allows for governments to continue undertaking certain activities on the Crown estate where native title has not been extinguished
- states that compensation may be owing to native title holders for certain past and future acts.

There have been no native title claims over the subject site. The nearest Native Title claim submitted in the vicinity of the proposed works area is generally east of the Toorale National Park, which includes parts of Bourke, Nyngan and Cobar. This submission to the Commonwealth Government was in 2012 by the Ngemba, Ngiyampaa, Wangaaypuwan and Wayilwan groups (NNTT, 2018).

4.2 State legislation and policies

4.2.1 *Environmental Planning and Assessment Act 1979* (EP&A Act)

All development in NSW is assessed in accordance with the provisions of the EP&A Act and the EP&A Reg. The EP&A Act provides a system for environmental planning and assessment, including approvals and environmental impact assessment requirements for proposed developments. Implementation of the EP&A Act is the responsibility of the Minister for Planning, statutory authorities and local councils.

The proponent of the project is the NSW Government acting through the OEH. Under section 5.1 of the EP&A Act, certain government entities are deemed to be a determining authority and it is assumed that this project shall be assessed under Part 5 of the EP&A Act. The project aligns with a number of activities permissible without consent under the *State Environmental Planning Policy (Infrastructure) 2007* (ISEP). Further detail regarding the ISEPP is given in Section 4.2.3.

Notwithstanding this, under section 5.5 of the EP&A Act, a determining authority has the duty to fully consider the environmental impact of an activity and is required to "take into account to the fullest extent possible all matters affecting, or likely to affect the environment" arising from the proposal. This is facilitated through the current REF, the purpose of which is to identify, assess and determine the significance of potential environmental impacts, as well as mitigating actions and responsibilities to minimise potential impacts.

Assessment of potential impacts shall be in accordance with section 5A of the EP&A Act, and requires the proponent to consider the significance of potential impacts on biota listed under the *Biodiversity Conservation Act* (BC Act) and the *Fisheries Management Act 1999* (FM Act) through assessments of significance (5-part tests). If the proposed works are considered likely to have a significant impact on the environment or any threatened species, population or ecological community, or their habitat, an

Environmental Impact Statement (EIS) or Species Impact Statement (SIS) will be required. Assessments of significance conclude that there will be no significant impact on listed BC Act species (Appendix G).

Pursuant to section 5.5 of the EP&A Act, a determining authority shall consider the effect of an activity on any wilderness area (within in meaning of the *Wilderness Act 1987*) in the locality in which the activity is intended to be carried on. The proposed works are not located in a wilderness area and should not have an effect on any wildness areas outside of the project area.

4.2.2 *Environmental Planning and Assessment Regulation 2000* (EP&A Reg)

Clause 228(2) factors (NSW Legislation)

There are no specific guidelines in force under clause 228(1) of the EP&A Reg for the proposed modification of the dams. As such, the factors that need to be taken into account when considering the environmental impact of an activity are identified under clause 228(2) of the EP&A Reg and the section of the REF where these items have been assessed. Table 7 summarises the compliance of the proposed project under the EP&A Reg.

Table 7: Compliance with clause 228(2) of the EP&A Reg

Clause 228(2) Factors	Impact	Section of REF
Any environmental impact on a community?		
The proposed modifications have a net improvement to environmental flows from the Warrego to the Darling River. Works are in a remote location away from local residents and towns. Short term and minimal adverse impacts to air quality, traffic and water resources would be limited to the construction stage and would be managed through the preparation and implementation of a Construction Environmental Management Plan (CEMP) and environmental safeguards.	Low	Section 5.4.2
Any transformation of a locality?		
The proposed modifications will not transform the locality.	Nil	Section 5.2
Any environmental impact on the ecosystem of the locality?		
The proposed modifications will not result in any significant adverse impacts on the ecosystem of the locality. The proposed modifications at Peebles Dam will result in some insignificant impacts to local vegetation within the development footprint, however, will improve the delivery of environmental flows management and fish passage, hence provide benefits to the ecosystem within the Warrego River, and the Darling River. Changes to flooding patterns may result in decreased inundation within Ross, however, these changes will represent a more natural flooding regime and enable improved connection between Ross Billabong and the Darling River. Increased retention of water at Homestead Dam is likely to provide increased instream habitat and drought refugia relative to current breach arrangement, however, fish passage will be temporarily reduced relative to current conditions. This will be further rectified following implementation of Phase 2 of the Toorale Water Infrastructure Project which will incorporate a fishway included in the works.	Low	Section 5.2, 5.6

Clause 228(2) Factors	Impact	Section of REF
Any short-term impacts will be minimised by appropriate mitigation measures.		
Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?		
The proposed modifications will not have any long-term impacts that reduce an aesthetic, recreational, scientific or other environmental quality or value of the locality. Potential short-term impacts to amenity may exist during the construction phase only.	Low	Section 5.4, 5.3
Any effect in a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present generations?		
• Adoption and implementation of the mitigation measures will allow for any impacts to Aboriginal heritage items to be acceptable and managed. For example, the management of a single cultural tree will be protected via the implementation of demarcation and contractor inductions. • The proposed reinstatement of Homestead Dam will result in improved cultural outcomes for Aboriginal community that want the storage reinstated • No direct impacts from the proposed modifications to non-indigenous heritage are anticipated at the locally-listed Homestead Dam. Indirect impacts include reinstate water levels that are consistent with enhanced environmental, social and aesthetic outcomes that are consistent with cultural and historic values at Homestead. The proposed development involves direct impacts to Peebles Dam however these impacts will be minimised by appropriate mitigation measures.	Low	Section 6.3
Any impact on habitat of any protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)?		
There are no significant negative impacts on habitat for protected fauna. • Proposed works at Homestead Dam will result in improved habitat/refugia conditions for aquatic and terrestrial fauna • Removal of Peebles Dam shall allow for improved longitudinal connectivity and fish migration between the Warrego River and the Darling River. If any impacts are identified during the construction phase, these can be readily managed through the implementation of the mitigation measures.	Low	Section 5.2
Any endangering of any species of animals, plants or other form of life, whether living on land, in water or in the air?		
The proposed works would not result in the endangering of any species of animal, plant or other form of life.	Low	Section 5
Any long-term effects on the environment?		
All construction works associated with the proposed modifications would have short-term impacts on the environment and would be rehabilitated following completion of construction activities. The long-term effects on water flow through	Low	Section 5.3, 5.6

Clause 228(2) Factors	Impact	Section of REF
the Warrego will benefit from the proposed works by providing improved connectivity of lower end of system with Darling River Impacts to longitudinal connectivity and fish passage at Homestead Dam are short term and consistent with those that existed prior to the breach in 2012. The long term Toorale Water Infrastructure Project will remove some of the impacts created by the short-term proposal.		
Any degradation on the quality of the environment?		
There would be minor aesthetic impacts during construction. These impacts would be temporary for the duration of the works.	Low	Section 5.3, 5.4
Any risk to the safety of the environment?		
Risks would be limited to the construction stage and can be managed through the preparation and implementation of a CEMP.	Low	Section 6.3
Any reduction in the range of beneficial uses of the environment?		
The proposed modifications would not result in the reduction of beneficial uses of the environment. The proposed modifications will enable for more efficient delivery of environmental flows within the Warrego River and to the Darling River. Some disruptions to flow may occur, however these will be short-term and dependent on water flows at the time of construction.	Low	Section 5.4, 5.6
Any pollution of the environment?		
Risks of pollution to the environmental would be minimal. The potential for water pollution, erosion and contamination to land exist but would be minimal and avoided with the safeguards and mitigation measures in the REF and CEMP.	Low	Section 5.1
Any environmental problems associated with the disposal of waste?		
Infrastructure at Peebles Dam will be reused by NPWS staff and embankment material from Peebles Dam will be reused on Homestead Dam and/or returned to original borrow pits. Any additional waste generated during construction will be disposed of a licenced waste facility. Where possible waste generated would be reused and recycled.	Low	Section 5.11
Any increased demands on resources, natural or otherwise which are, or are likely to become, in short supply?		
All materials required for the proposed works are available and are not currently or likely to be in short supply.	Low	Section 5.11
Any cumulative environmental effect with other existing or likely future activities?		
Cumulative impacts of the current proposal are anticipated to be minor but positive. The impacts associated with the proposed dam works would be short term during the construction phase.	Low	Section 5

4.2.3 *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP)

The aim of this Policy is to facilitate the effective delivery of infrastructure across NSW by identifying whether certain types of infrastructure require consent, can be carried out without consent or are exempt development. In the absence of a PoM adopted by the Minister, clause 8 of the ISEPP provides that, in the event of an inconsistency between it and any other environmental planning instrument, including an LEP, the ISEPP will prevail.

Pursuant to clause 127(m) of the ISEPP, development for the purpose of maintenance or replacement of components of water supply systems that does not increase capacity (or increases capacity only to a minimal extent) may be carried out by or on behalf of a public authority as exempt development. However, the development must in connection with a water supply system and comply with clause 20 and involve no greater soil and vegetation disturbance than necessary and no increase in stormwater drainage and run-off from the site.

Under the *Bourke Local Environmental Plan 2012* (Bourke LEP), a water supply system means any of the following:

a) a water reticulation system,
b) a water storage facility,
c) a water treatment facility,
d) a building or place that is a combination of any of the things referred to in paragraphs (a)–(c)

Therefore, a water storage facility, including a dam, weir or reservoir for the collection and storage of water, is a component of a water supply system. As such, within the meaning of the ISEPP, the proposed modifications at Homestead Dam is considered to be maintenance and/or replacement of existing water storage facilities.

The removal of the Peebles Dam embankment is permissible under clause 129(1) of the ISEPP, whereby development for the purpose of waterway management activities may be carried out by or on behalf of a public authority without consent. The section of the Peebles Dam embankment is within the main Warrego River channel and is therefore instream management to restore environmental flows for ecological purposes, pursuant to clause 129(b).

Notwithstanding the above, under section 111 of the EP&A Act, a determining authority has the duty to fully consider the environmental impact of an activity and is required to "take into account to the fullest extent possible all matters affecting, or likely to affect the environment" arising from the proposal.

The ISEPP does not switch off the requirement for approvals under the FM Act for works affecting KFH. As such, OEH is required to obtain approval under section 199 of Part 7 of the FM Act to undertake dredging and reclamation works if open trenching is used in waterways classified as KFH (Section 4.2.8).

4.2.4 *National Parks and Wildlife Act 1974* (NPW Act)

The NPW Act is administered by the Director-General of the NPWS, who is responsible for the control and management of all national parks, historic sites, nature reserves, and Aboriginal areas (among others). The main aim of the Act is to conserve the natural and cultural heritage of NSW.

Section 81 of the NPW Act provides for operations under a plan of management (PoM). The Toorale PoM is a statutory document required under the NPW Act. Once the Minister has adopted a plan, the plan must be carried out and no operations may be undertaken in relation to the lands to which the plan relates unless the operations are in accordance with the plan.

Whilst the proposed activity is in accordance with the Toorale PoM, the PoM is currently in draft form. In the absence of a PoM adopted by the Minister, clause 8 of the ISEPP provides that, in the event of an inconsistency between it and any other environmental planning instrument, including a Local Environment Plan (LEP), the ISEPP will prevail.

The NPW Act also affords protection for Aboriginal cultural heritage in NSW. Part 6 of the NPW Act provides specific protection for Aboriginal objects and places by making it an offence to destroy, deface, damage, or move them from the land, irrespective of their level of significance or issues of land tenure. Pursuant to sections 89 and 90 it is an offence to disturb an Aboriginal object or knowingly destroy or damage, or cause the destruction or damage to, an Aboriginal object or Aboriginal place, except in accordance with a permit or consent under sections 87 and 90 of the NPW Act. The OEH must be notified on the discovery of Aboriginal objects under section 89A of the NPW Act.

The *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010b) as adopted by the *National Parks and Wildlife Regulation 2009* (NPW Reg) made under the NPW Act, provides guidance to individuals and organisations to exercise due diligence when carrying out activities that may harm Aboriginal objects. This Code also determines whether proponents should apply for consent in the form of an AHIP under section 90 of the Act. The NPW Act provides that a person who exercises due diligence in determining that their actions will not harm Aboriginal objects has a defence against prosecution if they later unknowingly harm an object without an AHIP. However, if an Aboriginal object is encountered in the course of an activity work must cease and an application should be made for an AHIP. Two AHIPs have been approved for the proposed works under permit numbers 4175 and 4369.

In addition to the Due Diligence Code of Practice, *Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010c) was developed to support the process of investigating and assessing Aboriginal cultural heritage. It specifies the minimum standards for archaeological investigation undertaken in NSW under the NPW Act.

4.2.5 Heritage Act 1977

Under section 140 of the *Heritage Act 1977* (Heritage Act) a person must not disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damage or destroyed unless the disturbance or excavation is carried out in accordance with an excavation permit. A relic is any deposit, artefact, object or material that relates to the settlement of the area that comprises NSW, not being Aboriginal settlement, and is of State or local heritage significance.

Section 140 does not apply to a relic that is subject to an interim heritage order made by the Minister or a listing on the State Heritage Order. ELA has undertaken a Historic Heritage Assessment to determine any potential impacts of the proposed works on Non-Aboriginal heritage (5.10).

4.2.6 Native Title Act 1994

This Act (enabling the Commonwealth Native Title Act) provides for the recognition of traditional Aboriginal ownership of land in NSW. The enabling of the Act has seen the rise of native claimant groups across the site who aim to prove traditional land ownership through historic connection. Native title claimant groups are routinely consulted on matters of Aboriginal cultural heritage, which relate to locations of which they have traditional knowledge or association - irrespective of whether their native title claims have been determined by the judicial system. Consultation regarding matters relating to Aboriginal cultural heritage has been conducted through the excavation works conducted and completed by Biosis on behalf of OEH in April 2018 (Biosis, 2018).

4.2.7 *Biodiversity Conservation Act 2016* (BC Act)

The purpose of the BC Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. NSW OEH is responsible for administering the BC Act.

The BC Act contains provision relating to threatened species and ecological communities listings and assessment, section 5A of the EP&A Act and repealing the *Threatened Species Conservation Act 1995* (TSC Act). The BC Act also provides for a biodiversity offsets scheme, a single biodiversity assessment methodology (BAM), calculation and retirement of biodiversity credits and biodiversity assessment and approvals. The BC Act also contains measures for flora and fauna protection, repealing parts of the NPW Act. The *Biodiversity Conservation Regulation 2017* supports the BC Act.

The BC Act lists and protects threatened species, populations and ecological communities that are under threat of extinction in NSW. Assessments of significance for the impact to threatened species and endangered ecological communities in accordance with section 7.3 of the Act have been undertaken for the proposed works. No significant impacts are likely to result, and therefore a BDAR or a SIS is not required to be prepared.

Potential impacts to threatened species and communities listed under the BC Act are addressed in Section 5.2.2, 5.3.2 and in Appendix G of this report.

4.2.8 *Fisheries Management Act 1994* (FM Act)

The FM Act is the principal piece of legislation protecting aquatic habitat in NSW. The act aims to conserve fish stocks, key fish habitat, aquatic vegetation, and threatened species, populations and communities. Threatened aquatic species, populations and Endangered Ecological Communities (EECs) are listed under Schedules 4, 4A and 5 of the FM Act, while key threatening processes are listed under Schedule 6. Depending on the location and type of activity, developments undertaken by public authorities, or contractors on their behalf, may be required to apply for a permit under Part 7 of the FM Act.

For areas mapped as Key Fish Habitat (KFH), permits are required for activities that have direct or indirect impact on marine vegetation, require dredging or excavation of bed or bank, obstruct fish passage, or involve land reclamation. The Warrego River is mapped as KFH.

Division 3 of Part 7 of the FM Act outlines the provisions for the management of dredging and reclamation work, consistent with the objectives of ecologically sustainable development. For the purposes of this proposal, water land is defined as land submerged by water, whether permanently or intermittently. The works will involve excavation of the creek bank and as such does involve dredging or reclamation works as defined under Division 3 of the FM Act at these waterway crossings. Pursuant to section 199 of the FM Act, a public authority must not carryout dredging or reclamation work except under the authority of a permit issued by the Minister.

Under section 218 of the FM Act, fishways are required during the construction, alteration, or modification of a dam. A public authority that wishes to modify a dam on a waterway must notify the Minister of the proposal and, if requested by the Minister, include a suitable fishway as part of the works.

The removal of Peebles Dam will allow for the free passage of fish, whereas the proposed works at Homestead Dam will reintroduce an obstruction to unimpeded passage of fish relative to the breached condition. During the construction process, fish passage will need to be maintained as per conditions set out in the Part 7 Fisheries Act Permit. The dams already constitute considerable barriers to fish passage, and the proposed work will not create any additional obstructions to the movement of fish at Peebles Dam.

4.2.9 *Water Management Act 2000* (WM Act)

The *Water Management Act 2000* (WM Act) aims to provide for the sustainable and integrated management of water sources for NSW. The Act requires developments on waterfront land to be ecologically sustainable, and recognises the benefits of aquatic ecosystems to agriculture, fisheries, and recreation. Waterfront land is defined as the bed of any river, together with any land lying between the bed of the river and a line parallel to, and the prescribed distance (being 40 m) inland of, the highest bank of the river.

Section 91E(1) of the WM Act identifies that it is an offence to carry out a controlled activity in, on or under waterfront land without gaining a controlled activity approval. Controlled activities are defined in section 31 of the WM Act. However, under clause 38 of the *Water Management (General) Regulation 2011* (WM Reg) public authorities are exempt from section 91E(1) of the WM act, and therefore do not require any approvals for controlled activities on waterfront land. Therefore, OEH does not need to apply for controlled activity approval under the WM Act. Despite this, the objectives of protecting water sources will be managed through the CEMP for the works.

Structures for the storage and diversion of water are registered under Works Approvals, and access water is administered under an entitlement of WALs and tradable allocation system of classes of access security, based on the reliability of the entitlement and availability of the water resource. Water can only be extracted at a site holding a valid Works Approval. Rules for access of water and determining the maximum entitlement or sustainable yield for water sources are set out in regional WSPs.

The four main WALs for Toorale under the NSW WM Act are held by the CEWH. Works Approvals remain held by the Director General of the NPWS for administration of the structures.

Any modification to site structures covered by Works Approvals may require amended work approval applications. This will be assessed based on the significance of change, and whether it requires advertised consultation. Initial consultation with DPI Water has been conducted regarding likely changes, and minor changes and structure removals do not require advertised consultation, provided that it can be demonstrated that:

- There is no impact on other users
- No increase in the take of water occurs from structures
- There is consistency with the *NSW Water Sharing Plan for the Intersecting Streams Unregulated and Alluvial Water Sources* 2011.

The proposal to repair the damaged structure at Homestead Dam is permissible provided it is undertaken in accordance with the existing Works Approval. Following decommissioning, the Works Approval for Peebles Dam shall be cancelled.

4.2.10 Biosecurity Act 2015

The *Biosecurity Act 2015* (Biosecurity Act) repealed the *Noxious Weeds Act 1993* and provides a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

Part 3 of the Biosecurity Act applies a general biosecurity duty for any person who deals with biosecurity matter or a carrier to prevent, eliminate or minimise any biosecurity risk they may pose. Under section 23 of the Act, a person who fails to discharge a biosecurity duty is guilty of an offence.

Whilst the Act provides for all biosecurity risks, implementation of the Act for weeds is supported by Regional Strategic Weed Management Plans (RSWMP) developed for each region in NSW. Appendix 1 of each RSWMP identifies the priority weeds for control at a regional scale. However, landowners and managers must take appropriate actions to reduce the impact of problem weed species regardless of whether they are listed in Appendix 1 of the RSWMP or not as the general biosecurity duty applies to these species.

A number of weeds were identified within the proposed development footprint and are detailed in Section 5.2. One listed priority weed was recorded within the study area (*Prosopis spp.)* (Western LLS, 2017)

4.2.11 *Contaminated Land Management Act* (1997)

A review of the NSW Environment Protection Authority (EPA) Contaminated Land Record under section 58 of the *Contaminated Land Management Act 1997* (CLM Act) and the List of NSW contaminated sites notified to the NSW EPA under section 60 of CLM Act did not reveal any registered contaminated land sites within or surrounding the proposed site.

A review of premises currently regulated by an Environmental Protection Licence (EPL) under the *Protection of the Environment Operations Act 1997* (POEO Act) and premises that are no longer required to be licensed under the POEO Act did not reveal any premises within or surrounding the proposed site.

Pursuant to clause 7 of the *State Environmental Planning Policy No 55 – Remediation of Land* there is no apparent reason to consider that land to be impacted by the proposal would be contaminated.

A review of the Toorale draft PoM revealed that contaminants and dangerous substances exist at some sites as a relic of former use, such as asbestos, petrochemical residue or chemicals from activities such as sheep dipping. The Plan acknowledges the requirements to avoid harm to the environment and human health. The most recent geotechnical report completed by A.S. James (2018) does not indicate such contaminated soils. The PoM does not identify where these potentially contaminated locations are situated in regard to the proposed works. It can be accepted that these areas would be located in human altered landscapes and buildings, rather than the dam structures within the Warrego.

4.2.12 Bourke Local Environment Plan 2012

The following land use zone applies to the two dam sites in accordance with the Bourke LEP:

- E1 National Parks and Nature Reserves

The objectives of the E1 Zone are:

- To enable the management and appropriate use of land that is reserved under the NPW Act or that is acquired under Part 11 of that Act.
- To enable uses authorised under the NPW Act.
- To identify land that is to be reserved under the NPW Act and to protect the environmental significance of that land.

Uses authorised under the NPW Act are permitted without consent. However, in the absence of a PoM adopted by the Minister, clause 8 of the ISEPP provides that, in the event of an inconsistency between it and any other environmental planning instrument, including an LEP, the ISEPP will prevail (Section 4.2.3).

4.3 Summary of Licences and Approvals Required

A summary of approvals and licences required are outlined below:

- Cancel works approval once Peebles Dam has been removed and pipes have been decommissioned.
- Continue managing and operating Homestead Dam as per current works approval
- AHIP – already obtained

5 Environmental Assessment

5.1 Landscape, Topography, Geology and Soils

5.1.1 Existing environment

Toorale is located at the confluence of the Warrego and Darling rivers. The Gundabooka National Park and State Conservation Area are located southeast of Toorale, across the Darling River. The park straddles three of the most poorly reserved bioregions in NSW. It protects significant areas of the Darling Riverine Plains Bioregion (49,119 ha) and Mulga Lands Bioregion (35,355 ha), as well as a portion of the Cobar Peneplain Bioregion (67 ha) (OEH, 2018a).

Overall, the landscape at Toorale is flat with river channels and floodplain features dominant. There are only a few large rises in the study area however low rises of cretaceous sandstones and red soil terraces are more common. Between Bourke and Wilcannia the Darling River has a simple landscape of channels, floodplains, billabongs and slightly higher red soil terraces (OEH, 2018a).

Toorale also contains an unusually high diversity of Mitchell landscapes, one of which was not previously protected within the NSW park system and five others that are now significantly better represented following Toorale's reservation. Homestead Dam is located within the Paroo-Warrego Channels and Floodplains landscape which includes parts of seven land systems including the Walkdens land system (Mitchell, 2002; Figure 4). The Paroo-Darling Channels and Floodplains landscape is characterised by channels, floodplains and dune field islands of Quaternary alluvium and aeolian sand, with occasional salinas and extensive scalds along the Warrego River. Relief is low (to 5 m) and channel and floodplain soil, such as which Homestead Dam is located in, are gray cracking, crab-holey clay (Mitchell, 2002).

Peebles Dam is located within the Mid-Darling Channels and Floodplains landscape, which includes parts of six land systems including the Nelyambo land system (Mitchell, 2002; Figure 4). This landscape consists of active floodplains with highly sinuous intermittently flowing anabranches with channels incised 10 to 15 m, lateral flood outs, terrace patches with recent and ancient dunes. Quaternary alluvium is heavy grey cracking clays with some sandy earths and sands within the channel loops, and terrace plains have sandy yellow texture contrast, red or yellow sands in dunces (Mitchell, 2002).

Toorale's high landscape and ecosystem diversity is reflected in the presence of 12 different land systems (Walker, 1991) including old erosional surfaces of undulating downs, sand plains, dunefields and alluvial floodplains. Ten of these 12 land systems were not represented in the NSW park system prior to Toorale's reservation. Homestead Dam is located entirely within the Walkdens land system, which is characterised by backplains of the Darling and Warrego River and channels and depressions of Quaternary alluviums (Walker, 1991; Figure 4). Relief in the Walkdens land system is usually less than 1 m (Walker, 1991). Peebles Dam is located within the Nelyambo land system which incorporates the Darling River floodplain which consists of extensive plains of Quaternary alluvium, slightly elevated areas, isolated dunes and minor drainage areas (Walker, 1991; Figure 4).

Geology

The sites are underlain by Quaternary floodplain, outwash and drainage flat deposits comprising of clayey silt and sand (NSW Geological Survey 1: 250,000). At depth the Quaternary deposits are underlain by Cretaceous deposits of sandstone, siltstone and claystone, known as the Rolling Downs Group (A.S. James, 2018).

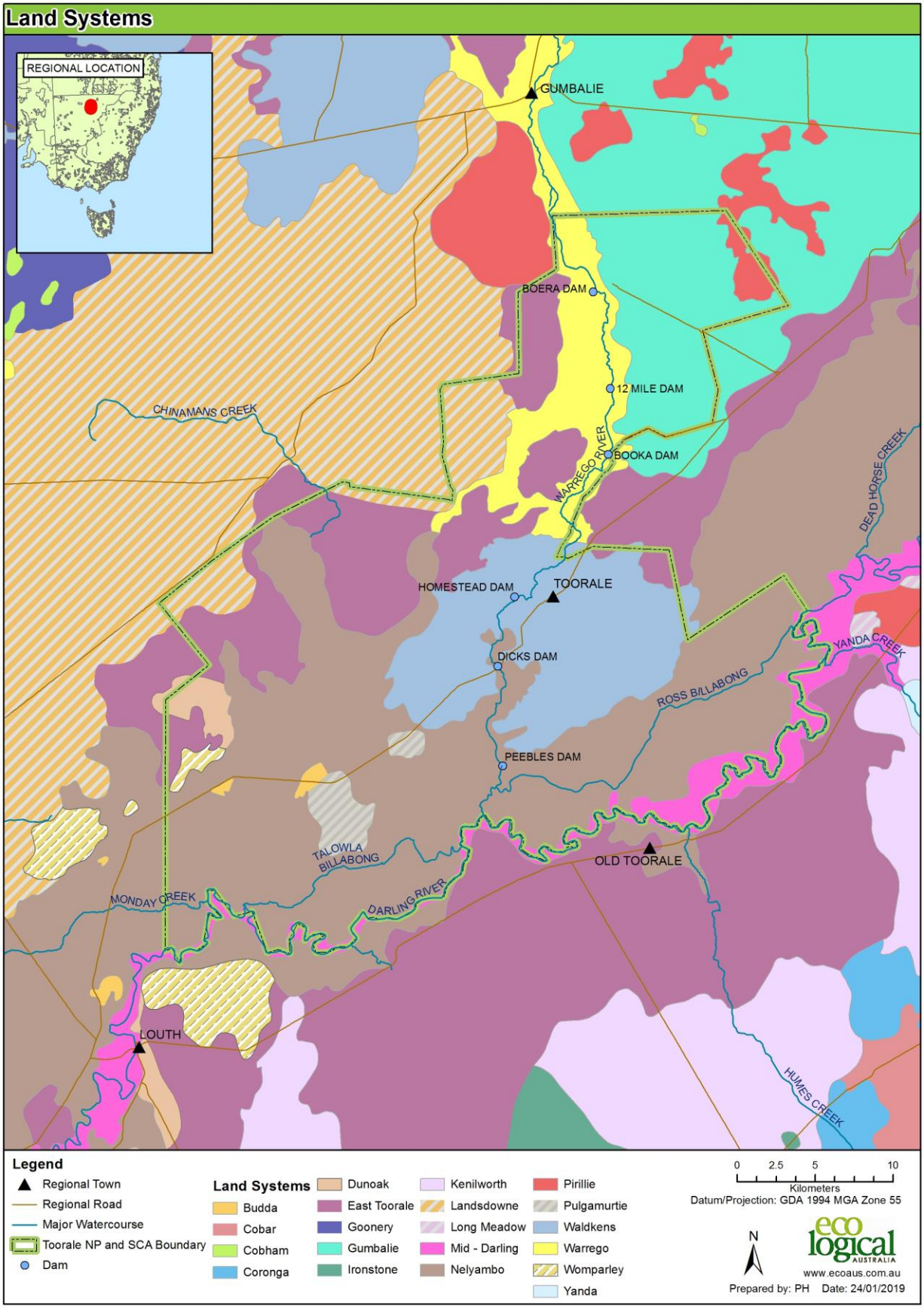

Figure 4: Land systems

Soils, erosion and sedimentation

The project sites include old erosional surfaces of undulating downs, sand plains, dunefields and alluvial floodplains. Both sites occur on Vertosol soils as per the Australian Soil Classification (Grey, Brown and Red Clays under the Great Soils Group classification). These are clay soils with shrink-swell properties that exhibit cracking when dry and at depth have slickensides and/or lenticular peds (Isbell, 2016). Gilgai (microrelief) may also be present but may have been smoothed out due to past agricultural practices, however the shrinking and swelling processes that created them are still operating (Isbell, 2016).

The Australian Soil Resource Information System online database indicates that there is an extremely-low to low probability of occurrence of potential acid sulfate soils (PASS) at Homestead Dam, while there is an extremely-low to high probability of occurrence of PASS at Peebles Dam (Fitzpatrick, Powell & Marvanek, 2011). Mapping indicates that PASS would generally occur within the upper 1 m of wet/riparian areas. However, the data confidence level of the mapping is low hence the classification is provisional due to a lack of analytical data available or ground truthing. Furthermore, an extensive study undertaken by the Murray-Darling Basin Authority (MDBA) found that waterways containing acid sulfate soils at levels of concern were located in the southern part of the Murray-Darling Basin (MDBA, 2009).

Modelled Exchangeable Sodium Percentage (ESP) at Homestead and Peebles Dams ranges between 2 – 4% in soil 0 – 30 cm deep (OEH, 2017a). At the 30 – 100 cm depth, modelled ESP is variable ranges between ≤2 – 6% at Homestead Dam, and 4 – 8% at Peebles Dam (OEH, 2017a). In Australia, soil sodicity is defined as an ESP of 6% (Isbell, 2016). Modelled ESP and presence of Vertosols which are characterised by strongly sodic subsoils, data at both dams indicate subsoils are sodic, particularly at Peebles Dam, indicating that dispersion is likely if exposed to water from rainfall or runoff. The topsoils are unlikely to be sodic. Generally, the erodibility of the surface soil and subsoil differ; surface erodibility primarily relates to sheet and rill erosion, while subsoil erodibility relates to gully erosion (Murphy and Lawrie, 1998). Whilst soils on the Site are sodic, no evidence of sheet or significant gully erosion was recorded on the Site during site inspections.

Salinity is the accumulation of salt in land and water to a level that damages the natural and built environment. Hydrogeological landscape and salinity hazard mapping is not available for Toorale. Modelled Electrical Conductivity ($EC_{1:5}$) indicates topsoils may be moderately saline at Homestead Dam (0.1 – 0.2 dS/m) and at Peebles Dam (0.2 – 0.3 dS/m) (OEH, 2017a). Modelled salinity increases with depth, with subsoils salinity at Homestead Dam ranging between 0.3 to 0.5 dS/m and at Peebles Dam modelled salinity is between 0.5 to 0.75 dS/m (OEH, 2017a). Furthermore, evidence of dryland salinity impacts are present at Toorale. Scalding is evident on pale clay soils in areas that have been overgrazed. Ponding structures have been constructed to control scalding in these areas.

Homestead Dam and Peebles Dam are located in areas mapped as Grey, Brown and Red Clays (Vertosols), which are classified as ”D - Very slow infiltration” under the Hydrologic Groups of Soils system (OEH, 2017b). Whilst the confidence level of the Hydrologic Groups of Soils mapping at Toorale is very low, infiltration is initially rapid in Vertosols via the cracks, but are imperfectly drained when wet, or if surface soil is dispersive.

Land Capability

Land capability classes aim to classify land according to its inherent ability and protection from erosion and other forms of land degradation. The classification of any land is based on biophysical features which determine the limitations and hazards of that land. The main hazards and limitations include water erosion, wind erosion, soil structure decline, soil acidification, salinity, waterlogging, shallow soils and

rockiness, and mass movement. The eight-class system recognises four types of land uses with land capability decreasing from Class 1 to Class 8 (OEH, 2012):

- Class 1 – 3: land suitable for cultivation;
- Class 4 – 5: land suitable for grazing and restricted cultivation;
- Class 6: land suitable for grazing; and
- Class 7 – 8: land not suitable for agricultural production.

Peebles Dam is mapped as high capability land (Class 3). Class 3 land has moderate limitations for more intensive use other than grazing and cropping with cultivation, and suitability for a variety of land uses can be maintained if carefully managed to prevent long-term degradation (OEH, 2012). Land and soil capability declines to Class 4 land at Homestead Dam. Class 4 land has moderate to high limitations for high impact land uses and restricts land management options for regular cropping, high-intensity grazing and horticulture (OEH, 2012). Under current management practices, soils at these locations are not cultivated for cropping and grazing, and livestock have now been excluded from Toorale.

Embankments

The embankments in the sites were initially constructed approximately 120 years ago and are likely to consist of locally sourced materials (A.S. James, 2018). Furthermore, A. S. James (2018) assumed in their geotechnical investigation that the embankments are not constructed to satisfy current Australian Standard Compaction methods.

The embankment of Homestead Dam consists of bare earth with no grass cover or equivalent protection from weathering processes. The causeway near the Homestead Dam is underlain by a sandy clay. Adjacent to the Homestead Dam, the surface soil is comprised of a sandy silt, which is underlain by a very stiff clay with calcrete lenses. The embankments around Homestead Dam are currently stable, with evidence of previous erosion.

The Peebles Dam embankment was not included in the scope of the geotechnical investigation undertaken by A.S. James (2018). However, the Peebles embankment appears of a similar nature and in similar condition to the embankments on the other upstream storages.

Contaminated Land

A review of the EPA Contaminated Land Record under section 58 of the CLM Act and the List of NSW contaminated sites notified to the NSW EPA under section 60 of CLM Act did not reveal any registered contaminated land sites within or surrounding Toorale.

A review of premises currently regulated by an EPL under the POEO Act and premises that are no longer required to be licensed under the POEO Act did not reveal any identified premises within or surrounding Toorale.

Pursuant to Clause 7 of the State Environmental Planning Policy No 55 – Remediation of Land there is no apparent reason to consider that land to be utilised by the Proposed Development would be contaminated.

Whilst no registered contaminated land occurs within Toorale, potential contamination associated with past agricultural activities may exist on site. These include sheep dips, import and fill material, demolition of old buildings and stockpiling of wastes.

5.1.2 Potential Impacts

Peebles Dam

Landscape and topography

The landscape and topography of the area in Toorale will not be altered. The river channel features (dams) will be impacted with the modification of the dam. These are considered in Section 5.3.

Soils

The proposed works would involve site disturbance through excavation, removal of topsoil, rock and vegetation, vehicle access and other construction activities. These excavation activities have the potential to results in soil erosion (including wind erosion from stockpiles), decreased stability and sedimentation due to localised temporary removal of groundcover and the disturbance of the soil profile. The extent of the impact is likely to be dependent upon:

- Size and weight of machinery;
- Extent of vegetation removal; and
- Sensitivity of land.

Approximately 2,200 m^3 of spoil material will be removed and deposited in the existing borrow pits at Peebles Dam. Whilst the proposed works at Homestead Dam may utilise 1,500 m^3 of this spoil if deemed suitable, all residual spoil from the removal of the embankment at Peebles Dam will be deposited in local borrow pits resulting from earlier earthworks at the site. Therefore, the proposed works do not require the disturbance of *in-situ* soil resources within the proposed disturbance areas as the embankment will only be removed to the existing bed level. The spoil cannot be reinstated as topsoil and subsoil, due to mixing in the past, and will therefore essentially be stockpiled. Apart from the potential re-use of a portion of the spoil, there is no proposed future use of the remaining spoil.

A geotechnical survey of the Peebles Dam embankments has not been undertaken. Therefore, there are uncertainties regarding the stability of the existing soil structure for re-use, particularly given the sodic nature of Vertosol subsoils. There is the potential for erosion of stockpiles that may be created in the burrow pits during heavy rainfall events, particularly if there is a decline in soil structure resulting in low infiltration rates and increased run-off. The water erosion hazard of these soils will be greatly reduced by installation and monitoring of sediment and erosion controls during the construction period.

Dust particles may be released as a result of a range of activities associated with the Proposed Development including:

- Vegetation clearing (minor);
- Earthworks;
- Stockpiles;
- Loading and unloading of material; and
- Haulage on unsealed roads.

Fuels and lubricants will be used on site during construction activities and may pose a potential contamination risk to soils and waterways in the event of a spill. These chemicals may alter soil properties and can impact negatively on soil health and consequently plant growth or if absorbed by plants/animals could potentially enter the food chain with adverse impacts. Contaminants in the soil can be mobilised during rainfall events which may potentially spread contamination through the soil profile, or into surface or groundwater potentially impacting aquatic habitats.

Due to the location of the works occurring in the Warrego River channel, there is potential for post-construction soil erosion downstream of the embankment location following its removal due to increased flow velocity.

Homestead Dam

Landscape and topography

The landscape and topography of the area in Toorale will not be altered. The river channel features (dams) will be impacted with the modification of the dam. These are considered in Section 5.3.

Soils

The proposed works would involve site disturbance through excavation, removal of topsoil, subsoil and vegetation, vehicle access and other construction activities. The extent of the impact is likely to be dependent upon:

- Size and weight of machinery;
- Extent of vegetation removal; and
- Sensitivity of land.

If suitable, the proposed works at Homestead Dam will utilise 1,500 m^3 of spoil that will be generated by the removal of the Peebles Dam embankment. Therefore, the proposed works do not require the disturbance of *in-situ* soil resources within the proposed impact areas. Spoil material will be transported to the site by tipper trucks, and any stockpiling of material at Homestead Dam will be of short duration, therefore, alteration of physical and chemical soil properties, including structure, fertility, permeability and microbial activity are not anticipated.

Due to the location of the works occurring in the Warrego River channel, there is potential for soil erosion to occur if a flow occurred during construction. Excavation and deposition in the channel may increase erosion hazard, particularly if sodic soils are used and not ameliorated or protected. However, the likelihood of erosion from flows is unlikely as the proposed activity will be scheduled for a no flow period, or water will be redirected away from the construction area.

There is the potential for erosion during heavy rainfall events, particularly if there is a decline in soil structure resulting in low infiltration rates and increased run-off. The water erosion hazard of these soils will be greatly reduced by installation and monitoring of sediment and erosion controls during the construction period.

Dust particles may be released as a result of a range of activities associated with the Proposed Development including:

- Vegetation clearing (minor);
- Earthworks;
- Stockpiles;
- Loading and unloading of material; and
- Haulage on unsealed roads.

Water and wind erosion could result in the loss of soil from the landscape and a subsequent movement of soils and associated nutrients into watercourses leading to reductions in water quality at the site and downstream.

Geotechnical surveys indicate that the embankments are stable in their current state, however evidence of erosion was observed on site (A.S. James, 2018). If this erosion continues, the stability of the embankments could be compromised. Instability of the embankments has occurred in the past and Homestead Dam embankment is currently breached, hence sedimentation of the Warrego River has taken place.

Depending on the time of year the proposed works are undertaken, the *in-situ* sandy clay/clayey sands may exist at moisture significantly below the optimum moisture content. The addition of water directly prior to compaction is unlikely to provide a uniform moisture distribution throughout the clay fill. This is likely to result in dry zones within the wall that are highly susceptible to dispersion and ultimate failure of the structure by piping. Furthermore, due to the potentially dispersive characteristics of the clays, there is a high potential for silts and clays to be washed out along flow paths resulting in not only embankment instability, but decreased water quality from sedimentation.

Fuels and lubricants will be used on site during construction activities and may pose a potential contamination risk to soils and waterways in the event of a spill. These chemicals may alter soil properties and can impact negatively on soil health and consequently plant growth or if absorbed by plants/animals could potentially enter the food chain with adverse impacts. Contaminants in the soil can be mobilised during rainfall events which may potentially spread contamination through the soil profile, or into surface or groundwater potentially impacting aquatic habitats.

5.1.3 Mitigation measures

Mitigation measures for physical and chemical impacts are outlined in Section 6.3.

5.2 Terrestrial Ecology

5.2.1 Existing environment

Toorale is a large, highly diverse park with extensive, high conservation value wetlands, floodplains and riparian habitats. Toorale supports a diverse biodiversity (OEH, 2016), including many State and nationally-listed threatened species and communities (ELA, 2017).

Four ecological communities were identified as potentially meeting NSW and Commonwealth definitions as EECs. These are presented in Table 8.

Table 8: Ecological communities that occur in Toorale

Community Name	NSW Status	Commonwealth Status
Artesian Springs Ecological Community in the Great Artesian Basin	BC – Critically Endangered	Not listed
Brigalow-Gidgee woodland/shrubland in the Mulga Lands and Darling Riverine Plains Bioregions	BC - Endangered	Not listed
Coolibah-Black Box Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain and Mulga Lands Bioregion	BC - Endangered	EPBC - Endangered
Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River	FM - Endangered	Not Listed

BC – *Biodiversity Conservation Act 2016*, FM – *Fisheries Management Act 1994*, EPBC –*Environment Protection and Biodiversity Conservation Act 1999*

Vegetation Communities

There are 27 vegetation communities categorised as Plant Community Types (PCTs) in Toorale, 15 of which occur on the dryland landscapes, and 12 occur on floodplain landscapes (Figure 5).

Approximately 18,600 hectares (or roughly 20 %) of Toorale is covered by Coolibah – Black Box Woodland EEC, a threatened floodplain woodland community. Historic water management practices have helped to create a vast wetland ecosystem that encompasses nearly 30,000 hectares on Toorale and adjoining properties. The four PCTs that occur surrounding Homestead and Peebles Dam are presented in Table 9, and shown in Figure 6 and Figure 7.

The Coolabah EEC (mapped as PCT 40 in Figure 5, Figure 6 and Figure 7) is found in proximity to Homestead and Peebles Dams. PCT 40 occurs broadly along the floodplain of the Darling and Warrego Rivers. It is listed as Endangered as *"Coolibah-Black Box Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain and Mulga Lands Bioregion"* on the NSW BC Act and as "*Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions*" under the federal EPBC Act). This EEC encompasses three vegetation communities, as mapped by Gowans et al. (2012).

The main vegetation community surrounding both Homestead Dam and Peebles Dam is Coolabah Open Woodland (PCT 40). This community is characterised by Coolabah (*Eucalyptus coolabah subsp. coolabah or subsp. excerata)* and often Black Box (*Eucalyptus largiflorens)* tree species (Figure 8). Within the impact areas, these tree species typically provide habitat in the form of small hollows that may be

used by parrots and microbats (L. Copeland pers. comm.). Due to the long-term impacts of changed flooding regimes on its condition, and its rate of decline, this vegetation community is listed as an EEC under NSW BC Act and the federal EPBC Act. Chenopod low open shrubland vegetation community (PCT 212) is also found in the Homestead Dam impact area (Figure 6; Figure 8). This is the largest vegetation community found at Toorale, covering approximately 40% of the total area (ELA, 2017).

Table 9: Plant Community Types at within the project impact areas.

PCT	Community Common Name	Dam
212	Chenopod low open shrubland - ephemeral partly derived forbland saline wetland on occasionally flooded pale clay scalds in the NSW North Western Plains	Homestead
40*	Coolabah open woodland wetland with chenopod/grassy ground cover on grey and brown clay floodplains	Homestead and Peebles
25	Lignum shrubland wetland on floodplains and depressions of the Mulga Lands Bioregion, Channel Country Bioregion in the arid and semi-arid (hot) climate zones	Peebles
41	River Red Gum open woodland wetland of intermittent watercourses mainly of the arid climate zone	Peebles

* EEC

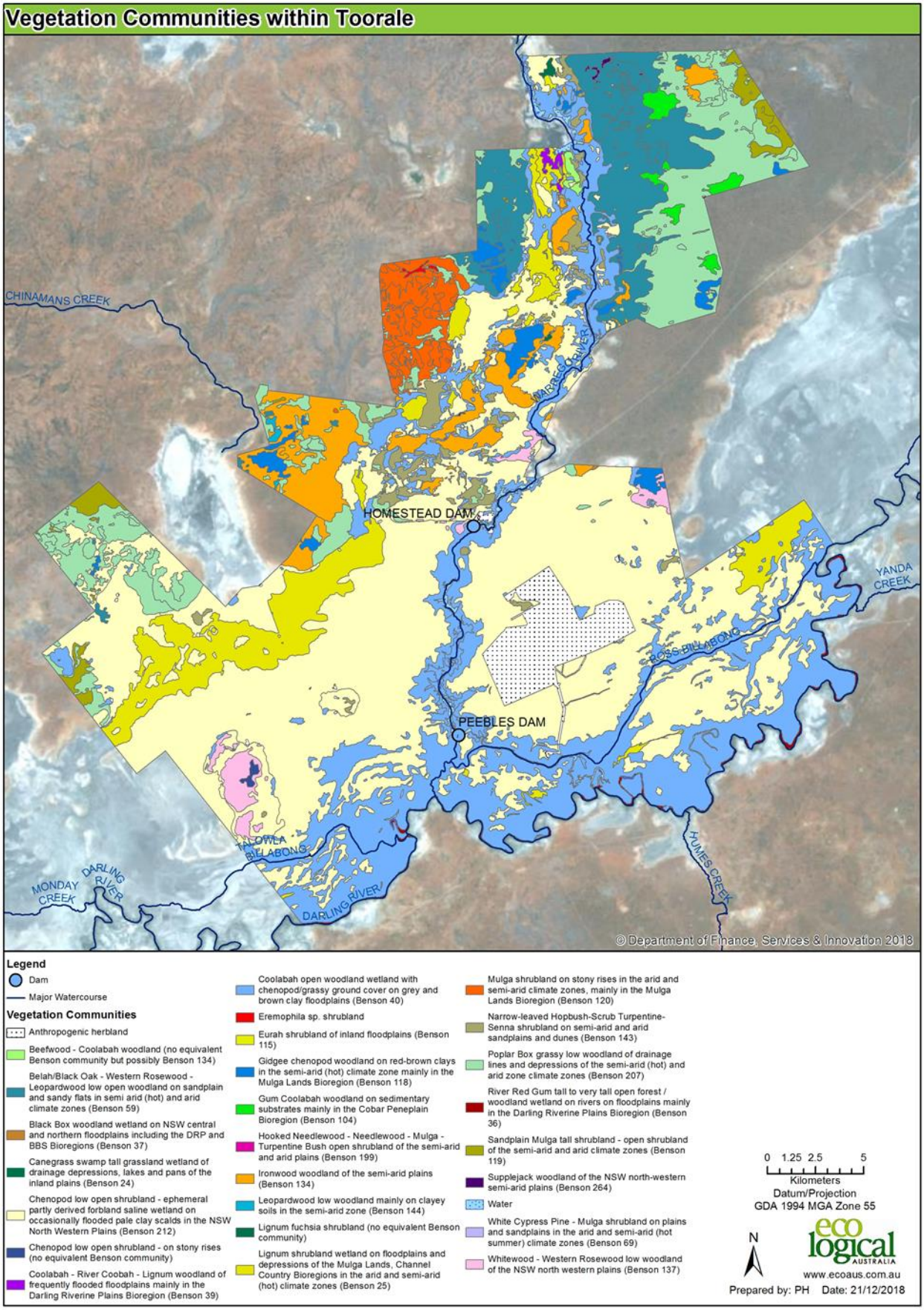

Figure 5: Vegetation Communities in Toorale

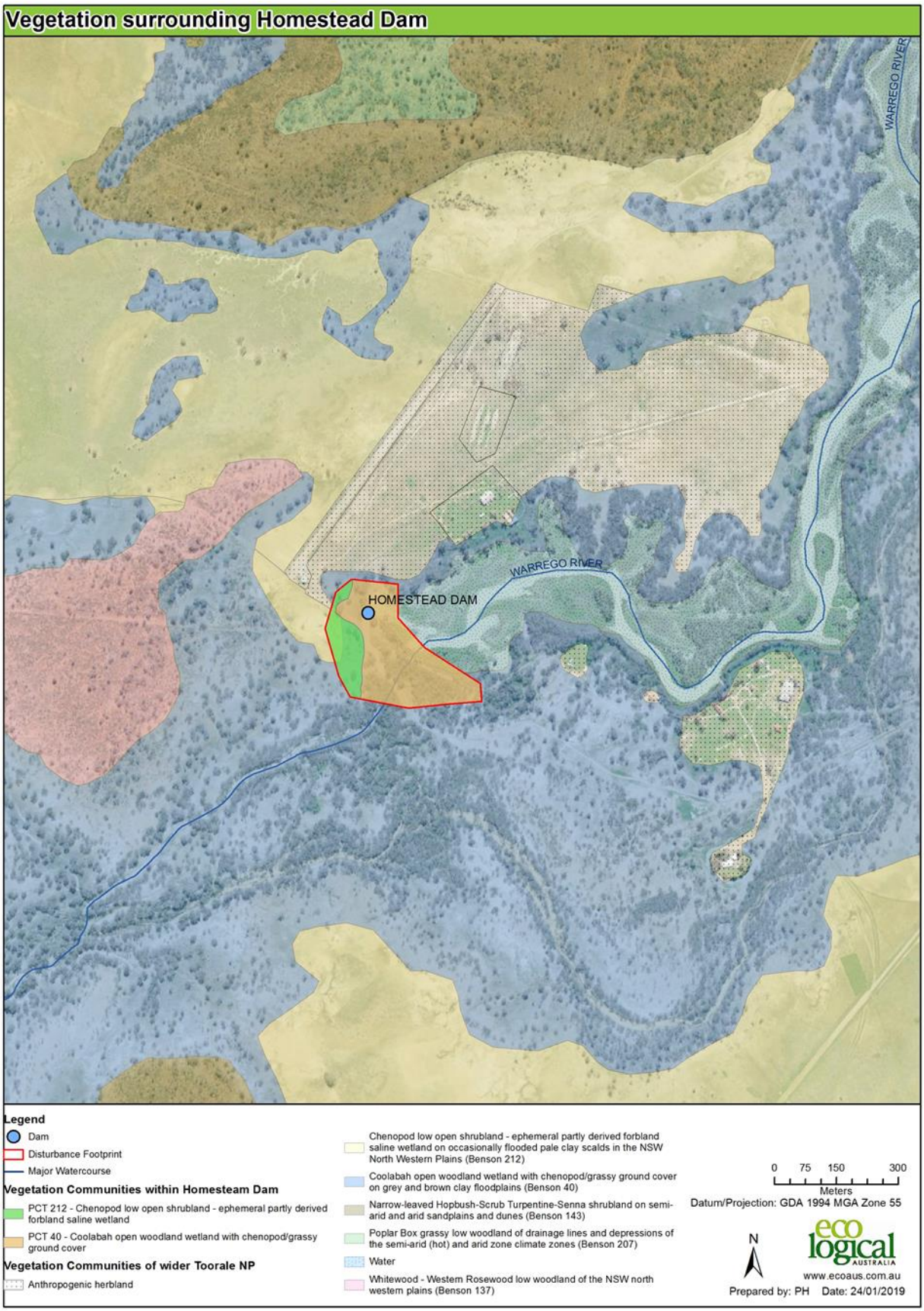

Figure 6: Plant Community Types at Homestead Dam within project area of actual or potential impact

Figure 7: Plant Community Types at Peebles Dam within project areas of actual or potential impact

Figure 8: PCT types notes in the impact areas of the proposed development. PCT 40 at Homestead Dam (top left), PCT 212 at Homestead Dam (top right), PCT 41 at Peebles Dam (bottom left), and PCT 25 at Peebles Dam (bottom right)

Other vegetation communities found in the Peebles Dam project area include Lignum shrubland wetland (PCT 25), and River Red Gum open woodland and wetland (PCT 41) (ELA, 2017; Figure 7).

PCT 25 is characterised as a floodplain shrubland that relies on flooding frequency to drive the structure and diversity of this community (Figure 8). It grows on Grey Vertosols on the Western Floodplain and along channels and in depressions to a height of 0.5 – 4.0 m. This PCT covers an area of 5,850 ha (6%) within Toorale (Gowans et al 2012). Dominated by Tangled Lignum, River Cooba and *Eremophilla* species. Tangled lignum appearing as large dense clumps up to 4 m on more frequently flooded areas. These shrublands form habitat for nesting waterbirds on the Western Floodplain (Biosis, 2016).

PCT 41 is characterised as open woodland or tall open woodland composed of the arid zone sub-species of River Red Gum, sometimes with Coolabah in northern areas (Figure 8). The trees are more widely spaced and shorter in stature, and ground cover is sparser than in the River Red Gum communities in wetter climes. This community occurs on sandy or loamy soils in sandy creeks on sandplains of lower slopes of rises or hills in the arid climate zone of far north western NSW. Within Toorale this PCT covers an area of 250 ha (<1%; Gowans et al. 2012)

Flora

ELA (2017) conducted a desktop assessment of the potential flora and fauna that could be found at Toorale. Following a literature review and database searches (OEH, 2019a), a comprehensive list was compiled of 551 plant species known or likely to occur at Toorale (Appendix D). Native species dominate, comprising 506 species compared to 45 introduced exotic species. Of the exotics, one species was listed as a Priority Weed under the North West RSWMP (*Prosopis* spp.). In addition to the desktop assessment on the likely flora at Toorale, fieldwork was conducted in May 2018 to confirm species currently present in the study area. This included surveys of five biobanking plots which were completed within the proposed impact areas (Figure 6, Figure 7, Table 10). Table 11 shows the plant species that were found surrounding each dam site.

Table 10: Biobanking plots at Homestead and Peebles Dam

Plot Location	Easting	Northing	PCT number
Homestead Dam	0343264	6649229	212
Homestead Dam	0343448	6649162	40
Peebles Dam	0343073	6638229	25
Peebles Dam	0343497	6637810	41
Peebles Dam	0342299	6637973	40

Table 11: Plant species found at Homestead and Peebles Dam

Scientific Name	Common Name	Homestead Dam	Peebles Dam
Acacia stenophylla	River Cooba	x	x
Acacia victoriae	Elegant Wattle	x	
Chenopodium auricomum	Queensland Bluebush	x	
Duma florulenta	Lignum	x	x
Enchylaena tomentosa	Ruby Saltbush	x	
Eragrostis setifolia	Neverfail		x
Eremophila bignoniiflora	Eurah		x
Eremophila deserti	Turkeybush	x	
Eucalyptus camaldulensis	River Red Gum		x
Eucalyptus coolabah	Coolibah	x	x
Eucalyptus largiflorens	Black Box		x
Glinus lotioides			x
Haloragis glauca	Raspwort	x	
Lycium ferocissimum	African Boxthorn	x	
Maireana sedifolia	Pearl Blubush	x	
Maireana coronata	Crown Fissure-weed	x	

Scientific Name	Common Name	Homestead Dam	Peebles Dam
Medicago polymorpha	Burr Medic		x
Paspalidium jubiflorum	Warrego Grass	x	x
Salsola australis	Roly Poly		x
Sclerolaena bicornis	Goathead Burr	x	
Sclerolaena birchii	Galvanised Burr		x
Sclerolaena calcarata	Redburr	x	
Sclerolaena divaricata	Tangled Copperburr	x	
Sclerolaena muricata var. *muricata*	Black Rolypoly		x
Stemodia florulenta	Bluerod	x	

Fauna

As per the Biodiversity Status Report (ELA 2017), and review of the Bionet database (OEH, 2019b), 377 fauna species were identified as known or likely to occur at Toorale (Appendix E). Figure 9 represents the threatened species search within a 10 km radius of Homestead Dam, with the same search completed for Peebles Dam shown in Figure 10. This list includes only vertebrate taxa and invertebrates with cultural or economic value, and contains the following numbers of species:

- 231 Aves – birds
- 67 Reptilia – reptiles
- 41 Mammalia – mammals
- 19 Actinoptergii – ray-finned fish
- 17 Amphibia – frogs
- 1 Crustacea - crustaceans
- 1 Gastropoda – snails

These animals occupy a wide range of ecological niches, for example, woodland birds, migratory wading birds, ground-nesting and hollow-nesting birds, and burrowing and arboreal mammals. The diversity of species reflects the variety of habitat elements in Toorale (OEH, 2018a).

The Toorale Draft PoM lists the following threatened and significant animals recorded in Toorale in Table 12 with their BC Act status. None of these species are listed under EPBC Act.

Native animal surveys on sections of the property were conducted in 2003, 2004 and 2015 (Kelly 2004; Shelley et al. 2003). These surveys, along with other opportunistic sightings, have recorded 255 native animal species (although 7 are only identified to genus level), including 158 birds, 56 reptiles, 27 mammals and 14 frogs. The diversity of species, occupying a wide range of ecological niches (such as woodland birds, migratory wading birds, ground-nesters, hollow-nesters, burrowing and arboreal mammals) is significant and indicates the variety of habitat elements in Toorale.

Table 12: Fauna identified at Toorale

Common Name	Scientific Name	BC status
Reptiles		
Interior blind snake	*Ramphotyphlops endoterus*	E
Leopard ctenotus	*Ctenotus pantherinus*	E
Ringed brown snake	*Pseudonaja modesta*	E
Birds		
Australian bustard	*Ardeotis australis*	E
Barking owl	*Ninox connivens*	V
Black falcon	*Falco subniger*	V
Blue-billed duck	*Oxyura australis*	V
Brolga	*Grus rubicunda*	V
Grey-crowned babbler (eastern subspecies)	*Pomatostomus temporalis*	V
Grey falcon	*Falco hypoleucos*	V
Hall's babbler	*Pomatostomus halli*	V
Hooded plover	*Thinornis rubricollis*	E
Little eagle	*Hieraaetus morphnoides*	V
Pink cockatoo	*Lophochroa leadbeateri*	V
Painted honeyeater	*Grantiella picta*	V
Red-tailed black cockatoo	*Calyptorhynchus banksii samueli*	V
Shy heathwren	*Hylacola cautus*	V
Spotted harrier	*Circus assimilis*	V
Varied sittella	*Daphoenositta chrysoptera*	V
White-fronted chat	*Epthianura albifrons*	V
Mammals		
Little pied bat	*Chalinolobus picatus*	V
Yellow-bellied sheathtail-bat	*Saccolaimus flaviventris*	V

V – Vulnerable, E - Endangered

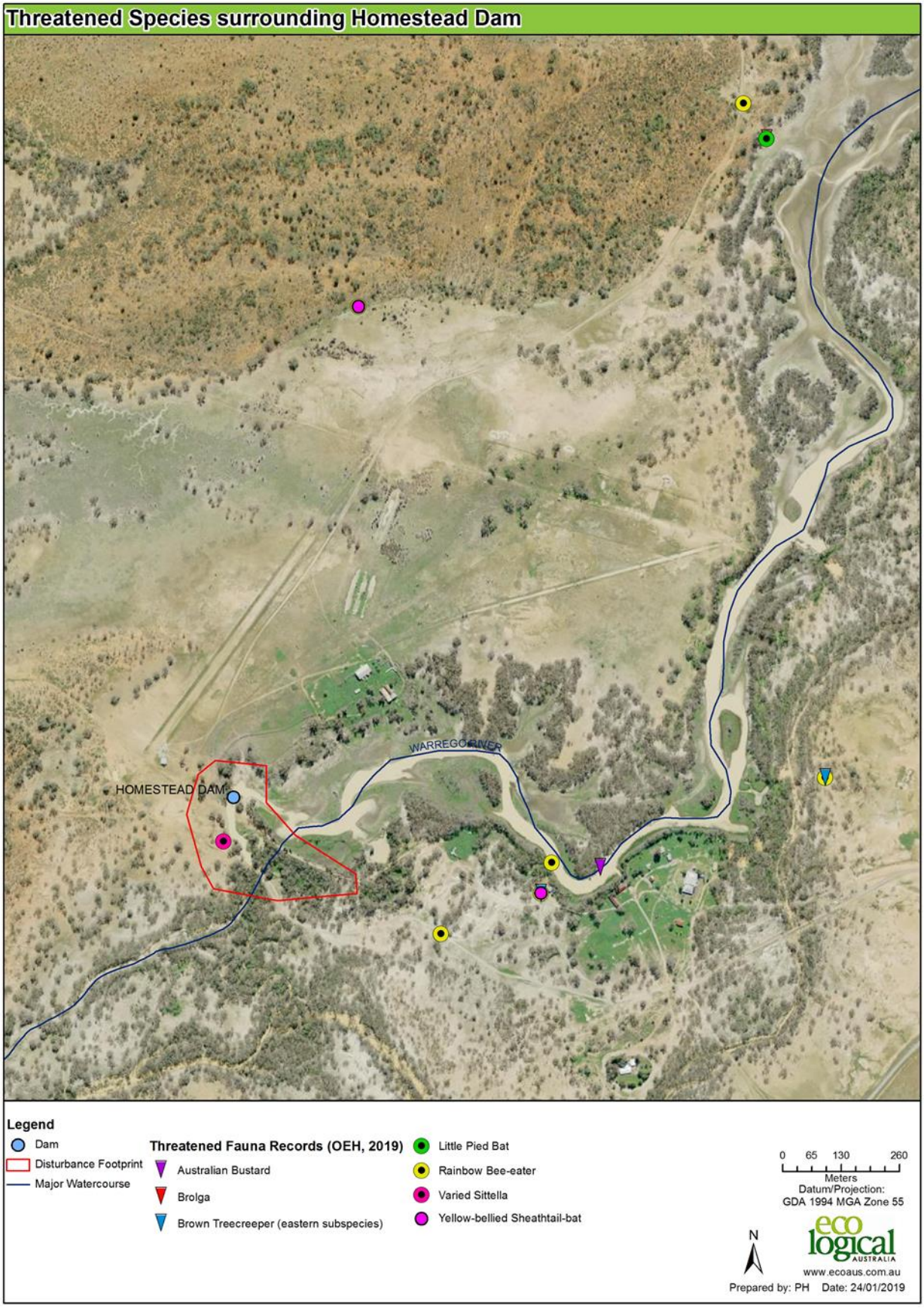

Figure 9: Threatened species records surrounding Homestead Dam

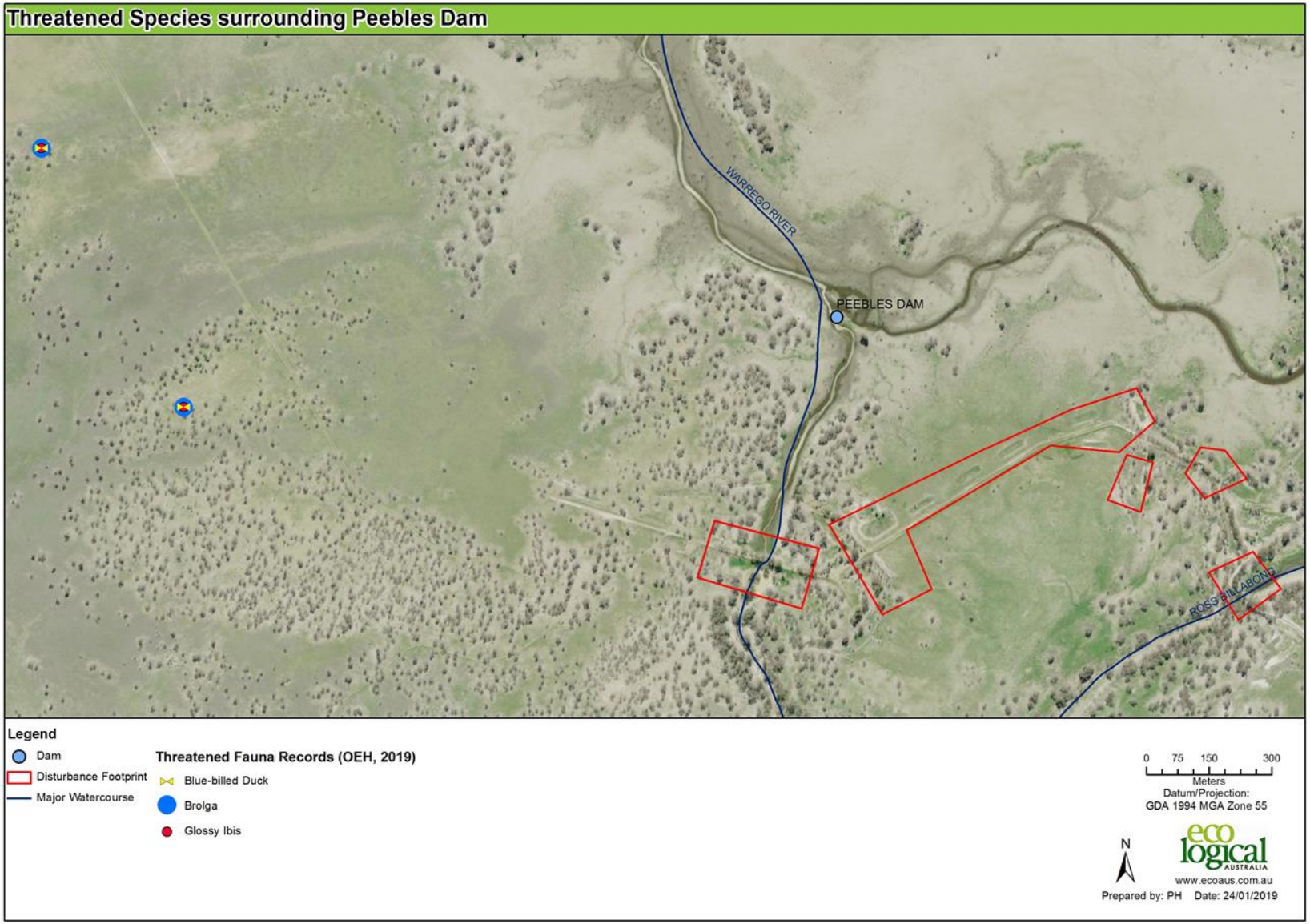

Figure 10: Threatened species records surrounding Peebles Dam

A further 16 animals that have also been recorded on Toorale, while not currently listed as threatened species, are of conservation concern in the NSW Western Division (see Table 13).

Table 13: Species that are rare or have limited breeding abilities

Common Name	Scientific Name
Reptiles	
Murray turtle	*Emydura macquarii*
Birds	
Australian pelican	*Pelecanus conspicillatus*
Bourke's parrot	*Neopsephotus bourkii*
Crested bellbird (southern)	*Oreoica gutturalis*
Australasian darter	*Anhinga novaehollandiae*
Great cormorant	*Phalacrocorax carbo*
Olive-backed oriole	*Oriolus sagittatus*
Pied Cormorant	*Phalacrocorax varius*
Mammals	
Swamp wallaby	*Wallabia bicolor*
Amphibians	
Broad-palmed frog	*Litoria latopalmata*
Desert froglet	*Crinia deserticola*
Rough frog	*Cyclorana verrucosa*

Fieldwork undertaken in May 2018 which involved a two-person transverse across the impact areas around Homestead and Peebles Dams, confirmed the presence of twenty-seven bird species (Table 14). No other vertebrates were encountered. 'X' in the table indicates that the species was identified.

Table 14: Bird species identified at Homestead and Peebles Dam

Common Name	Scientific Name	Homestead Dam	Peebles Dam
Australian Magpie	*Cracticus tibicen*	x	x
Apostlebird	*Struthidea cinerea*	x	
Australian Raven	*Corvus coronoides*		x
Australian Ringneck	*Barnardius zonarius*	x	x
Black Kite	*Milvus migrans*		x
Common Bronzewing	*Phaps chalcoptera*	x	
Grey Shrike-thrush	*Colluricincla harmonica*	x	
Magpie Lark	*Grallina cyanoleuca*	x	x

Common Name	Scientific Name	Homestead Dam	Peebles Dam
Peaceful Dove	*Geopelia placida*		x
White-plumed Honeyeater	*Lichenostomus penicillatus*	x	x
Yellow-throated Miner	*Manorina flavigula*	x	x

Pest animals have been recorded at Toorale, specifically goats and pigs. Goats contribute to the total grazing impact on native vegetation. The goats have been recorded in the dryland landscapes and areas adjacent to permanent water. Pigs are also widespread throughout the property.

Threatened species

Flora and fauna listings for Toorale include a large number of species listed under the following legislation:

- NSW *Biodiversity Conservation Act*;
- NSW *Fisheries Management Act*; and
- Commonwealth *Environment Protection and Biodiversity Conservation Act*.

Four listed flora and fourteen listed fauna species were recorded as having the potential to occur within the study area. Impact assessments were undertaken for these species (Appendix G). Listed flora (Appendix D) and fauna species (Appendix E) are summarised below in Table 15 - Table 18 (note some species may occur in more than one classification).

Table 15: Listed flora species with potential to occur within the study area

Scientific Name	Common Name	NSW Status	Commonwealth. Status
Lepidium monoplocoides	Winged pepper-cress [9190]	E	
Atriplex infrequens	A saltbush	V	V
Austrostipa metatoris		V	
Dentella minutissima		E	

P – Protected, V – Vulnerable, E – Endangered

Table 16: Listed fauna species with potential to occur within the study area

Scientific Name	Common Name	NSW Status	Commonwealth. Status
Fish			
Maccullochella peelii	Murray Cod		V
Birds			
Ardeotis australis	Australian Bustard	E	
Calyptorhynchus banksii samueli	Red-tailed Black-Cockatoo (inland subspecies)	V	
Daphoenositta chrysoptera	Varied Sittella	V	
Epthianura albifrons	White-fronted Chat	V	

Scientific Name	Common Name	NSW Status	Commonwealth. Status
Falco hypoleucos	Grey Falcon	E	
Falco subniger	Black Falcon	V	
Grus rubicunda	Brolga	V	
Hieraaetus morphnoides	Little Eagle	V	
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	
Oxyura australis	Blue-billed Duck	V	
	Mammals		
Chalinolobus picatus	Little Pied Bat	V	
Phascolarctos cinereus	Koala	V	V
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	

V – Vulnerable, E – Endangered

Table 17: Summary of listed NSW species that potentially occur in the study area

Fauna	Critically Endangered	Endangered	Endangered Population	Vulnerable	Protected	**Total**
			Fauna			
Actinopterygii		1		1		**2**
Amphibia				1	14	**15**
Aves	1	6		26	150	**183**
Gastropoda	1		2			**3**
Mammalia		2		7	21	**30**
Reptilia		4		1	51	**56**
			Flora			
Flora		3		2	4	**9**
Total	**2**	**16**	**2**	**38**	**240**	**298**

Table 18: Summary of listed Commonwealth species that potentially occur in the study area

Fauna/Flora	Critically Endangered	Endangered	Endangered Population	Vulnerable	Protected	**Total**
Actinopterygii				1	**1**	
Amphibia						
Aves	4	3		3	**10**	4

Fauna/Flora	Critically Endangered	Endangered	Endangered Population	Vulnerable	Protected	**Total**
Gastropoda						
Mammalia				2	**2**	
Reptilia						
Total	**4**	**3**	**0**	**6**	**13**	**4**

Assessments of likelihood are provided for all listed flora, fauna and EECs in Appendix F. Assessments of Significance are given in Appendix G and Appendix H.

The most recent fieldwork conducted by ELA in May 2018 found that a single individual of a threatened species (Varied Sittella) observed flying low overhead in the Coolabah at Booka Dam. It is listed as Vulnerable on the NSW BC Act.

Weeds

Fourteen significant weeds have been recorded within Toorale as identified in Table 6 of the Draft PoM (OEH 2018a), including five species listed as priority weeds under the Western RSWMP (Table 19). Eight species have a wide distribution (African Boxthorn, Athel Pine, Bathurst Burr, Buffel Grass, Golden Dodder, Mexican Poppy, Noogoora Burr and Thornapple), while Phoenix Palm and Parkinsonia's distribution have been restricted to Homestead Dam and its vicinity (Toorale Homestead).

Table 19: Weeds identified in Toorale including their distribution and status

Species name	Common Name	Distribution	Western RSWMP
African Boxthorn	*Lycium ferocissimum*	Scattered throughout, prefers red soils	State (Asset Protection) and Regional (Asset Protection) Priority Weed
Athel Pine	*Tamarix aphylla*	Scattered riparian areas	State (Asset Protection) Priority level weed
Bathurst Burr	*Xanthium spinosum*	4 sites in 2011 vegetation survey (Gowans et al. 2012)	
Buffel Grass	*Cenhrus ciliaris*	Broadly distributed landscape weed	
Century Plant	*Agave americana*	Old Dara Homestead site	
Giant Reed	*Arundo donax*	Warrego Dam walls	Regional (Containment) Priority weed
Golden Dodder	*Cuscuta campestris*	Toorale's western floodplain	
Mexican Poppy	*Argemone ochroleuca* subsp. *ochroleuca*	Infestations on floodplains and disturbed areas; spread by floodwaters	
Noogoora Burr	*Xanthium occidentale*	Found along waterways	

Species name	Common Name	Distribution	Western RSWMP
Parkinsonia	*Parkinsonia aculeata*	One at Toorale Homestead (treated)	State (Eradication) Priority Weed
Phoenix Palms	*Phoneix* sp.	Homestead Dam walls	
Prickly Pear	*Opuntia* sp.	Garden of riginal Boera Homestead site	
Thornapple	*Datura ferox*	Disturbed areas; mainly irrigation channels	
Wild Tobacco	*Solanum mauritianum*	Boera Dam wall	

Only one listed above was identified during surveys undertaken for the proposed works. African Boxthorn was identified in one plot at Homestead Dam with a low cover (<2%). Other exotic weeds identified during surveys included *Sisymbrium* sp. at Homestead Dam, and *Medicargo polymorpha* (Burr Medic) and Noogoora Burr at Peebles Dam. Cover of Burr Medic was high (20%), however, number of individuals and cover of Noogoora Burr and *Sisymbrium* sp. were low (<10%).

5.2.2 Potential impacts

Peebles Dam

Vegetation Communities

An area of approximately 16.76 ha was assessed as being within the potential disturbance area at Peebles Dam (Table 20). However, it is unlikely that the full area will be impacted by the proposed activities, and in practice is likely to be limited to the area of dam wall to be removed, the borrow pits to which spoil will be returned, and some small areas around these where vehicles and machinery will manoeuvre. This consists of three vegetation communities, but mostly Lignum Shrubland wetland and Coolabah open woodland PCTs. Vegetation that may be removed for the proposed works comprises trees, shrubs and groundcover. The proposed works will likely involve the clearing of trees and vegetation on the Peebles Dam bank, along with areas within the borrow pits. Large mature trees and hollow bearing trees on the edge of the disturbance areas will be avoided as much as possible. Given the small areas that are likely to be affected by the proposed development, clearing of, or disturbance to, these vegetation communities will have negligible impact on the vegetation communities at a regional scale.

Coolabah open woodland communities adjacent to Ross Billabong may be indirectly impacted by the proposed works outside of the surveyed impact areas, due to a potentially reduced wetting regime within Ross Billabong. This may be especially true for the larger more established trees in these communities, that likely rely on water in Ross Billabong when it holds water. Monitoring of the health and composition of these communities is recommended to assess any future change related to the proposed development. If changes are noted, existing infrastructure and water licences owned by the CEWH could be utilised to provide water to Ross Billabong to improve the condition of these communities.

Table 20: PCT's within the proposal area that may be impacted by the proposed works

PCT	PCT Common Name	BC Act	EPBC Act	Maximum area of disturbance (ha)	
				Peebles Dam	Homestead Dam
25	Lignum shrubland wetland on floodplains and depressions of the Mulga Lands Bioregion, Channel Country Bioregion in the arid and semi-arid (hot) climate zones			7.50	
40	Coolabah open woodland wetland with chenopod/grassy ground cover on grey and brown clay floodplains	E	E	7.77	5.48
41	River Red Gum open woodland wetland of intermittent watercourses mainly of the arid climate zone			1.49	
212	Chenopod low open shrubland - ephemeral partly derived forbland saline wetland on occasionally flooded pale clay scalds in the NSW North Western Plains				1.60
			Total area (ha)	**16.76**	**7.08**

Threatened Ecological Communities

Approximately 7.77 ha of the proposed disturbance area is classified as PCT 40: Coolabah open woodland wetland with chenopod/grassy ground cover on grey and brown clay floodplains. This PCT represents a Threatened Ecological Community (TEC) under both the BC Act and EPBC Act. Disturbance and vegetation clearing will be kept to a minimum to avoid high impacts.

An assessment of significance (5-part test) under the BC Act (Appendix G) and an EPBC Act assessment under the EPBC Act Significant Impact Guidelines (Appendix H) was prepared for the Coolibah-Black Box Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain and Mulga Lands Bioregions EEC under the BC Act, and the Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions EEC under the EPBC act.

The maximum area of the Coolabah-Black Box woodland (7.77 ha) to be impacted is relatively minor, and there are relatively large areas of the EEC that will remain adjacent to the study area. In addition, the proposed works will not further isolate or fragment areas of the EEC, and a further 18,600 ha of this EEC remains within Toorale National Park. For these reasons, assessment results concluded that the impacts are unlikely to be significant and as such no SIS or EPBC Act referral is considered necessary for this vegetation community.

Threatened Flora

From the database search, two threatened flora species were identified to have the potential to occur within the disturbance footprint of Peebles Dam:

- *Atriplex infrequens*
- *Dentella minutissima*

An assessment of significance under the BC Act was prepared for both species, and an EPBC Act assessment of significance was prepared for *Atriplex infrequens*.

While these species were identified during the database search as having the potential to occur around Peebles Dam, no individuals were identified during the field survey. If these species are identified during pre-clearing surveys, these areas should be avoided. The test of significance and Significant Impact Criteria assessment carried out for each of these species concluded that the proposed disturbances associated with these works is unlikely to result in a significant impact upon these species, therefore, no SIS and / or EPBC Referral is required.

Threatened Fauna

Thirteen threatened fauna species (ten species of birds and three mammals) have been recorded as having the potential to occur within the impact area of Peebles Dam. The proposed works may impact threatened fauna by removing native vegetation and/or fragmenting habitat.

All the threatened fauna species identified have potential to use habitat on and around Peebles Dam. However, due to the mobile nature of these species and the high homogeneity and comparatively low cumulative area of habitat being impacted, the project is deemed to not significantly impact any of the fauna species observed during the survey period.

The test of significance and Significant Impact Criteria assessment carried out for each of these species concluded that the proposed disturbances associated with these works is unlikely to result in a significant impact upon these species, therefore, no SIS and / or EPBC Referral is required.

Weeds

Burr Medic and Noogoora Burr were identified within the proposed impact area at Peebles Dam. The use of machinery in areas of weeds and inadequate weed management procedures may facilitate the spread of these weeds, particularly in any spoil transported to Homestead Dam.

Homestead Dam

Vegetation Communities

An area of approximately 7.08 ha was assessed at Homestead Dam (Table 20). However, only a small section of the assessed area is likely to be directly impacted by the proposed activities (the area within and around the channel where the embankment will be constructed). This area consists of Coolabah open woodland and Chenopod open shrubland PCTs. Vegetation to be potentially impacted by the proposal comprises trees, shrubs and groundcover. Mature and/or hollow bearing trees within potential impact area will be avoided as much as possible. Given the small areas that are likely to be directly affected by the proposed development, disturbance to these vegetation communities will have negligible impact on the vegetation communities at a regional scale.

Threatened Ecological Communities

Approximately 5.48 ha of the assessed area is located within PCT 40: Coolabah open woodland wetland with chenopod/grassy ground cover on grey and brown clay floodplains. This PCT represents a Threatened Ecological Community (TEC) under both the BC Act and EPBC Act.

An assessment of significance (5-part test) under the BC Act (Appendix G) and an EPBC Act assessment under the EPBC Act Significant Impact Guidelines (Appendix H) was prepared for the Coolibah-Black Box Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain and Mulga Lands

Bioregions EEC under the BC Act, and the Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions EEC under the EPBC act. The maximum area of the Coolabah-Black Box woodland (5.48 ha) that may potentially be impacted is relatively minor, and there are relatively large areas of the EEC that will remain adjacent to the study area. In addition, the proposed works will not further isolate or fragment areas of the EEC, and a further 18,600 ha of this EEC remains within Toorale National Park. For these reasons, assessment results concluded that the impacts are unlikely to be significant and as such no SIS or EPBC Act referral is considered necessary for this vegetation community.

Threatened Flora

Two threatened flora species were identified to have the potential to occur within the impact area surrounding Homestead Dam. These were:

- *Atriplex infrequens*
- *Dentella minutissima*

An assessment of significance under the BC Act or EPBC Act were prepared for these species.

While these species were identified during the database search as having the potential to occur around Peebles Dam, no individuals were identified during the field survey. If these species are identified during pre-clearing surveys, these areas should be avoided if possible. The test of significance and Significant Impact Criteria assessment carried out for each of these species concluded that the proposed disturbances associated with these works is unlikely to result in a significant impact upon these species, therefore, no SIS and / or EPBC Referral is required.

Threatened Fauna

Thirteen threatened fauna species (ten species of birds and three mammals) have been recorded as having the potential to occur within the impact area of Homestead Dam. The proposed works may impact threatened fauna by removing native vegetation and/or fragmenting habitat.

All the threatened fauna species identified, have potential to utilise the habitat on and around Homestead Dam. However, due to the mobile nature of these species and the high homogeneity and comparatively low cumulative area of habitat being impacted, the project is deemed to not significantly impact any of the fauna species observed during the survey period

The test of significance and Significant Impact Criteria assessment carried out for each of these species concluded that the proposed disturbances associated with these works is unlikely to result in a significant impact upon these species, therefore, no SIS and / or EPBC Referral is required.

Weeds

African Boxthorn and *Sisymbrium* sp. were identified within the proposed impact area at Homestead Dam. The use of machinery in areas of weeds and inadequate weed management procedures may facilitate the spread of these weeds.

5.2.3 Mitigation measures

Mitigation measures for biological impacts are outlined in Section 6.3.

5.3 Aquatic Ecology

5.3.1 Existing environment

The waterholes, wetlands and channels associated with the Warrego River provide aquatic refuge to animals and plants in an otherwise dry landscape (ELA, 2017). While the Warrego River and floodplain at Toorale is semi-permanent compared to the Darling River, these areas provide potentially better quality aquatic habitat and support a different assemblage of species than the Darling River alone (CEWO 2015, 2017). For example, clear differences have been noted between the invertebrate communities of the Warrego and Darling Rivers, with the Warrego communities displaying varied community structure over time contributing to increased regional diversity (CEWO, 2017).

Nine species of fish have been surveyed in the dams and waterholes within Toorale during the LTIM project since 2015 (Table 21; CEWO 2015, 2017, 2018). Six of these are native species, and three (Goldfish (*Carassius auratus*), Common Carp (*Cyprinus carpio*) and Mosquito Fish (*Gambusia holbrooki)*) are exotic species. Six species have been recorded in Homestead Dam, while four have been recorded in Ross Billabong, which receives water from the Warrego River when it backs up behind Peebles Dam. The fish population within the Warrego River at Toorale fluctuates in response to prevailing water levels. Individuals appear to persist in this section of the Warrego because of the dams which provide refuge habitat during periods of no flow. Native species have been shown to spawn and recruit in response to connection events when the gates at Boera Dam are opened, even if they are only opened for a short period of time (<16 days; CEWO, 2017). Significant spawning of Carp and Goldfish were also noted following a larger flow event in the Warrego in 2016 (CEWO, 2017). During this event, the Darling River was also in flood, potentially providing the opportunity for fish to move up into the Warrego River. More widespread inundation of the channel network of the Warrego could also have provided improved conditions for the spawning of these exotic species.

Specifically, for Peebles Dam, the dam was originally installed to divert water into Ross Billabong, where it was then stored for use in the irrigation areas. The dam has undergone several failures and rebuilds. The dam is a significant barrier to fish attempting to migrating upstream from the Darling River. As this dam is the first barrier reached upstream of the Darling River, this has been given the highest priority for fish passage remediation.

Table 21: Fish species surveyed within the Warrego River dams and waterholes during the LTIM project (2015 - 2018).

Species name	Common Name	Boera Dam	Booka Dam	Homestead Dam	Dicks Dam	Ross Billabong
*Carassius auratus**	Goldfish	x	x	x	x	
*Cyprinus carpio**	Common Carp	x	x	x	x	x
Gambusia holbrooki	Mosquito fish	x	x			
Hypseleotris spp.	Carp Gudgeon	x				
Leiopotherapon unicolor	Spangled Perch	x	x	x	x	x
Macquaria ambigua	Golden Perch	x	x	x	x	x
Melanotaenia fluviatilis	Australian Rainbowfish	x	x			
Nematalosa erebi	Bony Herring	x	x	x	x	x

Species name	Common Name	Boera Dam	Booka Dam	Homestead Dam	Dicks Dam	Ross Billabong
Neosilurus hyrtlii	Hyrtl's Catfish	x	x	x	x	

* Denotes exotic species

Monitoring of water birds and frogs through the LTIM project has shown that the dams within the Warrego River provide important refuge habitat during periods of low flow. Over the monitoring years, species richness, abundance and diversity have tended to change with habitat type and inundation, rather than season. Frog abundance has tended to be higher at sites such as Booka Dam and the Western Floodplain that have higher quality habitat (woody debris and shrubs such as lignum and River Cooba) near the edge of the waterholes. While Homestead Dam was not surveyed as part of the LTIM monitoring for frogs, the high available habitat that will likely be present when the dam is reinstated, will provide good quality frog habitat.

Species lists for frogs and birds and tortoises can be found in Section 5.2.

5.3.2 Potential impacts

Peebles Dam

The proposed works will be undertaken during dry periods, so dam dewatering will not be required. Aquatic habitat will have retracted under natural flow regimes.

The removal of Peebles Dam has the potential to impact aquatic communities in several ways. The removal of the dam will increase connectivity between the Lower Warrego River and the Darling River. This will allow animals to move more freely both up and downstream and through this reach. This increased connection will benefit fish species by allowing for the increased movement of juvenile individuals out of the Warrego system and into the larger more permanent Darling system, and also by allowing adults to migrate more freely into the Warrego system during connection events. The Warrego system is thought to be an important contributor of juvenile Golden Perch (*Macquaria ambigua)* to the broader Murray-Darling system (G. Butler DPI Fisheries, pers comm), so increasing connectivity and opportunities to migrate will have positive environmental benefits. In contrast, the lower Warrego has been recognised as a Carp breeding hotspot (Gilligan 2005), with recent LTIM monitoring showing a large breeding response of these fish during times of high flow in the Warrego and Darling systems. Increasing the connectivity between the systems may increase exotic fish movement, breeding and recruitment in the lower Warrego system. Ongoing fish monitoring in the Warrego waterholes should continue following the construction phase of the project to monitor changes to the exotic fish population.

It is possible that water flow into Ross Billabong to the east of Peebles Dam will be reduced with the proposed removal of Peebles Dam (Section 5.6.2). This may impact the aquatic ecology of this waterhole, given that the amount of water flowing into it, may reduce. Reductions to the depth, area and duration of inundation would be expected, and hence its value as an aquatic refuge in the Warrego system for a range of species, including fish, invertebrates, frogs and birds may be reduced. For mobile species such as birds and frogs, a reduction in the permanence of Ross Billabong will be offset by an increase in the permanence of Homestead Dam, lessening the regional impact of changes to Ross Billabong.

Homestead Dam

The partial reinstatement of a dam wall at Homestead Dam will reduce connectivity and movement opportunities for aquatic animals within the main channel of the Warrego River relative to the breached condition. At present, in its breached condition, Homestead Dam provides a minor barrier to movement

in this section of the Warrego. This loss of connectivity will be balanced by the recommissioning of the outlet pipes, but it is expected that these will only be opened periodically, reducing movement opportunities.

The impact of the reinstated dam wall at Homestead Dam on the aquatic ecology of the lower Warrego system will be offset by the increase in inundated area and permanence within the dam itself following installation. In its upper reaches, Homestead Dam has substantial areas of fringing lignum and river cooba, which has been shown to provide good habitat for frogs and other aquatic species at other locations within Toorale (CEWO 2016,2017). Reinstating the permanence of the dam will also benefit the aquatic ecology by providing suitable refuge habitat for longer periods of time. This is especially important in semi-arid systems like the Warrego, which only flow periodically.

The proposed works will be undertaken during dry periods, so dam dewatering will not be required.

5.3.3 Mitigation Measures

Mitigation measures are provided in Section 6.3.

5.4 Community and Social

5.4.1 Existing environment

Toorale is bisected by unsealed road classified as Rural Local Road 10 (RLR10). Toorale Road is the only public road in Toorale and is administered and maintained by Bourke Shire Council. It (Toorale Road) provides the most direct route between Louth and Bourke, as well as access to Toorale and surrounding properties.

The Toorale Road crosses the Warrego River at a location known as Dick's Dam, a concrete causeway that allows traffic to cross the river at low flows. Bourke Shire Council closes Toorale Road when wet weather conditions render it unpassable to traffic and to prevent damage to the road surface. If road closures are not abided by, there is the potential for damage to the road surface to occur such as incised wheel tracks and fines are incurred if the road closure is not observed. Toorale Road is also closed to through traffic when flows over the causeway at Dick's Dam reach a certain level (approximately 30cm depth).

Several properties adjoin Toorale, and some of these benefit from access to water from Boera and Booka dams for stock management, water supply and/or aesthetic value. Downstream users benefit from flows contributed by the Warrego River, including those supplied by the CEWO water entitlements, that increase the availability of water in the Darling River. Adjacent landholders also indicated the importance of water in this dry landscape to them on a spiritual and emotional level, as well as an appreciation of the bird and fish life that occurs.

5.4.2 Potential impacts

As most of the potential impacts on the community are common to both dams, they have been considered together.

Access

Access to Toorale to undertake the proposed works will be by Toorale Road, an unsealed road classified as RLR10. Toorale Road is the only public road in Toorale and is administered and maintained by Bourke Shire Council. Council closes the road when wet weather conditions rendered it unpassable to traffic and to prevent damage to the road surface. If road closures are not abided by, there is the potential for damage to the road surface to occur such as incised wheel tracks. All other park roads and management trails are managed by NPWS, consistent with the Rural Fire Service Bush Fire Coordinating Committee 'category 1 fire management trails'. All trails and roads are affected by flooding and some trails on black soil becomes impassable during wet conditions. Potential impacts to community members will be low due to the quantity of movements predicted in the construction phase of the proposed works.

Visitation to Toorale is strongly seasonal with the main visitor season extending from autumn to spring (with peaks in the school holidays) and with lowest visitor numbers during summer. Access to the park is by council-managed Toorale Road that bisects the park.

There may be a short term (1 week) increase in heavy vehicle traffic along Toorale Road as the works are being implemented to allow for delivery of construction plant. This equipment is not dissimilar to that used for existing agricultural and road maintenance activities within the district. Traffic volumes will be low.

Works will not be undertaken in the event of rain and/or when the road is closed avoiding damage to the road. Given that the proposed works will be scheduled for dry weather periods when water levels in the dams are low, there will be no impact to water levels and hence access over Dicks Dam.

Neighbouring and downstream landholders

There are no residences in the vicinity of the proposed activity, and so residents will not be directly impacted by construction activities.

Removal of Peebles Dam will remove a major barrier to flows and will enable more efficient transfer or water between the lower Warrego River and the Darling River, benefitting downstream landholders and environments.

The temporary reinstatement of Homestead Dam will not result in any changes to the operation of the existing water management system upstream of Homestead Dam, and as such, neighbouring properties will be unaffected. Homestead Dam will be operated in accordance with the existing works approval conditions, reflecting no change to existing, pre-breach, conditions.

The proposed activity is not likely to affect existing community services or infrastructure (roads, power, water, drainage, waste management, educational and social services. During the construction period, there will be a slight increase in heavy vehicle traffic along Louth Road. All other community services will not be impacted upon.

Noise

All areas, including the dams and access routes, are located in a remote environment, hence background noise is low and consists of mostly of natural sounds. Anthropogenic sources of noise are mainly restricted to Homestead Dam due to its proximity to the Toorale Homestead precinct and include vehicles accessing the precinct and areas west of the Warrego River, and from recreational users of the site. It is likely that the Rating Background Level (RBL) at all sites would be less than 30 dB(A). Accordingly, the RBL is set at 30 dB(A) in accordance with the NSW *Industrial Noise Policy.*

The proposed works will generate construction noise and additional traffic noise. It is anticipated that the noise impact from traffic created by personnel moving to and from site will be short-term and minimal, and in-line with the NSW *Road Noise Policy*. Heavy vehicle movements at the construction site following initial mobilisation will be restricted to the work area and therefore expected to be minimal.

With the exception of recreational users, there are no additional residents that may be impacted by noise due to the remote location and absence of rural residences.

Air Emissions

Dust emissions will be generated during the earthworks. There are no rural residents in proximity to the proposed works. Dust emission impacts are also not anticipated at the Toorale Homestead precinct located approximately 1 km east of the proposed works at Homestead Dam.

5.4.3 Mitigation Measures

Mitigation measures are provided in Section 6.3

5.5 Park Management and Operation

5.5.1 Existing environment

Visitation to Toorale is strongly seasonal with the main visitor season extending from autumn to spring (with peaks in the school holidays) and with lowest visitor numbers during the heat of summer. Access to the park is by Toorale Road and then via designated tracks to identified visitor sites.

Since 2012, NPWS has been progressively implementing the Toorale and Gundabooka Nature Tourism Action Plan (NTAP). The NTAP contains a suite of actions to support establishment of visitation and tourism at Toorale. Amongst the experiences implemented, NPWS has made a significant investment in developing the Homestead Precinct, which was opened to visitors in August 2017.

Toorale NP and SCA is managed by the Bourke Area of NPWS. The Bourke Area office is located 45 minutes away by car, although some field staff reside on park. NPWS staff maintain and operate the storages on Toorale in accordance with approval conditions and the CEWH five-year watering strategy. However, maintenance of Homestead Dam has been held off until a decision is made with regard to longer term modifications to the structure. The pipes are left open at Peebles Dam and the existing infrastructure is not maintained consistent with operational objectives for this storage.

All trails and roads are affected by flooding and some trails on black soil becomes impassable during wet conditions.

Prior to the breach in 2012, the embankment across Homestead Dam was one of two points of access for NPWS staff to the western side of the park when flows in the Warrego River were high. The other point, at Boera Dam, is more difficult to get to and more problematic in wet conditions. Since the breach, NPWS has used the low-level causeway downstream of the breach site to cross the Warrego River but is unable to cross once flows increase. NPWS requires a safe route across the river in high-level flows.

The embankment at Peebles Dam/Duncans Wall forms part of a trail through the southern part of the park and is used to access areas of the park for maintenance and operational purposes. However, access to this part of the park at all times is not critical and alternative routes are available.

5.5.2 Potential Impacts

Visual amenity

The proposed activity is likely to cause a positive impact on the scenic landscape within Toorale, in particular for visitors to Toorale Homestead which will benefit from increased water permanence. During the construction phase, there will be negligible impact on the visual amenity as the proposed activity is generally not visible to park visitors or passers-by.

Community recreational values

Reinstatement of Homestead Dam will enhance the visitor experience of the Homestead Precinct by returning water to the storage. This represents an important part of the historic and cultural context of the precinct and the basis for its occurrence in this location.

Impacts at Homestead Dam during the construction phase will be short-term and restricted. Most park visitors do not progress past the Homestead visitor precinct. Signage and barriers will be erected to ensure visitors to not access the works area. Access across the Warrego at Homestead Dam will be available across the existing causeway in case of emergencies or essential activities for NPWS staff only, personnel working on park or others with the agreement of NPWS Bourke Area.

Negligible impacts will occur at Peebles Dam since it is not a visitation site for visitors. Construction works are predicted to be of short duration (1-2 weeks).

Community safety

Short term construction impacts along Louth Road may occur to the community as the project is being completed. Particular impacts may be certain access restrictions for the public to the construction zone which will be demarcated, and no public will be allowed access for their safety.

In regard to the safety of the community, the proposed project will bring about positive gains for the wider region in particular. The changes proposed will allow for better management and control over the water resources in low, medium and high natural flow events. The movement of water will be better handled to ensure water is directed to the most appropriate areas and to ensure the reduction in flooding impacts to the community.

Once the bank is reinstated at Homestead Dam, the potential safety risk to visitors will be reduced from the present situation with the breach.

Economy and community services

The proposed activity is not likely to affect economic factors (including decreases and increases). The works will facilitate environmental flows down the Warrego. Several landholders adjoining Toorale have benefitted from the existing water management arrangements for access to water supply and livestock management purposes. To ensure the landholders that hold value to the water flows within the Warrego, the management actions by NPWS are reflected in the conditions attached to the works approvals to appropriately replenish downstream storages and to contribute to flow in the Darling River.

The proposed activity is not likely to affect existing community services or infrastructure (roads, power, water, drainage, waste management, educational and social services. During the construction period, there will be a slight increase in heavy vehicle traffic along Louth Road. All other community services will not be impacted upon.

Bushfire risk

As per the NSW Planning Portal (NSW Government, 2018), the Bushfire risk at Toorale is listed as medium (Vegetation class 3). The proposed activity will not result in any changes to the bushfire risk rating. The activities proposed to be conducted does not increase the bushfire risk due to the location of the proposed works and use of existing tracks within Toorale. Works will be undertaken in accordance with the existing Toorale National Park Fire Management Strategy.

Bushfire hazard

Potential ignition sources during the construction and operations phases of the proposed works would include:

- Vehicle exhaust systems in dry vegetation;
- The storage of waste and combustible materials onsite;
- Storage of flammable liquids;
- Lightning strikes; and
- Cigarette butts disposed of carelessly on-site and from cars travelling along roads.

The bush fire hazard associated with the activities listed above is considered highly manageable through equipment selection, appropriate access arrangements, fuel load reduction programs, safety protocols during periods of high fire risk and the implementation of an emergency response plan as detailed in Toorale's Fire Management Strategy.

Park Operations and Management

Reinstatement of Homestead Dam will increase the maintenance and operating requirements at the site relative to the current situation. However, it will return the storage to pre-breach conditions when the structure is operated in accordance with the works approval, i.e. the maintenance and operation liability is no greater than if the dam wall had not breached or was repaired.

Replacement of the embankment at Homestead Dam will also reinstate an accessible, high-flow crossing to the western side of the park for NPWS personnel, which is particularly important for responding to emergencies or incidents.

Removal of the embankment at Peebles Dam will reduce vehicle access to that part of the park when the Warrego River is flowing. However, NPWS has advised that this impact is not significant since the timing of access is not critical.

Although the pipes at Peebles Dam have been left open since NPWS took over management of Toorale, staff still need to visit the site to remove debris that blocks the pipe entrances during flow events. Removal of the infrastructure at this site will reduce the maintenance liability for NPWS.

Vehicles will access Toorale to undertake the proposed works by Toorale Road, and once on park by existing management trails. It is likely that the road and trails will require grading to repair their condition after heavy vehicle movements required for the activity.

5.5.3 Mitigation measures

Mitigation measures for community impacts are outlined in Section 6.3.

5.6 Surface water resources

5.6.1 Existing environment

The Warrego and Darling Rivers meet in the south-west of Toorale which is upstream of Louth. Between these two Rivers, their catchments comprise 21% of the Murray-Darling Basin. Together, they provide less than 5% of catchment flows (MDBA, 2016). The Darling River flows for approximately 2,750 kilometres, making it the longest river in Australia. The catchment begins in the Great Diving Range around Armidale and flows generally in a south western direction towards its junction with the Murray River in south-west NSW. The Warrego Rivers' headwaters are south of Ka Ka Mundi in the Carnarvon Ranges near Tambo in south-west Queensland. It flows in a southerly direction for approximately 800 km, where it joins the Darling River in Toorale. The Warrego River is an intermittent stream, with flow varying with season and rainfall. Major flooding events occur approximately every 5 years.

The Warrego River flows through Toorale in a southerly direction from the most northern part of Toorale, upstream of Boera Dam (Figure 2). The River hosts multiple water structures, made up of dam embankments, flow diversion works, levee banks, training embankments, pumps, pipes and irrigation channels. Many of these water structures were established before the 1860's, mainly by Toorale Station owner Samuel McCaughey. However, the dams have been subject to numerous modifications, failures, rebuilds and upgrades through time (Alluvium, 2018).

The original aim of the water structures was to maximise the storage of water within the Warrego River channel, as well as to divert and retain water on floodplain pasture areas to support pastoral and agricultural activities. Currently, there are six main dam structures along the Warrego River within Toorale which are detailed in Section 1.4.1. These structures have significantly altered the flow of this part of the Warrego for over 100 years and any modifications to the dams or how they operate may change the duration, extent or spread of flooding events (OEH, 2018a).

Even though the pipes are permanently open on Peebles Dam, inundation mapping using satellite imagery captured during several recent flow events down the Warrego River suggests that water backs up behind the wall, in some cases for several kilometres upstream (Appendix I). Aided by this damming, water then connects Ross Billabong to the east, with water persisting in the main waterhole adjacent to the historical wool scour and irrigation development for many months.

Given the highly variable nature of flows within the Warrego River, these dams periodically dry out. Water levels in the dams are determined primarily by climatic and river flow conditions, but also through the operational regime of the regulating gates on Boera Dam. Figure 11 shows water levels in Boera Dam and Dicks Dam (where regular stage heights are recorded) relative to the operation of the Boera Dam regulating gates over the past four years. This highlights the variable nature of water levels in the dams within Toorale.

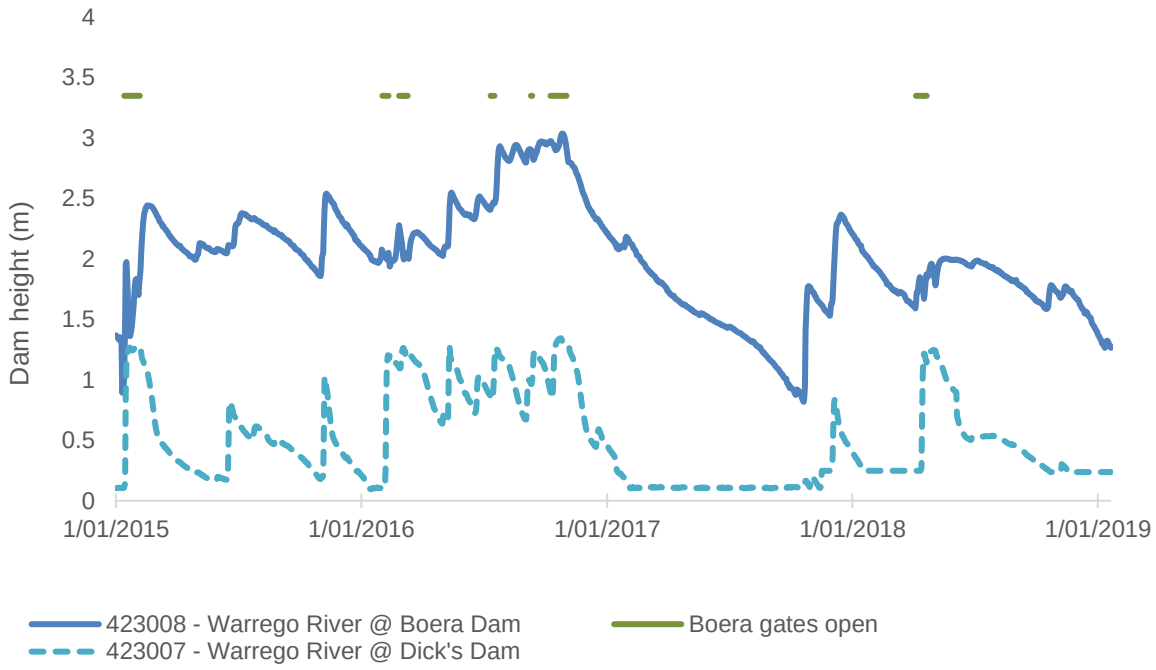

Figure 11: Water levels in Boera and Dicks Dams compared to the operation of Boera regulating gates.

Water quality

Water Quality Objectives for Uncontrolled Streams within the Barwon-Darling and Far Western region (DECCW, 2006a) include:

- Aquatic ecosystems;
- Visual amenity;
- Primary and secondary contact recreation;
- Livestock water supply;
- Irrigation water supply;
- Homestead water supply;
- Drinking water at point of supply (disinfection only/clarification and disinfection/groundwater); and
- Aquatic foods (cooked).

Event based water quality sampling has been undertaken since 2015 through the LTIM project. This has been undertaken at Boera, and Booka Dams (upstream of Homestead Dam) and in Ross Billabong, which receives water from Peebles Dam (Commonwealth of Australia 2017). Water quality in the lower Warrego River within Toorale tends to be temporally variable in response to flow down the river. Turbidity tends to be relatively high (100 – 500 NTU) in the Warrego dams, typically above the ANZECC guidelines (6-50 NTU). Similarly, nitrogen, phosphorus and dissolved organic carbon are usually found in high concentrations within the Warrego dams. Measures of pH vary, but during drier periods as water levels in the dams drop, pH tends to increase above ANZECC guidelines (6-5 – 8). Electrical conductivity tends to remain within ANZECC guidelines (0.125 – 2.2 mS/cm) and dissolved oxygen tends to be below the ANZECC guidelines (85 – 110%). While water quality is variable, it has remained within safe levels for aquatic fauna throughout the LTIM sampling (Commonwealth of Australia 2015).

5.6.2 Potential impacts

The proposed works include changes to the water infrastructure and, accordingly, changes to the way these systems currently operate. Many of the impacts raised in this section have also been raised previously in the PoM. Any works may require an amended works approval application which will be assessed by NSW DPI.

Peebles Dam

The proposed activity provides sustainable water management outcomes, returning flows in the lower Warrego River to a more natural state that shall promote improved water and fish passage, as well as positively affecting the delivery of environmental water for downstream users and the environment

It is proposed to undertake decommissioning activity during a period of no flow when Peebles Dam shall be dry. This shall ensure no impacts to flow volumes and inundation patterns during the construction period.

Specific changes to the wetting and drying regime of Ross Billabong with the proposed development is unclear. However, it is considered likely that connectivity with the Warrego River will likely be reduced, in turn reducing the frequency, depth and permanence of water within the billabong. This may have implication for aquatic biota (Section 5.3) and riparian trees vegetation (Section 5.2). There may also be implications for water quality in Ross Billabong given the shorter permanence times that are likely to occur post dam removal. However, these changes would be representative of conditions prior to the development of Peebles Dam and are considered unlikely to deteriorate to such as point as to be harmful to aquatic biota.

There is a very low likelihood of pollution of waters through hazardous materials management and erosion/sedimentation during decommissioning works, due to the use of heavy machinery and plant to modify the dam wall. The heavy machinery requirements are given in Section 2.5.

Once completed, the proposed works will allow for better water quality outcomes than the current breached conditions. There will be no impact upon the Warrego during the operation and maintenance phase of the proposed works.

Homestead Dam

Once reconstructed, the full supply level will be 1 m less than that of the approved Homestead Dam prior to it becoming breached in 2012. This is a proposed interim measure pending approval of the larger Toorale water infrastructure project which will return the dam to its original full supply level and provide for improved fish passage.

It is proposed to undertake decommissioning activity during a period of no flow when Homestead Dam shall be dry. This shall ensure no impacts to flow volumes and inundation patterns during the construction period.

The temporary reinstatement of Homestead Dam will ensure the more efficient capture and storage of surface water within the Warrego River than currently occurs. Post construction, Homestead Dam will hold an increased storage area and volume of water, compared to its currently breached state. This will increase the persistence of stored water, likely resulting in improved water quality outcomes. Reinstatement of the dam wall and the control pipes will also allow for more flexible management of water levels in the dam, and control of water flows downstream.

The proposed reinstatement of Homestead Dam wall will re-establish a physical barrier to fish and flows (See Section 5.3), when compared to the existing breached state. The resultant level of linear connectivity would be similar to that experienced prior to the breach. This will be a temporary condition prior to further works on Homestead Dam scheduled as part of Stage 2 of the Toorale Water Infrastructure Project.

The proposed works at Homestead Dam are considered unlikely to impact flooding regimes and availability of water for downstream users in the Warrego, relative to existing conditions. Construction works are temporary in nature and will be scheduled during times of no flow. During the operation stage, the flooding regimes shall not be impacted as the operation of the regulating pipes on the dam will be in accordance with the existing work approval conditions. Downstream flows are considered likely to increase compared to the pre-breached condition, as water levels within the dam will be managed in such as was as to maintain the dam at 98.5 metres or below to protect the dam wall, in effect allowing more water to flow down the river below the dam. There will also be a low impact upon the delivery of Commonwealth environmental water as the pipes will be operated to pass these flows in a coordinated manner with Booka and Boera storages upstream.

There is a low likelihood of pollution of waters through hazardous materials management and erosion/sedimentation. However, pollution may occur during the construction phase of the proposed works due to the use of heavy machinery to reconstruct the dam. The heavy machinery requirements are given in Section 2.5. Overall, the proposed works will allow for better water management/quality outcomes compared to the current breached conditions. There will be negligible impact, compared to approved-works conditions, during the operation and maintenance phase of the project.

It is noted that there is potential for the reconstructed dam to again be breached during a large flood event, as occurred in 2012. Design and construction measures will be taken to minimise the chance of future failure. Failure of the wall would lead to a short-term increase in erosion and sedimentation downstream, with the extent and duration of the sediment accumulation dependent on the nature of successive flows down the system. Given the similarity of the wall material to the sediment in the bed, minimal impacts would be envisaged with respect to habitat quality loss downstream. Some filling of downstream pools would likely occur, but these would likely be scoured again during successive flow events through the system.

5.6.3 Mitigation measures

Mitigation measures for natural resource impacts are outlined in Section 6.3.

5.7 Groundwater

5.7.1 Existing environment

No hydrogeological studies have been undertaken within Toorale. Therefore, the hydrogeological setting for the proposed works has been based on the available hydrogeological data from the WaterNSW real-time data website (WaterNSW, 2018) and the Bureau of Meteorology (BoM) Groundwater Explorer database (BoM 2017), which identify a single groundwater source within the Site, described as the Warrego Alluvial.

Alluvial groundwater sources associated with the Warrego River are included in the WSP for the Intersecting Streams Unregulated and Alluvial Water Sources (NSW OOW, 2011). The Warrego water source is located within the Mulga Lands bioregion and the two alluvial aquifer systems relevant to the Warrego River are the Paroo alluvial groundwater source and the Warrego alluvial groundwater source. Groundwater resources in and surrounding Toorale and the Warrego River are shown in Figure 12.

The alluvial groundwater sources are comprised of Quaternary aeolian sands and alluvial sediments surrounding small areas of Tertiary silcretes in the northern portion of the alluviums. Small areas of Palaeozoic bedrock are characterised in the central section of the alluviums, whilst in the lower reaches of both systems; Devonian quartz sandstone is surrounded by Quaternary aeolian sands and alluvial clays (NSW OOW, 2011). In the alluvium of the unregulated rivers, groundwater is largely derived from rainfall. The Intersecting Streams experience variable rainfall over time and groundwater levels in these areas of alluvium respond readily to climatic conditions. In these unregulated alluvials, the storage is limited and when the groundwater level falls below the bed of the river, the river runs dry (NSW OOW, 2011).

Water take from groundwater sources is regulated and monitored by the DPI - Water to ensure the sustainability of the water sources in the region. There are 18 bore licences in the Paroo alluvium and 16 bore licences in the Warrego alluvium (NSW OOW, 2011). These licences are for a range of purposes such as stock and domestic access as well as town water supply.

Interrogation of the WaterNSW Real Time Data website indicates no groundwater monitoring bores within the REF Survey locations; however, a 12 km radius search for surrounding bores revealed 8 registered bores which access groundwater from the Warrego Alluvial (Table 22 and Figure 13).

Table 22: Registered bore details near the Site

Bore ID	E (m)	N (m)	Type	Total depth (m)	SWL* (mbgl)	Salinity	Yield (L/s)
GW039472	344598	6632434	Unknown	35.5	12.5	602 mg/L	0.8
GW800752	339765	6634834	Unknown	49.5			
GW036796	348253	6635941	Stock, Domestic	17.3	8.7		2.2
GW006837	339871	6639547	Stock, Domestic	105.2	18.30	“salty”	1.05
GW010815	334558	6641284	Stock, Domestic	109.7		“V. Salty”	
GW007331	353050	6652358	Stock	202.7	16.5	“salty”	0.95
GW012269	351587	6655787	Stock	182.3	15.5	over 14000 ppm	0.3

GW006943	342366	6659137	Unknown	79.2	6.10	“Fresh”	0.3

*SWL = standing water level (within the aquifer).

Based on this information it is concluded that surrounding groundwater levels within the aquifer are moderately deep, and range between approximately 8.7 metres below ground level (mbgl) to the south-east of the Peebles Dam, and 18.3 mbgl to the west of Peebles Dam. The available data describes water quality from the alluvial aquifer as “Salty” to ‘Fresh” with one reporting a salinity level of over 14,000 ppm (WaterNSW, 2018). Groundwater yield records suggest the surrounding alluvial aquifer has low productivity, with all three registered bores that contain yield data (Table 22) reporting groundwater yields of < 3 L/s.

DPI - Water protects the environmental values in the alluvial groundwater sources by reserving the total storage volume and a proportion of recharge to the sources as planned environmental water. Only a portion of the recharge from rainfall has been made available for extraction and recharge from any other sources is included as planned environmental water. There are no high priority groundwater dependant ecosystems in the alluvium (NSW OOW, 2011), although the BoM Groundwater Explorer database (BOM 2017) does include areas around Homestead Dam as high potential terrestrial groundwater dependent ecosystem (Figure 13).

5.7.1 Potential impacts

Groundwater within the vicinity of the proposed work area is relatively deep and of low productivity and use. Surface water-groundwater interactions in the Warrego River catchment are also considered low. These factors coupled with the proposed works being undertaken above ground, suggest that it is unlikely that there will be any direct or indirect impacts on regional or local groundwater sources. The proposed work may have some localised impact on water storage within the banks of Peebles and Homestead Dams. In the case of Peebles Dam, these may impact the riparian trees surrounding Ross Billabong, and the condition and composition of these communities should be monitored to detect any change in these communities. Given that water levels will likely increase in Homestead dam with the proposed works, bank storage of water should also increase, improving access to water for the surrounding vegetation communities.

5.7.2 Mitigation measures

There are no mitigation measures required for groundwater.

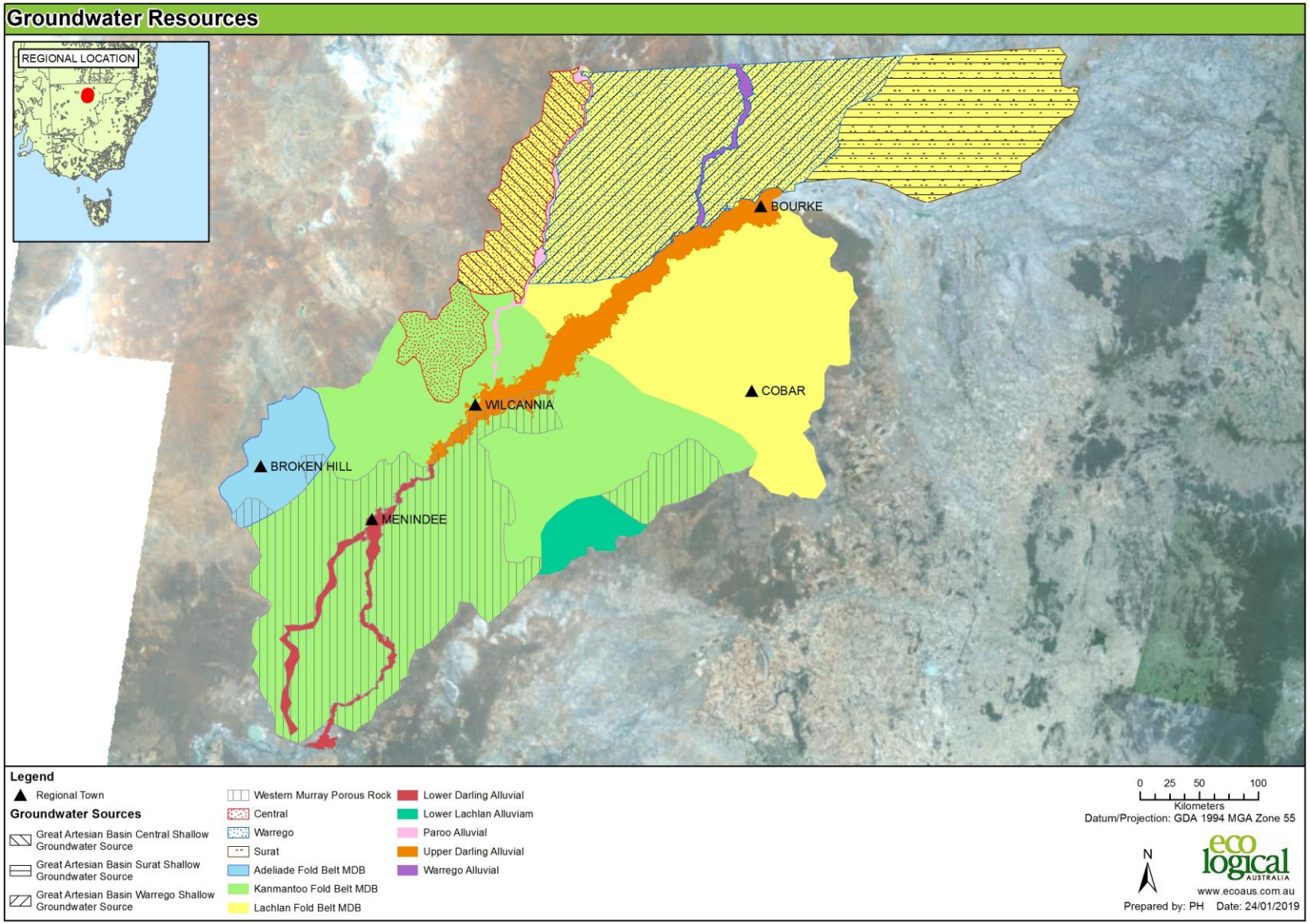

Figure 12: Regional groundwater sources in the vicinity of Toorale

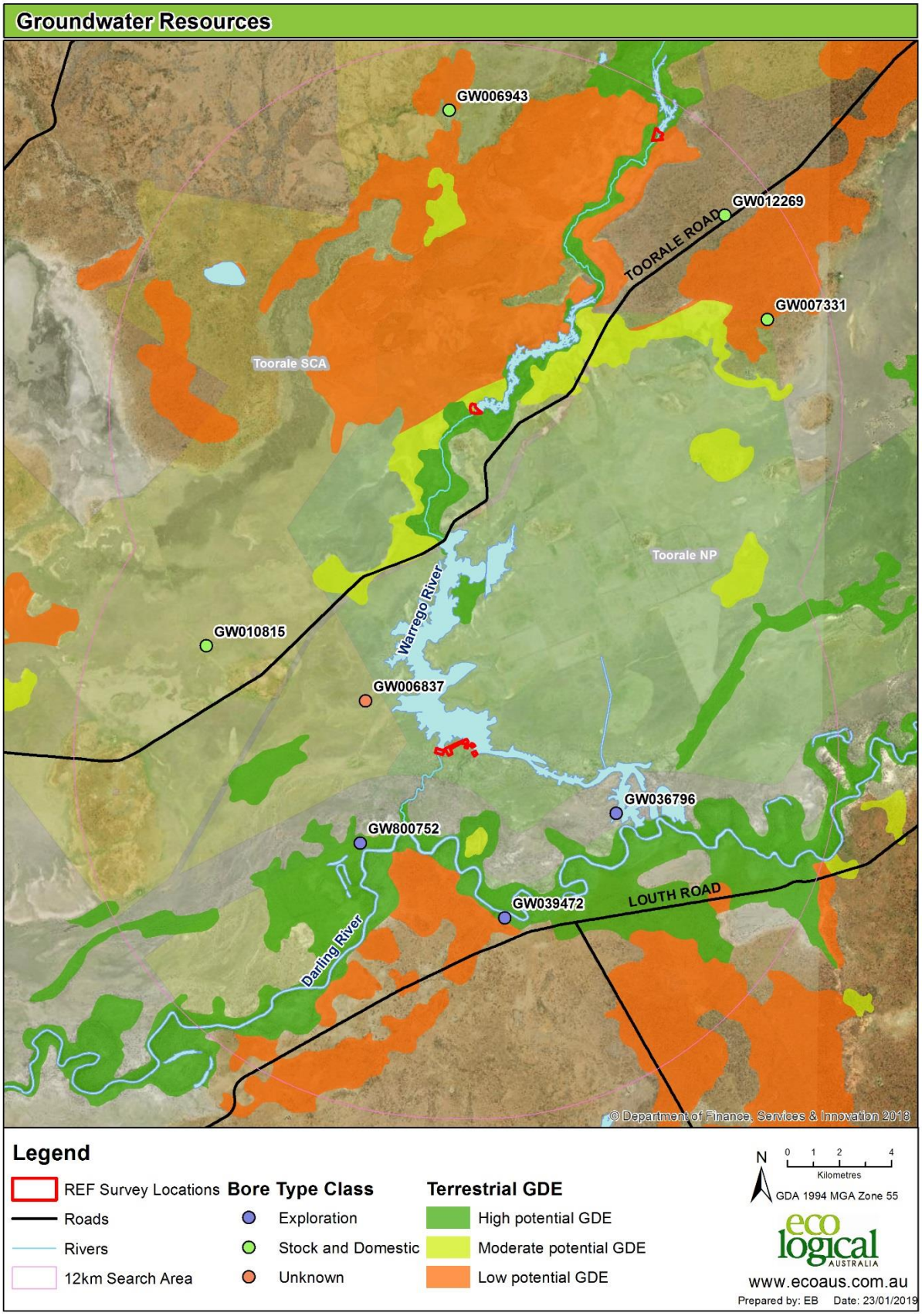

Figure 13: Groundwater resources. Source: WaterNSW, 2019; BoM, 2019.

5.8 Aboriginal Cultural Heritage

5.8.1 Existing Environment

The area around the junction of the Warrego and Darling rivers is part of Country for the Kurnu-Baakandji Aboriginal People. Toorale has extensive evidence of Aboriginal occupation and activity, including over 500 known Aboriginal sites. These include artefacts, quarries, scarred trees, ovens, middens, stone arrangements, burials, tool manufacturing sites and Aboriginal post-contact sites. Subsurface artefacts recorded during test excavations undertaken during 2018 near Boera Dam have been dated at over 50,000 years old, supporting the long connection of Aboriginal people to the area and its historical significance (Biosis, 2018b).

Many Aboriginal people and families have a strong and ongoing connection to Toorale, having worked on the station for many generations over the past 150 years as stockmen, drovers, shearers, fencers and domestic workers. Toorale therefore represents a unique opportunity for these individuals as well as the broader Kurnu-Baakandji community to maintain connections or reconnect with Country, renew kinship relations, support the teaching of younger generations, and develop and practice traditional customs (more information is included in Martin 2009). More recently Baakandji individuals have been employed by the OEH as field assistants in all of the archaeological fieldwork which has occurred at the site in 2017 and 2018. A Memorandum of Understanding exists between the Toorale JMC and the NPWS to provide advice on the management of the park.

5.8.2 Previous Assessments

A number of Aboriginal and historical archaeological assessments have taken place within the Toorale area. These assessments were largely development driven and therefore concentrated on targeted surface and subsurface investigations. Suzanne R. Hudson Consulting (2009) and Martin (2009, 2012, 2013a, 2013b) have undertaken both large scale and small targeted investigations within Toorale Station. The assessments have identified that the entire Toorale Station site, especially areas associated with the Darling and Warrego River floodplains and sandy lunettes, are significant to the local Aboriginal community.

A desktop and field study was conducted by Biosis in 2017 to determine the likelihood of previously unrecorded Aboriginal archaeological sites or areas of Aboriginal archaeological sensitivity being present within the direct impact footprint for this assessment. A search of the Aboriginal Heritage Information Management System (AHIMS) database for previously registered Aboriginal sites at Toorale identified a total of 791 registered sites. In addition, the archaeological field survey identified twenty previously unregistered Aboriginal sites (Biosis 2018a). Two ACHAs have been prepared by Biosis and AHIP (C0003079) issued in 2017 covers the survey, geotechnical investigations and construction works at all four dam sites including Homestead and Peebles Dams. A second AHIP issued for in 2018 (C004300) covers the modified project works area at Boera and Peebles Dams (Figure 14 – Figure 16).

Consultation with the Aboriginal community has been undertaken in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW 2010). The “Toorale water infrastructure study: Aboriginal cultural heritage assessment report” (Biosis, 2018) provides detailed information about the process followed, methodology, consultation, results and recommendations for management. Additional to the Aboriginal Cultural Heritage Assessment (ACHA) completed by Biosis in 2018, there are two approved Aboriginal Heritage Impact Permits (AHIP) for the potential impact areas of the proposed works.

Results

Homestead Dam

An Aboriginal artefact scatter consisting of 51 artefacts and two hearth features were recorded within the boundaries of the Homestead Dam study area (Figure 14). The site (Homestead 1 AHIMS# 16-3-0720) measures 450 metres by 250 metres, has evidence of some disturbance and represents a common example of a site within the area (Biosis 2018a). The site has direct historical associations with Toorale Homestead. In 2017, Biosis assessed the site as having moderate scientific potential, due to the potential of intact subsurface archaeological deposits. The significance of this site has been assessed as high (Biosis, 2018a).

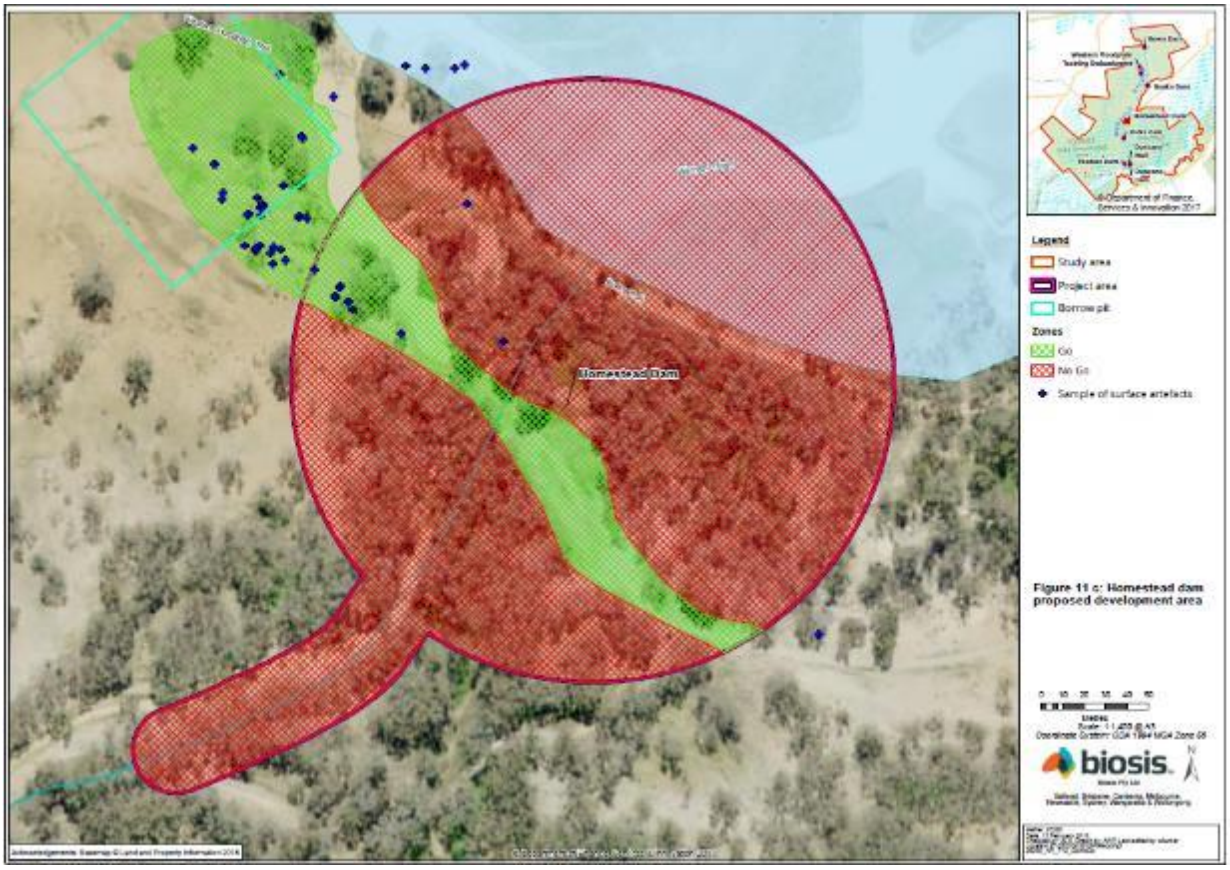

Figure 14: Homestead Dam heritage assessment and artefacts found

In late 2017, Biosis undertook test excavations at Homestead Dam which revealed a subsurface deposit of both Aboriginal and historical heritage items. Further archaeological test excavations at this site have not been required (Biosis, 2018b).

The Homestead Dam precinct has high significance to the Kurnu-Baarkandji people, represented by the Toorale JMC. Throughout consultation undertaken for this project, the JMC has consistently emphasised their wish to have the dam wall put back at Homestead Dam so that they can continue cultural practices, including a future aspiration to access and store cultural water there. The JMC also wishes to see access across the river during flow reinstated at this site, for both Aboriginal people and for the NPWS personnel managing the park. The JMC has also strongly expressed a desire to have work commence at Homestead Dam as a priority.

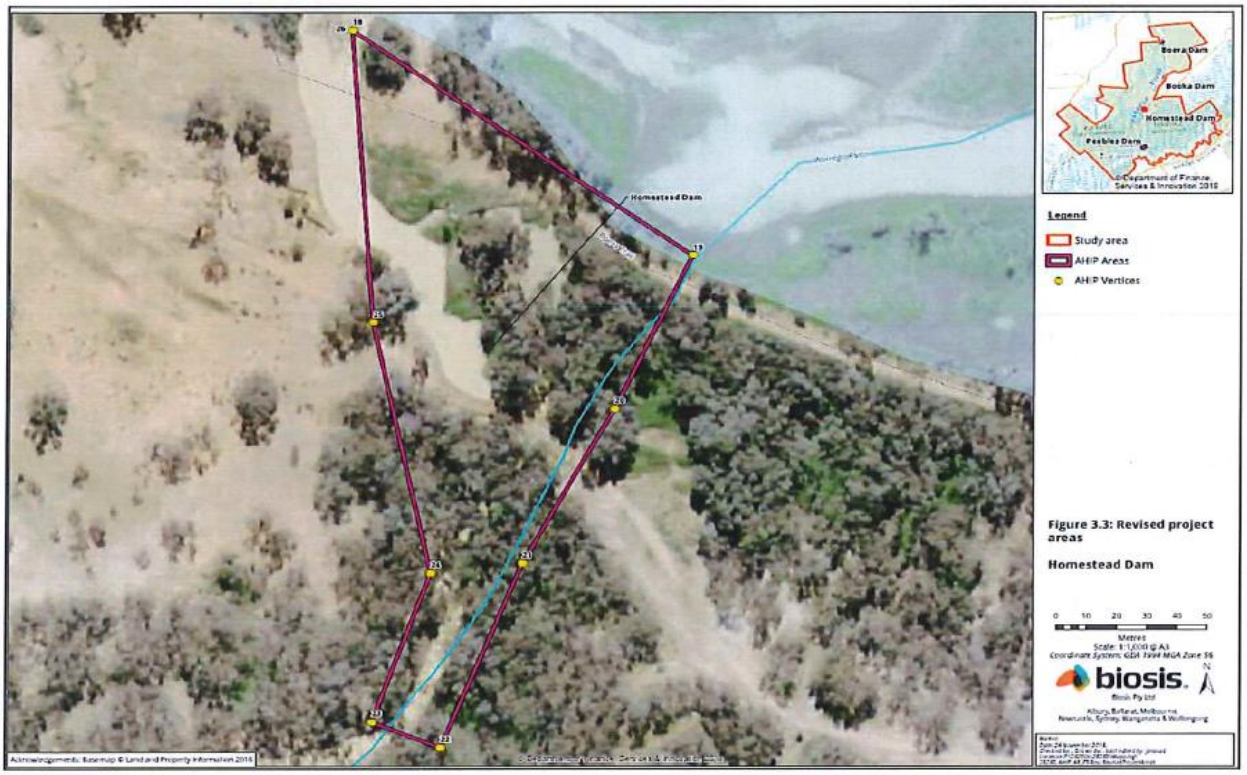

Figure 15: Homestead Dam AHIP area

Peebles Dam

The original archaeological survey of the area of Peebles Dam to be removed in 2017 identified a very low-density scatter (Peebles 1) consisting of eight Aboriginal artefacts (Figure 16). The site was assessed by Biosis (2018a) as being a contact period site as evident by a number of historic items including three glass bottles and a silver spoon located within the site boundaries. The site area measures approximately 80 metres wide and 250 metres in length. The site displays evidence of disturbances and based on its association with the period of contact between Aboriginal people and European settlers would be considered a less common site type within the area. Biosis (2018a) assessed that the direct historical association is high, however the archaeological significance of the site is assessed as moderate. The AHIP C0003079 allowed for the community collection of the surface artefacts identified at Peebles 1 and the partial destruction of Peebles 1. This does not include the destruction of human remains should they be identified during the course of the works.

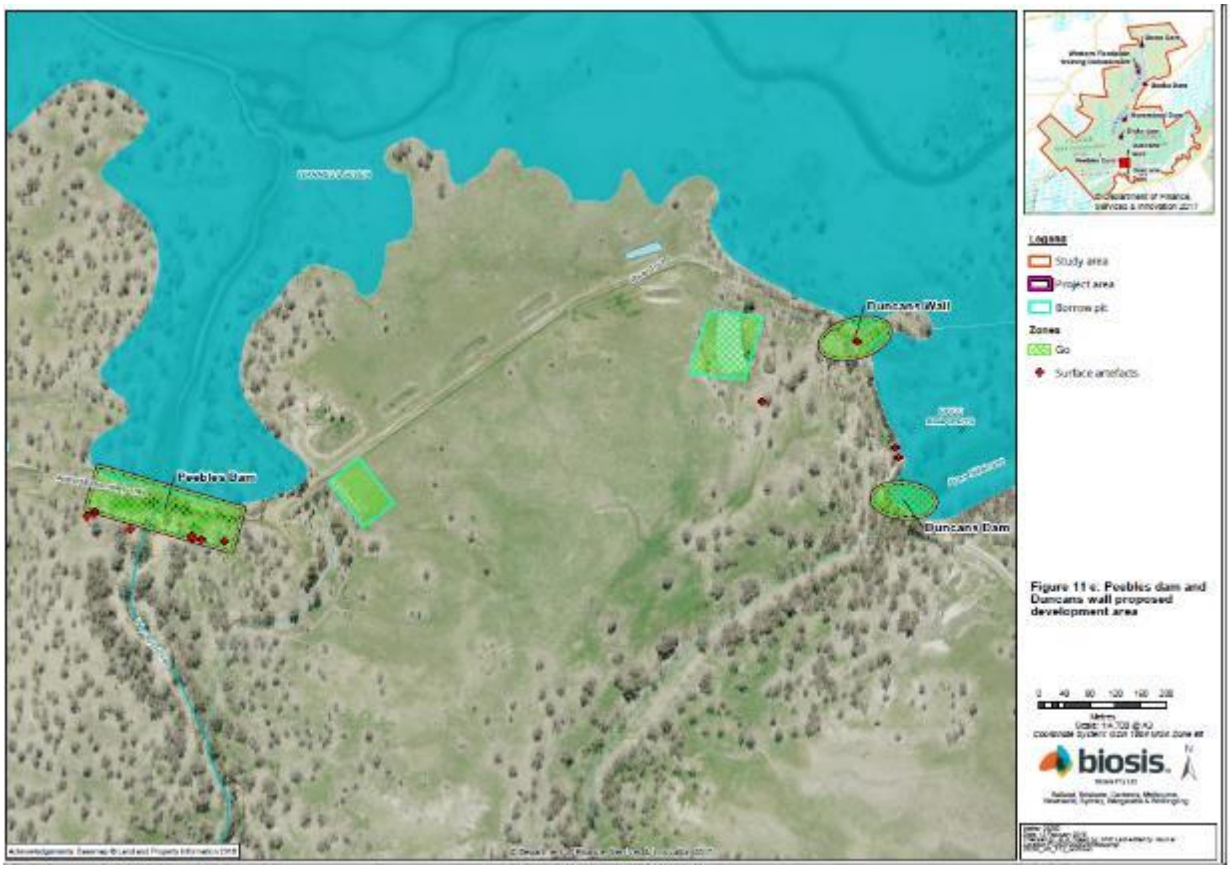

Figure 16: Peebles Dam heritage assessment area and artefacts found

A subsequent survey of the borrow pit area was undertaken in 2018 which identified an additional 19 Aboriginal sites, which consist of a variety of stone tools, grinding stones and hearths (Figure 17). The majority of the sites were assessed by Biosis as being of low significance due to the common site type and moderately disturbed context. There were two sites which were assessed as having moderate scientific value due to the uncommon site type. The AHIP (C004301) which covers the modified project area includes permission to harm all Aboriginal objects located within the AHIP boundary (Figure 16 and Figure 17). Consultation with the Aboriginal community resulted in the Kurnu– Baakandji JMC stating they were happy for Peebles Dam to be removed as there was little cultural value associated with the dam.

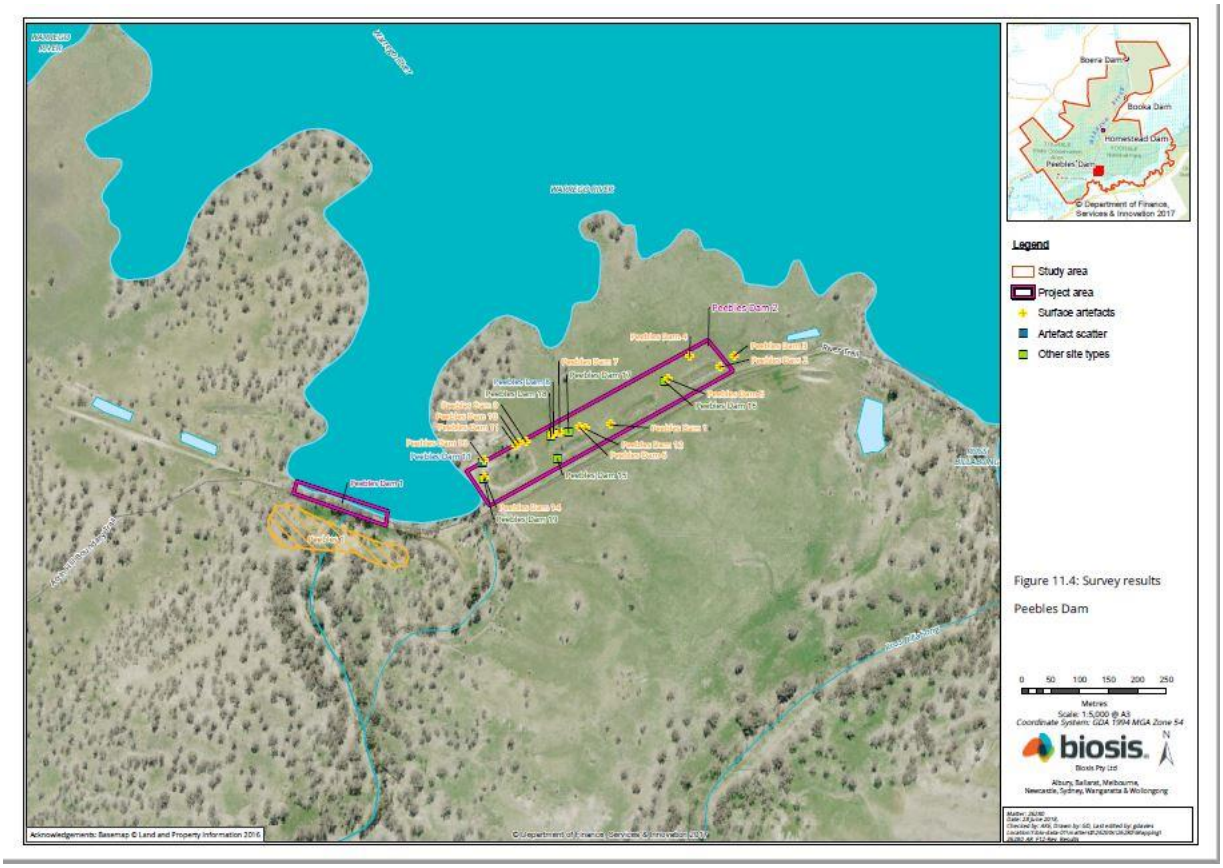

Figure 17: Peebles Dam additional heritage assessment area and artefacts found

5.8.3 Potential Impacts

The proposed activity may impact upon the following:

- Disturbance of bank within the Warrego River;
- Indirect ground disturbance for machinery access;
- Indirect impacts on artefact scatters surrounding Homestead and Peebles Dam;
- Indirect impact on Cultural tree near Homestead Dam.

Homestead Dam

The previously recorded Aboriginal heritage site (Homestead 1, AHIMS # 16-3-0720) is located within the proposed disturbance area and is likely to be impacted by the proposed works (Biosis, 2018a). The significance of this site has been assessed as high (Biosis, 2018a). Biosis assessed that the impacts from works associated with the full proposal at this site will result in direct and partial harm and partial loss of value. However, the works associated with Phase 1, i.e. replacement of the existing breach, are likely to have a lesser impact that that assessed in the ACHA and permitted under the AHIPs.

The site represents a common example of sites within the area and in cases where conservation is not practical, options for management such as salvage and community collection are considered as mitigative measures. Approved AHIP (C004300) covers the project works area and includes permission to harm all Aboriginal objects located within the AHIP boundary (Figure 14).

As a condition of AHIP C0003079, a surface collection of visible archaeological artefacts has been conducted within the Homestead Dam proposed impact area in areas that were potentially impacted by

geotechnical investigations. The collection was undertaken with a representative of the Toorale JMC. No further salvage is required for Phase 1 works.

Peebles Dam

The Aboriginal Heritage site Peebles 1 is located within the study area covered by AHIP C0003079 (Biosis, 2018a). The significance of this site has been assessed as moderate and the impacts from geotechnical and construction works will result in direct and total harm and total loss of value. As a condition of the AHIP, a surface collection of visible archaeological artefacts has been conducted on the area of Peebles Dam wall in areas that were potentially impacted by geotechnical investigations. The collection was undertaken with a representative of the Toorale JMC.

An additional 19 Aboriginal sites, Peebles 2-19 were located and assessed by Biosis (2018b) as being of low significance while two sites were assessed as having moderate scientific value. This study area is covered by AHIP (C004301) and includes permission to harm all Aboriginal objects located within the AHIP boundary (Figure 16).

Consultation with the Toorale JMC indicates regarding removal of the section of the dam wall identified no issues of concern regarding potential impacts to Aboriginal cultural values apart from sequencing of Project works.

5.8.4 Mitigation Measures

Mitigation measures for Aboriginal cultural and historic heritage impacts are outlined in Section 6.3

5.10 Historic Heritage

5.10.1 Existing environment

Toorale is considered an icon of Australian pastoral heritage. At its peak in the late 19th century, it was a significant part of the largest sheep station in the world, where up to 265,000 sheep were shorn in its 46-stand shearing shed. Historically, Toorale has made a significant contribution at a local, State and Federal-level as a large pastoral enterprise. The property has changed hands several times since being first leased in 1857 by W. B. Tooth. In particular, Toorale Station is associated with two of the most significant Australian wool barons, Sir Samuel Wilson and Sir Samuel McCaughey.

Toorale played a role in the stories that shaped the national mythologies of that era. Henry Lawson's brief stint at Toorale in 1892 was inspirational to his subsequent poetry. Toorale is also associated with the 1890s battles between shearers and pastoralists along the Darling River, the rise of unionism and the birth of the Labor Party in Australia. Combined with its continuous pastoral use, Toorale exemplifies the history of land settlement and pastoralism in New South Wales that has defined much of Australia's cultural identity.

Toorale also embodies evolving environmental perspectives towards the environment, and the relational history between Aboriginal and non-Aboriginal people that has underpinned the pastoral industry (Polychrest, 2013).

The historic buildings at Toorale, in particular the Old Toorale Woolshed (built around 1873–74) and Toorale Homestead (built around 1896), are considered 'iconic monuments to the pastoral history of the nation' as they represent 'the biggest and the best of the far western region's surviving historic pastoral buildings with the most significant technology and history attached' (Sheppard 2013).

Toorale is largely a landscape of absence, as much of the very old historic fabric was ephemeral or was removed by the corporate owners after 1969 (OEH, 2018). The current Conservation Management Plan (CMP) for Toorale (Sheppard 2013) concludes that there are four precincts considered to possess very significant historic fabric, these are:

- The Toorale Homestead Precinct;
- The Old Toorale Woolshed Precinct;
- The Boera Precinct (i.e. the Boera Dam & Floodwaters Scheme), and
- The Nissen & Quonset Huts Shearing Sheds Precinct.

The CMP states that each of these precincts meet the criteria for State Heritage listing. However, the precinct and property as a whole is not the subject of an interim heritage order, nor has it been added to the State Heritage Register in accordance with the *Heritage Act 1977*.

Homestead Dam

Homestead Dam is a 540 m embankment 30 km downstream from Boera Dam. Homestead Dam was constructed in the 1870s to provide water for domestic purposes and amenity following the construction of the Homestead property (Shepard CMP 2013). Flooding as early as 1880 carried away portions of the dam infrastructure, which was replaced by July 1880 (Shepard HHIR 2013:21). The Dam was breached during flooding in 2010 and has not been repaired.

A search of the Bourke Shire LEP, State Heritage Register, the Historic Heritage Information Management System for National Parks (HHIMS) and Australian Heritage Database revealed two heritage listings located within the Homestead Dam Development Footprint, which are also the only listings within 10 km (Figure 18):

- Toorale Homestead and Outbuildings, Toorale Station via Bourke, NSW, Australia is listed on Schedule 5 of the Bourke LEP (Item 28) and is 1 km to the west of the Homestead.
- Toorale is listed on NPWS Historic Heritage Inventory and covers Built Heritage, Archaeological Resources and Landscape.

Heritage values associated with Toorale Homestead are described under the 'Significance' sub-heading below.

Peebles Dam

Peebles Dam is the southernmost Dam on the Warrego River, located approximately 45 km downstream of Boera Dam. A low-level version of the Dam was constructed in the 1870s to divert water into Ross Billabong from the Warrego River to supply the woolshed and wool scour. The higher version of the Dam was constructed in 1986 as part of Duncans Wall, a 2840 m embankment (Shepard HHIR 2013). The Dam was breached during flooding in 2012 and has not been repaired.

A search of the Bourke Shire LEP 2012, State Heritage Register, the Historic Heritage Information Management System for National Parks (HHIMS) and Australian Heritage Database did not reveal any heritage listings within the Peebles Dam Development Footprint, but revealed three listings within 10 km (Figure 18):

- Toorale Homestead and Outbuildings, Toorale Station via Bourke, NSW, Australia is listed on Schedule 5 of the Bourke LEP (Item 28) and is 8.7 km to the north.
- The Darling River is listed on Schedule 5 of the Bourke LEP (Item 10) and is 3.2 km to the south.
- Toorale is listed on NPWS Historic Heritage Inventory and covers Built Heritage, Archaeological Resources and Landscape.

Relationship of the historic precincts to the Proposed Works

- The CMP includes both Homestead and Peebles Dams as part of the Boera Dam Floodwaters Scheme. They are small components of a much larger water management scheme. The Dams and water management in general across the entire Toorale property has constantly evolved and has been modified through time to adapt to new technologies, uses and farming practices.
- The Toorale Homestead is located over 1 km from the Homestead Dam repair works footprint.
- The Old Toorale Woolshed Precinct is located adjacent to Ross Billabong, which is associated with Peebles Dam. It is located approximately 5.5 km from the Peebles works footprint.

Site survey

Detailed pedestrian survey of both dams and the Toorale Homestead and its surrounds was undertaken over three days (28-30 May 2018) by a qualified and experienced ELA Archaeologist and heritage consultant. The dam structure and associated water management infrastructure at Homestead Dam and Peebles Dam has been photographed in detail. Historic heritage site inspections undertaken by ELA did not identify any historically significant features or fabric associated with the section of Peebles Dam wall that shall be removed or the section of Homestead Dam that will be repaired.

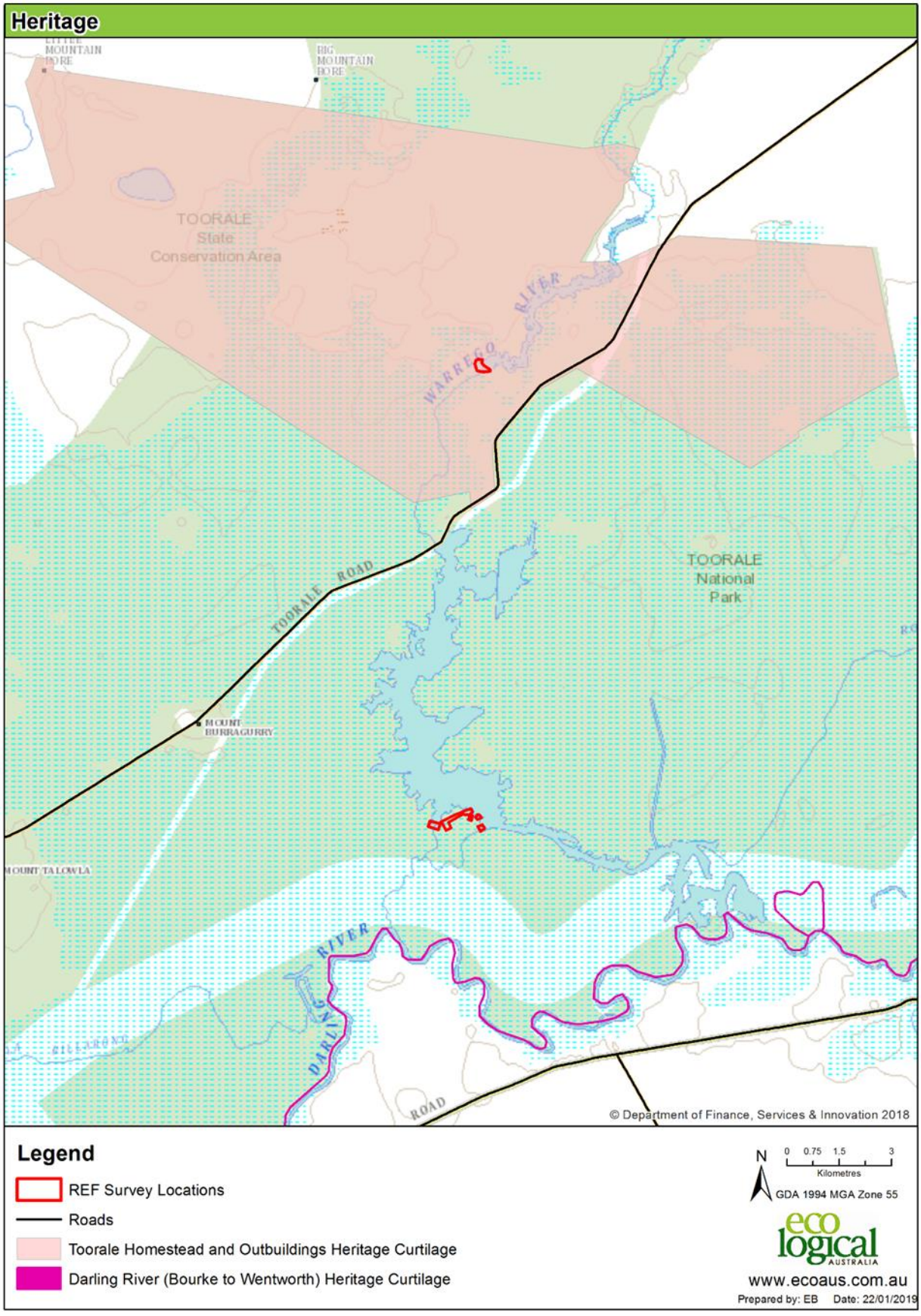

Figure 18: Historic heritage listings in the vicinity of the proposed works

Significance

The statement of significance and a physical description of the locally listed Toorale Homestead and Outbuildings is provided below.

Statement of Significance:

"The homestead of 'Toorale' represents well the prosperity and challenge of remote rural 'Australian pastoral settlers. The National Trust on their visit of August 1986 stated: 'Toorale' is a remarkable example of a large western homestead of unpretentious appearance yet with an interior of surprisingly sophisticated details. The house is remarkable too for its size, and spacious atrium, the scale and variety of outbuildings, the extensive collection of rural equipment within its curtilage, that make the complex of outstanding significance"

Physical Description:

'Toorale' homestead is both magnificent and unusual. Built primarily of 'lath and plaster' walls internally and ripple iron cladding externally, it contained 27 large rooms. A formal section of the house for the owners at the south is connected directly to a generous central hall 18m x 6m (atrium) with all the service rooms arranged around it containing stores, kitchens, servant's accommodation and wash rooms. The 4m high hall is lit by coloured glass roof lights, and a generous verandah surrounds the whole homestead flanked by enormous Phoenix palm trees, creating an 'oasis' setting.

Once beautifully finished internally, today only remnants of the elaborate wall papers (dating from the late 19th and early 20th C) remain, but most of the delicately patterned Wunderlich ceilings are still intact, and the broad panelled solid timber doors, with fanlights and side lights reflected the wealth and prosperity of the good wool seasons before the drought of 1895. Toorale's single storey building features a large gabled section roof behind, a smaller hipped section. The roof is of corrugated iron, and there are original ogee gutters and timber eaves. Verandahs on all sides of the building have been partially enclosed. The front door is a large four-panel door with bolection mouldings, semicircular Georgian fan and sidelights. There were several very ornate marble fireplaces, including one exceptional one in coloured marble; one of the fireplaces was removed to the Royal Hotel (now The Port Of Bourke) in Bourke. Ceilings in the house are very high (3 metres or more). The long hallway leading from the front door to the atrium features a square fanlight and coloured sidelights, while there are fine plaster motifs on the arch above the door. From the atrium, three panels of coloured glass and corresponding roof lights are visible. Roof timbers are of heavy sawn timber construction. In the structure there is some termite damage. The remains of the laundry are located in the northeast corner of the house and include copper troughs. The small cellar is entered by stairs off the northern verandah. Outside the main house the old garden is still defined by concrete edgings, a galvanised pipe rose frame to the west and south of the building and some original, old fashioned roses. To the north of the house is a meat house on stumps and with a hipped and gabled corrugated iron roof. The sides are gauzed and the original mechanism for hanging meat remains. there is also a small store. and complex contains numerous other outbuildings.

(https://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=1220008)

The CMP states that the Toorale Homestead and the associated McCaughey era outbuildings complex meet the criteria for listing on the State Heritage Register, but currently it remains a locally listed item.

In regard to the dams, The Boera Dam & Floodwaters Scheme is recognised in the CMP as meeting the criteria for listing on the State Heritage Register for its historical, social, research and particularly technological values. The CMP includes the following observations:

'The success of McCaughey's c.1882 Boera Dam and Floodwaters Scheme at Toorale in particular is thought to have underpinned the then Governments decision to go ahead with the Burrunjuck Reservoir and the Northern Murrumbidgee Canal Scheme in 1907.'

'The construction of the Boera Dam and Floodwaters Scheme c.1882 by Samuel McCaughey is one of the most massive nineteenth century civil engineering and water management constructions known to be undertaken by a private individual on a remote property in New South Wales.'

'The modified flow regimes associated with the Boera Dam have resulted in a tenfold increase in flood frequency across the Western Floodplain and the creation of a diverse wetland, which is an important breeding habitat for colonial water birds. Those wetlands have important research potential.'

The CMP concludes that all the dams and water management at Toorale contribute to the potential State significance of the whole site as they constitute a significant technological achievement for the time. No dams are identified as individually significant. However, the CMP also states that the most significant phase of construction for the earthworks, which form the dams, which divert water into the Western Floodplain, occurred when Samuel McCaughey took over in 1880. Both Homestead and Peebles dams were constructed prior to this time for specific purposes not associated with floodplain watering.

Homestead Dam is included in the listed Homestead and Outbuildings heritage curtilage and in the CMP it is associated with the heritage significance of the standing Homestead site. The Dam was constructed for domestic use and is not noted in the CMP as a significant item on its own right, nor is it discussed as part of Toorale's listing. The heritage curtilage of the Toorale Homestead and Outbuildings listing extends across much of Toorale National Park and the State Conservation Area and is not confined to the homestead and its immediate surroundings (Figure 18).

Peebles Dam, is also associated with the wider Boera Dam and Floodwaters Scheme, but was originally constructed to supply water to the woolshed and wool scour. It is located outside the Toorale's listed heritage curtilage (Figure 18).

Both dams have a long history of construction and modification (CMP 2013: Appendix B). Due to continuous alteration over the years and documentation of dam construction, dams have little research potential and therefore have little or only local historical archaeological significance. NPWS has invested significant amount of money to conserve and repair the historic heritage in this precinct and this work would enhance that investment.

5.10.2 Potential impacts

Potential impacts are assessed in the Statement of Historic Impact (SoHI - Appendix J) and summarised below.

Homestead Dam

The proposed works are to repair the previously breached dam wall consistent with the existing works approval and to reinstate Homestead Dam to a state that is consistent with its recognised heritage values. Material from Peebles Dam may be used to fill the breach at Homestead Dam.

- There are no potential direct impacts to heritage values associated with Toorale Homestead Precinct posed by the proposed reinstatement of Homestead Dam. Establishment of 98.5 m AHD water levels in Homestead Dam will enhance the significance of the Homestead precinct by reinstating the storage capacity of the dam for high volume events and thereby retaining a reasonably constant water level. Re-establishment of existing historic water management infrastructure is a positive heritage outcome for the historic Toorale Homestead setting and the local ecosystem.
- There will be no archaeological impact as materials will be added to the fill the breach and no excavation is proposed.

- The works area is 1 km to the west of the Homestead and materials required for repair of the Dam will be trucked on existing roads outside the immediate Homestead Precinct. Indirect impacts such as temporary noise, dust and disturbance in the precinct will be minor or non-existent.

Peebles Dam

The proposed works are to increase the capacity to deliver flows to the lower Warrego River by removing a portion of the Peebles Dam embankment to allow Warrego River flows to pass through to the Darling River.

- Allowing Warrego River flows to pass through to the Darling River is a positive ecological outcome.
- Material from the embankment will be used to repair the Homestead Dam and/or be returned to nearby borrow pits. Much of the current embankment was constructed in the 1980s when it became part of the main irrigation storage water system for Toorale (Shepard HHIR 2013:45). Construction of the embankment has extensively disturbed the former stream bed location and its surrounds.
- There will be no archaeological impact as it not considered that the embankment will contain a resource that has archaeological research potential. Documentation and information regarding the construction of the dams is known and it is unlikely that additional information will be obtainable.
- Removal of part of the embankment will not have a materially detrimental effect on the heritage significance of the Boera Dam and Floodwaters Scheme, the Woolshed Precinct or Toorale as a whole.
- There are no potential direct or indirect impacts to heritage values associated with the woolsheds as they are located approximately 5.5 km away. Temporary noise, dust and disturbance will not impact on any significant heritage values.

Legislative compliance

For the historic heritage of Toorale, NPWS's statutory responsibilities for cultural heritage come under the following legislation:

- Heritage Act 1977 for historical archaeological sites and items listed on the State Heritage Register;
- National Parks and Wildlife Act 1974 (excluding pre-contact Aboriginal cultural heritage);
- Environmental Planning and Assessment Act 1979 for locally listed items under Part 5 of the Act;
- Bourke LEP 2012;
- Bourke DCP 2012; and
- State Environmental Planning Policy (Infrastructure) 2007.

The proposed works are addressed in relation to the requirements and the relevant clauses and controls of the above legislation, if relevant, the *NPWS Guidelines for historic heritage approvals* (2016) and the management policy contained in the CMP.

Heritage Act 1977

Toorale and its dams are not listed on the State Heritage Register. Archaeological relics are unlikely to be present within the dam embankments.

The NPWS Guidelines for historic heritage approvals (2016)

The NPWS Guidelines for historic heritage approvals (2016) state that for places on reserved lands that are of state significance but have not yet been added to the State Heritage Register;

i. No application is required to the Heritage Council of NSW unless a project involves excavation.
ii. Written notification is required to the Heritage Council of NSW for demolition.
iii. An Aboriginal Heritage Impact Permit (AHIP) may also be required if work has the potential to harm an Aboriginal object or place.

The proposed works for both Homestead Dam and Peebles Dam have been assessed under Part 5 of the EP&A Act. This Part applies for infrastructure projects approved by the local council or a State agency undertaking the project. No excavation permit is required from the Heritage Council.

Development consent from council is not required, however for a locally listed heritage item, written notice to the Local Council is required to carry out a development, including demolition, with consideration of any response received within 21 days. To comply with this, OEH shall provide a copy of the REF and any specific CMP, heritage assessment or impact assessment to the Bourke Shire Council. Consultation with the local community and local stakeholders is also recommended.

Infrastructure SEPP 2007

SEPP (Infrastructure) 2007 states that certain categories of development which are of no more than minimal environmental impact are 'exempt development'. There will be positive and negative impacts. This project will result in minimal heritage impact and a positive environmental effect. The activity is permitted without Development Consent from Council, however written notice to the Local Council is required under Clause 14 of the Infrastructure SEPP 2007, to carry out demolition affecting a locally listed heritage item with consideration of any response within 21 days.

Bourke LEP 2012

The objectives of Heritage conservation in the Bourke LEP 2012 are to conserve the environmental heritage of Bourke including the fabric, settings, views and heritage significance of heritage items and heritage conservation areas, archaeological sites, Aboriginal objects and Aboriginal places of heritage significance (Table 23).

Table 23: Relevant Bourke LEP 2012 Clauses

Clause	Discussion
2) **Requirement for consent** Development consent is required for any of the following: (a) demolishing or moving any of the following or altering the exterior of any of the following (including, in the case of a building, making changes to its detail, fabric, finish or appearance): (i) a heritage item, (ii) an Aboriginal object, (iii) a building, work, relic or tree within a heritage conservation area, (b) altering a heritage item that is a building by making structural changes to its interior or by making changes to	The Homestead Dam Development Footprint is located within the curtilage of a listed local heritage item. Pursuant to clause 127(m) of the ISEPP, the activity is permitted without Development Consent.

Clause	Discussion
anything inside the item that is specified in Schedule 5 in relation to the item, (c) disturbing or excavating an archaeological site while knowing, or having reasonable cause to suspect, that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed, (d) disturbing or excavating an Aboriginal place of heritage significance, (e) erecting a building on land: (i) on which a heritage item is located or that is within a heritage conservation area, or (ii) on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance, (f) subdividing land: (i) on which a heritage item is located or that is within a heritage conservation area, or (ii) on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance.	
(5) **Heritage assessment** The consent authority may, before granting consent to any development: (a) on land on which a heritage item is located, or (b) on land that is within a heritage conservation area, or (c) on land that is within the vicinity of land referred to in paragraph (a) or (b), require a heritage management document to be prepared that assesses the extent to which the carrying out of the proposed development would affect the heritage significance of the heritage item or heritage conservation area concerned.	Pursuant to clause 127(m) of the ISEPP, the activity is permitted without Development Consent. This REF and Heritage Impact Assessment fulfils this clause as the proposed development is within the curtilage of a heritage item.

Bourke DCP

The general heritage provisions set out in the Bourke DCP are applicable to all Heritage Items, Heritage Conservations Areas, Potential Heritage Items (Built Environments, Cultural and Visual Landscapes, European Archaeological Sites) and for development in the vicinity of Heritage Places. However, it principally concerns buildings, alterations, additions and fencing and therefore does not directly apply to the proposed works associated with this project. The conservation objectives of the DCP include retention and conservation of heritage items and their significant elements and settings.

Toorale National Park & State Conservation Area CMP (Shepard 2013)

The CMP recommended that the procedures for managing the site be consistent with the management of the site as a State Heritage item, however this contradicts the *The NPWS Guidelines for historic heritage approvals*. Policy relevant to dams and water management in the CMP is as follows:

CMP Policy	Response
7.5.2 Fabric Management of Water Infrastructure Partial decommissioning of historic water infrastructure where necessary will where possible be carried out in a sensitive manner so that the majority of the Dam or tank remains to identify its location, size and shape and evidence the construction techniques used. As historic water infrastructure is modified or decommissioned the opportunity will be taken to identify and record any unusual or obviously historic construction techniques and materials.	While the proposal will result in the removal or modification of part of the embankment and water management infrastructure at Peebles Dam, none of the directly impacted infrastructure has been assessed as individually significant and dates to the 20th century. Furthermore, the physical structure at Peebles Dam has been breached, rebuilt and modified throughout its existence up to the end of the end of Clyde Agriculture's ownership (2008). The embankment at Homestead Dam has been breached since 2012.

Conclusions

Based on the information provided above, it is concluded that the proposed works will result a positive impact on historic heritage values associated with the Toorale Homestead Precinct, and no significant impact to other historic precincts associated with the site.

The non-repair of Homestead Dam was noted within the CMP as potentially contravening 'Minimum Standards of Maintenance' provisions under the *State Heritage Act 1977* (CMP 2013:104). Therefore, the works to repair the Homestead Dam site will enhance the heritage significance of the area as it will reinstate an element of the modified landscape to better reflect its previous state, helping to restore the historic Toorale Homestead setting and the local ecosystem.

Removal of the within-channel section of Peebles Dam embankment will not impact the overall significance of the Boera Dam & Floodwaters Scheme or Toorale as a whole. The remaining portions of the embankment will be visible and able to be interpreted if required.

Removal of part of Peebles Dam embankment will result in altered flooding regimes in the lowest reaches of the Warrego river catchment, however these will be more representative of natural flow regimes than those associated with full development of the Boera Dam & Floodwaters Scheme and likely more similar to conditions associated with the historic context of the Old Toorale Woolshed Precinct.

The overarching context of the larger Toorale Water Infrastructure Project aligns with this objective, seeking to retain and enhance environmental outcomes associated with the ongoing operation of the Boera Dam & Floodwaters Scheme. Actions associated with the Toorale Water Infrastructure Project include retention and sympathetic modification to Boera Dam and Booka Dam and reinstatement of Homestead Dam. Implementation of these actions (as a whole) demonstrates concurrence with the objects of the CMP.

The proposed decommission of the Peebles Dam has been discussed with the Toorale JMC and the removal of the Peebles Dam was deemed acceptable, due to the lack of Aboriginal or historical heritage material in the area (Biosis 2016:56). The interim proposal at Homestead Dam is not supported by the JMC due to potential impacts to the access tracks between the two sites. Mitigation measures, including post-works grading, will minimise any potential impacts of concern.

5.10.3 Mitigation measures

It is anticipated that the removal of of Peebles Dam wall will result in altered flooding regimes in the lowest reaches of the Warrego River catchment which will be more representative of natural flow regimes

associated with the historic context of the Old Toorale Woolshed Precinct. Notwithstanding this, it is recommended that the proponent implement ongoing surveillance and monitoring of water levels and riparian vegetation within Ross Billabong in the vicinity of the Toorale Woolshed to determine potential changes to vegetation as a result of the decommissioning of Peebles Dam and develop and implement a response plan should vegetation condition deteriorate in such a manner as to negatively impact heritage amenity values associated with the Shearers Quarters and Woolshed.

The removal of part of Peebles Dam constitutes further modification of the Boera Dam & Floodwaters Scheme, which is considered consistent with the past adaptive management principles that underpin the scheme. To ensure that a continuous history of the Scheme is maintained it is recommended that a pre and post works photographic record be compiled (that meets OEH requirements for such recording).

As historic water infrastructure is modified or decommissioned the opportunity will be taken to identify and record any unusual or obviously historic construction techniques and materials' (CMP 2013:129).

Reuse or interpretation of any existing pipes or water management infrastructure that require removal shall be considered.

Historic features and landscapes within and beyond the heritage precincts will, where practical, be interpreted. Additional mitigation measures for cultural and historic heritage impacts are outlined in Section 6.3.

5.11 Natural resources

5.11.1 Existing Environment

Natural resources relating to the proposed works include the surrounding environment (such as the water resources of the Warrego River) as well as the resources and materials to be used during the construction stage of the proposed works.

Communities living on the Darling River downstream of its confluence with the Warrego River benefit from the water flows from the Warrego River, as well as the impounding of water within storages at Toorale, especially during connecting flow events that occur when water levels are low in the Darling. Monitoring for the LTIM project has demonstrated improvements in Darling River water quality with inflows from the Warrego system (CEWO 2017). As part of the Toorale water licence conditions, flows entering Toorale down the Warrego River, must be let through the system to provide connection with the Darling River before licence conditions are met and the CEWH can manage the water.

Materials within Homestead and Peebles Dam that are currently in place include the bank spoil material, concrete pipes and metal gates and platforms. For the current stage of proposed works, these materials will be reused in the works (such as for fill at Homestead Dam) or will be stored and reused or sold later by NPWS.

5.11.2 Potential impacts

Peebles Dam

The proposed activity is not likely to result in the degradation of the park or any other area reserved for conservation purposes. The impact area footprint has been specified and impacts assessed to ensure minimal to no degradation of the park will occur.

The activity is not likely to negatively affect the use of, or the community's ability to use natural resources at Toorale. The activity is likely to positively affect the quantity, connectivity and quality of water resources of the Warrego River. The proposed works will support more efficient and sustainable release of environmental water for region wide benefits. Therefore, there will be no impacts upon the Warrego River or Darling River catchments.

The proposed activity ensures the efficient use of natural resources with the aim of reusing as much spoil material from Peebles Dam for the construction of Homestead Dam. Existing tracks will be used for construction activities to ensure minimal impact. Once construction is complete and the proposed activity is within the operation stage, the works will allow for the efficient allocation of water to downstream water users and environment.

There are minor potential impacts of the use of resources in the construction phase with the machinery used. The primary resource required for machinery include diesel fuel and lubricants.

Homestead Dam

The proposed activity is not likely to result in the degradation of the park or any other area reserved for conservation purposes. The direct impact area footprint has been specified and impacts assessed to ensure minimal to no degradation of the park.

The activity is likely to positively affect the quantity and use of water resources of the Warrego River within the immediate vicinity of the works. The proposed works at Homestead Dam will allow for the reinstatement and/or maintenance of *in-situ* values whilst providing capacity to pass the required flows

downstream. The removal of Peebles will further enhance the passage of flows in the lower reaches of the Warrego, and to the Darling River.

The proposed activity ensures the efficient use of natural resources with the aim of reusing as much spoil material from Peebles Dam for the construction of Homestead Dam. Existing tracks will be utilised for construction activities to ensure minimal impact

There are minor potential impacts of the use of resources in the construction phase with the machinery used, e.g. the use of diesel fuel and lubricants.

One of the waste products from the proposed activities at Peebles Dam includes the spoil material from the embankment. Some of this material will be reused in the proposed activities at Homestead Dam.

5.11.3 Mitigation measures

Mitigation measures for contamination, waste and emission impacts are outlined in Section 6.3.

6 Environmental Management

6.1 Residual environmental risk and impacts

Following consideration of the proposed construction and operational safeguards, controls and mitigation measures to be implemented by OEH as part of the project design, Table 24 is used to reassess the risks associated with each of the potential impacts identified in Section 5.

Table 24: Risk Assessment Matrix

Risk Assessment Matrix		Consequence				
Likelihood		Minor	Major	Severe	Critical	Catastrophic
		A	B	C	D	E
Very Unlikely	1	Low	Low	Medium	Medium	Medium
Unlikely	2	Low	Low	Medium	Medium	High
Possible	3	Low	Medium	High	High	High
Likely	4	Medium	Medium	High	High	Extreme
Almost Certain	5	Medium	High	High	Extreme	Extreme

6.2 Key risks

There are a number of environmental risks related to the project identified through this REF. Mitigation measures have been outlined for each of the risks identified. The following section brings these mitigation measures together, augments them where additional actions are required and outlines a framework for their management during construction and/or operation. Residual risk levels are then assessed.

Modification to Peebles Dams improves water connectivity and fish passage along the Warrego River. It may however, reduce the flow of water into Ross Billabong, in turn reducing its value as an aquatic refuge for fauna, and impacting on the condition of riparian vegetation communities adjacent to the Billabong. These impacts become the key environmental risks for the proposed works at Peebles Dam.

Th reinstatement of Homestead Dam will increase water storage capacity, providing a more permanent water source for aquatic flora and fauna and for amenity at the Toorale Homestead Precinct. However, it will reduce the passing of flows relative to breached condition and increases the risk of further obstructing fish passage under the interim state assessed in this REF.

To manage these risks, the following documents and supporting processes will be in place (further details are provided in Section 6.3):

- A Construction Environmental Management Plan (CEMP) will be developed for the project. The CEMP will include the following sub plans:
    - **Working in waterways management –** this sub plan must outline the processes to follow whilst working within the Warrego River environment. This should include appropriate fish passage as construction is occurring in accordance with "*Why do fish need to cross the road?*" (Fairfull & Witheridge, 2003)

- **Erosion and sediment management –** this sub plan must outline erosion and sediment risks and reference the Erosion and Sediment Control Plan (ESCP) which will outline the process to be put in place to manage these risks. The ESCP needs to be developed by a suitably qualified person.
- **Pollution and incident response management –** this sub plan must outline the processes for managing a pollution event or other environmental incident. This would include spill response requirements (spill kits etc), incident notification process and roles and responsibilities for managing and reporting any incidents.
- **Heritage management –** There are no anticipated significant impacts to historic heritage. Obtained AHIPs cover the maximum areas that may be disturbed and all conditions associated with the AHIP shall be observed. Staff induction shall outline how any unexpected finds (both aboriginal or non-Aboriginal) will be managed. This must include requirements around stopping work and notifying appropriate people in the event of an unexpected find.
- **Waste management and storage of hazardous materials –** this sub plan needs to outline how waste will be minimised and managed, how hazardous materials will be stored, refuelling procedures etc. Working in and around a waterway increases the risks associated with hazardous materials and refuelling.
- **Flora and fauna management –** this sub plan needs to outline measures to prevent direct impacts to native fauna and minimise any impacts on areas of native vegetation or existing habitat.
- **Public amenity –** this sub plan needs to clearly outline management measures that will be in place to ensure impacts to park visitors and other residents are minimised.

Other items to be included in the CEMP and sub-plans:

- **Induction and pre-start –** this sub item needs to outline the induction process for workers coming onto the project as well as any toolbox talks required and the process for undertaking pre-start checks of machinery for damage and wear and tear (in particular hydraulic hoses, fuel tanks etc) before the start of work each day.
- **Environmental Control Maps (ECMs)** will be developed for the full length of the project. These are maps that have all areas of environmental significance clearly identified along the route. Hard copies of these will be on-site at all times and displayed where they can be seen by the project team. They should be discussed as part of the pre-start before works commence

6.3 Environmental Controls and Residual Risk

A summary of the environmental controls and residual risks of the proposed dam modification works are outlined in Table 25 and Table 26.

Table 25: Summary of environmental controls and residual risk relevant to Peebles Dam proposed works

Risk	Mitigation measures	Additional mitigation measures	Documentation	Residual risk

Soils and sedimentation	• Laydown and temporary spoil stockpile areas are to be placed, secured and managed if flooding or weather conditions suggest the likelihood of high water flows and therefore sedimentation risks.
	• Weed control programs would be implemented on stockpiles if required.
	• Account for weather events during construction:
	  ○ If heavy rainfall is predicted the site should be stabilised and works modified to prevent erosion for the duration of the wet period; and
	  ○ Works methods shall be modified during high wind conditions if excess dust is generated.
	• Schedule works when there is no/low flow through the Warrego River. If this is not possible, a coffer dam shall be established to protect the site while the wall is removed.
	• The area of disturbance should be limited to the smallest practicable footprint possible.
	• Potential soil contamination will be managed by the implementation of a spill response procedure.
	• Appropriate rehabilitation measures should be provided to stabilise the site including restoration of the banks to their natural shape at the completion of works.
		• Develop a CEMP including a section outlining soil and contamination risks on project and linking to the ESCP.
		• Detail erosion and sediment controls on ECMs for each area
		• Make project team aware of erosion and sediment and contamination issues and mitigation measures through project induction
			CEMP
			ESCP
			ECM
			Induction
				MEDIUM

Risk	Mitigation measures	Additional mitigation measures	Documentation	Residual risk
Flora and fauna impacts	Maintain native vegetation where possible and reduce impact by the following actions: • Clearly marking construction zone • Minimize root disturbance or compacting in the drip zone of trees and shrubs • Should mature trees or habitat trees be required to be removed, the trees should be surveyed by a suitably qualified person and marked for supervised clearing and possible salvage if hollows are present. Monitor the condition and composition of vegetation communities adjacent to Ross Billabong to assess impact of changed water regime. • If reductions noted, consider the use of environmental water to provide inundation in Ross Billabong under existing license conditions.	• Native vegetation should be clearly marked on the ECMs to identify approved vegetation removal (disturbance footprint). • Develop a process for review and approval if additional vegetation not assessed in this REF needs to be removed. • Mitigation measures should be briefed to all project staff in a site induction and at toolbox talks	ECM CEMP Induction	LOW
Weeds	Where necessary the following biosecurity measures should be applied during completion of works: • All machinery and vehicles brought on site would be free of any soil, seed or plant material. • Restrict vehicle and personal access from areas of known weed infestation during proposed works to prevent spread and reinfestation. • Control weed infestations prior to proposed works commencing to prevent the spread of weeds in spoil. • Evidence of compliance with biosecurity requirements should be documented, e.g. a Vehicle wash down register. • Follow up monitoring of work sites post construction to assess the potential establishment of weed species.	• Develop a CEMP including a section outlining flora and fauna mitigation measures • Where weeds are an issue mitigation measures should be briefed to the project team as part of the induction requirements.	CEMP Vehicle wash down register if required Induction	LOW

Risk	Mitigation measures	Additional mitigation measures	Documentation	Residual risk
Aquatic ecology and water	• Continuation of monitoring following construction phase as per LTIM requirements: vegetation, fish (including exotic species), fish, frog, invertebrate, waterbirds and hydrology. • Addition of Ross Billabong for aquatic and water monitoring. • Operate water infrastructure to maximise park management and environmental outcomes (both within the boundaries of Toorale and further downstream) subject to license conditions.	None		LOW

Community impacts	• Provide community information regarding potential impacts on amenity during construction
	• Public access should be excluded from the construction zone, including laydown and stockpile areas.
	• Signage to prevent access by non-construction related traffic to the construction zone.
	• Grade road and access tracks as necessary once works have ceased
	• Project information will be available to parties that do have access to areas of Toorale to outline the need for the works, potential impacts, changes to access and the expected duration of the proposed works.
	• Compliance with the Parks fire management strategy and State of NSW and OEH *Fire Management Manual* (2017) and associated strategy for emergency response actions in times of fire risk. Protocols to be used in the environmental management plans may include safety protocols such as:
	  • Basic training of all staff in the use of firefighting equipment on site
	  • Firefighting equipment lists will be detailed in the Work Method Statements;
		• Develop a CEMP including a section outlining public and contractor safety impacts and mitigation measures
		• Site plans should indicate no go zones, site signage locations, firefighting equipment locations
			ECM
			CEMP
			Induction
			OEH *Fire Management Manual* (2011)
				LOW

Risk	Mitigation measures	Additional mitigation measures	Documentation	Residual risk
	• Management procedures for hot works, smoking, vehicle use off formal access tracks, and the use and storage of fuel and flammable chemicals; and • Daily monitoring of the Fire Danger Rating, and communication of any further mitigation measures required to all staff and contractors.			
Aboriginal heritage	• Works to be conducted in accordance with AHIP number C0003079, permit ID 4175 and AHIP number C0004300, permit ID 4369 and in consultation with the JMC. • Laydown areas or site office areas must be kept within AHIP footprint. • Aboriginal cultural heritage induction be undertaken by all staff and contractors working on site. • Boundaries of AHIP area should be marked. • Complete Aboriginal site impact recording forms following completion of proposed works. • Complete remaining conditions outlines in AHIP: preparation and submission to OEH of a report about harm to Aboriginal Objects within 4 months of the completion of works under the AHIP. • Stop work if any potential heritage sites or human remains have been identified during construction. • Aboriginal objects are protected under the NPW Act regardless if they are registered on AHIMS or not. If suspected Aboriginal objects, such as stone artefacts or scarred trees are located during future works, works must cease in the affected area and an archaeologist called in to assess the finds. If the finds are found to be Aboriginal objects, OEH must be notified under section 89A of the NPW Act. Appropriate management and	• In consultation with the JMC develop a CEMP including a section outlining archeologically sensitive areas and any heritage areas • Mark on ECM archeologically sensitive areas, AHIMS sites • Point out sensitive sites and any AHIMS sites in the work area for that day in pre-start briefing each day • Make project team aware archeology and heritage issues and mitigation measures through project induction • Brief project team on unexpected finds and discovery of human remains process at induction • Induction to address elements related to relevant legislation, AHIP conditions,	CEMP ECM	LOW

Risk	Mitigation measures	Additional mitigation measures	Documentation	Residual risk
	avoidance or an approval under a section 90 AHIP should then be sought if Aboriginal objects are to be moved or harmed. • In the event that human remains are found, works will immediately cease, and the NSW Police should be contacted. If the remains are suspected to be Aboriginal, OEH may also be contacted at this time to assist in determining appropriate management. • Collect artefacts, store in keeping place, put back in same location once works complete. • Avoid any identified cultural heritage places in the construction planning and construction stage.	location of identified heritage sites, basic identification skills for Aboriginal and non-Aboriginal artefacts and human remains, penalties and non-compliance • Ongoing Aboriginal consultation and assessment activities should be undertaken as part of the project		
Historic Heritage	• Implement ongoing surveillance and monitoring of water levels within Ross Billabong in the vicinity of the Toorale Woolshed to determine potential changes to vegetation as a result of the decommissioning of Peebles Dam. Develop and implement a response plan should vegetation condition deteriorate in such a manner as to negatively impact heritage values associated with the Shearers Quarters and Woolshed Precinct. • Maintain and protect remaining components of Boera Precinct, including Duncans Wall. • To ensure that a continuous history of the Boera Dam and Floodwaters Scheme is maintained it is recommended that a pre and post works photographic record be compiled (that meets OEH requirements for such recording).	• Induction to address elements related to relevant legislation and CEMP requirements • Brief project team on unexpected finds and discovery of human remains process at induction	CEMP Induction	LOW

Risk	Mitigation measures	Additional mitigation measures	Documentation	Residual risk
Noise and vibration	• Work within approved hours between 7 AM and 6 PM	• Make project team aware of noise issues and mitigation measures through induction	CEMP Induction	LOW
Resources, emissions and waste	• Where possible, reuse spoil material at Homestead Dam • Store, sell or reuse the two steel pipes from Peebles Dam. • Felled trees to be removed and stored for use as firewood, traffic barriers or placed in situ as woody habitat • To avoid release to the environment, all hazardous materials (fuels, lubricants, herbicides, etc.) will be disposed of off-site in accordance with NSW EPA guidelines. • Machinery will be inspected daily to ensure no oil, fuel or lubricants are leaking from the machinery. Machines will be maintained as per manufacturers specifications. • Selection of appropriate machinery for construction works. • All hazardous materials will be stored in accordance with existing or agreed NPWS procedures. All contractors and staff will be appropriately trained through site induction and toolbox talks to prevent, minimise and manage accidental spills. • Spill response procedures will follow existing or agreed NPWS procedures. • If suspected soil contamination is encountered, the suspected materials should be segregated and placed in a designated bunded stockpile covered in plastic sheeting to prevent rainfall infiltration and/or soil migration during windy conditions. Pending disposal at a licenced waste facility suspected contaminated should be tested to determine waste classification. Records of waste analysis, classification and disposal dockets would be recorded and maintained.	• Make project team aware of issues and mitigation measures through project induction • Emergency response training for all staff • Correct waste disposal techniques communicated to all staff	CEMP Induction Emergency response training	LOW

Risk	Mitigation measures	Additional mitigation measures	Documentation	Residual risk
	• Spent oils and liquids from construction plant and equipment will be disposed of appropriately in a properly licenced facility. Dust generation from vehicle movements on access tracks will be controlled by the following measures on site: • All vehicles on-site should be confined to a designated route; • Trips and trip distances should be controlled and reduced where possible, for example by coordinating delivery and removal of materials to avoid unnecessary trips; • Excess dust may be managed by application of water using a water truck. • Manage stockpiles as the ESCP. • Post-construction, ensure any deterioration of tracks is rehabilitated to the same or better standard than pre-construction.			

Table 26: Summary of environmental controls and residual risk relevant to Homestead Dam proposed works

Risk	Mitigation measures	Additional mitigation measures	Documentation	Residual risk
Soils and sedimentation	• Laydown and stockpile areas are to be placed, secured and managed if flooding or weather conditions suggest the likelihood of high water flows and therefore sedimentation risks. • The plan should identify areas requiring management control, include inspection and checklist and be reviewed by a suitably qualified professional prior to any works commencing. These	• Develop a CEMP including a section outlining soil and contamination risks on project and linking to the ESCP. • Detail erosion and sediment controls on ECMs	CEMP ESCP ECM Induction	MEDIUM

Risk	Mitigation measures	Additional mitigation measures	Documentation	Residual risk

	controls must be suitably maintained and monitored to ensure the measures and controls in place are effective. Controls can be removed once soils are stabilised.
	• Account for climatic events during construction:
	  ○ If heavy rainfall is predicted the site should be stabilised and works modified to prevent erosion for the duration of the wet period; and
	  ○ Works methods shall be modified during high wind conditions if excess dust is generated.
	• Schedule works when there is no/low flow through the Warrego River. If this is not possible, water diversion works shall be implemented to minimise the risk of water erosion whilst construction works are undertaken.
	• The area of disturbance should be limited to the smallest practicable footprint possible.
	• Potential soil contamination will be managed by the implementation of a spill response procedure.
		• Brief on the erosion and sediment controls in the work area for that day in pre-start briefing each day
		• Make project team aware of erosion and sediment and contamination issues and mitigation measures through project induction		

Flora and fauna impacts	Maintain native vegetation where possible and reduce impact by the following actions: • Clearly marking construction zone • Minimize root disturbance or compacting in the drip zone of trees and shrubs • Should mature trees or habitat trees be required to be removed, the trees should be surveyed by a suitably qualified person and any hollows marked for supervised clearing and possible salvage.	• Develop a CEMP including a section outlining flora and fauna mitigation measures • Native vegetation should be clearly marked on the ECMs to identify approved vegetation removal (disturbance footprint). • Develop a process for review and approval if additional vegetation not	ECM CEMP Induction	LOW

Risk	Mitigation measures	Additional mitigation measures	Documentation	Residual risk
		assessed in this REF needs to be removed. • Mitigation measures should be briefed to all project staff in a site induction and at toolbox talks		
Weeds	Where necessary the following biosecurity measures should be applied during completion of works: • All machinery and vehicles brought on site would be free of any soil, seed or plant material. • Restrict vehicle and personal access from areas of known weed infestation during the proposed works to prevent spread and reinfestation. • Control African Boxthorn and any other weed infestations prior to proposed works commencing to prevent the spread of infestations. • Evidence of compliance with biosecurity requirements should be documented, e.g. a Vehicle wash down register. • Follow up monitoring of work sites post construction to assess the potential establishment of weed species.	• Develop a CEMP including a section outlining flora and fauna mitigation measures • Where weeds are an issue mitigation measures should be briefed to the project team as part of the induction requirements.	CEMP Vehicle wash down register if required Induction	LOW
Aquatic ecology and water	• Continuation of monitoring following construction phase as per LTIM requirements: vegetation, fish (including exotic species), fish, frog, invertebrate, waterbirds and hydrology. • Operate water infrastructure in accordance with license conditions, environmental water strategies, and, where required, CEWH instructions.	None		LOW

Risk	Mitigation measures	Additional mitigation measures	Documentation	Residual risk
	• Operate water infrastructure to maximise park management and environmental outcomes (both within the boundaries of Toorale and further downstream) subject to license conditions. This will include the operation of the Homestead Dam regulating gates to maintain water levels at 98.5 m to protect the dam wall from overtopping, scouring and possible breaching.			

Community impacts	• Provide community information regarding potential increases in heavy traffic during construction
	• Public access should be excluded from the construction zone, including laydown and stockpile areas.
	• Signage to prevent access by non-construction related traffic to the construction zone.
	• Grade road and access tracks as necessary once works have ceased
	• Project information to be made available to parties that do have access to areas of Toorale to outline the need for the works, potential impacts, changes to access and the expected duration of the proposed works.
	• Compliance with the Parks fire management strategy and State of NSW and OEH *Fire Management Manual* (2017) and associated strategy for emergency response actions in times of fire risk. Protocols to be used in the environmental management plans may include safety protocols such as:
	  • Basic training of all staff in the use of firefighting equipment on site
	  • Firefighting equipment lists will be detailed in the Work Method Statements;
		• Develop a CEMP including a section outlining public and contractor safety impacts and mitigation measures
		• Site plans should indicate no go zones, site signage locations, firefighting equipment locations
			ECM
			CEMP
			Induction
			OEH *Fire Management Manual* (2011)
				LOW

Risk	Mitigation measures	Additional mitigation measures	Documentation	Residual risk
	• Management procedures for hot works, smoking, vehicle use off formal access tracks, and the use and storage of fuel and flammable chemicals; and • Daily monitoring of the Fire Danger Rating, and communication of any further mitigation measures required to all staff and contractors.			
Aboriginal heritage	• Works to be conducted in accordance with AHIP number C0003079, permit ID 4175 and AHIP number C0004300, permit ID 4369. • The works must avoid impacts on AHIMS sites and areas of archaeological sensitivity. If impacts on AHIMS Sites cannot be avoided an Aboriginal heritage impact permit (AHIP) will be required. • Vehicles to keep to existing tracks outside of areas covered by AHIP. • Laydown areas or site office areas must be kept within the area covered by the AHIP • It is recommended an Aboriginal cultural heritage induction be undertaken by all staff and contractors working on site. • Complete Aboriginal site impact recording forms following completion of proposed works. • Continue to inform groups about the management of Aboriginal cultural heritage sites within the study area throughout the life of the project. • Stop work if any potential heritage sites or human remains have been identified during construction. • In the event that human remains are found, works will immediately cease, and the NSW Police should be contacted. If the remains are suspected to be Aboriginal, OEH may also be	• Develop a CEMP including a section outlining archeologically sensitive areas and any heritage areas • Point out sensitive sites and any AHIMS sites in the work area for that day in pre-start briefing each day • Make project team aware archeology and heritage issues and mitigation measures through project induction • Brief project team on unexpected finds and discovery of human remains process at induction • Induction to address elements related to relevant legislation, AHIP conditions, location of identified heritage sites, basic identification	CEMP ECM	LOW

Risk	Mitigation measures	Additional mitigation measures	Documentation	Residual risk
	contacted at this time to assist in determining appropriate management. • In consultation with JMC, collect surface artefacts, store in keeping place, put back in same location once works complete. • Pending approval of the works, the remaining Aboriginal sites in the impact footprint will be subject to archaeological salvage to be catalogued and analysed to contribute to knowledge of Aboriginal archaeological site type and distribution through the Bourke region. •	skills for Aboriginal and non-Aboriginal artefacts and human remains, penalties and non-compliance • Ongoing Aboriginal consultation and assessment activities should be undertaken as part of the project		
Historic Heritage	• As far as is practical, maintain and protect remaining significant historic fabric of Homestead Dam Wall.	• Induction to address elements related to relevant legislation and CEMP requirements • Brief project team on unexpected finds process at induction	CEMP Induction	LOW
Noise and vibration	• Inform park visitors of noise impacts at Homestead Dam • Work within approved hours between 7 AM and 6 PM	• Develop a CEMP including a section outlining sensitive receivers and noise mitigation measures (may be in the CNVMP) • Make project team aware of noise issues and mitigation measures through induction	CEMP CNVMP ECM Induction	LOW

Risk	Mitigation measures	Additional mitigation measures	Documentation	Residual risk
Resources, emissions and waste	• To avoid release to the environment, all hazardous materials (fuels, lubricants, herbicides, etc.) will be disposed of off-site in accordance with NSW EPA guidelines. • All hazardous materials will be stored in accordance with existing or agreed NPWS procedures. All contractors and staff will be appropriately trained through site induction and toolbox talks to prevent, minimise and manage accidental spills. • Spill response procedures will follow existing or agreed NPWS procedures. • If suspected soil contamination is encountered, the suspected materials should be segregated and placed in a designated bunded stockpile covered in plastic sheeting to prevent rainfall infiltration and/or soil migration during windy conditions. Pending disposal at a licenced waste facility suspected contaminated should be tested to determine waste classification. Records of waste analysis, classification and disposal dockets would be recorded and maintained. • Spent oils and liquids from construction plant and equipment will be disposed of appropriately in a properly licenced facility. Dust generation from vehicle movements on access tracks will be controlled by the following measures on site: • All vehicles on-site should be confined to a designated route; • Trips and trip distances should be controlled and reduced where possible, for example by coordinating delivery and removal of materials to avoid unnecessary trips; • Excess dust to be managed by application of water using a water truck.	• Develop a CEMP including a section outlining resources, emission and waste risks on project • Make project team aware of issues and mitigation measures through project induction • Emergency response training for all staff • Correct waste disposal techniques communicated to all staff	CEMP Induction Emergency response training	LOW

Risk	Mitigation measures	Additional mitigation measures	Documentation	Residual risk
	• Post-construction, ensure any deterioration of tracks is rehabilitated to the same or better standard than pre-construction.			

7 Ecologically Sustainable Development

The *National Strategy for Ecologically Sustainable Development 1992* defines Ecologically Sustainable Development (ESD) as:

> *"using, conserving and enhancing the community's resources so that ecologically processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased*."

Schedule 2 of the EP&A Reg outlines four principles of ESD that have been considered in this REF (Table 27).

Table 27: Consideration of ecologically sustainable development principles

ESD Principle	Comment
Precautionary principle The precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by: i. careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and ii. an assessment of the risk-weighted consequences of various options	The full proposal has been carefully considered and based around a set of objectives aimed at a conservative change to the existing water management arrangements on Toorale. Potential impacts associated with construction and operational processes have been considered, risks minimised through design protocols. Mitigation measures nominated will reduce the likelihood or consequences of identified environmental impacts. These mitigation measures are subject to review throughout the entirety of the proposed works. Considerable consultation with Aboriginal groups has been undertaken
Inter-generational equity Inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations	The proposed works will contribute to improved environmental outcomes both within Toorale and the downstream environment through improved water management and connectivity. The proposed works ensure a valued community recreational area is maintained for future generations. Mitigation measures nominated will reduce the likelihood or consequences of identified environmental impacts. These mitigation measures are subject to review throughout the entirety of the proposed works.
Conservation of biological diversity and ecological integrity Conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration	The proposed work, particularly when viewed in the context of the larger Toorale Water Infrastructure Project aim to increase longitudinal connectivity and water management outcomes within the lower Warrego River. This provides for improved water management and fish passage outcomes.

ESD Principle	Comment
	Potential impacts to species and vegetation communities of state and national significance were identified and mitigation measures developed. The mitigation measures developed will minimise any impacts to biodiversity throughout the entirety of the works.
Improved valuation, pricing and incentive mechanisms Improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as: i. polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement, ii. the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste, **iii.** environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.	Proposal was developed and refined after extensive consultation, technical investigations etc to ensure that most cost-effective, environmentally acceptable option has been adopted OEH has conducted extensive consultation with the local community and government departments to gauge community views and values to value the dams in the Warrego.

8 Conclusion

There is need to modify the water infrastructure at Toorale to enable greater capacity to divert flow through the Warrego River to the Darling River, whilst also protecting and maintaining the values of Toorale National Park.

The proposed changes to the water infrastructure at Toorale are subject to consideration by OEH under Part 5 of the EP&A Act. This REF considers the statutory requirements relating to, and the potential environmental impacts resulting from, Phase 1 of the proposed Toorale Water Infrastructure Project.

Environmental impacts have been assessed in accordance with Clause 228(2) of the EP&A Act and are presented in section 5 of this REF. When considering the likely environmental significance of the impacts associated with the proposed activity, most aspects are considered to be low or negligible.

The proposed development is unlikely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the BC Act or FM Act and therefore a SIS or EIS is not required. Furthermore, the proposed development is unlikely to affect Commonwealth land or have an impact on MNES and does not require referral to the Federal Minister for the Environment.

Potential negative environmental impacts are short term and associated with the construction phase of the project. The positive impacts upon the environment, such as the benefit gained from the improved environmental flows, improved cultural outcomes and allowance for improved fish passage between the Warrego River and the Darling River have a significant positive, long term impact on the Warrego-Darling River system and regional area.

Mitigation measures as detailed in this REF will ameliorate or minimise any expected impacts to generally acceptable levels. Mitigation measures are detailed in Table 25 and Table 26 of Section 6.3. The remaining residual risks are considered low, with the exception of potential for soil erosion and/or during construction works if unexpected adverse weather conditions are experienced.

This REF concludes that construction and operation of Phase 1 of the Toorale Water Infrastructure Project is unlikely to result in a significant adverse environmental impact. The proposed development does not result in negative permanent change to the environment. Any low or medium impacts are short term in nature (during the construction stage) and long-term arrangements of the two dams are considered to provide a net positive impact upon the environment.

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Appendix A Engineering Plans for Peebles Dam

OFFICE OF ENVIRONMENT & HERITAGE

PEEBLES DAM - DETAILED DESIGN

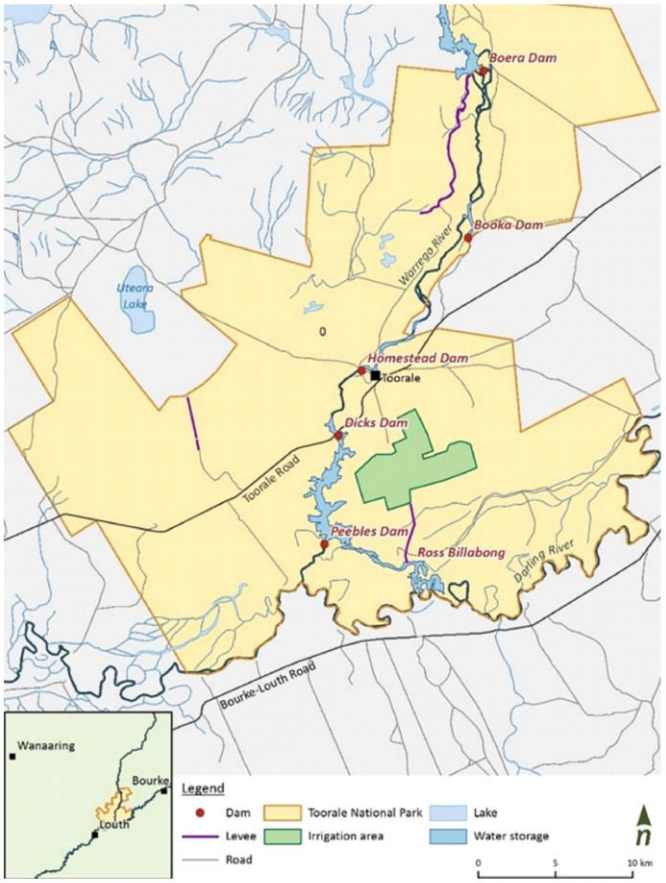
DRAWING NOTES:
GENERAL NOTES
1. REDUCED LEVELS ARE RELATIVE TO AUSTRALIAN HEIGHT DATUM
2. SITE TO BE EXCAVATED TO SLOPES SHOWN. TOPSOIL TO BE KEPT SEPARATE AND SPREAD OVER DISTURBED AREAS AT COMPLETION OF WORKS.
3. STRUCTURES MUST BE SURVEY CONTROLLED TO ENSURE THAT A CONSISTENT GRADE IS OBTAINED.
4. UPON COMPLETION OF WORKS, THE CONTRACTOR SHALL ENSURE THAT THE SITE IS CLEAN AND TIDY WITH ALL RUBBISH AND OTHER MATERIALS REMOVED TO THE SATISFACTION OF THE SUPERINTENDENT.
5. PRE-DISTURBANCE SOIL PROFILES AND COMPACTION LEVELS ARE TO BE REINSTATED.
6. ALL DISTURBED AREAS ARE TO BE LEFT IN A STABLE CONDITION. SLOPES SHOULD BE STABILISED USING APPROPRIATE EROSION CONTROL MEASURES.

EXCAVATION
7. ALL DISTURBED SURFACES ARE TO BE TOPSOILED AND REVEGETATED WITH SPECIES APPROVED BY SUPERINTENDENT.
8. EXCAVATION SHALL BE UNDERTAKEN IN A MANNER THAT MINIMISES DISTURBANCE TO MATERIAL OUTSIDE THE LIMITS OF THE BATTERS.

VEGETATION
9. TREES WITHIN VICINITY OF WORKS MUST BE PROTECTED AT ALL TIMES IN ACCORDANCE WITH AS 4970-2009 PROTECTION OF TREES ON DEVELOPMENT SITE.
10. TREES IN EXCAVATED AREAS ARE TO BE REMOVED AND DISPOSED OF IN ACCORDANCE WITH SUPERVISORS INSTRUCTIONS.

HIGH FLOW CONTINGENCIES
11. CONTINGENCIES TO MANAGE RISKS ASSOCIATED WITH FLOOD EVENTS DURING CONSTRUCTION ARE REQUIRED.
12. ADEQUATE EROSION AND SEDIMENT CONTROLS MUST BE IN PLACE AT THE END OF EACH DAY AND THE SITE MUST BE STABILISED AGAINST SOIL EROSION AS SOON AS POSSIBLE.

EARTHWORKS
13. NOTWITHSTANDING THE LIMITS OF CUTTING AND FILLING SHOWN ON THE DRAWINGS, THE ACTUAL LIMITS SHALL BE DETERMINED ON SITE BY THE SUPERINTENDENT DURING CONSTRUCTION. SIMILARLY, THE FINISHED SURFACE LEVELS MAY BE ADJUSTED BY THE WRITTEN DIRECTION OF THE SUPERINTENDENT DURING CONSTRUCTION.
14. TOPSOIL AND SUBSOIL SHOULD BE STOCKPILED SEPARATELY.
15. THE EXISTING SURFACE IS TO BE CLEAR OF VEGETATION MATTER PRIOR TO THE START OF ANY FILLING.
16. ALL TOPSOIL SHALL REMAIN ON SITE AND BE REUSED ON DISTURBED AND CONSTRUCTED SURFACES AS SHOWN IN THESE DRAWINGS.



REV	DESCRIPTION	APP'D	DATE
A	DRAFT DETAILED DESIGN ISSUE	M.B	24.08.18

NSW GOVERNMENT Office of Environment & Heritage
OFFICE OF ENVIRONMENT & HERITAGE NSW

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DESIGNED:	DRAWN:	CHECKED:	APPROVED:	PROJECT No:
M. BAIN	J. McMILLAN	M. BAIN	R. HARDIE	P318002

TOORALE
FUNCTIONAL DESIGN DRAWINGS
SCHEDULE OF DRAWINGS AND LOCATION PLAN

REVISION:	SHEET No.:	ORIGINAL SIZE: A1	SCALE: SCALE
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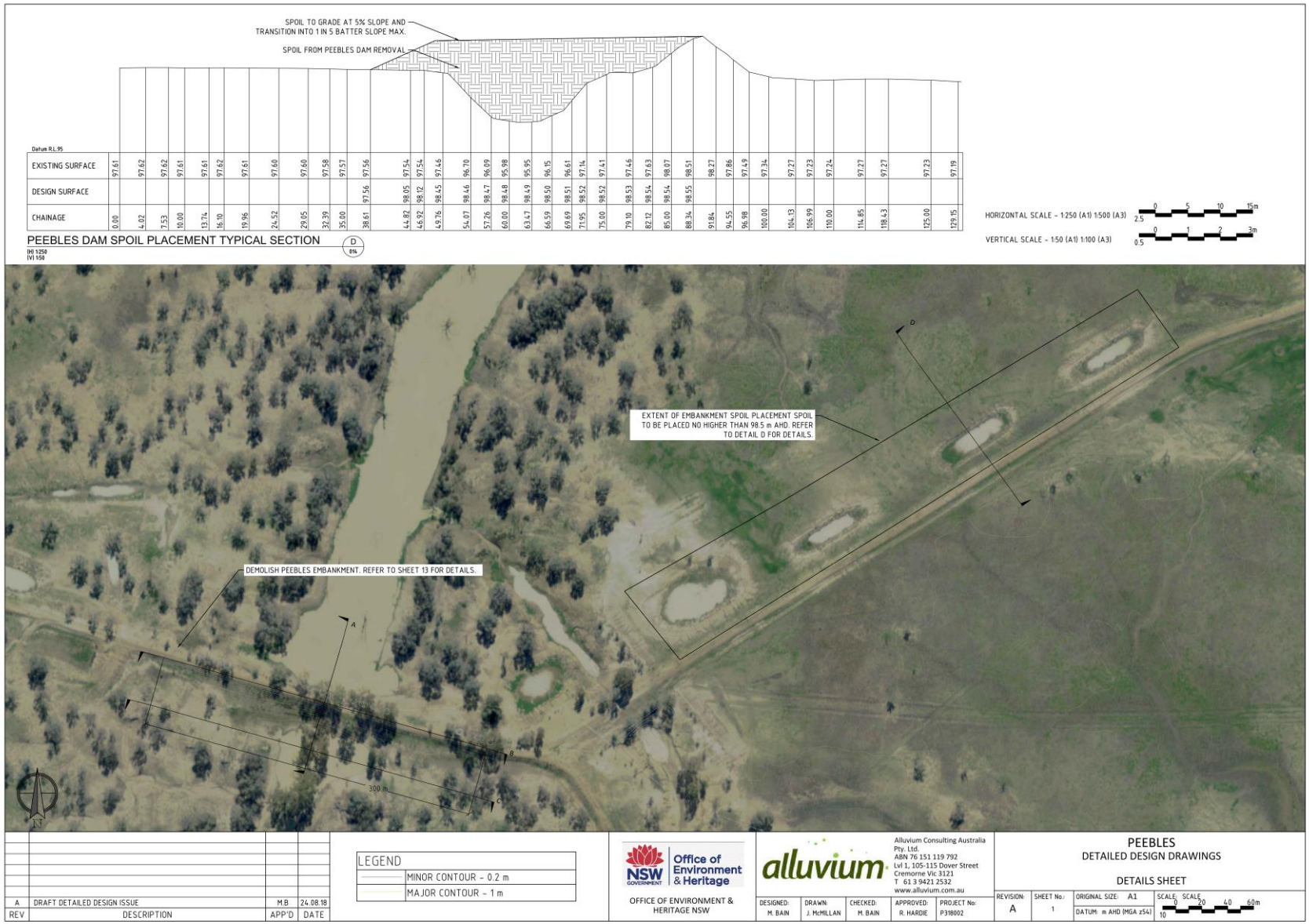
SPOIL TO GRADE AT 5% SLOPE AND TRANSITION INTO 1 IN 5 BATTER SLOPE MAX.
SPOIL FROM PEEBLES DAM REMOVAL
Datum R.L.95
EXISTING SURFACE
DESIGN SURFACE
CHAINAGE
PEEBLES DAM SPOIL PLACEMENT TYPICAL SECTION
D
(H) 1:250
(V) 1:50
HORIZONTAL SCALE - 1:250 (A1) 1:500 (A3)
VERTICAL SCALE - 1:50 (A1) 1:100 (A3)
EXTENT OF EMBANKMENT SPOIL PLACEMENT SPOIL TO BE PLACED NO HIGHER THAN 98.5 m AHD. REFER TO DETAIL D FOR DETAILS.
DEMOLISH PEEBLES EMBANKMENT. REFER TO SHEET 13 FOR DETAILS.
300 m
N
A
DRAFT DETAILED DESIGN ISSUE
M.B
24.08.18
REV
DESCRIPTION
APP'D
DATE
LEGEND
MINOR CONTOUR - 0.2 m
MAJOR CONTOUR - 1 m
Office of Environment & Heritage
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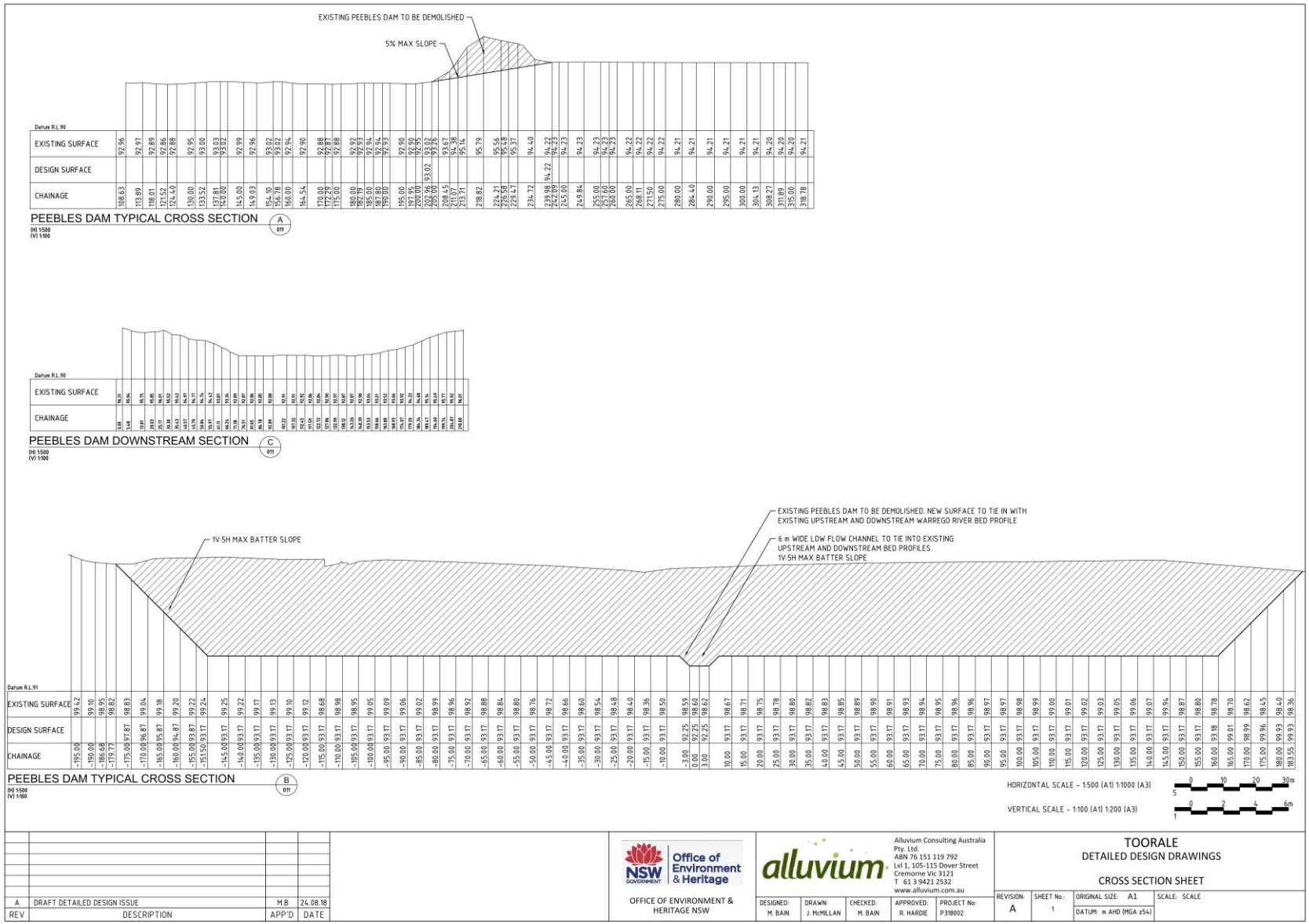
APPROVED: R. HARDIE
PROJECT No: P318002
PEEBLES
DETAILED DESIGN DRAWINGS
DETAILS SHEET
REVISION: A
SHEET No.: 1
ORIGINAL SIZE: A1
DATUM: m AHD (MGA z54)
SCALE: SCALE


EXISTING PEEBLES DAM TO BE DEMOLISHED
5% MAX SLOPE
PEEBLES DAM TYPICAL CROSS SECTION
(H) 1:500
(V) 1:100
PEEBLES DAM DOWNSTREAM SECTION
(H) 1:500
(V) 1:100
EXISTING PEEBLES DAM TO BE DEMOLISHED. NEW SURFACE TO TIE IN WITH EXISTING UPSTREAM AND DOWNSTREAM WARREGO RIVER BED PROFILE
6 m WIDE LOW FLOW CHANNEL TO TIE INTO EXISTING UPSTREAM AND DOWNSTREAM BED PROFILES. 1V:5H MAX BATTER SLOPE
1V:5H MAX BATTER SLOPE
PEEBLES DAM TYPICAL CROSS SECTION
(H) 1:500
(V) 1:100
HORIZONTAL SCALE - 1:500 (A1) 1:1000 (A3)
VERTICAL SCALE - 1:100 (A1) 1:200 (A3)
A DRAFT DETAILED DESIGN ISSUE M.B 24.08.18
REV DESCRIPTION APP'D DATE
OFFICE OF ENVIRONMENT & HERITAGE NSW
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PROJECT No: P318002
TOORALE
DETAILED DESIGN DRAWINGS
CROSS SECTION SHEET
REVISION: A
SHEET No.: 1
ORIGINAL SIZE: A1
DATUM: m AHD (MGA z54)
SCALE: SCALE

Appendix B JMC Consultation Log

TOORALE WATER INFRASTRUCTURE PROJECT

CONSULTATION LOG – TOORALE JOINT MANAGEMENT COMMITTEE

2016

19 March – teleconference

Purpose

Introduction to Project

Seek feedback from the JMAC about out when and how the consultants can meet with the JMAC members in that time (late April/Early May) to talk about issues, and what they wanted considered as part of designing the project, and what information they wanted beforehand.

JMC Feedback

- which dams in the Warrego are being decommissioned and there are concerns of Aboriginal artefacts being held within the dam walls
- don't want dams to be decommissioned if the dam walls contain Aboriginal sites.
- want to know what the actual plan for decommissioning entails.
- Don't see any problem with decommissioning the Irrigation channels that Clyde Agriculture built, but any of the earlier dams within the Warrego River should be preserved.
- Is there any capacity to employ an Aboriginal Consultant to survey and map Aboriginal artefacts associated with the dams, as well as provide for Aboriginal involvement and employment to assist with dam archaeological surveys.
- should be looking at the cultural aspects of the water, e.g. cultural water to be used for cultural purposes.
- want an outline of what is involved with every dam to be decommissioned and they want an Aboriginal Consultant to survey and map the dams to identify Aboriginal sites that could be impacted by the decommissioning.
- Any future water requirements need to include Aboriginal local people and provide training and employment opportunities for Aboriginal people and should not only benefit the environment
- The Western Floodplain is to maintain flows
- What is the projection of water flow would be achieved with the decommissioning.
- the Commonwealth's access to water rights can't be at the cost to the Baakandji community.
- contractors carrying out the decommissioning project to do everything by the book and everything is to be considered prior to any dams being decommissioned.

Project Response

JMC feedback was noted and carried forward into project planning and design

7-8 May – on-site workshop/meeting

Purpose

This meeting included a tour of the key project sites with project team staff and a half day meeting in Bourke to discuss the JMC concerns and values of the Toorale in relation to the project.

JMC Feedback

Major values, concerns or recommendations relating to the project recorded at the JMC meeting include:

- Natural resources in the area important, bush tucker
- Concerns regarding tourism, and the potential for tourists to steal artefacts
- Dam walls contain Aboriginal sites
- Homestead dam to be repaired for fish passage and also cultural water storage for potential jetty/pontoon access
- Ross Billabong area of high cultural significance. Junction of the Darling and Warrego is location of a dreamtime story.
- Stone artefacts are contained within dam walls
- Greater concern over the potential for additional flows to impact on sites
- Minimal impacts to dam walls lessened concerns
- All dams to be considered in the site options
- Indigenous training and employment opportunities in the project works be recommended
- Flows to the Western Floodplain to be maintained
- Access to cultural flows
- Management of flow regime to achieve cultural objectives.*Project Response*

Project Response

The JMC feedback was considered and incorporated into the business case concept plan

26 August – on-site JMC meeting

Purpose

Presentation of the draft Toorale Water Delivery Project Business Case for comment

JMC Feedback

- Supported Option B (gates at Boera dam) as the preferred arrangement but they were not happy with Option A.
- Asked that more employment opportunities for Aboriginal people be made available during this project.

Project Response

JMC feedback noted

2017

9 March 2017 - AHIP consultation

Purpose

Consultants Biosis provided each Registered Aboriginal Parties, or “RAPs”, (including the JMC) with a copy of the study methodology pack outlining the proposed Aboriginal cultural heritage assessment process and methodology for this study. RAPs were given 28 days to review and prepare feedback on the proposed methodology.

JMC/RAP feedback

No comments from RAPs were received at this stage of consultation.

13 May – on-site JMC meeting

Purpose

At the completion of fieldwork undertaken to support the Aboriginal Cultural Heritage Assessment, a meeting was held with the Toorale JMC to discuss the management of cultural heritage sites which may be impacted as part of the construction.

JMC Feedback

(As shown in ACHA report)

Project Response

The feedback of the JMC has been incorporated into the AHIP conditions

26 August – on-site meeting

Purpose

To update the JMC on progress with the Toorale Environmental Water Infrastructure project and explain that the application for the AHIP had been lodged. Also to seek advice on who to contract as site monitors to be engaged to salvage artefacts and to monitor proposed survey and geotechnical investigations.

JMC Feedback

The JMC provided feedback on appropriate site monitors to engage. Requested copy of AHIP when issued.

Project Response

Site monitors have been sought and engaged based on JMC advice. Copy of AHIP has been provided to JMC.

25 November – on-site JMC meeting

Purpose

Provide project update, specifically the upcoming salvage of Aboriginal artefacts, and marking out the no go areas, and to table the Project AHIP.

JMC Feedback

The JMC noted the new information

Project Response

n/a

2018

12-13 May 2018 - meeting

Purpose

Presentation of results of text excavations at Boera and Homestead. Consult JMC on analysis of samples and artefacts.

Project update. Discuss design issues

JMC Feedback

- The JMC approved Biosis taking samples from pits for OSL dating.
- Do not want prefabricated “tombstone” ridges used in rock ramp due to maintenance, visual impact, employment, safety and longevity. Want natural rock used at all 3 sites where a rock ramp is proposed
- Want employment opportunities for Bourke
- Want Alluvium to review the need for number/width of culverts/gates required at Boera
- Use Peebles soil to fill holes at Homestead and Boera
- Prefer box culverts to a bridge at Homestead
- Responsibility for management should be shared between Commonwealth and State

Project Response

Samples collected and sent for analysis

JMC feedback noted and considered in design process.

14-15 July – meeting

Purpose

To provide project update, to discuss fishway design issues and canvass reprioritisation of works to start with Peebles and partial rebuild of Homestead Dam within 18/18 FY

JMC Feedback

- Still want a rock-ramp style fishway at Homestead
- Don't want 100s of tons of rock transported across country
- Will support a prefab style made to look more like rocks for dams under 2m
- For barriers over 2m prefer a vertical slot fishway because less impact, but need access over both sides
- Don't want impact to cultural trees on banks of Homestead Dam
- Would like prefabricated structure to be made on-park if possible
- Want the project to lean more towards ACH side of things
- Want Matt Gordos to speak to some of committee in the interim by telecon about what the options are that can be put together. Also to come and speak at the next JMC meeting.
- Don't want Peebles (and Homestead partial) commenced in 18/19

Project Response

JMC recommendations carried forward in design process to make prefabricated ridges more rock-like in appearance. Revise fish passage to a vertical slot structure at Boera to minimise footprint. Arrangement made for DPI Fisheries to attend next JMC meeting. Prefabricated ridges will reduce volume of rock needed to be transported on park.

12 October

Purpose

For DPI Fisheries to attend and present on fish passage matters, and to advise the JMC about developments with the dating of the sample taken from the test pit at Boera Dam.

JMC Feedback

- The JMC is happy that the project has now addressed all the issues they have raised
- They now have a better understanding of fishways and why they are important
- They support a VS fishway at Boera and rock ramp fishways at Booka and Homestead as long as ridges are made to resemble rocks as described on the day
- Believe that transporting soil from Peebles to Homestead will have too great an impact
- Want the fishways to be prefabricated in Bourke or contracted/made on site.

Project Response

Could not guarantee that construction materials will be sourced from/made in Bourke since it will be subject to procurement guidelines as well as providers of services of such a specialised nature being available in Bourke. Can try to write documentation in a way that will encourage this outcome. Also advised JMC members to alert people in Bourke community that this work is potentially coming so that they can skill/gear up and be positioned to apply for it.

Appendix C EPA Advice

NSW EPA

Our reference SF17/57565; DOC17/616381
Contact Matthew Prince, 02 6883 5354
Date 15 December 2017

Sonya Ardill
Senior Environmental Water Planner
Regional Operations Division
Office of Environment and Heritage
48- 52 Wingewarra Street Dubbo
NSW 2830

Dear Sonya,

I refer to your email dated 8 December 2017 to the Environment Protection Authority ("EPA") requesting input from the EPA in relation to the proposed modification to the existing earth bank weirs across the lower Warrego River on Toorale National Park via Bourke NSW (the project).

With reference to the information supplied within the email, the EPA understands that the project involves minor modifications to existing earth bank weirs across the Lower Warrego River to enable more frequent passing of small to moderate flow events that come down the River. Base on this advice the EPA would like to advise that the project is not Integrated Development from the EPA's perspective and will not require an Environment Protection Licence.

The EPA recommends that the Environmental Assessment for the project should consider the following general matters.

- **Water quality impacts** - identification of appropriate pollution control systems to protect surface and ground water resources such as sediment and erosion controls during construction and operational stages and inclusion of permanent sediment and erosion and stormwater controls where required.
- **Noise** – identify potential impacts and mitigation strategies to be incorporated during construction and operation to minimise noise and comply with NSW policies and legislation on noise control.
- **Odour and Dust** – identify impacts from odour and dust during the construction and operational periods and identify mitigative measures.
- **Storage of chemicals/ fuels** - ensure adequate control measures are in place for storages to reduce risk of spills contaminating waterways and land.
- **Waste management** – options and strategies for waste minimisation, reuse and recycling should be assessed as appropriate.

It is recommended that in achieving a high standard of sediment and erosion controls and general site management the proponent, or any contractor engaged by the proponent, develop and implement the

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central.west@epa.nsw.gov.au

proposal in accordance with relevant guidelines such as the EPA endorsed publication "*Soils and Construction, Volume 1, 4th Edition*," March 2004 by Landcom.

It should be noted that this information are guidelines only and it is up to the proponent (and later the consent/determining authority after appropriate consultation) to determine the detail and comprehensiveness of the surveys and level of assessment required to form legally defensible conclusions regarding the impact of the proposal.

The scale and intensity of the proposed development should dictate the level of investigation. It is important that all conclusions are supported by adequate data.

If you have any questions, or wish to discuss this matter further please contact Mr Matthew Prince at the EPA's Central West Dubbo office by telephoning 02 6883 5354 or by email at central.west@epa.nsw.gov.au.

Yours sincerely

BRAD TANSWELL
Head Central West Operations - Dubbo
Environment Protection Authority

Appendix D Flora species list

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Acanthaceae	*Rostellularia adscendens*	Pink tongues				Bionet,
Aizoaceae	*Geijera parviflora*	Hairy carpet-weed				Bionet, Fauna 2003,
Aizoaceae	*Tetragonia eremaea*					Bionet,
Aizoaceae	*Tetragonia tetragonioides*	New zealand spinach				Bionet, Fauna 2003, LTIM sp list,
Aizoaceae	*Trianthema triquetra*	Small hogweed				Bionet,
Amaranthaceae	*Alternanthera denticulata*	Lesser joyweed				Bionet, Fauna 2003, LTIM sp list,
Amaranthaceae	*Alternanthera nodiflora*	Common joyweed				Bionet, Fauna 2003, LTIM sp list,
Amaranthaceae	*Amaranthus macrocarpus*	Dwarf amaranth				Bionet,
Amaranthaceae	*Amaranthus mitchellii*	Boggabri weed				Bionet,
Amaranthaceae	*Ptilotus atriplicifolius var. atriplicifolius*	Crimson foxtails				Fauna 2003,
Amaranthaceae	*Ptilotus exaltatus var. exaltatus*	Tall mulla mulla	P			Bionet,
Amaranthaceae	*Ptilotus gaudichaudii var. gaudichaudii*	Paper foxtail				Fauna 2003,
Amaranthaceae	*Ptilotus leucocomus*	Small purple foxtail				Bionet,
Amaranthaceae	*Ptilotus obovatus var. obovatus*	Silver tails	P			Bionet,
Amaranthaceae	*Ptilotus polystachyus var. polystachyus*	Long tails				Bionet,
Amaranthaceae	*Ptilotus sessilifolius var. sessilifolius*					Bionet,
Amaranthaceae	*Ptilotus spathulatus f. spathulatus*	Pussy-tails				Bionet,
Amaryllidaceae	*Crinum flaccidum*	Darling lily				Bionet, LTIM sp list,
Apiaceae	*Ammi majus*	Bishops weed			I	Fauna 2003,
Apiaceae	*Daucus glochidiatus*	Australian carrot				Bionet, Fauna 2003, LTIM sp list,
Apiaceae	*Daucus* sp.					LTIM sp list,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Apiaceae	*Eryngium paludosum*					Bionet, Fauna 2003, LTIM sp list,
Apiaceae	*Trachymene ochracea*	White parsnip				Bionet,
Apocynaceae	*Alstonia constricta*	Quinine bush				Bionet,
Apocynaceae	*Marsdenia australis*	Doubah				Bionet,
Apocynaceae	*Rhyncharrhena linearis*	Purple pentatrope				Bionet,
Asphodelaceae	*Bulbine bulbosa*	Bulbine lily				LTIM sp list,
Asphodelaceae	*Bulbine* sp.	Native leek				Fauna 2003,
Asteraceae	*Angianthus brachypappus*	Spreading cup-flower				Bionet,
Asteraceae	*Aster subulatus*	Wild aster			I	Bionet, LTIM sp list,
Asteraceae	*Asteraceae* sp.					LTIM sp list,
Asteraceae	*Brachyscome ciliaris*	Variable daisy				Bionet,
Asteraceae	*Brachyscome curvicarpa*					Bionet,
Asteraceae	*Brachyscome dentata*					LTIM sp list,
Asteraceae	*Brachyscome lineariloba*	Hard-headed daisy				Bionet,
Asteraceae	*Brachyscome melanocarpa*	Black-seeded daisy				LTIM sp list,
Asteraceae	*Brachyscome* sp.					Bionet, LTIM sp list,
Asteraceae	*Calotis cuneata*	Mountain burr-daisy				Fauna 2003, LTIM sp list,
Asteraceae	*Calotis cuneifolia*	Purple burr-daisy				Bionet, LTIM sp list,
Asteraceae	*Calotis erinacea*	Tangled burr-daisy				Fauna 2003,
Asteraceae	*Calotis hispidula*	Bogan flea				Bionet, LTIM sp list,
Asteraceae	*Calotis inermis*	Fluffy burr-daisy				Bionet,
Asteraceae	*Calotis lappulacea*	Yellow burr-daisy				LTIM sp list,
Asteraceae	*Calotis latiuscula*					LTIM sp list,
Asteraceae	*Calotis plumulifera*	Woolly-headed burr-daisy				Bionet,
Asteraceae	*Calotis scabiosifolia*	Rough burr-daisy				LTIM sp list,
Asteraceae	*Carthamus lanatus*	Saffron thistle			I	Bionet, Fauna 2003, LTIM sp list,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Asteraceae	*Centaurea melitensis*	Maltese cockspur			I	Bionet, Fauna 2003, LTIM sp list,
Asteraceae	*Centipeda cunninghamii*	Common sneezeweed				Bionet, Fauna 2003,
Asteraceae	*Centipeda minima subsp. minima*					Bionet, LTIM sp list,
Asteraceae	*Centipeda* sp.					LTIM sp list,
Asteraceae	*Centipeda thespidioides*	Desert sneezeweed				LTIM sp list,
Asteraceae	*Chrysocephalum apiculatum*	Common everlasting				LTIM sp list,
Asteraceae	*Chthonocephalus pseudevax*	Ground-heads				Fauna 2003,
Asteraceae	*Cichorium intybus*	Chicory				LTIM sp list,
Asteraceae	*Cirsium vulgare*	Spear thistle				LTIM sp list,
Asteraceae	*Conyza bonariensis*	Flaxleaf fleabane			I	Bionet, LTIM sp list,
Asteraceae	*Conyza* sp.	A fleabane				LTIM sp list,
Asteraceae	*Craspedia uniflora*		P			Bionet,
Asteraceae	*Cymbonotus maidenii*					Bionet,
Asteraceae	*Eclipta platyglossa*	Yellow twin-heads				LTIM sp list,
Asteraceae	*Eriochlamys cupularis*					Bionet,
Asteraceae	*Eucalyptus vicina*	Star cudweed				Bionet,
Asteraceae	*Glinus lotoides*	Cobbler's tack				Bionet, LTIM sp list,
Asteraceae	*Glycine tabacina*	Erect yellow heads				LTIM sp list,
Asteraceae	*Harmsiodoxa blennodioides*					Bionet,
Asteraceae	*Hypericum gramineum*	Catsear				LTIM sp list,
Asteraceae	*Iseilema vaginiflorum*	Grass cushions				Bionet,
Asteraceae	*Isotropis wheeleri*					Bionet,
Asteraceae	*Lactuca saligna*	Willow-leaved lettuce				LTIM sp list,
Asteraceae	*Lactuca serriola*	Prickly lettuce				LTIM sp list,
Asteraceae	*Leiocarpa brevicompta*	Flat billy-buttons				Bionet,
Asteraceae	*Leiocarpa leptolepis*	Pale plover-daisy				Bionet,
Asteraceae	*Leiocarpa panaetioides*	Wooly buttons				Bionet,
Asteraceae	*Leiocarpa* sp.					LTIM sp list,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Asteraceae	*Leptorhynchos baileyi*	Woolly buttons				Bionet,
Asteraceae	*Minuria integerrima*	Smooth minuria				Bionet, LTIM sp list,
Asteraceae	*Myriocephalus rhizocephalus*	Woolly-heads				Bionet,
Asteraceae	*Olearia pimeleoides*					Bionet,
Asteraceae	*Podolepis capillaris*	Invisible plant				Bionet,
Asteraceae	*Pseudognaphalium luteoalbum*	Jersey cudweed				Bionet, Fauna 2003, LTIM sp list,
Asteraceae	*Pterocaulon sphacelatum*	Applebush				Bionet,
Asteraceae	*Pycnosorus chrysanthes*	Golden billy-buttons	P			Bionet, Fauna 2003,
Asteraceae	*Rhodanthe floribunda*	Common white sunray				Bionet, LTIM sp list,
Asteraceae	*Rhodanthe* sp.	Slender sunray				Fauna 2003,
Asteraceae	*Rhodanthe stricta*					LTIM sp list,
Asteraceae	*Rutidosis helichrysoides*	Grey wrinklewort				Bionet, Fauna 2003,
Asteraceae	*Senecio glossanthus*					LTIM sp list,
Asteraceae	*Senecio quadridentatus*					LTIM sp list,
Asteraceae	*Senecio runcinifolius*					LTIM sp list,
Asteraceae	*Senecio* sp.	Groundsel, fireweed				LTIM sp list,
Asteraceae	*Silybum marianum*	Variegated thistle			I	Bionet, Fauna 2003,
Asteraceae	*Sonchus asper*	Prickly sowthistle			I	Fauna 2003,
Asteraceae	*Sonchus oleraceus*	Common sowthistle			I	Bionet, Fauna 2003, LTIM sp list,
Asteraceae	*Sonchus* sp.					LTIM sp list,
Asteraceae	*Taraxacum officinale*	Dandelion				LTIM sp list,
Asteraceae	*Verbesina encelioides subsp. encelioides*	Crownbeard			I	Bionet, LTIM sp list,
Asteraceae	*Vittadinia cervicularis var. cervicularis*	A fuzzweed				Bionet,
Asteraceae	*Vittadinia cuneata*	A fuzzweed				Bionet, LTIM sp list,
Asteraceae	*Vittadinia eremaea*					Bionet,
Asteraceae	*Vittadinia quadridentatus*					LTIM sp list,
Asteraceae	*Vittadinia* sp.	Fuzzweed				Fauna 2003, LTIM sp list,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Asteraceae	*Vittadinia sulcata*					Bionet,
Asteraceae	*Xanthium occidentale*	Noogoora burr			I	Bionet,
Asteraceae	*Xanthium spinosum*	Bathurst burr			I	Bionet, LTIM sp list,
Asteraceae	*Xerochrysom* sp.					LTIM sp list,
Asteraceae	*Zaleya galericulata*	Hogweed				LTIM sp list,
Azollaceae	*Azolla filiculoides*	Pacific azolla				Bionet,
Boraginaceae	*Cynoglossum australe*					LTIM sp list,
Boraginaceae	*Cynoglossum* sp.					LTIM sp list,
Boraginaceae	*Echium marginale*					LTIM sp list,
Boraginaceae	*Echium plantagineum*	Patterson's curse			I	Bionet, LTIM sp list,
Boraginaceae	*Hedypnois rhagadioloides*	Common heliotrope			I	LTIM sp list,
Boraginaceae	*Heliotropium europaeum*	Prostrate heliotrope				Bionet, Fauna 2003, LTIM sp list,
Brassicaceae	*Alyssum linifolium*	Flax-leaf alyssum			I	Bionet, Fauna 2003,
Brassicaceae	*Brassica* sp.	Brassica				LTIM sp list,
Brassicaceae	*Brassica tournefortii*	Mediterranean turnip			I	Bionet, LTIM sp list,
Brassicaceae	*Brassicaceae* sp.	Mustards				LTIM sp list,
Brassicaceae	*Haloragis* sp.					Bionet, LTIM sp list,
Brassicaceae	*Lepidium africanum*	Peppercress			I	Fauna 2003,
Brassicaceae	*Lepidium bonariense*	Argentine peppercress				LTIM sp list,
Brassicaceae	*Lepidium campastre*					LTIM sp list,
Brassicaceae	*Lepidium campestre*					LTIM sp list,
Brassicaceae	*Lepidium leptopetalum*					Bionet,
Brassicaceae	*Lepidium monoplocoides*	Winged pepper-cress [9190]	E			PMST 2017
Brassicaceae	*Lepidium papillosum*	Warty peppercress				Bionet,
Brassicaceae	*Lepidium pseudohyssopifolium*	Peppercress				Bionet, LTIM sp list,
Brassicaceae	*Lepidium* spp.	A peppercress			I	Bionet, LTIM sp list,
Brassicaceae	*Phlegmatospermum cochlearinum*	Oval-podded cress				Bionet,
Brassicaceae	*Sisymbrium erysimoides*	Smooth mustard			I	Bionet, Fauna 2003,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Brassicaceae	*Sisymbrium irio*					LTIM sp list,
Brassicaceae	*Sisymbrium officinale*					LTIM sp list,
Brassicaceae	*Sisymbrium orientale*	Indian hedge mustard			I	Bionet,
Brassicaceae	*Sisymbrium* sp.					LTIM sp list,
Campanulaceae	*Wahlenbergia communis*	Tufted bluebell				Bionet, LTIM sp list,
Campanulaceae	*Wahlenbergia fluminalis*	River bluebell				Bionet,
Campanulaceae	*Wahlenbergia gracilenta*	Annual bluebell				Bionet, LTIM sp list,
Campanulaceae	*Wahlenbergia gracilis*	Sprawling bluebell				Bionet,
Campanulaceae	*Wahlenbergia* sp.	Native bluebell				Fauna 2003, LTIM sp list,
Campanulaceae	*Wahlenbergia* spp.	Bluebell				Bionet,
Campanulaceae	*Wahlenbergia stricta*	Tall bluebell				Bionet,
Campanulaceae	*Walwhalleya proluta*					Bionet, LTIM sp list,
Campanulaceae	*Whalenbergia gracillis*					LTIM sp list,
Campanulaceae	*Whalenbergia* sp.	Noogoora burr				LTIM sp list,
Capparaceae	*Apophyllum anomalum*	Warrior bush				Bionet, Fauna 2003,
Capparaceae	*Capparis mitchellii*	Native orange				Bionet,
Caryophyllaceae	*Petrorhagia nanteulii*					LTIM sp list,
Caryophyllaceae	*Silene* sp.					LTIM sp list,
Caryophyllaceae	*Stellaria angustifolia*	Swamp starwort				Bionet, LTIM sp list,
Caryophyllaceae	*Stellaria media*	Common chickweed			I	Bionet, LTIM sp list,
Caryophyllaceae	Unknown *Caryophyllaceae*					LTIM sp list,
Casuarinaceae	*Casuarina cristata*	Belah				Fauna 2003,
Casuarinaceae	*Casuarina pauper*	Black oak				Bionet,
Chenopodiaceae	*Atriplex angulata*	Fan saltbush				Bionet, Fauna 2003, LTIM sp list,
Chenopodiaceae	*Atriplex conduplicata*					Bionet,
Chenopodiaceae	*Atriplex eardleyae*	Small saltbush				Bionet,
Chenopodiaceae	*Atriplex holocarpa*	Pop saltbush				Bionet, Fauna 2003,
Chenopodiaceae	*Atriplex infrequens*	A saltbush	V,P	V		Bionet,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Chenopodiaceae	*Atriplex leptocarpa*	Slender-fruit saltbush				Bionet, LTIM sp list,
Chenopodiaceae	*Atriplex limbata*					Bionet,
Chenopodiaceae	*Atriplex lindleyi*	Eastern flat-top saltbush				Bionet,
Chenopodiaceae	*Atriplex muelleri*	Mueller's saltbush				Bionet, LTIM sp list,
Chenopodiaceae	*Atriplex pseudocampanulata*					Bionet,
Chenopodiaceae	*Atriplex* sp.	A saltbush				Bionet, Fauna 2003, LTIM sp list,
Chenopodiaceae	*Atriplex spongiosa*	Pop saltbush				Bionet,
Chenopodiaceae	*Atriplex stipitata*	Mallee saltbush				Bionet,
Chenopodiaceae	*Atriplex suberecta*					LTIM sp list,
Chenopodiaceae	*Chenopodium auricomum*	Queensland bluebush				Bionet,
Chenopodiaceae	*Chenopodium cristatum*	Crested goosefoot				Bionet,
Chenopodiaceae	*Chenopodium curvispicatum*					Bionet,
Chenopodiaceae	*Chenopodium desertorum*	Desert goosefoot				Bionet,
Chenopodiaceae	*Chenopodium melanocarpum*	Black crumbweed				Bionet, LTIM sp list,
Chenopodiaceae	*Chenopodium nitrariaceum*	Nitre goosefoot				Bionet, LTIM sp list,
Chenopodiaceae	*Chenopodium* sp.	Crumbweed				Fauna 2003, LTIM sp list,
Chenopodiaceae	*Dissocarpus biflorus var. biflorus*					Bionet,
Chenopodiaceae	*Dissocarpus biflorus var. cephalocarpus*	Many-horned cpperburr				Bionet,
Chenopodiaceae	*Dissocarpus paradoxus*	Cannonball				Bionet, Fauna 2003,
Chenopodiaceae	*Dysphania pumilio*	Small crumbweed				Bionet,
Chenopodiaceae	*Dysphania* sp.					LTIM sp list,
Chenopodiaceae	*Einadia hastata*	Berry saltbush				LTIM sp list,
Chenopodiaceae	*Einadia nutans*	Climbing saltbush				Bionet, Fauna 2003, LTIM sp list,
Chenopodiaceae	*Einadia nutans ssp eremaea*	Climbing saltbush				Fauna 2003,
Chenopodiaceae	*Einadia nutans subsp. nutans*	Climbing saltbush				Bionet,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Chenopodiaceae	*Einadia polygonoides*	Knotweed goosefoot				LTIM sp list,
Chenopodiaceae	*Einadia trigonos*					LTIM sp list,
Chenopodiaceae	*Enchylaena tomentosa*	Ruby saltbush				Bionet, LTIM sp list,
Chenopodiaceae	*Maireana aphylla*	Cotton bush				Bionet,
Chenopodiaceae	*Maireana brevifolia*					Bionet,
Chenopodiaceae	*Maireana coronata*	Crown fissure-weed				Bionet,
Chenopodiaceae	*Maireana decalvans*	Black cotton bush				Bionet,
Chenopodiaceae	*Maireana enchylaenoides*	Wingless fissure-weed				Bionet,
Chenopodiaceae	*Maireana georgei*	Slit-wing bluebush				Bionet,
Chenopodiaceae	*Maireana microcarpa*					Bionet,
Chenopodiaceae	*Maireana sclerolaenoides*					Bionet,
Chenopodiaceae	*Maireana* spp.	Cotton bush, bluebush, fissure-weed				Bionet,
Chenopodiaceae	*Maireana triptera*	Three-wing bluebush				Bionet,
Chenopodiaceae	*Maireana villosa*	Silky bluebush				Bionet,
Chenopodiaceae	*Malacocera tricornis*	Soft horns				Bionet,
Chenopodiaceae	*Osteocarpum acropterum*	Water weed				Bionet,
Chenopodiaceae	*Osteocarpum acropterum var. acropterum*					Bionet,
Chenopodiaceae	*Osteocarpum scleropterum*	Squash bush	E1,P			Bionet,
Chenopodiaceae	*Rhagodia spinescens*	Thorny saltbush				Bionet, Fauna 2003, LTIM sp list,
Chenopodiaceae	*Salsola australis*					LTIM sp list,
Chenopodiaceae	*Salsola kali var. kali*	Buckbush				Bionet, LTIM sp list,
Chenopodiaceae	*Salsola tragus*	Buckbush				Bionet, Fauna 2003,
Chenopodiaceae	*Scleroblitum atriplicinum*	Purple goosefoot				LTIM sp list,
Chenopodiaceae	*Sclerolaena anisacanthoides*	Yellow burr				Bionet,
Chenopodiaceae	*Sclerolaena articulata*					Bionet,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Chenopodiaceae	*Sclerolaena bicornis*	Goathead burr				Bionet, LTIM sp list,
Chenopodiaceae	*Sclerolaena bicornis var. bicornis*					Bionet,
Chenopodiaceae	*Sclerolaena bicornis var. horrida*	Goathead burr				Bionet,
Chenopodiaceae	*Sclerolaena birchii*	Galvanised burr				Fauna 2003, LTIM sp list,
Chenopodiaceae	*Sclerolaena brachyptera*	Short-winged copperburr				Bionet,
Chenopodiaceae	*Sclerolaena calcarata*	Redburr				Bionet, LTIM sp list,
Chenopodiaceae	*Sclerolaena convexula*	Tall copperburr				Bionet, Fauna 2003,
Chenopodiaceae	*Sclerolaena cuneata*					LTIM sp list,
Chenopodiaceae	*Sclerolaena decurrens*	Green copperburr				Bionet,
Chenopodiaceae	*Sclerolaena diacantha*	Grey copperburr				Bionet,
Chenopodiaceae	*Sclerolaena divaricata*	Tangled copperburr				Bionet, LTIM sp list,
Chenopodiaceae	*Sclerolaena eriacantha*	Silky copperburr				Bionet, Fauna 2003,
Chenopodiaceae	*Sclerolaena intricata*	Poverty bush				Bionet,
Chenopodiaceae	*Sclerolaena lanicuspis*	Woolly copperburr				Bionet,
Chenopodiaceae	*Sclerolaena muricata*	Black rolypoly				Bionet, LTIM sp list,
Chenopodiaceae	*Sclerolaena muricata var. muricata*	Black rolypoly				Bionet, LTIM sp list,
Chenopodiaceae	*Sclerolaena muricata var. semiglabra*	Black rolypoly				Bionet,
Chenopodiaceae	*Sclerolaena muricata var. villosa*	Black rolypoly				Bionet, LTIM sp list,
Chenopodiaceae	*Sclerolaena obliquicuspis*					Bionet,
Chenopodiaceae	*Sclerolaena parallelicuspis*					Bionet,
Chenopodiaceae	*Sclerolaena patenticuspis*					Bionet,
Chenopodiaceae	*Sclerolaena* sp.	Copperburr species				Bionet, Fauna 2003, LTIM sp list,
Chenopodiaceae	*Sclerolaena stelligera*	Star copperburr				Bionet,
Chenopodiaceae	*Sclerolaena tetracuspis*	Brigalow burr				Bionet,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Chenopodiaceae	*Sclerolaena tricuspis*	Giant redburr				Bionet, Fauna 2003, LTIM sp list,
Chenopodiaceae	*Sclerolaena ventricosa*	Salt copperburr				Bionet,
Chenopodiaceae	*Tecticornia pergranulata*					Bionet,
Chenopodiaceae	*Tecticornia pergranulata subsp. pergranulata*					Bionet,
Chenopodiaceae	*Tecticornia triandra*	Desert glasswort				LTIM sp list,
Convolvulaceae	*Convolvulus clementii*	Desert bindweed				Bionet,
Convolvulaceae	*Convolvulus erubescens*	Australian bindweed				Bionet, Fauna 2003,
Convolvulaceae	*Convolvulus graminetinus*					LTIM sp list,
Convolvulaceae	*Convolvulus remotus*					Bionet,
Convolvulaceae	*Convolvulus spp.*	A bindweed			I	Bionet,
Convolvulaceae	*Cuscuta campestris*	Golden dodder			I	Bionet,
Convolvulaceae	*Hypochaeris radicata*					LTIM sp list,
Cucurbitaceae	*Citrullus lanatus var. lanatus*	Wild melon, camel melon,bitter			I	Bionet,
Cucurbitaceae	*Cucumis melo subsp. agrestis*	Ulcardo melon				LTIM sp list,
Cucurbitaceae	*Cucumis myriocarpus*					LTIM sp list,
Cucurbitaceae	*Cucumis myriocarpus subsp. leptodermis*	Paddy melon			I	Bionet, LTIM sp list,
Cupressaceae	*Callitris glaucophylla*	White cypress pine				Bionet,
Cyperaceae	*Cyperus difformis*	Dirty dora				Bionet,
Cyperaceae	*Cyperus fulvus*	Sticky sedge				Bionet,
Cyperaceae	*Cyperus* sp.					LTIM sp list,
Cyperaceae	*Eleocharis pallens*	Pale spike sedge				Bionet, LTIM sp list,
Cyperaceae	*Eleocharis pusilla*					LTIM sp list,
Cyperaceae	*Eleocharis* sp.	Spike-rush, spike-sedge				LTIM sp list,
Elatinaceae	*Bergia trimera*	Small water-fire				LTIM sp list,
Euphorbiaceae	*Chamaesyce drummondii*	Caustic weed				Bionet, Fauna 2003, LTIM sp list,
Euphorbiaceae	*Chamaesyce sp.*					LTIM sp list,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Euphorbiaceae	*Euchiton sphaericus*	Plains spurge				Bionet,
Euphorbiaceae	*Euphorbia planiticola*					Bionet,
Fabaceae	*Exocarpos aphyllus*					Fauna 2003,
Fabaceae	*Parkinsonia aculeata*	Parkinsonia, jerusalem thorn, jelly bean tree, horse bean			I	PMST 2017
Fabaceae	*Prosopis* spp.	Mesquite, algaroba [68407]			I	PMST 2017
Fabaceae	*Trifolium glomeratum*					LTIM sp list,
Fabaceae	*Trifolium* sp.					LTIM sp list,
Fabaceae (Caesalpinioideae)	*Senna circinnata*					Bionet,
Fabaceae (Caesalpinioideae)	*Senna form taxon 'petiolaris'*	Woody cassia				Bionet,
Fabaceae (Faboideae)	*Aeschynomene indica*	Budda pea				Bionet, LTIM sp list,
Fabaceae (Faboideae)	*Glossocardia bidens*	Silky glycine				Bionet,
Fabaceae (Faboideae)	*Glycine canescens*	Twining glycine				Bionet,
Fabaceae (Faboideae)	*Glycine clandestina*	Variable glycine				Bionet,
Fabaceae (Faboideae)	*Isoetopsis graminifolia*	Wheeler's lamb-poison				Fauna 2003,
Fabaceae (Faboideae)	*Medicago laciniata*	Cut-leaf medic			I	Bionet, Fauna 2003,
Fabaceae (Faboideae)	*Medicago minima*	Woolly burr medic			I	Bionet,
Fabaceae (Faboideae)	*Medicago polymorpha*	Burr medic			I	Bionet, LTIM sp list,
Fabaceae (Faboideae)	*Medicago* sp.					LTIM sp list,
Fabaceae (Faboideae)	*Sesbania cannabina var. cannabina*	Sesbania pea				Bionet, LTIM sp list,
Fabaceae (Faboideae)	*Swainsona bracteata*					Bionet,
Fabaceae (Faboideae)	*Swainsona greyana*	Darling pea				Bionet,
Fabaceae (Faboideae)	*Swainsona phacoides*	Dwarf swainson-pea				Bionet,
Fabaceae (Faboideae)	*Swainsona procumbens*	Broughton pea				Bionet, LTIM sp list,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Fabaceae (Faboideae)	*Swainsona* sp.					Bionet, LTIM sp list,
Fabaceae (Faboideae)	*Templetonia aculeata*	Spiny mallee pea				Bionet,
Fabaceae (Faboideae)	*Trigonella suavissima*	Coopers clover				Bionet, LTIM sp list,
Fabaceae (Mimosoideae)	*Acacia aneura*	Mulga				Bionet, Fauna 2003,
Fabaceae (Mimosoideae)	*Acacia cambagei*	Gidgee				Bionet, Fauna 2003,
Fabaceae (Mimosoideae)	*Acacia excelsa*	Ironwood				Bionet,
Fabaceae (Mimosoideae)	*Acacia excelsa ssp excelsa*	Ironwood				Fauna 2003,
Fabaceae (Mimosoideae)	*Acacia oswaldii*	Miljee				Bionet,
Fabaceae (Mimosoideae)	*Acacia salicina*	Cooba				Bionet,
Fabaceae (Mimosoideae)	*Acacia* spp.	Wattle				Bionet,
Fabaceae (Mimosoideae)	*Acacia stenophylla*	River cooba				Bionet, LTIM sp list,
Fabaceae (Mimosoideae)	*Acacia tetragonophylla*	Dead finish				Bionet,
Fabaceae (Mimosoideae)	*Acacia victoriae*					Bionet, Fauna 2003, LTIM sp list,
Fabaceae (Mimosoideae)	*Acacia victoriae subsp. victoriae*	Elegant wattle				Bionet,
Frankeniaceae	*Flindersia maculosa*					Bionet, Fauna 2003,
Gentianaceae	*Centaurium spicatum*	Spike centaury				Fauna 2003,
Geraniaceae	*Erodium crinitum*	Blue crowfoot				Bionet,
Goodeniaceae	*Gnephosis arachnoidea*	Cut-leaf goodenia				Bionet, Fauna 2003,
Goodeniaceae	*Goodenia cycloptera*	Mallee goodenia				Bionet,
Goodeniaceae	*Goodenia fascicularis*	Pale goodenia				Bionet, LTIM sp list,
Goodeniaceae	*Goodenia glauca*					Bionet,
Goodeniaceae	*Goodenia heteromera*	Scrambles eggs				Bionet, LTIM sp list,
Goodeniaceae	*Goodenia pinnatifida*	Goodenia species				Bionet, LTIM sp list,
Goodeniaceae	*Velleia paradoxa*					LTIM sp list,
Haloragaceae	*Hakea tephrosperma*	Rough raspwort				Bionet,

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Haloragaceae	*Haloragis aspera*					LTIM sp list,
Haloragaceae	*Haloragis glauca f. glauca*	Variable raspwort				Bionet,
Haloragaceae	*Haloragis heterophylla*	A raspwort				Bionet, LTIM sp list,
Hydrocharitaceae	*Ottelia ovalifolia subsp. ovalifolia*	Swamp lily				Bionet,
Hypericaceae	*Hibiscus trionum*					Bionet, LTIM sp list,
Juncaceae	*Jasminum lineare*	Tussock rush				Bionet,
Juncaceae	*Juncus aridicola*	A rush				Bionet,
Juncaceae	*Juncus* sp.	A rush				Bionet, LTIM sp list,
Juncaceae	*Juncus subglaucus*	Rush				Bionet,
Juncaceae	*Juncus usitatus*					LTIM sp list,
Lamiaceae	*Mentha australis*	River mint				Bionet, LTIM sp list,
Lamiaceae	*Mentha* sp.					LTIM sp list,
Lamiaceae	*Prostanthera striatiflora*	Jockey's cap				Bionet,
Lamiaceae	*Salvia verbenaca*	Vervain			I	Bionet, LTIM sp list,
Lamiaceae	*Teucrium racemosum*	Grey germander				Bionet,
Lobeliaceae	*Lobelia darlingensis*	Darling pratia				Bionet,
Lobeliaceae	*Lobelia purpurascens*					LTIM sp list,
Lobeliaceae	*Pratia concolor*	Poison pratia				LTIM sp list,
Loranthaceae	*Amyema maidenii subsp. maidenii*					Bionet,
Loranthaceae	*Amyema miraculosum subsp. boormanii*					Bionet,
Loranthaceae	*Amyema quandang*	Grey mistletoe				Bionet,
Loranthaceae	*Amyema quandang var. quandang*	Grey mistletoe				Bionet,
Loranthaceae	*Amyema* sp.	Mistletoe				Bionet, LTIM sp list,
Loranthaceae	*Lysiana exocarpi*					Bionet,
Loranthaceae	*Lysiana exocarpi subsp. exocarpi*					Bionet, LTIM sp list,
Loranthaceae	*Lysiana* spp.					Bionet,
Loranthaceae	*Lysiana subfalcata*					LTIM sp list,
Lythraceae	*Ammannia multiflora*	Jerry-jerry				Bionet, LTIM sp list,
Malvaceae	*Abutilon leucopetalum*					Bionet,
Malvaceae	*Abutilon malvifolium*					LTIM sp list,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Malvaceae	*Abutilon otocarpum*	Desert chinese-lantern				Bionet, Fauna 2003, LTIM sp list,
Malvaceae	*Abutilon oxycarpum*	Straggly lantern-bush				LTIM sp list,
Malvaceae	*Abutilon* sp.	Lantern-bush				LTIM sp list,
Malvaceae	*Heliotropium supinum*	Velvet-leaf hibiscus				LTIM sp list,
Malvaceae	*Hibiscus krichauffianus*	Flower-of-an-hour				Bionet,
Malvaceae	*Malva parviflora*	Small-flowered mallow			I	Bionet, LTIM sp list,
Malvaceae	*Malva* sp.	Mallow				LTIM sp list,
Malvaceae	*Malvastrum americanum*	Spiked malvastrum			I	Bionet, LTIM sp list,
Malvaceae	*Sida corrugata*	Corrugated sida				Bionet, LTIM sp list,
Malvaceae	*Sida cunninghamii*	Ridge sida				Bionet, LTIM sp list,
Malvaceae	*Sida fibulifera*	Pin sida				Bionet, LTIM sp list,
Malvaceae	*Sida filiformis*					Bionet,
Malvaceae	*Sida glauca*					LTIM sp list,
Malvaceae	*Sida intricata*					Bionet,
Malvaceae	*Sida rhombifolia*	Paddy's lucerne				LTIM sp list,
Malvaceae	*Sida* sp.	Sida species				Fauna 2003, LTIM sp list,
Malvaceae	*Sida trichopoda*	High sida				Bionet, LTIM sp list,
Marsileaceae	*Marsilea drummondii*	Common nardoo				Bionet, Fauna 2003, LTIM sp list,
Marsileaceae	*Marsilea* sp.	A nardoo				LTIM sp list,
Myoporaceae	*Eremophila bignoniiflora*	Eurah				Bionet,
Myoporaceae	*Eremophila deserti*	Turkeybush				Bionet, LTIM sp list,
Myoporaceae	*Eremophila glabra*	Tar bush				Bionet,
Myoporaceae	*Eremophila longifolia*	Emubush				Bionet,
Myoporaceae	*Eremophila mitchellii*	Budda				Bionet, Fauna 2003,
Myoporaceae	*Eremophila polyclada*	Flowering lignum				Bionet, Fauna 2003,
Myoporaceae	*Eremophila serrulata*	Green fuchsia bush				Bionet,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Myoporaceae	*Eremophila* spp.					Bionet,
Myoporaceae	*Eremophila sturtii*	Turpentine				Bionet, Fauna 2003,
Myoporaceae	*Myoporum montanum*	Western boobialla				Bionet, LTIM sp list,
Myoporaceae	*Myoporum platycarpum*	Sugarwood				Bionet,
Myrtaceae	*Corymbia tumescens*					Bionet,
Myrtaceae	*Eryngium rostratum*	River red gum				LTIM sp list,
Myrtaceae	*Eucalyptus camaldulensis*	Coolibah				Bionet,
Myrtaceae	*Eucalyptus coolabah*					Bionet, Fauna 2003, LTIM sp list,
Myrtaceae	*Eucalyptus coolabah subsp. coolabah*	Gum coolibah				Bionet,
Myrtaceae	*Eucalyptus intertexta*	Black box				Bionet,
Myrtaceae	*Eucalyptus largiflorens*	Bimble box				Bionet, LTIM sp list,
Myrtaceae	*Eucalyptus populnea*	Bimble box				Fauna 2003,
Myrtaceae	*Eucalyptus populnea subsp. bimbil*					Bionet, LTIM sp list,
Nitrariaceae	*Nitraria billardierei*	Dillon bush				Bionet,
Nitrariaceae	*Nitraria* spp.					Bionet,
Nyctaginaceae	*Boerhavia dominii*	Tarvine				Bionet, LTIM sp list,
Oleaceae	*Ixiolaena* sp.	Desert jasmine				LTIM sp list,
Onagraceae	*Frankenia serpyllifolia*					Bionet,
Onagraceae	*Ludwigia peploides subsp. montevidensis*	Water primrose				LTIM sp list,
Oxalidaceae	*Oxalis perennans*					Bionet, LTIM sp list,
Oxalidaceae	*Oxalis* sp.					Bionet, LTIM sp list,
Papaveraceae	*Argemone ochroleuca ssp ochroleuca*	Mexican poppy			I	Fauna 2003,
Papaveraceae	*Argemone ochroleuca subsp. ochroleuca*	Mexican poppy			I	Bionet, LTIM sp list,
Phormiaceae	*Dianella longifolia*	Blueberry lily				Bionet,
Phormiaceae	*Dianella* spp.					Bionet,
Phyllanthaceae	*Phyllanthus fuernrohrii*					Bionet,
Phyllanthaceae	*Phyllanthus lacunarius*					Bionet,
Phyllanthaceae	*Phyllanthus lacunellus*					Bionet,
Phyllanthaceae	*Phyllanthus* spp.				I	Bionet, LTIM sp list,

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Phyllanthaceae	*Sauropus trachyspermus*					Bionet,
Pittosporaceae	*Pittosporum angustifolium*	Butterbush				Bionet,
Plantaginacea	*Stemodia florulenta*					LTIM sp list,
Plantaginaceae	*Plantago cunninghamii*	Sago-weed				Bionet, LTIM sp list,
Plantaginaceae	*Plantago debilis*					LTIM sp list,
Plantaginaceae	*Plantago* sp.	Plantain				Fauna 2003, LTIM sp list,
Poaceae	*Arista* sp.	Wiregrass				Fauna 2003,
Poaceae	*Aristida anthoxanthoides*					Bionet,
Poaceae	*Aristida contorta*	Bunched kerosene grass				Bionet,
Poaceae	*Aristida holathera var. holathera*	Erect kerosene grass				Bionet,
Poaceae	*Aristida jerichoensis*	Jericho wiregrass				Bionet,
Poaceae	*Aristida jerichoensis var. jerichoensis*	Jericho wiregrass				Bionet,
Poaceae	*Aristida obscura*	Small brush wiregrass				Fauna 2003,
Poaceae	*Aristida* spp.	A wiregrass				Bionet,
Poaceae	*Asperula gemella*	Twin-leaved bedstraw				LTIM sp list,
Poaceae	*Asperula geminifolia*					LTIM sp list,
Poaceae	*Astrebla lappacea*	Curly mitchell grass				Bionet,
Poaceae	*Astrebla pectinata*	Barley mitchell grass				Bionet,
Poaceae	*Austrostipa acrociliata*					Bionet,
Poaceae	*Austrostipa metatoris*		V			PMST 2017
Poaceae	*Austrostipa nitida*					Bionet,
Poaceae	*Austrostipa nodosa*	A speargrass				Bionet,
Poaceae	*Austrostipa scabra*	Rough speargrass				Fauna 2003,
Poaceae	*Austrostipa scabra subsp. scabra*	Rough speargrass				Bionet,
Poaceae	*Austrostipa* sp.	A speargrass				Fauna 2003, LTIM sp list,
Poaceae	*Austrostipa* spp.	A speargrass				Bionet,
Poaceae	*Bothriochloa macra*	Red grass				Bionet,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Poaceae	*Cenchrus ciliaris*	Buffel grass			I	Bionet, Fauna 2003, LTIM sp list, PMST 2017
Poaceae	*Chloris pectinata*	Comb chloris				Bionet,
Poaceae	*Chloris* spp.				I	Bionet,
Poaceae	*Chloris truncata*	Windmill grass				Bionet, Fauna 2003,
Poaceae	*Chrysopogon fallax*					Bionet,
Poaceae	*Cymbopogon obtectus*	Silky heads				Bionet,
Poaceae	*Cynodon dactylon*	Common couch				Fauna 2003, LTIM sp list,
Poaceae	*Dactyloctenium radulans*	Button grass				Bionet,
Poaceae	*Deyeuxia* sp.					LTIM sp list,
Poaceae	*Dichanthium sericeum*	Queensland bluegrass				Bionet,
Poaceae	*Dichanthium sericeum subsp. humilius*					Bionet,
Poaceae	*Digitaria brownii*	Cotton panic grass				Bionet,
Poaceae	*Digitaria ciliaris*	Summer grass			I	Bionet,
Poaceae	*Digitaria* sp.					LTIM sp list,
Poaceae	*Diplachne fusca*	Brown beetle grass				Bionet, LTIM sp list,
Poaceae	*Echinochloa colona*	Awnless barnyard grass				Bionet, LTIM sp list,
Poaceae	*Echinochloa crus-galli*	Barnyard grass			I	Bionet,
Poaceae	*Echinochloa inundata*	Marsh millet				Bionet, LTIM sp list,
Poaceae	*Echinochloa* spp.				I	Bionet,
Poaceae	*Enneapogon avenaceus*	Bottle washers				Bionet,
Poaceae	*Enneapogon cylindricus*	Jointed nineawn				Bionet,
Poaceae	*Enneapogon gracilis*	Slender nineawn				Bionet,
Poaceae	*Enneapogon intermedius*					Bionet,
Poaceae	*Enneapogon nigricans*	Niggerheads				Bionet,
Poaceae	*Enteropogon acicularis*	Curly windmill grass				Bionet,
Poaceae	*Eragrostis australasica*	Canegrass				Bionet, LTIM sp list,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Poaceae	*Eragrostis cilianensis*	Stinkgrass			I	Bionet,
Poaceae	*Eragrostis dielsii*	Mallee lovegrass				Bionet,
Poaceae	*Eragrostis elongata*	Clustered lovegrass				Bionet,
Poaceae	*Eragrostis eriopoda*	Woollybutt				Bionet,
Poaceae	*Eragrostis lacunaria*	Purple lovegrass				Bionet,
Poaceae	*Eragrostis laniflora*	Woollybutt				Bionet,
Poaceae	*Eragrostis microcarpa*					Bionet,
Poaceae	*Eragrostis parviflora*	Weeping lovegrass				Bionet,
Poaceae	*Eragrostis pergracilis*					Bionet,
Poaceae	*Eragrostis setifolia*	Neverfail				Bionet,
Poaceae	*Eragrostis* spp.	A lovegrass			I	Bionet, Fauna 2003, LTIM sp list,
Poaceae	*Eriachne mucronata*	Mountain wanderrie grass				Bionet,
Poaceae	*Eriochloa crebra*	Cup grass, tall cupgrass				Bionet, LTIM sp list,
Poaceae	*Eriochloa pseudoacrotricha*	Early spring grass				Bionet,
Poaceae	*Ipomoea lonchophylla*	Small flinders grass				Bionet,
Poaceae	*Iseilema membranaceum*	Red flinders grass				Bionet,
Poaceae	*Lachnagrostis filiformis*					Bionet, LTIM sp list,
Poaceae	*Monachather paradoxus*	Bandicoot grass				Bionet,
Poaceae	*Panicum decompositum*	Native millet				Bionet,
Poaceae	*Panicum decompositum var. tenuius*					LTIM sp list,
Poaceae	*Panicum queenslandicum*	Yadbila grass				Bionet,
Poaceae	*Panicum* sp.	Panicum				LTIM sp list,
Poaceae	*Paspalidium constrictum*	Knottybutt grass				Bionet, LTIM sp list,
Poaceae	*Paspalidium jubiflorum*	Warrego grass				Bionet, LTIM sp list,
Poaceae	*Paspalidium* sp.					Bionet, LTIM sp list,
Poaceae	*Paspalum distichum*	Water couch				LTIM sp list,

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Poaceae	*Perotis rara*	Comet grass				Bionet,
Poaceae	*Phragmites australis*	Common reed				Bionet,
Poaceae	*Poaceae* sp.					LTIM sp list,
Poaceae	*Rytidosperma* spp.					Bionet,
Poaceae	*Setaria paspalidioides*					Bionet,
Poaceae	*Sorghum halepense*	Johnson grass			I	Bionet,
Poaceae	*Sorghum* spp.				I	Bionet,
Poaceae	*Sporobolus actinocladus*	Katoora grass				Bionet,
Poaceae	*Sporobolus caroli*	Fairy grass				Bionet, LTIM sp list,
Poaceae	*Sporobolus creber*	Slender rat's tail grass				Bionet, LTIM sp list,
Poaceae	*Sporobolus mitchellii*	Rat's tail couch				Bionet, LTIM sp list,
Poaceae	*Thellungia advena simile*					LTIM sp list,
Poaceae	*Thyridolepis mitchelliana*	Mulga mitchell grass				Bionet,
Poaceae	*Tragus australianus*	Small burrgrass				Bionet, LTIM sp list,
Poaceae	*Tripogon loliiformis*	Fiveminute grass				Bionet,
Poaceae	*Triraphis mollis*	Purple needlegrass				Bionet,
Poaceae	*Urochloa gilesii*					Bionet,
Poaceae	*Urochloa praetervisa*					Bionet,
Poaceae	*Urochloa subquadripara*	Green summer grass				Bionet,
Poaceae	*Urochloa texana*	Texas millet			I	Bionet,
Polygonaceae	*Duma florulenta*	Lignum				Bionet, LTIM sp list,
Polygonaceae	*Muehlenbeckia florulenta*	Lignum				Fauna 2003,
Polygonaceae	*Persicaria lapathifolia*	Pale knotweed				Bionet,
Polygonaceae	*Persicaria prostrata*	Creeping knotweed				LTIM sp list,
Polygonaceae	*Persicaria* sp.	Knotweed				LTIM sp list,
Polygonaceae	*Polygonum arenastrum*	Wireweed			I	Fauna 2003,
Polygonaceae	*Polygonum aviculare*	Wireweed			I	Bionet,
Polygonaceae	*Polygonum plebeium*	Small knotweed				Bionet,
Polygonaceae	*Polygonum* spp.				I	Bionet,

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Polygonaceae	*Rumex brownii*	Swamp dock				Bionet, LTIM sp list,
Polygonaceae	*Rumex* sp.	Dock				Fauna 2003, LTIM sp list,
Polygonaceae	*Rumex tenax*	Shiny dock				Bionet,
Portulacaceae	*Portulaca oleracea*	Pigweed				Bionet, Fauna 2003,
Primulaceae	*Anagallis arvensis*	Scarlet pimpernel				LTIM sp list,
Proteaceae	*Goodenia* spp.	Beefwood				Bionet, Fauna 2003, LTIM sp list,
Proteaceae	*Grevillea striata*					Bionet,
Proteaceae	*Hakea ivoryi*	Needlewood				Bionet,
Proteaceae	*Hakea leucoptera*	Hooked needlewood				Bionet,
Ranunculaceae	*Ranunculus pumilio*					LTIM sp list,
Ranunculaceae	*Ranunculus* sp.					LTIM sp list,
Rhamnaceae	*Ventilago viminalis*	Supple jack				Bionet, Fauna 2003,
Rubiaceae	*Dentella minutissima*		E1,P			Bionet, LTIM sp list,
Rubiaceae	*Synaptantha tillaeacea var. tillaeacea*					Bionet,
Rubiaceae	*Synostemon trachyspermus*	Slender spurge	wd			
Rutaceae	*Fabaceae* sp.	Leopardwood				LTIM sp list,
Rutaceae	*Gaura* sp.	Wilga				LTIM sp list,
Rutaceae	*Phebalium glandulosum subsp. glandulosum*					Bionet,
Santalaceae	*Euphorbia tannensis subsp. eremophila*	Leafless cherry				Bionet,
Sapindaceae	*Alectryon oleifolius*	Western rosewood				Bionet,
Sapindaceae	*Alectryon oleifolius subsp. elongatus*					Bionet,
Sapindaceae	*Atalaya hemiglauca*	Whitewood				Bionet,
Sapindaceae	*Dodonaea viscosa*					Bionet, LTIM sp list,
Sapindaceae	*Dodonaea viscosa subsp. angustissima*	Narrow-leaf hop-bush				Bionet, Fauna 2003, LTIM sp list,
Scrophulariaceae	*Verbascum virgatum*	Twiggy mullein				LTIM sp list,
Solanaceae	*Duboisia hopwoodii*	Pituri				Bionet,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Solanaceae	*Lycium ferocissimum*	African boxthorn			I	Bionet, Fauna 2003, LTIM sp list,
Solanaceae	*Nicotiana simulans*					Bionet,
Solanaceae	*Nicotiana suaveolens*	Native tobacco				Bionet,
Solanaceae	*Nicotiana velutina*					Bionet, Fauna 2003, LTIM sp list,
Solanaceae	*Physalis lanceifolia*				I	Bionet,
Solanaceae	*Physalis* spp.				I	Bionet,
Solanaceae	*Solanum ellipticum*	Velvet potato bush				Bionet,
Solanaceae	*Solanum esuriale*	Quena				Bionet, LTIM sp list,
Solanaceae	*Solanum ferocissimum*	Spiny potato-bush				Bionet,
Solanaceae	*Solanum jucundum*					Bionet,
Solanaceae	*Solanum nigrum*	Black-berry nightshade			I	Bionet, LTIM sp list,
Solanaceae	*Solanum sturtianum*	Thargominda h nightshade				Bionet,
Tamaricaceae	*Tamarix aphylla*	Athel pine, athel tree, tamarisk, athel tamarisk, desert tamarisk, flowering cypress, salt cedar			I	PMST 2017
Thymelaeaceae	*Pimelea microcephala subsp. microcephala*	Shrubby rice-flower				Bionet,
Thymelaeaceae	*Pimelea penicillaris*	Sandhill rice-flower				Fauna 2003,
Thymelaeaceae	*Pimelea trichostachya*	Spiked rice-flower				Bionet, Fauna 2003,
Verbenaceae	*Phyla canescens*	Lippia				LTIM sp list,
Verbenaceae	*Phyla nodiflora*	Carpet weed				LTIM sp list,
Verbenaceae	*Verbena gaudichaudii*	Verbena				LTIM sp list,
Verbenaceae	*Verbena officinalis*	Common verbena			I	Bionet, LTIM sp list,
Verbenaceae	*Verbena* sp.					LTIM sp list,
Verbenaceae	*Verbena supina*	Trailing verbena			I	Bionet, LTIM sp list,
Zygophyllaceae	*Tribulus micrococcus*	Spineless caltrop				Bionet,

Family	Scientific Name	Common Name	NSW status	Comm. status	Exotic	Sources
Zygophyllaceae	*Tribulus terrestris*	Cat-head				LTIM sp list,
Zygophyllaceae	*Zygophyllum ammophilum*	Sand twinleaf				Bionet,
Zygophyllaceae	*Zygophyllum iodocarpum*	Violet twinleaf				Bionet,

Appendix E Fauna species list

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed -ing	Sources
Actinop terygii	Ambassidae	*Ambassis agasizzii*	Olive perchlet	Epop			Capon 2009, WMA 2008 (Balcombe et al 2006)
Actinop terygii	Ambassidae	*Ambassis mulleri*	Western chanda perch				Capon 2009
Actinop terygii	Terapontida e	*Bidyanus bidyanus*	Silver perch	V		Potenti al	Capon 2009, WMA 2008 (Balcombe et al 2006)
Actinop terygii	Cyprinidae	*Carassius auratus*	Goldfish			Known	Capon 2009, ELA LTIM, WMA 2008 (Balcombe et al 2006)
Actinop terygii	Atherinidae	*Craterocephalus stercusmuscarum fulvus*	Unspeckled hardyhead				Capon 2009, WMA 2008 (Motell, 1998)
Actinop terygii	Cyprinidae	*Cyprinus carpio*	Common carp			Known	Capon 2009, ELA LTIM, WMA 2008 (Balcombe et al 2006)
Actinop terygii	Percichthyid ae	*Gadopsis marmoratus*	River black fish				Capon 2009
Actinop terygii	Galaxiidae	*Galaxias* spp.	Mountain galaxias				Capon 2009
Actinop terygii	Poeciliidae	*Gambusia holbrooki*	Mosquitofish			Known	Capon 2009, ELA LTIM, WMA 2008 (Balcombe et al 2006)
Actinop terygii	Eleotridae	*Hypseleotris* spp.	Carp gudgeons			Known	Capon 2009, ELA LTIM, WMA 2008 (Balcombe et al 2006), WMA 2008 (Motell, 1998)
Actinop terygii	Terapontida e	*Leiopotherapon unicolor*	Spangled perch			Known	Capon 2009, ELA LTIM, WMA 2008 (Balcombe et al 2006)
Actinop terygii	Percichthyid ae	*Maccullochella peelii*	Murray cod		V	Potenti al	Capon 2009, PMST 2017
Actinop terygii	Percichthyid ae	*Macquaria ambigua*	Golden perch			Known	Capon 2009, ELA LTIM, WMA 2008 (Balcombe et al 2006)

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed -ing	Sources
Actinop terygii	Melanotaeniidae	*Melanotaenia fluviatilis*	Crimson-spotted rainbow fish			Likely	Capon 2009, ELA LTIM, WMA 2008 (Balcombe et al 2006)
Actinop terygii	Polycentridae	*Morgurnda adspersa*	Purple-spotted gudgeon	E		Likely	Capon 2009
Actinop terygii	Clupeidae	*Nematalosa erebi*	Bony herring			Known	Capon 2009, ELA LTIM, WMA 2008 (Balcombe et al 2006)
Actinop terygii	Plotsidae	*Neosilurus hyrtlii*	Hyrtl's catfish			Known	Capon 2009, ELA LTIM, WMA 2008 (Balcombe et al 2006)
Actinop terygii	Retropinnidae	*Retropinna semoni*	Australian smelt				Capon 2009, WMA 2008 (Balcombe et al 2006)
Actinop terygii	Plotosidae	*Tandanus tandanus*	Eel-tailed catfish	Epop		Likely	Capon 2009, WMA 2008 (Balcombe et al 2006)
Amphibia	Myobatrachidae	*Crinia deserticola*	Desert froglet			Potential	Bionet, ELA LTIM, Fauna 2003, Capon 2009, OEH 2015
Amphibia	Myobatrachidae	*Crinia parinsignifera*	Eastern sign-bearing froglet			Potential	Bionet, ELA LTIM, OEH 2015
Amphibia	Hylidae	*Cyclorana novaehollandiae*	New holland frog, wide-mouthed frog			Likely	ELA LTIM
Amphibia	Hylidae	*Cyclorana platycephala*	Water-holding frog				Bionet, Fauna 2003, Capon 2009, OEH 2015
Amphibia	Hylidae	*Cyclorana* sp.					Bionet, OEH 2015
Amphibia	Hylidae	*Cyclorana verrucosa*	Rough frog				Bionet, OEH 2015
Amphibia	Myobatrachidae	*Limnodynastes fletcheri*	Barking frog, long-thumbed frog, marsh frog			Likely	Bionet, ELA LTIM, Fauna 2003, Capon 2009, OEH 2015
Amphibia	Myobatrachidae	*Limnodynastes salmini*	Salmon striped frog				Bionet
Amphibia	Myobatrachidae	*Limnodynastes tasmaniensis*	Spotted grass frog, spotted marsh frog				Bionet

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed -ing	Sources
Amphibia	Hylidae	*Litoria caerulea*	Green tree frog			Likely	Bionet, ELA LTIM, Fauna 2003, Capon 2009, OEH 2015
Amphibia	Hylidae	*Litoria latopalmata*	Broad-palmed frog				OEH 2015
Amphibia	Hylidae	*Litoria peronii*	Peron's tree frog			Likely	Bionet, ELA LTIM, Fauna 2003, Capon 2009, OEH 2015
Amphibia	Hylidae	*Litoria rubella*	Desert tree frog			Likely	Bionet, ELA LTIM, Fauna 2003, Capon 2009, OEH 2015
Amphibia	Myobatrachidae	*Neobatrachus sudelli*	Sudell's frog			Likely	ELA LTIM
Amphibia	Myobatrachidae	*Notaden bennettii*	Crucifix frog				OEH 2015
Amphibia	Myobatrachidae	*Uperoleia capitulata*	Small-headed toadlet			Likely	ELA LTIM
Amphibia	Myobatrachidae	*Uperoleia rugosa*	Wrinkled toadlet				Bionet
Aves	Meliphagidae	*Acanthagenys rufogularis*	Spiny-cheeked honeyeater				Bionet
Aves	Acanthizidae	*Acanthiza apicalis*	Inland thornbill				Bionet
Aves	Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped thornbill				Bionet
Aves	Acanthizidae	*Acanthiza nana*	Yellow thornbill				Bionet
Aves	Acanthizidae	*Acanthiza uropygialis*	Chestnut-rumped thornbill				Bionet
Aves	Accipitridae	*Accipiter cirrocephalus*	Collared sparrowhawk				OEH 2015
Aves	Accipitridae	*Accipiter fasciatus*	Brown goshawk			Likely	ELA LTIM
Aves	Acrocephalidae	*Acrocephalus australis*	Australian reed warbler			Likely	ELA LTIM
Aves	Acrocephalidae	*Acrocephalus stenoteoreus*	Clamorous reed-warbler				Capon 2009
Aves	Scolopacidae	*Actitis hypoleucos*	Common sandpiper			Likely	ELA LTIM
Aves	Aegothelidae	*Aegotheles chrisoptus*	Australian owlet-nightjar			Likely	ELA LTIM
Aves	Aegothelidae	*Aegotheles cristatus*	Australian owlet-nightjar				Capon 2009
Aves	Maluridae	*Amytornis modestus*	Thick-billed grasswren	CE	CE	Unlikely	PMST 2017
Aves	Anatidae	*Anas castanea*	Chestnut teal				Bionet

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed -ing	Sources
Aves	Anatidae	*Anas gracilis*	Australian grey teal				Capon 2009
Aves	Anatidae	*Anas rhynchotis*	Australasian shoveler				Bionet
Aves	Anatidae	*Anas superciliosa*	Pacific black duck				Bionet
Aves	Anhingidae	*Anhinga melanogaster*	Australian darter			Known	Capon 2009
Aves	Anhingidae	*Anhinga novaehollandiae*	Australasian darter				Bionet
Aves	Motacillidae	*Anthus australis*	Australian pipit				Fauna 2003
Aves	Motacillidae	*Anthus novaeseelandiae*	Australasian pipit australian pipit			Likely	ELA LTIM
Aves	Acanthizidae	*Aphelocephala leucopsis*	Southern whiteface				Bionet
Aves	Psittacidae	*Aprosmictus erythropterus*	Red-winged parrot				Bionet
Aves	Apodidae	*Apus pacificus*	Fork-tailed swift			Likely	ELA LTIM
Aves	Accipitridae	*Aquila audax*	Wedge-tailed eagle				Bionet
Aves	Ardeidae	*Ardea alba*	Great egret				Fauna 2003
Aves	Ardeidae	*Ardea ibis*	Cattle egret		M	Unlikel y	PMST 2017
Aves	Ardeidae	*Ardea intermedia*	Intermediate egret				Field Nats 2012
Aves	Ardeidae	*Ardea modesta*	Eastern great egret				Bionet
Aves	Ardeidae	*Ardea novaehollandiae*	White-faced heron				Capon 2009
Aves	Ardeidae	*Ardea pacifica*	White-necked heron				Bionet
Aves	Otididae	*Ardeotis australis*	Australian bustard	E		Potenti al	Bionet
Aves	Artamidae	*Artamus cinereus*	Black-faced woodswallow				Bionet
Aves	Artamidae	*Artamus cyanopterus cyanopterus*	Dusky woodswallow	V		Potenti al	Bionet
Aves	Artamidae	*Artamus leucorynchus*	White-breasted woodswallow			Likely	ELA LTIM
Aves	Artamidae	*Artamus minor*	Little woodswallow			Likely	ELA LTIM
Aves	Artamidae	*Artamus personatus*	Masked woodswallow				Bionet
Aves	Artamidae	*Artamus superciliosus*	White-browed woodswallow			Likely	ELA LTIM
Aves	Anatidae	*Aythya australis*	Hardhead				Bionet

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed -ing	Sources
Aves	Psittacidae	*Barnardius zonarius*	Australian ringneck				Bionet
Aves	Psittacidae	*Barnardius zonarius barnardi*	Mallee ringneck				Bionet
Aves	Anatidae	*Biziura lobata*	Musk duck				Bionet
Aves	Ardeidae	*Botaurus poiciloptilus*	Australasian bittern	V		Potential	Biosis 2016
Aves	Cacatuidae	*Cacatua leadbeateri*	Major mitchell's cockatoo				Fauna 2003
Aves	Cacatuidae	*Cacatua sanguinea*	Little corella			Likely	ELA LTIM
Aves	Cuculidae	*Cacomantis flabelliformis*	Fan-tailed cuckoo				Fauna 2003
Aves	Cuculidae	*Cacomantis pallidus*	Pallid cuckoo				Bionet
Aves	Scolopacidae	*Calidris ferruginea*	Curlew sandpiper	E	CE, Mi	Unlikely	OEH 2015
Aves	Cacatuidae	*Calyptorhynchus banksii*	Red-tailed black cockatoo			Likely	ELA LTIM
Aves	Cacatuidae	*Calyptorhynchus banksii samueli*	Red-tailed black-cockatoo (inland subspecies)	V		Potential	Bionet
Aves	Meliphagidae	*Certhionyx variegatus*	Pied honeyeater	V		Unlikely	OEH 2015
Aves	Cuculidae	*Chalcites basalis*	Horsfield’s bronze-cuckoo				Capon 2009
Aves	Cuculidae	*Chalcites osculans*	Black-eared cuckoo				Bionet
Aves	Charadriidae	*Charadrius australis*	Inland dotterel			Known	Bionet
Aves	Charadriidae	*Charadrius melanops*	Black-fronted plover				Capon 2009
Aves	Charadriidae	*Charadrius ruficapillus*	Red-capped plover				Bionet
Aves	Anatidae	*Chenonetta jubata*	Australian wood duck				Aerial Bird 2010
Aves	Hirundinidae	*Cheramoeca leucosterna*	White-backed swallow				OEH 2015
Aves	Laridae	*Chlidonias hybrida*	Whiskered tern				Bionet
Aves	Laridae	*Chroicocephalus novaehollandiae*	Silver gull				Bionet
Aves	Laridae	*Chrysococcyx basalis*	Horsfield's bronze-cuckoo			Likely	ELA LTIM
Aves	Laridae	*Chrysococcyx osculans*	Black-eared cuckoo			Likely	ELA LTIM
Aves	Megaluridae	*Cincloramphus cruralis*	Brown songlark				Bionet
Aves	Megaluridae	*Cincloramphus mathewsi*	Rufous songlark			Likely	ELA LTIM

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed-ing	Sources
Aves	Megaluridae	*Cinclosoma castanotum*	Chestnut quail-thrush	V		Potential	OEH 2015
Aves	Accipitridae	*Circus assimilis*	Spotted harrier	V		Likely	Fauna 2003
Aves	Cisticolidae	*Cisticola exilis*	Golden-headed cisticola			Likely	ELA LTIM
Aves	Climacteridae	*Climacteris affinis*	White-browed treecreeper				Bionet
Aves	Climacteridae	*Climacteris picumnus*	Brown treecreeper			Likely	ELA LTIM
Aves	Climacteridae	*Climacteris picumnus victoriae*	Brown treecreeper (eastern subspecies)	V		Potential	Bionet
Aves	Pachycephalidae	*Colluricincla harmonica*	Grey shrike-thrush				Bionet
Aves	Columbidae	*Columba livia*	Rock pigeon rock dove domestic pigeon				PMST 2017
Aves	Campephagidae	*Coracina maxima*	Ground cuckoo-shrike				OEH 2015
Aves	Campephagidae	*Coracina novaehollandiae*	Black-faced cuckoo-shrike			Likely	ELA LTIM
Aves	Campephagidae	*Coracina papuensis*	White-bellied cuckoo-shrike			Likely	ELA LTIM
Aves	Corcoracidae	*Corcorax melanorhamphos*	White-winged chough				Bionet
Aves	Corvidae	*Corvus bennetti*	Little crow				Bionet
Aves	Corvidae	*Corvus coronoides*	Australian raven				Bionet
Aves	Corvidae	*Corvus mellori*	Little raven				Bionet
Aves	Artamidae	*Cracticus nigrogularis*	Pied butcherbird				Bionet
Aves	Artamidae	*Cracticus tibicen*	Australian magpie				Bionet
Aves	Artamidae	*Cracticus torquatus*	Grey butcherbird				Bionet
Aves	Cuculidae	*Cuculus pallidus*	Pallid cuckoo				Fauna 2003
Aves	Anatidae	*Cygnus atratus*	Black swan			Likely	ELA LTIM
Aves	Anatidae	*Cyngnus atratus*	Australian black duck				Capon 2009
Aves	Alcedinidae	*Dacelo novaeguineae*	Laughing kookaburra				Bionet
Aves	Neosittidae	*Daphoenositta chrysoptera*	Varied sittella	V		Potential	Bionet
Aves	Anatidae	*Dendrocygna eytoni*	Plumed whistling-duck				OEH 2015
Aves	Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird				Bionet

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed -ing	Sources
Aves	Casuariidae	*Dromaius novaehollandiae*	Emu				Bionet
Aves	Ardeidae	*Egretta garzetta*	Little egret				OEH 2015
Aves	Ardeidae	*Egretta novaehollandiae*	White-faced heron				Bionet
Aves	Accipitridae	*Elanus axillaris*	Black-shouldered kite				Bionet
Aves	Charadriidae	*Elseyornis melanops*	Black-fronted dotterel				Bionet
Aves	Meliphagidae	*Entomyzon cyanotis*	Blue-faced honeyeater				Bionet
Aves	Cacatuidae	*Eolophus roseicapillus*	Galah				Bionet
Aves	Meliphagidae	*Epthianura albifrons*	White-fronted chat	V		Potential	Bionet
Aves	Meliphagidae	*Epthianura aurifrons*	Orange chat				Bionet
Aves	Meliphagidae	*Epthianura tricolor*	Crimson chat				Bionet
Aves	Charadriidae	*Erythrogonys cinctus*	Red-kneed dotterel				Bionet
Aves	Caprimulgidae	*Eurostopodus argus*	Spotted nightjar				Bionet
Aves	Falconidae	*Falco berigora*	Brown falcon				Bionet
Aves	Falconidae	*Falco cenchroides*	Nankeen kestrel				Bionet
Aves	Falconidae	*Falco hypoleucos*	Grey falcon	E		Potential	Bionet
Aves	Falconidae	*Falco longipennis*	Australian hobby				Fauna 2003
Aves	Falconidae	*Falco subniger*	Black falcon	V		Potential	Bionet
Aves	Rallidae	*Fulica atra*	Eurasian coot australian coot coot toorie			Likely	ELA LTIM
Aves	Scolopacidae	*Gallinago hardwickii*	Latham's snipe japanese snipe		Mi, M		PMST 2017
Aves	Rallidae	*Gallinula tenebrosa*	Dusky moorhen				Fauna 2003
Aves	Rallidae	*Gallinula ventralis*	Black-tailed native-hen				Fauna 2003
Aves	Meliphagidae	*Gavicalis virescens*	Singing honeyeater				Bionet
Aves	Columbidae	*Geopelia cuneata*	Diamond dove				Bionet
Aves	Columbidae	*Geopelia humeralis*	Bar-shouldered dove				Fauna 2003
Aves	Columbidae	*Geopelia placida*	Peaceful dove				Fauna 2003
Aves	Columbidae	*Geopelia striata*	Peaceful dove				Bionet

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed -ing	Sources
Aves	Columbidae	*Gerygone fusca*	Western gerygone				OEH 2015
Aves	Glareolidae	*Glareola maldivarum*	Oriental pratincole		C,J,K		Bionet
Aves	Monarchidae	*Grallina cyanoleuca*	Magpie-lark				Bionet
Aves	Meliphagidae	*Grantiella picta*	Painted honeyeater	V	V	Unlikely	OEH 2015
Aves	Gruidae	*Grus rubicunda*	Brolga	V			Bionet
Aves	Artamidae	*Gymnorhina tibicen*	Australian magpie				Fauna 2003
Aves	Accipitridae	*Haliaeetus leucogaster*	White-bellied sea-eagle	V	M	Unlikely	PMST 2017
Aves	Accipitridae	*Haliastur sphenurus*	Whistling kite				Bionet
Aves	Accipitridae	*Hamirostra melanosternon*	Black-breasted buzzard	V		Potential	OEH 2015
Aves	Accipitridae	*Hieraaetus morphnoides*	Little eagle	V		Potential	Bionet
Aves	Recurvirostridae	*Himantopus himantopus*	Black-winged stilt				Bionet
Aves	Hirundinidae	*Hirundo neoxena*	Welcome swallow			Likely	ELA LTIM
Aves	Campephagidae	*Lalage sueurii*	White-winged triller				Bionet
Aves	Campephagidae	*Lalage tricolor*	White-winged triller				Fauna 2003
Aves	Laridae	*Larus novaehollandiae*	Silver gull				Capon 2009
Aves	Megapodiidae	*Leipoa ocellata*	Malleefowl	E	V	Unlikely	PMST 2017
Aves	Meliphagidae	*Lichenostomus leucotis*	White-eared honeyeater				Fauna 2003
Aves	Meliphagidae	*Lichenostomus penicillatus*	White-plumed honeyeater				Fauna 2003
Aves	Meliphagidae	*Lichmera indistincta*	Brown honeyeater			Likely	ELA LTIM
Aves	Cacatuidae	*Lophochroa leadbeateri*	Major mitchell's cockatoo	V		Potential	Bionet
Aves	Accipitridae	*Lophoictinia isura*	Square-tailed kite	V		Unlikely	OEH 2015
Aves	Anatidae	*Malacorhynchus membranaceus*	Pink-eared duck				OEH 2015
Aves	Maluridae	*Malurus cyaneus*	Superb fairy-wren			Likely	ELA LTIM
Aves	Maluridae	*Malurus lamberti*	Variegated fairy-wren				Bionet
Aves	Maluridae	*Malurus leucopterus*	White-winged fairy-wren				Bionet

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed -ing	Sources
Aves	Maluridae	*Malurus splendens*	Splendid fairy-wren				Bionet
Aves	Meliphagidae	*Manorina flavigula*	Yellow-throated miner				Bionet
Aves	Meliphagidae	*Manorina melanocephala*	Noisy miner				Bionet
Aves	Maluridae	*Megalurus gramineus*	Little grassbird				Capon 2009
Aves	Petroicidae	*Melanodryas cucullata cucullata*	Hooded robin (south-eastern form)	V		Unlikely	OEH 2015
Aves	Meliphagidae	*Melithreptus brevirostris*	Brown-headed honeyeater				OEH 2015
Aves	Meliphagidae	*Melithreptus gularis gularis*	Black-chinned honeyeater (eastern subspecies)	V		Unlikely	OEH 2015
Aves	Psittacidae	*Melopsittacus undulatus*	Budgerigar				Bionet
Aves	Meropidae	*Merops ornatus*	Rainbow bee-eater		J, Mi	Likely	ELA LTIM
Aves	Phalacrocoracidae	*Microcarbo melanoleucos*	Little pied cormorant				Bionet
Aves	Petroicidae	*Microeca fascinans*	Jacky winter				Bionet
Aves	Accipitridae	*Milvus migrans*	Black kite				Bionet
Aves	Alaudidae	*Mirafra javanica*	Horsfield's bush lark				OEH 2015
Aves	Motacillidae	*Motacilla flava*	Yellow wagtail		Mi,M		PMST 2017
Aves	Monarchidae	*Myiagra inquieta*	Restless flycatcher			Likely	ELA LTIM
Aves	Estrildidae	*Neochmia modesta*	Plum-headed finch			Likely	ELA LTIM
Aves	Psittacidae	*Neopsephotus bourkii*	Bourke’s parrot				Capon 2009
Aves	Strigidae	*Ninox connivens*	Barking owl	V		Potential	OEH 2015
Aves	Strigidae	*Ninox novaeseelandiae*	Southern boobook				Bionet
Aves	Psittacidae	*Northiella haematogaster*	Blue bonnet				Bionet
Aves	Ardeidae	*Nycticorax caledonicus*	Nankeen night heron				Bionet
Aves	Cacatuidae	*Nymphicus hollandicus*	Cockatiel				Bionet
Aves	Columbidae	*Ocyphaps lophotes*	Crested pigeon				Bionet
Aves	Pachycephalidae	*Oreoica gutturalis*	Crested bellbird				Bionet

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed -ing	Sources
Aves	Pachycephalidae	*Oriolus sagittatus*	Olive-backed oriole				Fauna 2003
Aves	Anatidae	*Oxyura australis*	Blue-billed duck	V		Potential	Bionet
Aves	Pachycephalidae	*Pachycephala rufiventris*	Rufous whistler				Bionet
Aves	Pardalotidae	*Pardalotus rubricatus*	Red-browed pardalote				Bionet
Aves	Pardalotidae	*Pardalotus striatus*	Striated pardalote				Bionet
Aves	Passeridae	*Passer domesticus*	House sparrow				PMST 2017
Aves	Phasianidae	*Pavo cristatus*	Indian peafowl				Bionet
Aves	Pedionomidae	*Pedionomus torquatus*	Plains-wanderer	E	CE	Unlikely	PMST 2017
Aves	Pelecanidae	*Pelecanus conspicillatus*	Australian pelican				Bionet
Aves	Hirundinidae	*Petrochelidon ariel*	Fairy martin				Bionet
Aves	Hirundinidae	*Petrochelidon nigricans*	Tree martin				Bionet
Aves	Petroicidae	*Petroica goodenovii*	Red-capped robin				Bionet
Aves	Phalacrocoracidae	*Phalacrocorax carbo*	Great cormorant				Bionet
Aves	Phalacrocoracidae	*Phalacrocorax melanoleucos*	Little pied cormorant				Fauna 2003
Aves	Phalacrocoracidae	*Phalacrocorax sulcirostris*	Little black cormorant				Bionet
Aves	Phalacrocoracidae	*Phalacrocorax varius*	Pied cormorant				Bionet
Aves	Columbidae	*Phaps chalcoptera*	Common bronzewing				Bionet
Aves	Meliphagidae	*Philemon citreogularis*	Little friarbird				Bionet
Aves	Meliphagidae	*Philemon corniculatus*	Noisy friarbird			Likely	ELA LTIM
Aves	Threskiornithidae	*Platalea flavipes*	Yellow-billed spoonbill				Bionet
Aves	Threskiornithidae	*Platalea regia*	Royal spoonbill			Known	Bionet
Aves	Psittacidae	*Platycercus adscitus*	Pale-headed rosella				Bionet
Aves	Meliphagidae	*Plectorhyncha lanceolata*	Striped honeyeater				Bionet
Aves	Threskiornithidae	*Plegadis falcinellus*	Glossy ibis		C	Potential	Bionet
Aves	Podargidae	*Podargus strigoides*	Tawny frogmouth				Bionet

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed -ing	Sources
Aves	Podargidae	*Podiceps cristatus*	Great crested grebe carr goose crested grebe diver gaunt loon tippet grebe			Likely	ELA LTIM
Aves	Podicipedidae	*Poliocephalus poliocephalus*	Hoary-headed grebe				Bionet
Aves	Psittaculidae	*Polytelis swainsonii*	Superb parrot	V	V	Unlikely	OEH 2015
Aves	Pomatostomidae	*Pomatostomus halli*	Hall's babbler	V		Potential	OEH 2015
Aves	Pomatostomidae	*Pomatostomus ruficeps*	Chestnut-crowned babbler				Bionet
Aves	Pomatostomidae	*Pomatostomus temporalis temporalis*	Grey-crowned babbler (eastern subspecies)	V		Potential	OEH 2015
Aves	Rallidae	*Porphyrio porphyrio*	Purple swamphen azure-breasted gallinule bald coot black-backed gallinule black-backed water-hen blue bald coot blue-breasted swamphen eastern swamphen macquarie water-hen pukeko purple gallinule purple water-hen redbill swamphen tarler bird western swamphen			Likely	ELA LTIM
Aves	Rallidae	*Porzana tabuensis*	Spotless crake leaden crake little swamphen little tarler bird little waterhen putoto spotless water crake swamp rail tabuan crake			Likely	ELA LTIM
Aves	Psittacidae	*Psephotus haematonotus*	Red-rumped parrot			Likely	ELA LTIM
Aves	Psittacidae	*Psephotus varius*	Mulga parrot				Bionet
Aves	Ptilonorhynchidae	*Ptilonorhynchus maculatus*	Spotted bowerbird				Bionet

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed -ing	Sources
Aves	Meliphagidae	*Ptilotula penicillatus*	White-plumed honeyeater				OEH 2015
Aves	Recurvirostridae	*Recurvirostra novaehollandiae*	Red-necked avocet				Bionet
Aves	Rhipiduridae	*Rhipidura albiscapa*	Grey fantail				OEH 2015
Aves	Rhipiduridae	*Rhipidura leucophrys*	Willie wagtail				Bionet
Aves	Rostratulidae	*Rostratula australis*	Australian painted snipe		E	Unlikely	PMST 2017
Aves	Rostratulidae	*Rostratula benghalensis*	Painted snipe	E	Mi	Unlikely	PMST 2017
Aves	Acanthizidae	*Smicrornis brevirostris*	Weebill				Bionet
Aves	Estrildidae	*Stagonopleura guttata*	Diamond firetail	V		Potential	Bionet
Aves	Laridae	*Sterna hybrida*	Whiskered tern				Capon 2009
Aves	Anatidae	*Stictonetta naevosa*	Freckled duck	V		Known	OEH 2015
Aves	Glareolidae	*Stiltia isabella*	Australian pratincole				Bionet
Aves	Artamidae	*Strepera graculina*	Pied currawong				ELA LTIM
Aves	Corcoracidae	*Struthidea cinerea*	Apostlebird				Bionet
Aves	Sturnidae	*Sturnus vulgaris*	Common starling				OEH 2015
Aves	Podicipedidae	*Tachybaptus novaehollandiae*	Australasian grebe				Bionet
Aves	Anatidae	*Tadorna tadornoides*	Australian shelduck				Bionet
Aves	Estrildidae	*Taeniopygia bichenovii*	Double-barred finch				Bionet
Aves	Estrildidae	*Taeniopygia guttata*	Zebra finch				Bionet
Aves	Threskiornithidae	*Threskiornis aethiopica*	White ibis				Capon 2009
Aves	Threskiornithidae	*Threskiornis molucca*	Australian white ibis				Bionet
Aves	Threskiornithidae	*Threskiornis spinicollis*	Straw-necked ibis				Bionet
Aves	Alcedinidae	*Todiramphus pyrrhopygius*	Red-backed kingfisher				Fauna 2003
Aves	Alcedinidae	*Todiramphus sanctus*	Sacred kingfisher			Likely	ELA LTIM
Aves	Rallidae	*Tribonyx ventralis*	Black-tailed native-hen				Bionet
Aves	Rallidae	*Tringa glareola*	Wood sandpiper			Likely	ELA LTIM
Aves	Rallidae	*Tringa nebularia*	Common greenshank		C,J,K	Potential	OEH 2015

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed -ing	Sources
Aves	Rallidae	*Tringa stagnatilis*	Marsh sandpiper				Fauna 2003
Aves	Turdidae	*Turdus merula*	Common blackbird				PMST 2017
Aves	Tytonidae	*Tyto javanica*	Eastern barn owl				Bionet
Aves	Charadriidae	*Vanellus miles*	Masked lapwing				Bionet
Aves	Charadriidae	*Vanellus tricolor*	Banded lapwing				Bionet
Crustacea	Parastacidae	*Cherax destructor*	Yabby			Likely	ELA LTIM
Gastropoda	Viviparidae	*Notopala sublineata*	Darling river snail	CE		Potential	Biosis 2016
Mammalia	Dasyuridae	*Antechinomys laniger*	Kultarr	E		Potential	Bionet
Mammalia	Molossidae	*Austronomus australis*	White-striped freetail-bat				Bionet
Mammalia	Bovidae	*Bos taurus*	Domestic cattle				PMST 2017
Mammalia	Canidae	*Canis lupus familiaris*	Dog				PMST 2017
Mammalia	Bovidae	*Capra hircus*	Feral goat				Fauna 2003
Mammalia	Vespertilionidae	*Chalinolobus gouldii*	Gould's wattled bat				Bionet
Mammalia	Vespertilionidae	*Chalinolobus morio*	Chocolate Wattled Bat			Likely	ELA
Mammalia	Vespertilionidae	*Chalinolobus picatus*	Little pied bat	V		Potential	Bionet
Mammalia	Felidae	*Felis catus*	Cat				Bionet
Mammalia	Leporidae	*Lepus capensis*	Brown hare				Bionet
Mammalia	Leporidae	*Lepus europaeus*	Hare			Likely	ELA LTIM
Mammalia	Macropodidae	*Macropus fuliginosus*	Western grey kangaroo				Bionet
Mammalia	Macropodidae	*Macropus giganteus*	Eastern grey kangaroo				Bionet
Mammalia	Macropodidae	*Macropus robustus*	Common wallaroo				Bionet
Mammalia	Macropodidae	*Macropus rufus*	Red kangaroo				Bionet
Mammalia	Molossidae	*Mormopterus eleryi*	Bristle-faced free-tailed bat	E		Unlikely	OEH 2015
Mammalia	Molossidae	*Mormopterus petersi*	Inland free-tailed bat				OEH 2015
Mammalia	Molossidae	*Mormopterus planiceps*	Southern freetail bat				Fauna 2003

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed-ing	Sources
Mammalia	Muridae	*Mus musculus*	House mouse				Bionet
Mammalia	Vespertilionidae	*Myotis macropus*	Southern myotis	V		Unlikely	OEH 2015
Mammalia	Vespertilionidae	*Nyctophilus corbeni*	Corben's long-eared bat, South-eastern long-eared bat	V	V	Unlikely	PMST 2017
Mammalia	Vespertilionidae	*Nyctophilus geoffroyi*	Lesser long-eared bat				Bionet
Mammalia	Vespertilionidae	*Nyctophilus gouldi*	Gould's Long-eared bat			Likely	ELA
Mammalia	Leporidae	*Oryctolagus cuniculus*	European rabbit				Fauna 2003
Mammalia	Bovidae	*Ovis aries*	Sheep			Likely	ELA LTIM
Mammalia	Phascolarctidae	*Phascolarctos cinereus*	Koala	V	V	Potential	OEH 2015
Mammalia	Dasyuridae	*Planigale gilesi*	Paucident planigale				Bionet
Mammalia	Muridae	*Rattus* sp.	Rat				Bionet
Mammalia	Muridae	*Rattus villosissimus*	Long-haried rat	V		Unlikely	OEH 2015
Mammalia	Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied sheathtail-bat	V		Potential	Bionet
Mammalia	Vespertilionidae	*Scotorepens balstoni*	Inland broad-nosed bat				Bionet
Mammalia	Vespertilionidae	*Scotorepens greyii*	Little broad-nosed bat				Bionet
Mammalia	Dasyuridae	*Sminthopsis crassicaudata*	Fat-tailed dunnart				Bionet
Mammalia	Dasyuridae	*Sminthopsis macroura*	Stripe-faced dunnart	V		Unlikely	OEH 2015
Mammalia	Dasyuridae	*Sminthopsis murina*	Common dunnart				Bionet
Mammalia	Suidae	*Sus scrofa*	Feral pig				Fauna 2003
Mammalia	Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked echidna			Likely	ELA LTIM
Mammalia	Vespertilionidae	*Vespadelus baverstocki*	Inland forest bat	V		Potential	OEH 2015
Mammalia	Vespertilionidae	*Vespadelus vulturnus*	Little Forest Bat			Likely	ELA
Mammalia	Canidae	*Vulpes vulpes*	European fox				Fauna 2003
Mammalia	Macropodidae	*Wallabia bicolor*	Swamp wallaby				Fauna 2003

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed -ing	Sources
Reptilia	Typhlopidae	*Anilios bituberculatus*	Prong-snouted blind snake				Bionet
Reptilia	Typhlopidae	*Anilios endoterus*	Interior blind snake	E		Potenti al	Bionet
Reptilia	Typhlopidae	*Anilios ligatus*	Robust blind snake				Bionet
Reptilia	Boidae	*Antaresia stimsoni*	Stimson's python	V			OEH 2015
Reptilia	Chelidae	*Chelodina expansa*	Broad-shelled turtle			Likely	ELA LTIM
Reptilia	Chelidae	*Chelodina longicollis*	Eastern long-necked turtle			Likely	ELA LTIM
Reptilia	Scincidae	*Cryptoblepharus australis*	Inland snake-eyed skink				Bionet
Reptilia	Scincidae	*Cryptoblepharus carnabyi*	Carnaby's wall skink				Fauna 2003
Reptilia	Scincidae	*Cryptoblepharus pannosus*	Ragged snake-eyed skink				Bionet
Reptilia	Scincidae	*Cryptoblepharus* sp.					Bionet
Reptilia	Scincidae	*Cryptoblephaurs carnabyi*	Carnaby's wall skink				Capon 2009
Reptilia	Scincidae	*Ctenophorus nuchalis*	Central netted dragon				Fauna 2003
Reptilia	Scincidae	*Ctenotus leonhardii*	Leonhardi's ctenotus				Bionet
Reptilia	Scincidae	*Ctenotus olympicus*					Bionet
Reptilia	Scincidae	*Ctenotus pantherinus ocellifer*	Leopard ctenotus	E			Bionet
Reptilia	Scincidae	*Ctenotus regius*	Pale-rumped ctenotus				Bionet
Reptilia	Scincidae	*Ctenotus schomburgkii*	Barred wedgesnout ctenotus				Bionet
Reptilia	Pygopodidae	*Delma inornata*	Inornate delma				Fauna 2003
Reptilia	Elapidae	*Denisonia devisi*	De vis' banded snake				Bionet
Reptilia	Gekkonidae	*Diplodactylus steindachneri*	Box-patterned gecko				Fauna 2003
Reptilia	Gekkonidae	*Diplodactylus tessellatus*	Tessellated gecko				Bionet
Reptilia	Gekkonidae	*Diplodactylus vittatus*	Wood gecko				Bionet
Reptilia	Gekkonidae	*Dlema inornata*	Inornate delma				Capon 2009
Reptilia	Scincidae	*Egernia striolata*	Tree skink				Bionet
Reptilia	Chelidae	*Emydura macquarii*	Macquarie turtle				Bionet
Reptilia	Elapidae	*Furina diadema*	Red-naped snake				Bionet

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed -ing	Sources
Reptilia	Gekkonidae	*Gehyra variegata*	Tree dtella				Bionet
Reptilia	Gekkonidae	*Heteronotia binoei*	Bynoe's gecko				Bionet
Reptilia	Scincidae	*Lerista labialis*	Southern sandslider				Bionet
Reptilia	Scincidae	*Lerista muelleri*	Wood mulch-slider				Bionet
Reptilia	Scincidae	*Lerista punctatovittata*	Eastern robust slider				Bionet
Reptilia	Scincidae	*Lerista timida*	Timid slider				Bionet
Reptilia	Pygopodidae	*Lialis burtonis*	Burton's snake-lizard				Bionet
Reptilia	Agamidae	*Lophognathus burnsi*	Burns' dragon				Bionet
Reptilia	Gekkonidae	*Lucasium damaeum*	Beaded gecko				Bionet
Reptilia	Gekkonidae	*Lucasium steindachneri*	Box-patterned gecko				Bionet
Reptilia	Scincidae	*Menetia greyii*	Common dwarf skink				Bionet
Reptilia	Scincidae	*Morethia boulengeri*	Boulenger’s skink				Capon 2009
Reptilia	Gekkonidae	*Nephrurus levis*	Three-lined knob-tail				Bionet
Reptilia	Gekkonidae	*Oedura marmorata*	Marbled velvet gecko				Bionet
Reptilia	Elapidae	*Parasuta dwyeri*	Dwyer's snake				Bionet
Reptilia	Elapidae	*Parasuta nigriceps*	Mitchell's short-tailed snake				OEH 2015
Reptilia	Agamidae	*Pogona barbata*	Bearded dragon				Bionet
Reptilia	Agamidae	*Pogona vitticeps*	Central bearded dragon				Bionet
Reptilia	Elapidae	*Pseudechis australis*	King brown snake				Bionet
Reptilia	Elapidae	*Pseudonaja aspidorhyncha*	Strap-snouted brown snake				Bionet
Reptilia	Elapidae	*Pseudonaja modesta*	Ringed brown snake	E		Potential	OEH 2015
Reptilia	Elapidae	*Pseudonaja textilis*	Eastern brown snake				Bionet
Reptilia	Typhlopidae	*Ramphotyphlops bituberculatus*	Prong-snouted blind snake				OEH 2015
Reptilia	Typhlopidae	*Ramphotyphlops endoterus*	Interior blind snake	E			OEH 2015
Reptilia	Typhlopidae	*Ramphotyphlops ligatus*	Robust blind snake				OEH 2015
Reptilia	Typhlopidae	*Ramphotyphlops* sp.	Unidentified blind snake				OEH 2015

Class	Family	Scientific Name	Common Name	NSW status	Comm status	Breed -ing	Sources
Reptilia	Diplodactylidae	*Rhynchoedura angusta*	Border beaked gecko				Bionet
Reptilia	Diplodactylidae	*Rhynchoedura ormsbyi*	Eastern beaked gecko				Bionet
Reptilia	Diplodactylidae	*Rhynchoedura ornata*	Beaked gecko				Fauna 2003
Reptilia	Elapidae	*Suta suta*	Curl snake				Bionet
Reptilia	Scincidae	*Tiliqua rugosa*	Shingle-back				Bionet
Reptilia	Scincidae	*Tiliqua scincoides*	Common blue-tongue				Fauna 2003
Reptilia	Scincidae	*Trachydosaurus rugosus*	Shingleback lizard				Capon 2009
Reptilia	Agamidae	*Tympanocryptis tetraporophora*	Eyrean earless dragon				Bionet
Reptilia	Gekkonidae	*Underwoodisaurus milii*	Thick-tailed gecko				Bionet
Reptilia	Varanidae	*Varanus gouldii*	Gould's goanna				Bionet
Reptilia	Varanidae	*Varanus* sp.	Unidentified goanna				Bionet
Reptilia	Varanidae	*Varanus tristis*	Black-headed monitor				Bionet
Reptilia	Varanidae	*Varanus varius*	Lace monitor				OEH 2015
Reptilia	Elapidae	*Vermicella annulata*	Bandy-bandy				Bionet
Retilia	Chelidae	*Emydura macquarii macquarii*	Murray turtle			Likely	ELA LTIM

Appendix F Likelihood of Occurrence

Table A 1: Threatened ecological communities likelihood table

Community Name	Conservation Status		Habitat	BC Act listing equivalent	Habitat present (good, marginal, none)	Community known to occur in region (yes/no)	Community known to occur on site (yes/no)	Likelihood of occurrence	Impact Assessment Required
	BC Act	EPBC Act							
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	E	E	Found on the grey, self-mulching clays of periodically waterlogged floodplains, swamp margins, ephemeral wetlands, stream levees, drainage depressions and gilgais.	Coolibah-Black Box Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain and Mulga Lands Bioregions	Good	Yes	Yes	Yes	Yes

Table A 2: Threatened flora likelihood table

Scientific Name	Common Name	Conservation Status		Habitat	Habitat quality present (good, marginal, none)	Likelihood of occurrence	Impact Assessment Required
		BC Act	EPBC Act				
Atriplex infrequens	A saltbush	V	V	Broad drainage tracts, clay flats and possibly occasionally inundated habitats.	Good	Likely	Yes
Austrostipa metatoris	A spear-grass	V	V	Sandhills, sandridges, undulating plains and flat open mallee country, with red to red-brown clay-loam to sandy-loam soils.	Marginal	No	No
Dentella minutissima		E		"Mud flats, edges of drainage lines and waterholes, riparian sandy banks, white sandy-clay soil in damp areas and grey cracking clays.	Marginal	Potential	Yes

Scientific Name	Common Name	Conservation Status		Habitat	Habitat quality present (good, marginal, none)	Likelihood of occurrence	Impact Assessment Required
		BC Act	EPBC Act				
Lepidium monoplocoides	Winged Peppercress	E	E	Open woodland dominated by Allocasuarina luehmannii and/or eucalypts, wetland-grassland, or Maireana pyramidata shrubland. Occurs on seasonally moist to waterlogged sites, with heavy fertile soils.	Marginal	Unlikely	No

Table A 3: Threatened fauna likelihood table

Scientific Name	Common Name	Conservation Status		Habitat	Habitat quality present (good, marginal, none)	Likelihood of occurrence	Impact Assessment Required
		BC Act	EPBC Act				
Fish							
Maccullochella peelii	Murray Cod		V	Clear rocky streams to slow flowing, turbid rivers and billabongs. Frequently found in the main river channel and larger tributaries; also in floodplain channels when they contain water.	Good	Likely	Yes
Birds							
Amytornis modestus	Thick-billed Grasswren (eastern subspecies)	E4A	V	Saltbush, cottonbush, bluebush and nitre-bush areas on sandy plains or depressions in gibber; also along watercourses in clumps of Canegrass.	Marginal	No	No
Ardeotis australis	Australian Bustard	E1		Tussock and hummock grasslands, low shrublands and low open grassy woodlands; occasionally seen in pastoral and cropping country, golf courses and near dams.	Marginal	Potential	Yes
Calidris ferruginea	Curlew Sandpiper	E1	CE, M	"Littoral and estuarine habitats, including intertidal mudflats, non-tidal swamps, lakes and lagoons on the coast and sometimes inland."	Marginal	Unlikely	No

Scientific Name	Common Name	Conservation Status		Habitat	Habitat quality present (good, marginal, none)	Likelihood of occurrence	Impact Assessment Required
		BC Act	EPBC Act				
Calyptorhynchus banksii samueli	Red-tailed Black-Cockatoo (inland subspecies)	V		Dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimbil box woodlands.	Good	Likely	Yes
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V		Eucalypt woodlands and dry open forest.	Good	No	No
Daphoenositta chrysoptera	Varied Sittella	V		Inhabits eucalypt forests and woodlands, mallee and Acacia woodland.	Good	likely	Yes
Epthianura albifrons	White-fronted Chat	V		Saltmarsh vegetation, open grasslands and sometimes low shrubs bordering wetland areas.	Good	Potential	Yes
Falco hypoleucos	Grey Falcon	E1		Shrubland, grassland and wooded watercourses, occasionally in open woodlands near the coast, and near wetlands.	Good	Likely	Yes
Falco subniger	Black Falcon	V		Woodland, shrubland and grassland, especially riparian woodland and agricultural land. Often associated with streams or wetlands.	Good	Likely	Yes
Grantiella picta	Painted Honeyeater	V	V	Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests.	None	No	No
Grus rubicunda	Brolga	V		Open wetlands, grassy plains, coastal mudflats and irrigated croplands and, on the coast, mangrove-studded creeks and estuaries.	Marginal	Potential	Yes
Hieraaetus morphnoides	Little Eagle	V		Open eucalypt forest, woodland or open woodland, including sheoak or Acacia woodlands and riparian woodlands of interior NSW.	Good	Likely	Yes
Leipoa ocellata	Malleefowl	E1	V	Predominantly mallee communities. Less frequently found in other eucalypt woodlands, such as Inland Grey Box, Ironbark or Bimble Box Woodlands, or other woodlands dominated by Mulga or native Cypress Pine species.	Marginal	No	No

Scientific Name	Common Name	Conservation Status		Habitat	Habitat quality present (good, marginal, none)	Likelihood of occurrence	Impact Assessment Required
		BC Act	EPBC Act				
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V		Wide range of treed and treeless inland habitats, always within easy reach of water.	Good	Likely	Yes
Oxyura australis	Blue-billed Duck	V		Coastal and inland wetlands and swamps.	Marginal	Potential	Yes
Pedionomus torquatus	Plains-wanderer	E1	CE	Semi-arid, lowland native grasslands that typically occur on hard red-brown soils.	Good	No	No
Rostratula australis	Australian Painted Snipe	E1	E	Swamps, dams and nearby marshy areas.	Good	Unlikely	No
Mammals							
Chalinolobus picatus	Little Pied Bat	V		Dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimbil box woodlands.	Good	Likely	Yes
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	Mallee, *Allocasuarina luehmannii* (bulloke) and box eucalypt-dominated communities, especially box/ironbark/cypress-pine vegetation.	Good	No	No
Phascolarctos cinereus	Koala	V	V	Eucalypt forest and woodland communities, including coastal forests, rainforests, riparian areas, swamp sclerophyll forests, heathland and shrubland.	Good	Likely	Yes
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V		Almost all habitats, including wet and dry sclerophyll forest, open woodland, open country, mallee, rainforests, heathland and waterbodies.	Good	Yes	Yes

Appendix G BC Act Assessment of Significance (5-Part Test)

Coolibah-Black Box Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain and Mulga Lands Bioregions (EEC)

The Coolibah-Black Box Woodland is found on the grey, self-mulching clays of periodically waterlogged floodplains, swamp margins, ephemeral wetlands, and stream levees. The structure of the community may vary from tall riparian woodlands to very open 'savanna like' grassy woodlands with a sparse midstorey of shrubs and saplings. Typically, these woodlands form mosaics with grasslands and wetlands, and are characterised by Coolibah (Eucalyptus coolabah) and, in some areas, Black Box (E. largiflorens). Other tree species may be present including River Cooba (Acacia stenophylla), Cooba (A. salicina), Belah (Casuarina cristata) and Eurah (Eremophila bignoniiflora, OEH, 2019b).

a. in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

A maximum of 13.22 ha of Coolabah-Black Box Woodland was assessed for the proposed modifications to Toorale water infrastructure, and only a very small area actually cleared. There is a further 18,600 ha of this community occurring within the Toorale National Park which will not be impacted by the proposal. It is therefore considered unlikely that there will be an adverse effect on the extent of the ecological community such that its local occurrence would be placed at risk of extinction.

The potential for direct and secondary impacts associated with erosion, sedimentation and the transportation of weed propagules is to be managed via mitigation measures, to ensure that the composition of the EEC is not affected by the proposal.

c. in relation to the habitat of a threatened species or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The maximum area of this EEC assessed is 13.22 ha, and direct and in-direct impacts associated with the Toorale water infrastructure modifications are likely to be much less than this total area. Existing access tracks will be used where possible to prevent unnecessary disturbance.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Due to the small size of the proposed impact area and the EEC existing beyond and adjacent to the proposal boundaries the habitat is unlikely to become further fragmented or isolated.

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The Coolabah-Black Box woodland to be removed or modified is not considered to be important for the long-term survival of the EEC in the locality given the areas adjacent to the proposal area that will not be impacted. In addition, while up to 13.22 ha has been assessed within the study area, approximately 18,600ha of this EEC exists within Toorale National Park.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas identified under the BC Act as 'declared areas of outstanding biodiversity value' will be affected by the proposed activity.

e. the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

A key threatening process is defined under the BC Act as "*a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities*". The proposal has the potential to contribute to the following Key Threatening Processes (KTP):

- Clearing of native vegetation
- Invasion of native plant communities by exotic perennial grasses.

Whilst the proposal would increase the impact of the above threatening processes within the proposal area, the scale of the impact is not considered to be significant. The potential for weed invasion of the EEC will be managed through the recommendations in this report.

Conclusions

The proposal is considered unlikely to have a significant impact on this community due to:

- the limited extent of the impacts that would result from the proposed disturbance
- Only partial clearing is expected to occur within the proposed area
- the extent of EEC that remains adjacent to the study area and the wider region

Atriplex infrequens

Atriplex infrequens is a small spreading forb, with numerous branches covered with a minute scaly layer. The leaves are narrow, to 15 mm long. The flowers are clustered or solitary in the leaf axils (the angle where the leaves join the stem). The fruiting body is compressed and membranous with a dense covering of short soft hairs. It is associated with broad drainage tracts, clay flats and possibly occasionally inundated habitats. Very little ecological information is available for this specie, so it's critical habitat components can only be speculated as relatively undisturbed and ungrazed drainage lines and flats (OEH, 2018b).

No individuals have been recorded within the proposed disturbance areas, with the closest known record occurring approximately 9km north east of Homestead Dam in 2011 (ALA, 2019).

a. in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

It's lifecycle can be impacted by direct impacts of habitat removal or by indirect impacts which are undertaken during important stages of the species lifecycle or which reduce habitat quality. In order to place populations at risk of extinction, the impacts would have to be of a magnitude and duration that would inhibit the continual completion of the lifecycle stages

Atriplex infrequens is very uncommon, with the closest known record being approximately 9km north east of Homestead Dam. As the plant was not located within the proposed disturbance areas during the field survey, it is considered unlikely that the proposal would affect the lifecycle of this species such that it would place a local viable population at risk of extinction.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

c. in relation to the habitat of a threatened species or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Very little ecological information is available for this species, so it's critical habitat components can only be speculated as relatively undisturbed and ungrazed drainage lines and flats. Based on the above information it is concluded that a relatively small area of potential habitat may be removed or modified by this proposal.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

Given that the proposal consists of the modification of a small portion of potential habitat that exists within the locality, and that habitat would remain unaffected adjacent to the proposal area, the level of disturbance is unlikely to cause fragmentation or isolation of the species.

iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Given that field survey recorded no individuals occurring within the proposal area, the habitat to be modified by the proposal is not likely to be important for the long-term survival of this species.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal will not have any adverse effect on any declared area of outstanding biodiversity value.

e. the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A key threatening process is defined under the BC Act as "a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities". One key threatening process is relevant to *Atriplex infrequens* and the current proposal:

- Clearing of native vegetation

Whilst the proposal would increase the above threatening process, the scale of the impact is not considered to be significant.

Conclusions

The proposed disturbance is unlikely to significantly impact a local population of *Atriplex infrequens* given that:

- The proposal is expected to result in only partial disturbance of the potential impact area
- The proposal will not isolate or fragment any current connecting areas of habitat
- The closest known record of this species is approximately 9 km North of Homestead Dam

On the basis of the above consideration, it is not likely that the proposal will result in a significant impact on the survival of *Atriplex infrequens* at the locality. Consequently, a Species Impact Statement (SIS) is not required for the proposal with respect to this species.

Dentella minutissima

Dentella minutissima is a small, fleshy, mat-forming herb, covered with translucent hairs. Plants are often found creeping in mud and rooting at the nodes, forming a dense, green, carpet-like covering on the soil. Flowering time is late winter to autumn. It is often found on mud flats around a drying waterhole, sandy silt on the edge of a drainage line, white sandy-clay soil in damp areas and grey cracking clays in river bed or edges of waterholes (OEH, 2018b).

No individuals were recorded within the proposed disturbance area, however as this species is ephemeral it may occur within the proposal area owing to the right conditions. The closest known record of this species occurs 5 km south east of Homestead Dam (OEH, 2018a).

f. in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Dentella minutissima is known to disperse downstream during floods (OEH, 2018b). The removal of the embankment at Peebles Dam and the recommissioning of inlet pipes placed at Homestead Dam are expected to improve connectivity of the Warrego River. This will enable for a more sustained flow for the dispersal of this species downstream. Therefore, it is considered unlikely that the proposal would affect the lifecycle of this species such that it would place a local viable population at risk of extinction.

g. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

iii. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

iv. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

h. in relation to the habitat of a threatened species or ecological community:

iv. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed works may initially modify or remove a relatively small area potential habitat. After the initial disturbance, much of the habitat is expected to regenerate.

v. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

Given that habitat adjacent to the proposal area will remain unaffected and the infrastructure will allow for greater river connectivity resulting in a more sustained flow for this species dispersal, the level of disturbance is unlikely to cause fragmentation or isolation of the species.

vi. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The habitat that will be modified by the proposal is not expected to be important for the long-term survival of the species.

i. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal will not have any adverse effect on any declared area of outstanding biodiversity value.

j. t*he action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

A key threatening process is defined under the BC Act as “a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities”. Two key threatening process are relevant to *Dentella minutissima* in the current proposal:

- Clearing of native vegetation
- Changed flooding, drainage patterns and river regulation.

Whilst the proposal would increase the above threatening process, the scale of the impact is not considered to be significant.

Conclusions

The proposed disturbance is unlikely to significantly impact a local population of *Dentella minutissima* given that:

- No individuals will be removed by the proposal
- A relatively small area of potential habitat may be affected, although this is a small portion that is found within the locality
- The proposal will not isolate or fragment any current connecting areas of habitat
- Closest known record of this species is approximately 5km south east of the proposal

- Proposed infrastructure is expected to improve river connectivity

On the basis of the above consideration, it is not likely that the proposal will result in a significant impact on the survival of *Dentella minutissima* at the locality. Consequently, a SIS is not required for the proposal with respect to this species.

Ardeotis australis (Australian Bustard)

The Australian Bustard is a very large, heavy-bodied, ground-dwelling bird up to one m tall. The head, neck and breast are white, with dark grey specks. The upper surface of the wings and tail are brown with fine dark patterns. There is a bold black and white patch on the lower edge of the wing. It mainly occurs in inland Australia, inhabiting tussock and hummock grasses, low shrublands, grassy woodlands and near dams (OEH, 2018b).

No individual was recorded during the field survey, although the Australian bustard was recorded nearby Homestead Dam in 1994 (OEH, 2018a).

a. in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The proposal is not expected to have an adverse effect on the life cycle of this species as suitable foraging and nesting habitat will remain adjacent to the proposed area, and throughout the locality.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

c. in relation to the habitat of a threatened species or ecological community:

vii. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposal scope involves the potential removal/modification of 22 ha of habitat that is found within the proposal area.

viii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

The proposal will not fragment or isolate areas of habitat for this species due to the potential habitat that will remain adjacent to the proposal area, throughout the locality and that this species is highly mobile.

ix. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Due to the last known record of this species within the area, occurred in 1994, the habitat that will be modified by the proposal is not expected to be important for the long-term survival of the species.

k. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal will not have any adverse effect on any declared area of outstanding biodiversity value.

l. the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

A key threatening process is defined under the BC Act as "a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities". One key threatening process is relevant to *Ardeotis australis* and the current proposal:

- Clearing Loss, fragmentation and degradation of semi-arid open grassland woodlands

Whilst the proposal would increase the above threatening process, the scale of the impact is not considered to be significant.

Conclusions

The proposed disturbance is unlikely to significantly impact a local population of *Ardeotis australis* given that:

- Up to 22 ha of potential habitat may be disturbed within the study area. This is a small portion of similar habitat that is found within the locality
- The proposal will not isolate or fragment any current connecting areas of habitat
- Most previous known record of this species within the area occurred in 1994

On the basis of the above consideration, it is not likely that the proposal will result in a significant impact on the survival of *Ardeotis australis* at the locality. Consequently, a SIS is not required for the proposal with respect to this species.

***Calyptorhynchus banksia samueli* (Red-tailed Black-Cockatoo – inland species)**

The Red-tailed Black-Cockatoo (inland species) is a large black cockatoo with a strong bill and large crest. Male birds have a broad band of bright red across the tail. Female and immature birds have yellow spots on the head, neck and wings, yellowish bars across the chest and a paler red band across the tail. This species can be distinguished from the similar Glossy Black-Cockatoo by its greater size, large crest and louder call. They are found throughout a variety of habitats, but prefer Eucalyptus forests and woodlands, particularly river red gum and coolabah lined water courses (OEH, 2019b).

No individual was recorded during the field survey, although an individual has been recorded 4km south east of Homestead Dam in 1995 (OEH, 2019a).

m. in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The proposal is not expected to have an adverse effect on the life cycle of this species as roosting and foraging habitat will remain adjacent to the proposal area. In addition, pre-clearance surveys will be completed to ensure any habitat trees are felled under supervision by a trained ecologist.

n. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

v. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

vi. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

o. in relation to the habitat of a threatened species or ecological community:

x. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed works will potentially remove or modify a relatively small area of potential habitat.

xi. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

The proposal will not fragment or isolate areas of habitat for this species as the narrow extent of clearing associated with the proposal will not impact the ability of this highly-mobile species to move between areas of habitat.

xii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The proposed disturbance area provides potential foraging, roosting and breeding habitat for the Red-tailed Black-Cockatoo. However, given the availability of good quality habitat within the local vicinity, the habitat to be impacted by the proposed works is not likely to be important to the long-term survival of the species at the locality.

p. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal will not have any adverse effect on any declared area of outstanding biodiversity value.

q. the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

A key threatening process is defined under the BC Act as “a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities”. Three key threatening processes are relevant to Red-tailed Black-Cockatoo in the current proposal:

- Clearing of native vegetation
- Removal of dead wood and dead trees

Whilst the proposal would increase the impact of the above threatening processes within the proposal area, the scale of the impact is not considered to be significant.

Conclusions

The proposed disturbance is unlikely to significantly impact a local population of Red-tailed Black-Cockatoo given that:

- A relatively small area of potential habitat within the area may be removed or disturbed. Potential habitat will remain adjacent to the proposal and within the locality
- The proposal will not isolate or fragment any current connecting areas of habitat.
- It is unlikely that the disturbance will disrupt the lifecycle of this highly mobile species.

On the basis of the above consideration, it is not likely that the proposal will result in a significant impact on the survival of Red-tailed Black-Cockatoo at the locality. Consequently, a SIS is not required for the proposal with respect to this species.

***Daphoenositta chrysoptera* (Varied Sittella)**

The Varied sittella is a small (10 cm) songbird with a sharp, slightly upturned bill, short tail, barred undertail, and yellow eyes and feet. In flight the orange wing-bar and white rump are prominent. Distribution in NSW is continuous from the coast to the far West (including the Darling Riverine Plains). The Varied Sitella inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland (OEH, 2019b).

This species was recorded within the proposal area at Homestead Dam in 2015 (OEH, 2015a). During field survey an individual was also recorded to the North at Booka dam.

a. in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The proposed development would involve clearing or disturbance of a relatively small area of potential foraging and roosting habitat within the 22 ha study area. Habitat will remain adjacent to the proposed area and is spread widely throughout the locality meaning there is ample foraging habitat within the local area.

Given that this species is highly mobile, and that there is a relatively high abundance of similarly-aged trees and similar habitat in the surrounding landscape, it is considered unlikely that the proposal would impact on these species' lifecycles such that they would place viable local populations at risk of extinction. Prior to clearing, potentially impacted habitat trees will be identified and marked. A suitably qualified person will supervise the felling to assist in the recovery of any injured fauna.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

c. in relation to the habitat of a threatened species or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed disturbance will impact a relatively small area of potential habitat within the proposal area. Impacts to mature hollow bearing trees will be minimised, however, where necessary removal shall be supervised by suitably qualified staff as part of the proposed works.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

The small-scale clearing of the proposed area is unlikely to impede the movement of these highly mobile species between habitat patches.

iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The area of potential habitat that would be removed is unlikely to be important to the long-term survival of local populations of these species, as there is a large amount of similar vegetation located adjacent to the proposed areas and within the locality.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal will not have any adverse effect on any declared area of outstanding biodiversity value.

e. the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A key threatening process is defined under the BC Act as “a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities”. Two key threatening process are relevant to the Varied Sittella and the current proposal:

- Clearing of native vegetation
- Potential loss of hollow bearing trees

Whilst the proposal would result in clearing of native vegetation, the scale of the impact is not considered to be significant. Loss of hollow bearing trees shall be minimised and, where necessary, clearing will be supervised to minimise potential direct impacts to hollow-dwelling fauna.

Conclusions

The proposed disturbance is unlikely to significantly impact the Varied Sittella given that:

- These species are highly mobile and forages widely
- The proposal will not isolate or fragment any current connecting areas of habitat in terms of use by these highly mobile species
- Potential habitat for this species would remain at the site, directly adjacent to the proposed area and throughout the locality.

Therefore, the proposal is unlikely to have a significant impact on the microbat species listed above and their survival in the locality. As such, a SIS is not required.

***Epthianura albifrons* (White-fronted Chat)**

The White-fronted Chat is an endemic Australian passerine bird, 12 cm in length and weighing approximately 13 g. It has a short slender bill, long spindly legs, a short square-tipped tail and rounded wings. It is found across the southern half of Australia, from southernmost Queensland to southern Tasmania. They are usually found foraging on bare or grassy ground in wetland areas, and breed from late July through to early March, with 'open cut' nests built in low vegetation (OEH, 2018b)

This species was recorded approximately 3.5 km north east of Homestead Dam in 2015 (OEH, 2018a).

a. in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The proposed development would involve partial clearing or modification of relatively small area of potential foraging and nesting habitat within the 22 ha study area. Suitable habitat will remain unimpacted adjacent to the proposed area and is spread widely throughout the locality. As a result, there remains ample foraging habitat within the local area.

To avoid directly impacting on the species, the removal of habitat should occur outside the breeding season between late July and early March. If clearing is to occur within this period targeted searches for the distinct 'open-cup' shaped nests should be conducted prior to clearing. If a nest is located within the construction path an experienced ecologist should attempt to translocate the nest.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

c. in relation to the habitat of a threatened species or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed disturbance will impact a relatively small area of habitat within the proposal area.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

The small-scale clearing of the proposed area is unlikely to fragment the species as there is suitable habitat available extending beyond the boundary of the survey site.

iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The proposal may result in the removal or modification of relatively small areas of potential habitat for the White-fronted Chat. However, extensive areas of potential habitat extend within and beyond the study area that offer roosting and breeding habitat for this species.

Given the small amount of habitat that will be affected and the extent of the habitat adjacent to the proposed areas that will remain unaffected, it is considered unlikely that the proposed removal and modification would be critical to the long-term survival of the species within the locality.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal will not have any adverse effect on any declared area of outstanding biodiversity value.

e. the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A key threatening process is defined under the BC Act as "a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities". Two key threatening process are relevant to the White-fronted Chat in the current proposal:

- Clearing of native vegetation
- Loss of foraging and nesting habitat

Whilst the proposal would increase the above threatening process, the scale of the impact is not considered to be significant due to the ample foraging habitat that is to remain adjacent to the proposal area and in the locality.

Conclusions

The proposed disturbance is unlikely to significantly impact the White-fronted Chat given that:

- The proposed works would constitute a minor disturbance, given the larger areas of suitable habitat found beyond the proposal boundary that will remain unaffected
- If clearing works are completed outside of the breeding periods, there should be little to no impact upon the species
- The proposal will not isolate or fragment any current connecting areas of habitat in terms of use by this mobile species

Therefore, the proposal is unlikely to have a significant impact on this species and their survival in the locality. As such, a SIS is not required.

***Grus rubicunda* (Brolga)**

The Brolga is one of Australia's largest flying birds. It stands up to 1.3 metres tall, with a wingspan of up to 2.4 metres. It is pale bright grey with a broad band of bare red skin from the beak round the nape of the neck and a black dewlap under the chin. The long legs are black. It is found across Australia, except for the south-west and Tasmania. They feed in dry grasslands, desert claypans and wetlands (OEH, 2019b).

The Brolga has been recorded approximately 100m east of Homestead Dam in 2015, and 2.5km West of Peebles Dam in 2008 (ALA, 2019).

a. in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The proposed development will involve the decommissioning of Peebles Dam and the reinstallation of Homestead Dam. Minor alterations to the water regime are expected to result from the proposal. Although, given that these species are highly mobile, and that there is abundant aquatic vegetation along the watercourse within and outside of the proposal area, it is considered unlikely that the proposal would impact on these species' lifecycles such that they would place viable local populations at risk of extinction.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

c. in relation to the habitat of a threatened species or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposal will modify the current water regime of the two dams by returning Peebles Dam to pre-construction conditions, and the reinstallation of Homestead Dam. Shore fringing habitat that might be used by this species will undergo an initial disturbance and modification, although this is likely to subside.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

Given that the connectivity of the watercourses will be retained, and ample foraging habitat will remain adjacent to the watercourse, habitat for this species will not become fragmented or isolated as a result of the proposed action.

iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

This species is highly mobile, it is considered unlikely that the proposed modification would be critical to the long-term survival of the species within the locality.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal will not have any adverse effect on any declared area of outstanding biodiversity value.

e. the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A key threatening process is defined under the BC Act as "a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities". The following key threatening processes are relevant to the Brolga in the current proposal:

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands (as described in the final determination of the Scientific Committee to list the threatening process)
- Clearing of native vegetation

The proposal would result in a positive impact by increasing natural flow regime attributes at Peebles Dam. The reinstatement of Homestead Dam represents maintenance of the status quo. The scale of impact associated with the clearing of native vegetation is not considered to be significant.

Conclusions

The proposed disturbance is unlikely to significantly impact the Brolga given that:

- The proposed works would constitute a minor disturbance.
- The proposal will not isolate or fragment any current connecting areas of habitat in terms of use by these mobile species
- After initial disturbance it is expected much of the area will regenerate
- Ample foraging habitat will remain within the area
- Connectivity of the Warrego River is expected to improve as a result of the proposal

Therefore, the proposal is unlikely to have a significant impact on the Brolga and its survival in the locality. As such, a SIS is not required.

***Lophochroa leadbeateri* (Major Mitchell's Cockatoo)**

The Major Mitchell's Cockatoo is described as salmon-pink below and white above. Its most prominent feature is its large white-tipped crest that is banded in red and gold. It is found across arid and semi-arid inland, west of Bourke in NSW. It inhabits a wide range of treed and treeless inland habitats. They feed mostly on the ground, and nest in tree hollow throughout the second half of the year (OEH, 2019b).

Major Mitchell's Cockatoo has been recorded approximately 3.5km south east of Homestead Dam in 2017 and 1.5km south east of Peebles Dam in 1986 (OEH, 2019a, ALA, 2019).

a. in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The proposed development would involve partial clearing or modification of a relatively small area of potential foraging and nesting habitat located within the 22 ha study area. Habitat would remain adjacent to the proposed area and is spread widely throughout the locality. Meaning there is ample foraging habitat within the local area.

Given that these species are highly mobile, and that there is a relatively high abundance of similarly-aged trees and similar habitat in the surrounding landscape, it is considered unlikely that the proposal would impact on these species' lifecycles such that they would place viable local populations at risk of extinction. In addition, pre-clearing surveys will be carried out to locate habitat trees and a suitably qualified ecologist will supervise the felling to assist in the recovery of any injured fauna.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

c. in relation to the habitat of a threatened species or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed disturbance will potentially remove or modify a relatively small area of potential habitat within the study area.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

The small-scale clearing of the proposed area is unlikely to fragment the species as there is suitable habitat extending beyond the boundary of the proposal site. It is also unlikely that the clearing will impede such a highly mobile species.

iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Given the small amount of habitat that will be affected, the extent of remaining habitat remaining unaffected nearby and that this species is highly mobile, it is considered unlikely that the proposed removal and modification would be critical to the long-term survival of the species within the locality.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal will not have any adverse effect on any declared area of outstanding biodiversity value.

e. the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A key threatening process is defined under the BC Act as “a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities”. Three key threatening processes are relevant to the Major Mitchell’s Cockatoo in the current proposal:

- Clearing of native vegetation
- Loss of hollow-bearing trees
- Removal of dead wood and dead trees.

Whilst the proposal would result in the clearing of native vegetation and potential removal of deadwood and dead trees, the scale of the impact is not considered to be significant due to the ample foraging habitat that is to remain adjacent to the proposal area and in the locality.

Loss of hollow bearing trees shall be minimised and, where necessary, clearing will be supervised to minimise potential direct impacts to hollow-dwelling fauna.

Conclusions

The proposed disturbance is unlikely to significantly impact the Major Mitchells Cockatoo given that:

- The proposed works would constitute a minor disturbance, given the larger areas of suitable habitat found beyond the proposal boundary and within the locality that will remain unaffected
- The proposal will not isolate or fragment any current connecting areas of habitat in terms of use by these mobile species
- Pre-clearing inspections will be completed to ensure the species isn't nesting within the area to be cleared.

Therefore, the proposal is unlikely to have a significant impact on the Major Mitchells Cockatoo and their survival in the locality. As such, a SIS is not required.

***Oxyura australis* (Blue-billed Duck)**

The Blue-billed Duck is a small and compact duck, with a length of 40 cm. The male's head and neck are glossy black, and the back and wings are a rich, chestnut to dark-brown. During the summer breeding season, the male's bill turns bright blue. The female is brownish-black above, with narrow bands of light brown and mottled light brown and black below. It is endemic to south-eastern and south-western Australia. It prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. It is completely aquatic, feeding by day far from the shore and nesting in Cumbunji, Lignum, rushes and sedges between September and February (OEH, 2019b).

The Blue-billed Duck has been recorded approximately 3.5km West of Peebles Dam in 1995 (OEH, 2019a).

a. in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The proposed development will involve the decommissioning of Peebles Dam and the reinstallation of Homestead Dam. Minor alterations to the water regime are expected to result from the proposal. Although, the proposal is expected to improve connectivity. Given that this species is highly mobile, and that there is abundant aquatic vegetation along the watercourse within and outside of the proposal area, it is considered unlikely that the proposal would impact on these species' lifecycles such that they would place viable local populations at risk of extinction.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

c. in relation to the habitat of a threatened species or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed disturbance is expected to improve connectivity of the Warrego River, and is therefore unlikely to negatively modify the habitat of this species.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

Given that Homestead Dam reconstruction will involve the recommission of inlet pipes that will increase connectivity when open, and that Peebles Dam embankment will be removed, habitat for this species will not become fragmented or isolated as a result of the proposed action.

iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

This species is highly mobile, it is considered unlikely that the proposed modification would be critical to the long-term survival of the species within the locality.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal will not have any adverse effect on any declared area of outstanding biodiversity value.

e. the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A key threatening process is defined under the BC Act as “a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities”. One key threatening process is relevant to the Blue-billed Duck and the current proposal:

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands (as described in the final determination of the Scientific Committee to list the threatening process)

The proposal would result in a positive impact by increasing natural flow regime attributes at Peebles Dam and is expected to improve connectivity of the Warrego River. The reinstatement of Homestead Dam represents maintenance of the status quo. The scale of impact associated with the clearing of native vegetation is not considered to be significant.

Conclusions

The proposed disturbance is unlikely to significantly impact the Blue-billed Duck given that:

- The proposed works would constitute a minor disturbance.
- The proposal will not isolate or fragment any current connecting areas of habitat in terms of use by these mobile species
- The proposal is expected to improve connectivity of the watercourse

Therefore, the proposal is unlikely to have a significant impact on the Blue-billed Duck and their survival in the locality. As such, a SIS is not required.

Koala (*Phascolarctos cinereus*)

The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations located west of the Great Dividing Range (OEH 2019b).

Koalas feed on the leaves of more than 70 eucalypt species and 30 non-eucalypt species; however, specific species are preferred depending on availability. Foraging trees are present in the proposal area, primarily the River Red Gum (OEH, 2018).

No koalas have been recorded within the proposal area, although the River Red Gum open woodland wetland and Coolabah open woodland wetland with chenopod/grassy groundcover vegetation communities are potential foraging habitat.

a. in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The disturbance area includes a very small area of potential foraging habitat for the Koala. However, the removal of this habitat is unlikely to significantly affect the lifecycle of the species, as the area to be impacted is considered small, and similar habitat is available within the surrounding area.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

c. in relation to the habitat of a threatened species or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed disturbance will potentially impact up to 15 ha of koala habitat.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

The fragmentation impacts associated with the proposal are predicted to be minor. The minor scale clearing will not create a barrier to koala movement within the landscape, and no populations of Koala will become isolated by the proposal.

iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The proposal area provides habitat characteristics for the koala in the form of potential feed trees. However, there has been no records of koala sightings within 10km of the proposal area.

The vegetation adjacent to the proposed is of similar value and therefore the proposed works are not likely to affect the long-term survival of the species at the locality.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal will not have any adverse effect on any declared area of outstanding biodiversity value.

e. the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A key threatening process is defined under the BC Act as "a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities". One key threatening process is relevant to the Koala in the current proposal:

- Clearing of native vegetation

Whilst the proposal would increase the above threatening process, the scale of the impact is not considered to be significant.

Conclusions

The proposed disturbance is unlikely to significantly impact the Koala given that:

- The proposed works would constitute a minor disturbance, given the scale of the proposal and the suitable habitat adjacent to the disturbance boundaries.
- The proposal will not isolate or fragment any current connecting areas of habitat
- Larger areas of suitable foraging habitat are present within the surrounding landscape
- The Koala has not been recorded within 10km of the study area

Therefore, the proposal is unlikely to have a significant impact on the Koala and their survival in the locality. As such, a SIS is not required.

Falcons

The study area provides potential habitat for three species of threatened raptors.

- Hieraaetus morphnoides (Little Eagle)
- Falco hypoleucos (Grey Falcon)
- Falco subniger (Black Falcon)

These four species are apex predators. They each occupy different foraging niches, but all share the need for abundant vertebrate prey resources and large territories for breeding. They also overlap in their need for sheltered, mature canopy trees for nesting. All species build their nest out of sticks in a tree and lay their eggs around spring (or sometimes autumn), with young remaining in the nest for several months. All prey on birds, mammals and reptiles and occasionally insects, but only the Little Eagle forages on carrion (OEH 2018b).

Due to similar habitat requirements and associated impacts, one single Assessment of Significance (5-part test) has been undertaken for the raptors.

***Hieraaetus morphnoides* (Little Eagle)**

The Little Eagle is a medium to large, stocky raptor which closely resembles a kite rather than an eagle. It occupies open eucalypt forest, woodland or open woodland and grassland. This species may be in decline as a result of loss of prey species (decline in critical weight range marsupials and rabbits) and secondary poisoning from pindone (OEH 2018b).

The nearest recordings of the Little Eagle to the proposal area was approximately 5km north east of Homestead Dam in 1987 and 8km North of Peebles Dam in 2015.

***Falco hypoleucos* (Grey Falcon)**

The Grey Falcon is a medium-sized, compact, pale falcon with a heavy, thick-set, deep-chested appearance. Upperparts are uniform light grey, shading to blackish on the primaries, forming conspicuous dark wing tips. The tail has narrow blackish bars. The chin, throat and cheeks are white, and the rest of the underbody is pale grey. The eye-ring, cere and base of the bill are bright orange-yellow, and the tip of the bill black. In NSW, the Grey Flacon is sparsely distributed, most commonly recorded throughout the Murray Darling Basin. It is mostly found in shrublands, grasslands and wooded watercourses of arid and semi-arid regions (OEH,2018b).

The Grey Falcon was recorded approximately 3.5 km east of Homestead Dam in 2015.

***Falco subniger* (Black Falcon)**

The Black Falcon is a large, very dark falcon with pale grey cere, eye-rings and feet. It is uniformly dark brown to sooty black, with a pale throat and an indistinct black streak below each eye. It is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. The black falcon like most falcons utilize old nests from ravens and other birds of prey (OEH, 2018b).

The Black Falcon was recorded approximately 2.5 km east of Homestead Dam in 2015.

a. in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

There is potential for the three threatened raptor species to use the subject site for foraging, breeding or roosting purposes.

Given that these species are highly mobile, and that there is a relatively high abundance of similarly-aged trees and similar habitat in the surrounding landscape, it is considered unlikely that the proposal would impact on these species' lifecycles such that they would place viable local populations at risk of extinction. In addition, pre-clearing surveys will be carried out to locate habitat trees and a suitably qualified ecologist will supervise the felling to assist in the recovery of any injured fauna.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

c. in relation to the habitat of a threatened species or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed disturbance will potentially impact a relatively small area of potential habitat within the 22 ha study area. Loss of hollow bearing trees shall be minimised and, where necessary, clearing will be supervised to minimise potential direct impacts to hollow-dwelling fauna.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

The clearing and modification of the proposed area is unlikely to impede the movement of these highly mobile species between habitat patches.

iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The area of potential habitat that would be removed is unlikely to be important to the long-term survival of local populations of these species, as there is a large amount of similar vegetation located adjacent to the proposed areas and within the locality.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal will not have any adverse effect on any declared area of outstanding biodiversity value.

e. the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A key threatening process is defined under the BC Act as “a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities”. One key threatening process is relevant to the raptor species listed above in the current proposal:

- Clearing of native vegetation

Whilst the proposal would increase the above threatening process, the scale of the impact is not considered to be significant.

Conclusions

The proposed disturbance is unlikely to significantly impact threatened raptor species given that:

- These species are highly mobile and forage widely
- The proposal will not isolate or fragment any current connecting areas of habitat in terms of use by these highly mobile species

- Potential habitat for this species would remain at the site, directly adjacent to the proposed area and throughout the locality.
- The disturbance is not expected to significantly affect the raptors food sources

Therefore, the proposal is unlikely to have a significant impact on the raptor species listed above and their survival in the locality. As such, a SIS is not required.

Microchiropteran bats

Two species of microchiropteran bats have been recorded within Toorale National Park.

- *Chalinolobus picatus* (Little Pied Bat)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)

Due to similar habitat requirements and associated impacts, one single Assessment of Significance (5-part test) has been undertaken for microchiropteran bats.

Potential breeding, roosting and foraging habitat within the proposal area includes Coolabah open woodland wetland, Chenopod low open shrubland and River red gum open woodland wetland.

Chalinolobus picatus

The Little-Pied Bat is found in inland Queensland and NSW (including Darling Riverine Plains) extending slightly into South Australia and Victoria. The species occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimbil box woodlands, roosting in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings. The Little-Pied Bat can tolerate high temperatures and dryness but need access to nearby open water. It feeds on moths and possibly other flying invertebrates (OEH 2018b).

The closest known record of this species was occurred 2km north east of Homestead Dam.

Saccolaimus flaviventris

Saccolaimus flaviventris (Yellow-bellied Sheathtail-bat) roosts singly or in groups of up to six, in tree hollows and buildings. In treeless areas they are known to utilise mammal burrows. They forage in most habitats throughout their very wide range, including areas with and without trees and appear to defend an aerial territory (OEH 2018b).

This species has been recorded 100m east of Homestead Dam in 2003 and approximately 6km north east of Peebles Dam in 2015.

a. in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Lifecycle can be impacted by direct impacts of habitat removal or by indirect impacts which are undertaken during important stages of the species lifecycle or which reduce habitat quality. In order to place populations at risk of extinction, the impacts would have to be of a magnitude and duration that would inhibit the continual completion of the lifecycle stages

There is potential for the two threatened bat species to use the subject site for foraging, breeding or roosting purposes.

Given that these species are highly mobile, and that there is a relatively high abundance of similarly-aged trees and similar habitat in the surrounding landscape, it is considered unlikely that the proposal would impact on these species' lifecycles such that they would place viable local populations at risk of extinction. In addition, pre-clearing surveys will be carried out to locate impacted hollow-bearing trees and suitably qualified staff will supervise the felling to assist in the recovery of any injured fauna.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

c. in relation to the habitat of a threatened species or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed disturbance may impact a relatively small area of potential habitat within the 22 ha study area. Loss of hollow bearing trees shall be minimised and, where necessary, clearing will be supervised to minimise potential direct impacts to hollow-dwelling fauna.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

The small-scale clearing of the proposed area is unlikely to impede the movement of these highly mobile species between habitat patches.

iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The area of potential habitat that would be removed is unlikely to be important to the long-term survival of local populations of these species, as there is a large amount of similar vegetation located adjacent to the proposed areas and within the locality.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal will not have any adverse effect on any declared area of outstanding biodiversity value.

e. the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A key threatening process is defined under the BC Act as "a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities". Two key threatening process is relevant to the microbat species listed above in the current proposal:

- Clearing of native vegetation

- Loss of hollow bearing trees

Whilst the proposal would result in clearing of native vegetation, the scale of the impact is not considered to be significant. Loss of hollow bearing trees shall be minimised and, where necessary, clearing will be supervised to minimise potential direct impacts to hollow-dwelling fauna.

Conclusions

The proposed disturbance is unlikely to significantly impact threatened microbat species given that:

- These species are highly mobile and forages widely
- The proposal will not isolate or fragment any current connecting areas of habitat in terms of use by these highly mobile species
- Potential habitat for this species would remain at the site, directly adjacent to the proposed area and throughout the locality.

Therefore, the proposal is unlikely to have a significant impact on the microbat species listed above and their survival in the locality. As such, a SIS is not required.

Appendix H EPBC Act Significant Impact Guidelines

The EPBC Act Administrative Guidelines on Significance set out 'Significant Impact Criteria' that are to be used to assist in determining whether a proposed action is likely to have a significant impact on matters of national environmental significance. Matters listed under the EPBC Act as being of national environmental significance include:

- Listed threatened species and ecological communities
- Listed migratory species
- Wetlands of International Importance
- The Commonwealth marine environment
- World Heritage properties
- National Heritage places
- Nuclear actions

Specific **'Significant Impact Criteria'** are provided for each matter of national environmental significance except for threatened species and ecological communities in which case separate criteria are provided for species listed as endangered and vulnerable under the EPBC Act.

The relevant Significant Impact Criteria have been applied to the following species and communities:

- Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions– Endangered
- Atriplex infrequens (A saltbush) – Vulnerable
- Maccullochella peelii (Murray Cod) – Vulnerable
- Phascolarctos cinereus (Koala) – Vulnerable

Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions

This endangered ecological community (EEC) is found on the grey, self-mulching clays of periodically waterlogged floodplains, swamp margins, ephemeral wetlands, and stream levees. The structure of the community may vary from tall riparian woodlands to very open 'savanna like' grassy woodlands with a sparse midstorey of shrubs and saplings. Typically, these woodlands form mosaics with grasslands and wetlands, and are characterised by Coolibah (Eucalyptus coolabah) and, in some areas, Black Box (E. largiflorens). Other tree species may be present including River Cooba (Acacia stenophylla), Cooba (A. salicina), Belah (Casuarina cristata) and Eurah (Eremophila bignoniiflora, OEH, 2019b).

There is approximately 13.22 ha of this community mapped within the proposal area. It is expected that only a small portion of this will be cleared and modified.

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

Criterion 1: reduce the extent of an ecological community

The proposed works will potentially result in the removal or modification of up to 13.22 ha of this EEC. The community exists as an open woodland with sparse to dense areas within the area. This community occurs adjacent to the proposal areas and is a fraction of what is found within Toorale National Park (approx.18,600 ha).

Criterion 2: fragment or increase fragmentation of an ecological community

The proposed works will not result in the isolation or fragmentation of this community as it extends beyond the boundaries of the proposal area. It will also not further isolate any patches as many are already separated by the roads and watercourses found within the area.

Criterion 3: adversely affect habitat critical to the survival of an ecological community

There is no adopted or made recovery plan for this ecological community. Given that the community extends beyond the proposal area, that only a portion of the area is expected to be removed or modified and that a further 18,600 ha of this community exists within Toorale National Park, the proposed disturbance is not expected to adversely affect habitat critical to the survival of this EEC.

Criterion 4: modify or destroy abiotic factors necessary for an ecological community's survival, including reduction in groundwater levels, or substantial alteration of surface water drainage patterns

The proposal is unlikely to modify or destroy abiotic factors necessary for the ecological community's survival. Soil disturbance and alteration to surface water drainage is expected in areas of the proposal, although parts of the community are also anticipated to remain undisturbed. This EEC also extends beyond the bounds of the proposal. In addition, following the initial disturbance, parts of the EEC within the proposal area is expected to regenerate.

Criterion 5: cause substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species.

The proposed works is not expected to cause substantial change in the species composition of the EEC in the proposal area. In addition, weed management measures will be implemented to prevent exotic species becoming established within the EEC.

Criterion 6: cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

- **assisting invasive species, that are harmful to the listed ecological community, to become established, or**
- **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.**

The proposed disturbance has the potential to result in additional invasive species encroaching along the disturbance area. Although with effective biosecurity measures implemented as outlined within this report, it is unlikely that an invasive species will become established to cause a substantial reduction in the quality of the EEC.

The proposal is unlikely to cause the mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community.

Criterion 7: interfere with the recovery of an ecological community.

There is no adopted or made Recovery Plan for this ecological community.

Conclusions

Based on the above assessment it is concluded that the proposed development is unlikely to have a significant impact on Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions EEC. Referral to DSEWPaC for assessment and approval by the Environment Minister is NOT considered necessary.

Atriplex infrequens (A saltbush)

Atriplex infrequens is a small spreading forb, with numerous branches covered with a minute scaly layer. The leaves are narrow, to 15 mm long. The flowers are clustered or solitary in the leaf axils (the angle where the leaves join the stem). The fruiting body is compressed and membranous with a dense covering of short soft hairs. It is associated with broad drainage tracts, clay flats and possibly occasionally inundated habitats. Very little ecological information is available for this species, so it's critical habitat components can only be speculated as relatively undisturbed and ungrazed drainage lines and flats (OEH, 2018b).

No individuals have been recorded within the proposed disturbance areas, with the closest known record occurring approximately 9km north east of Homestead Dam in 2011 (ALA, 2019).

Criterion 1: lead to a long-term decrease in the size of an important population of a species

An important population is not considered to occur within the locality. Field survey recorded no individuals within the proposal area and therefore the proposal is unlikely to lead to a long-term decrease in an important population of this species.

Criterion 2: reduce the area of occupancy of an important population

The proposed disturbance will not reduce the area of occupancy of an important population, as there is no occupied habitat within the disturbance footprint.

Criterion 3: fragment an existing important population into two or more populations

The proposed disturbance will not fragment an existing *Atriplex infrequens* population into two or more populations. Given that the proposal area does not contain a population of this species.

Criterion 4: adversely affect habitat critical to the survival of a species

Habitat for *Atriplex infrequens* is not listed on the Register of Critical Habitat under the EPBC Act, and there is no critical habitat listed in the recovery plan for the species. Very little ecological information is available for this species, so it's critical habitat components can only be speculated as relatively undisturbed and ungrazed drainage lines and flats (OEH, 2018b).

Using this definition, parts of the proposal area may be potential habitat for this species. Although, due to field survey recording no individuals within the study area, and that after initial disturbance habitat is likely to regenerate, it is unlikely that the proposed works will adversely affect habitat critical to the survival of this species.

Criterion 5: disrupt the breeding cycle of an important population

Direct or indirect impacts that occur during important stages of the species' lifecycle or which reduce habitat quality may disrupt the breeding cycle. For disruption to occur, stages of the lifecycle would have to be inhibited over consecutive seasons for a significant proportion of the population.

This is unlikely to occur as a result of the current proposal, as a small area of potential habitat will be impacted, with extensive areas of suitable habitat remaining adjacent to the proposal area and within the locality. Therefore, the proposal is unlikely to disrupt the breeding cycle of *Atriplex infrequens.*

Criterion 6: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

It is unlikely that the development will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

The proposed disturbance will impact upon a small area of potential habitat for this species; however, there will be no impact to the quality of the habitat adjacent to the proposal area or the extensive habitat available in the wider region. The scale of vegetation clearing would not inhibit the breeding cycle for this species, and hence habitat patches would not become isolated.

Criterion 7: result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

Historical land use has led to a suite of invasive species within the locality. Whilst the proposed works has the potential to assist with the spread of invasive species, although with the various biosecurity measures implemented that are outlined in this report, it is unlikely that an invasive species will become established in this habitat.

Criterion 8: introduce disease that may cause the species to decline.

The proposed disturbance is not likely to introduce disease that may cause the species to decline.

Criterion 9: interfere with the recovery of the species.

The field survey confirmed no individuals of this species were within the proposal area. Targeted surveys are part of the recovery strategy for this species. The proposed works are not likely to interfere substantially with the recovery of this species.

Conclusions

Based on the above assessment it is concluded that the proposed development is unlikely to have a significant impact on *Atriplex infrequens*. Referral to DSEWPaC for assessment and approval by the Environment Minister is NOT considered necessary.

Maccullochella peelii (Murray Cod)

The Murray Cod is the largest freshwater fish in Australia. The species has been measured at up to 1.8 m in length and over 100 kg in weight although, according to McDowall (1996), it has been most commonly weighed at about 10 kg. The Murray Cod has a broad head with a rounded snout and a concave profile. It has a large mouth with the lower jaw approximately equal in length with the upper jaw or slightly protruding. The species is predominantly light olive to dark green in colour with mottled patterning and white to cream-coloured undersides. It is distributed throughout the Murray Darling Basin.

Criterion 1: lead to a long-term decrease in the size of an important population of a species

Since 2015, Eco-logical Australia have undertaken annual fish surveys within the Warrego River. The Murray Cod has yet to be identified within this system (CEWO, 2018). The closest records have occurred within the Darling River, approximately 8km South of Peebles Dam (ALA, 2018). Due to the absence of the Murray Cod in the Warrego River it is unlikely that the proposal will lead to a long-term decrease in an important population.

Criterion 2: reduce the area of occupancy of an important population

The proposed disturbance will not reduce the area of occupancy of an important population.

Criterion 3: fragment an existing important population into two or more populations

The proposal is predicted to increase connectivity in the system due to the removal of Peebles Dam and the recommissioning of outlet pipes at Homestead Dam. At times when these pipes are closed, habitat should increase up-stream of the dam due to an increase in available water. Therefore, the proposed disturbance should not fragment an existing Murray Cod population into two or more populations.

Criterion 4: adversely affect habitat critical to the survival of a species

The proposal is not expected to adversely affect habitat critical to the survival of the Murray Cod.

Criterion 5: disrupt the breeding cycle of an important population

Direct or indirect impacts that occur during important stages of the species' lifecycle or which reduce habitat quality may disrupt the breeding cycle. For disruption to occur, stages of the lifecycle would have to be inhibited over consecutive seasons for a significant proportion of the population.

This is unlikely to occur as a result of the current proposal, as connectivity of the river is expected to improve. Thus, allowing a more sustained passage for these fish.

Criterion 6: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

It is unlikely that the development will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. As, the proposal is expected to improve the connectivity of the Warrego River at both dams allowing the Murray Cod to move up and downstream of the infrastructure more freely.

Criterion 7: result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The lower Warrego has been recognized as a Carp breeding hotspot (Gilligan 2005), with recent LTIM monitoring showing a large breeding response of these fish during times of high flow in the Warrego and Darling systems. Increasing the connectivity between the systems may increase exotic fish movement, breeding and recruitment in the lower Warrego system. Ongoing fish monitoring in the Warrego waterholes should continue following the construction phase of the project to monitor changes to the exotic fish population. Options such as fish traps, which target exotic species, may need to be considered if exotic fish numbers increase substantially (ELA, 2017).

Criterion 8: introduce disease that may cause the species to decline.

The proposed disturbance is not likely to introduce disease that may cause the species to decline.

Criterion 9: interfere with the recovery of the species.

The proposal is not expected to interfere with the recovery of the species.

Conclusions

Based on the above assessment it is concluded that the proposed development is unlikely to have a significant impact on the Murray Cod. Referral to DSEWPaC for assessment and approval by the Environment Minister is NOT considered necessary.

Phascolarctos cinereus (Koala)

The Koala occurs in eucalypt woodlands and forests. In the Darling riverine plains management area, it primarily feeds on *Eucalyptus camaldulensis* and *E. coolabah* (OEH 2018b).

Koalas spend most of their time in trees but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than 2 ha to several hundred hectares in size. The species is generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year (OEH 2018b).

No koalas have been recorded within the proposal area with the closest known record occurring over 25km west (ALA, 2019). Although the River Red Gum open woodland wetland and Coolabah open woodland wetland with chenopod/grassy groundcover vegetation communities are potential foraging habitat. These communities make up approximately 15 ha of the proposal area.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Criterion 1: lead to a long-term decrease in the size of an important population of a species

The study area is not likely to support an important population of the Koala.

Criterion 2: reduce the area of occupancy of an important population

The study area is not likely to support an important population of the Koala.

Criterion 3: fragment an existing important population into two or more populations

The study area is not likely to support an important population of the Koala.

Criterion 4: adversely affect habitat critical to the survival of a species

Under the Koala Habitat Assessment Tool (DoE 2014), a score of five or more is considered to indicate that core Koala habitat is present. The assessment score for the current proposal (shown in Table C 1) produced a result of 4 at the Homestead site and a five at Peebles Dam, therefore, the vegetation within the study area meets the criteria for "Habitat likely to be critical to the survival of the Koala". The assessment on adverse effects was then undertaken, and the results indicated that the habitat loss associated with the proposed action is uncertain and that referral to the commonwealth depends on the nature of the proposal (Figure C 1). Based on the assessment of the action, the proposal will not adversely affect habitat critical to the survival of the Koala.

Therefore, referral to the DotEE is not recommended.

Criterion 5: disrupt the breeding cycle of an important population

The study area is not likely to support an important population of the Koala.

Criterion 6: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposed development is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the Koala is likely to decline. Given that there is no record of the Koala occurring within 10km of the proposal area. Only a small area of potential foraging habitat will be impacted by the proposal, with no impact to the quality of the habitat remaining adjacent to the proposed area. The scale of vegetation clearing would not inhibit the movement of the Koala, and hence habitat patches would not become isolated.

Criterion 7: result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The proposed development is unlikely to result in invasive species that are harmful to the Koala becoming established in its habitat. A suite of invasive species potentially harmful to the species are already established in the study area. It is unlikely that additional invasive species would become established as the result of the proposal.

Criterion 8: introduce disease that may cause the species to decline

The proposed development is unlikely to introduce disease that may cause the decline of the Koala, or interfere substantially with the recovery of the species.

Criterion 9: interfere substantially with the recovery of the species.

A national recovery plan has not been prepared for the Koala.

Koala EPBC Act referral assessment

The Koala habitat assessment tool (DotEE, 2014) was applied to the study area and wider locality to assess if the area constitutes habitat critical to the survival of the Koala. The study area scored a habitat score of 5 and results of this assessment are presented in **Table D1.**

Table C 1 Koala habitat assessment tool (after DoE 2014)

Attribute	Scores		Assessment criteria (Inland)	Assessment details	
	Homestead	Peebles			
Koala occurrence	0 (low)	0 (low)	No koala records within 10 km of the edge of the impact area.	Desktop	• EPBC PMST report identified Koala as 'Species or species habitat known to occur within area' • NSW Bionet search failed to identify a record of a Koala occurring within 10km of the proposal area
				On-ground	No evidence of Koala, including actual individuals, scats or scratches were identified during the field survey.
Vegetation composition	+1 (medium)	+2 (high)	Has forest or woodland with 2 or more species of known Koala food tree present.	On-ground	River Red Gum and Coolabah are tree species listed by OEH as primary Koala feed trees. Both species occur within the proposed area.
Habitat connectivity	+2 (high)	+2 (high)	Area is part of a contiguous landscape ≥ 1000 ha.	On-ground and mapping	A contiguous landscape is defined to encompass 'no barriers' with a barrier being defined as *'a feature (natural or artificial) that is likely to prevent the movement of Koalas. Natural barriers may include steep mountain ranges (cliffs), unsuitable habitats, major rivers / water bodies or treeless areas more than 2 km wide. Artificial barriers may include infrastructure (such as roads, rail, mines, large fences etc.) without effective Koala passage measures, or developments that create treeless areas more than 2 km wide.'* The study area is within and adjacent to the Warrego River riparian corridor. Although unsuitable habitat is present adjacent to both study areas, the riparian corridor consists of contiguous vegetation that covers an area greater than 1000 ha.

Attribute	Scores		Assessment criteria (Inland)	Assessment details	
	Homestead	Peebles			
Key existing threats	+1 (medium)	+1 (medium)	Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present.	On-ground and mapping	It is likely that Koalas have a minimal risk of dog attack and vehicle strikes in areas surrounding the study area on an infrequent basis.
Recovery value	0 (low)	0 (low)	Habitat is unlikely to be important	On-ground & Reporting	The interim recovery objectives are provided below: • Protect and conserve the quality and extent of habitat refuges for the persistence of the species during droughts and periods of extreme heat, especially in riparian environments and other areas with reliable soil moisture and fertility • Maintain the quality, extent and connectivity of large areas of koala habitat surrounding habitat refuges The study area is not considered to be a habitat refuge for the koala, as there are no records within 25 of the study areas. Although the study area is connected to a large contiguous area of potential koala habitat, it is not considered to surround any koala habitat refuge, with most the closest record occurring over 25 km to the west of the study site. In addition, because the study areas are surrounded by further potential habitat, the proposed project will not fragment the available habitat.
Total	4		Decision: Habitat likely to be critical to the survival of the Koala		

Will the action adversely affect habitat critical to the survival of the Koala

As the outcome from the above tool is greater than 5 at the Peebles Dam proposal area, the below flow chart is required to determine whether the habitat loss associated with the action is likely to adversely affect habitat critical to the survival of the Koala and require referral to the Department of the Environment and Energy (DotEE).

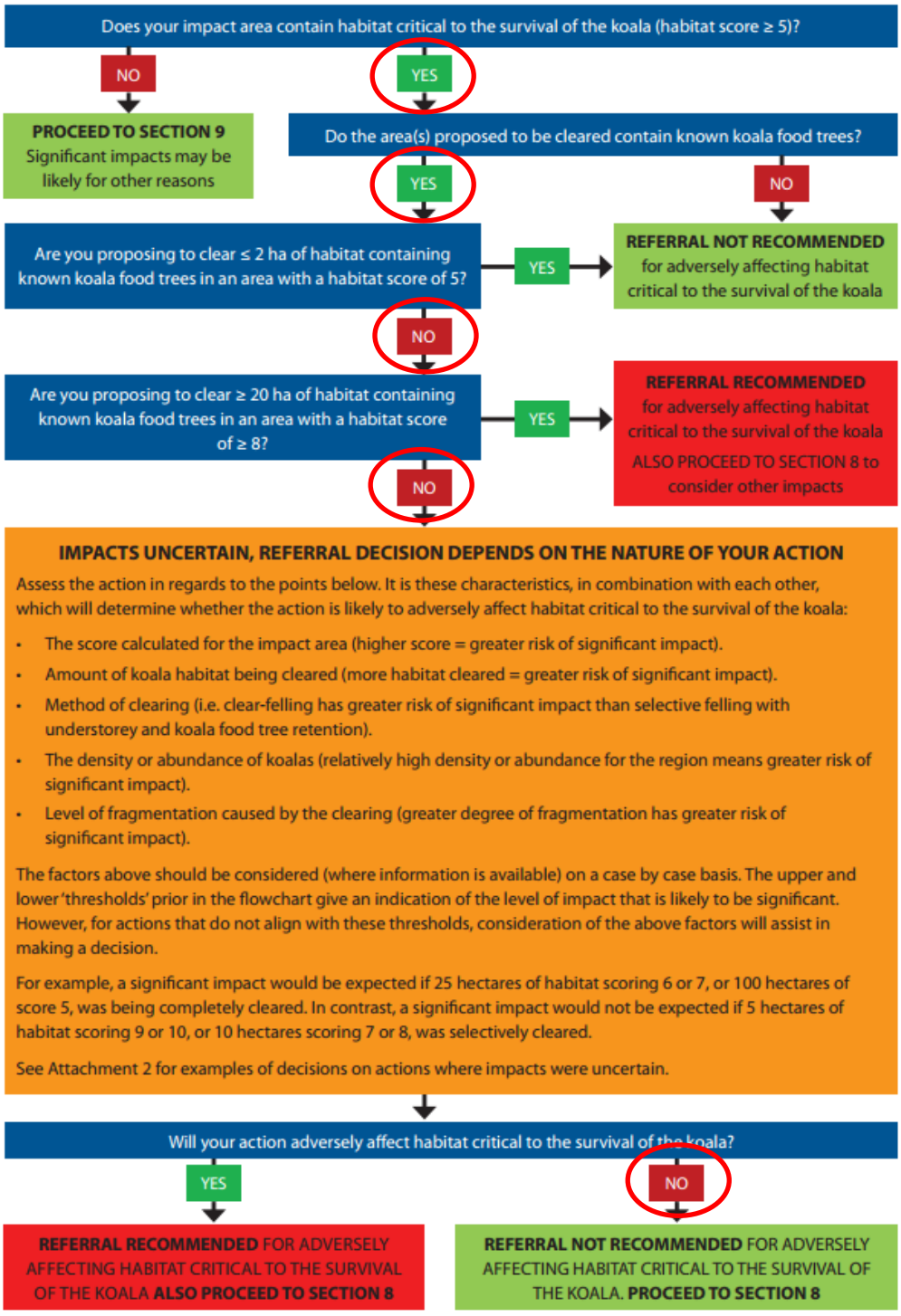


Figure C 1 Assessing adverse effects on habitat critical to the survival of the Koala (DoE, 2014)

The following questions from the above flowchart are answered below:

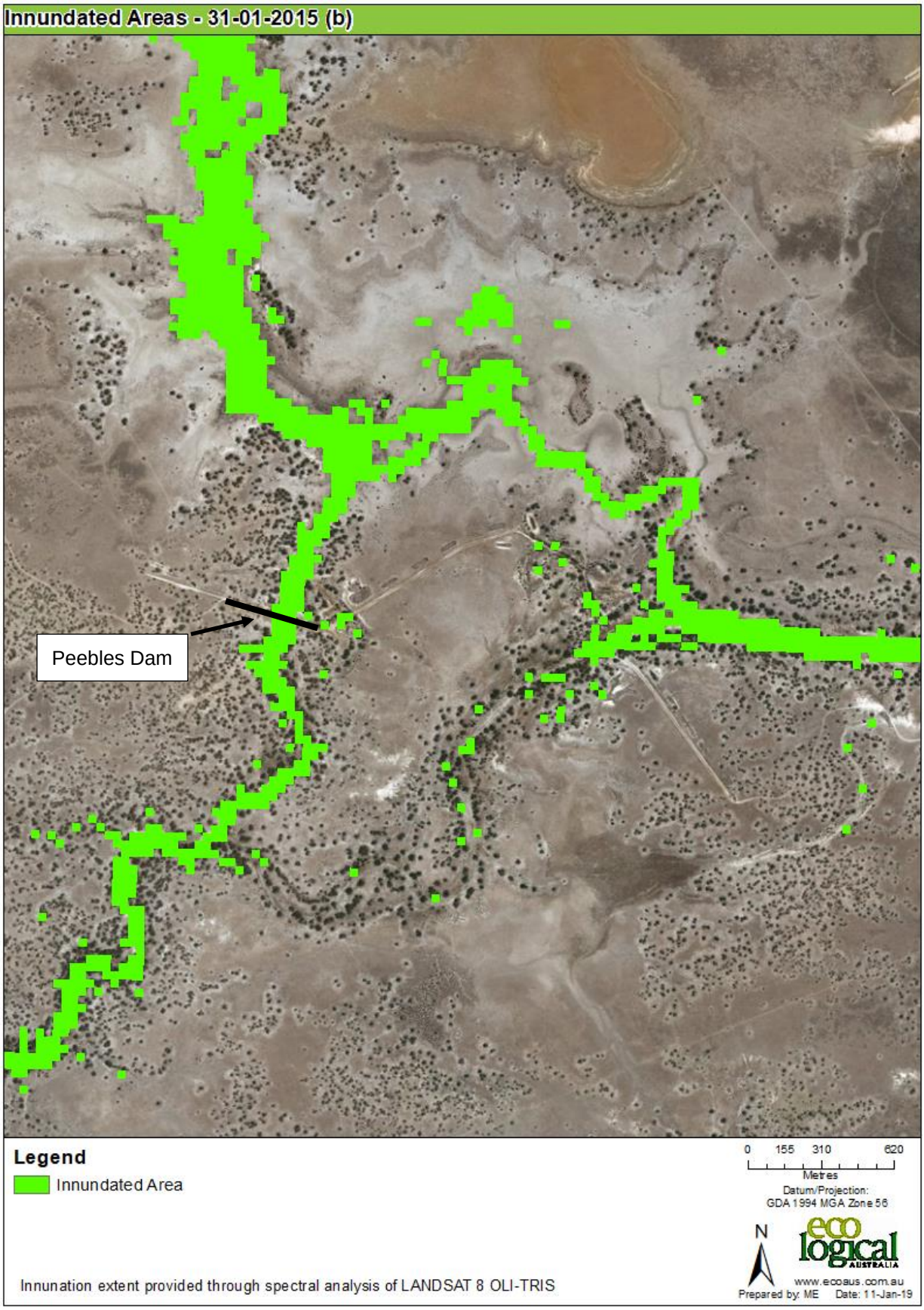
- Does your impact area contain habitat critical to the survival of the Koala (habitat score ≥5?) **Yes**
- Do the areas proposed to be cleared contain known koala trees? **Yes**
- Are you proposing to clear ≤2 ha of habitat containing known Koala food trees in an area with a habitat score of 5? **No**
- Are you proposing to clear ≥20 ha of habitat containing known koala food trees in an area with a habitat score of ≥8? **No**

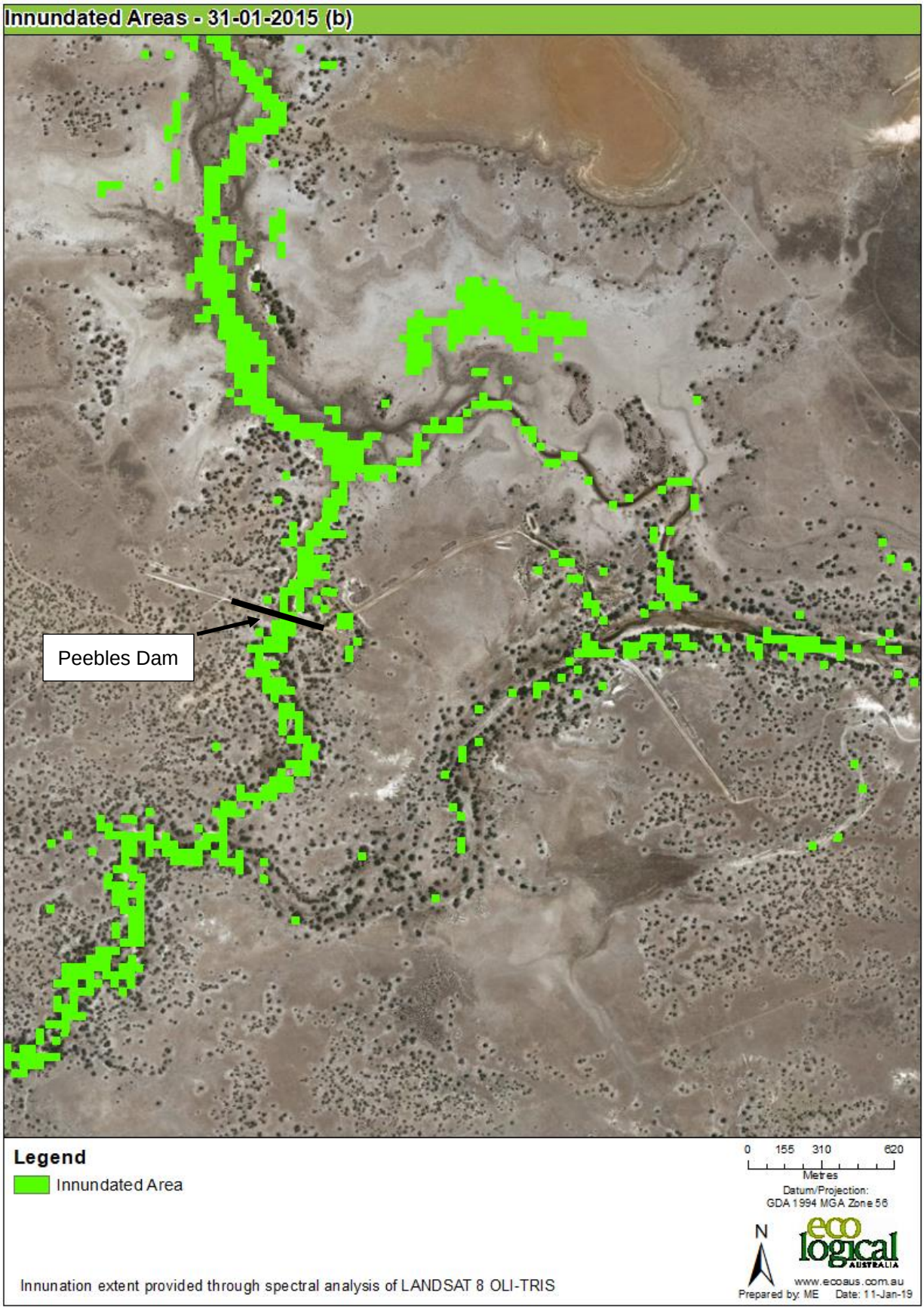
Impacts uncertain, referral decision depends on the nature of your action

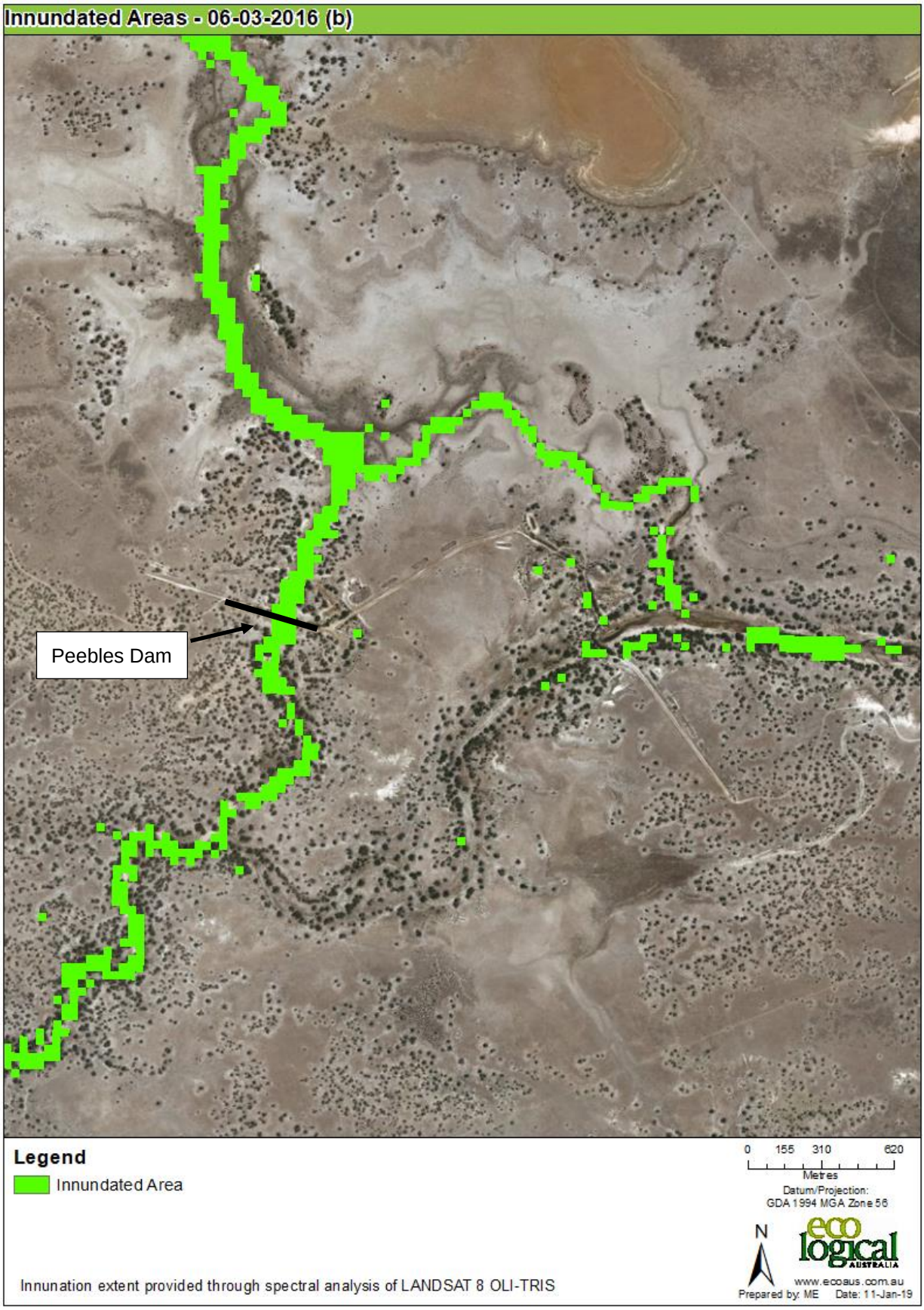
Based on the below, referral to the Commonwealth is not recommended.

- The Peebles Dam proposal site consists of approximately 1.49 ha of River Red Gum open woodland wetland and 7.74 ha of Coolabah open woodland wetland with chenopod/grassy groundcover.
- The area received a Koala habitat score of 5
- No koala has been recorded within the area, with the closest record occurring over 25km west (ALA, 2019).
- It is expected that the proposal will only partially clear the area.
- Further potential foraging habitat for the koala of the same value surrounds the project area. Therefore, the proposal will not fragment or isolate areas of habitat.

Appendix I Inundation mapping of Peebles Dam







Appendix J Phase 1: Statement of Heritage Impact

Toorale Water Infrastructure – Phase 1: Statement of Heritage Impact

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Template 2.8.1

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Abbreviations

Abbreviation	Description
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
Alluvium	Alluvium Pty Ltd
Biosis	Biosis Pty Ltd
CMP	Conservation Management Plan
DCP	Development control Plan
EIS	Environmental Impact Statement
ELA	Eco Logical Australia
EPA	NSW Environment Protection Authority
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Reg	Environmental Planning and Assessment Regulation 2000
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
Heritage Act	Heritage Act 1977
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
JMAC	Joint Management Advisory Committee
JMC	Joint Management Committee
LEP	Local Environment Plan

Abbreviation	Description
LLS	Local Land Services
LTIM Project	Long-Term Intervention Monitoring Project
MDBA	Murray Darling Basin Authority
Native Title Act	Commonwealth Native Title Act 1993
NPW Act	NSW National Parks and Wildlife Act 1974
NPW Reg	National Parks and Wildlife Regulation 2009
NPW	National Parks and Wildlife
NPWS	National Parks and Wildlife Service
NSW	New South Wales
OEH	New South Wales Office of Environment and Heritage
PoM	Plan of Management
RAPs	Registered Aboriginal Parties
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy
SHR	State Heritage Register
SoHI	Statement of Heritage Impact
Toorale	Toorale National Park and State Conservation Area

1. Introduction

1.1 Background

Eco logical Australia (ELA) has been commissioned by the New South Wales Office of Environment and Heritage to prepare a Statement of Heritage Impact (SoHI) to support a Review of Environmental Factors (REF) to satisfy environmental assessment and approval requirements to modify two dams at Toorale National Park and State Conservation Area (Toorale), within the Warrego River Catchment.

Toorale is an important part of Australian pastoral heritage. At its peak in the late 19th century, it was a significant part of the largest sheep station in the world. The historic buildings at Toorale, in particular the Old Toorale Woolshed (built around 1873–74) and Toorale Homestead (built around 1896), are considered 'iconic monuments to the pastoral history of the nation' as they represent 'the biggest and the best of the far western region's surviving historic pastoral buildings with the most significant technology and history attached' (Sheppard 2013).

'Toorale Homestead and Outbuildings, Toorale Station via Bourke, NSW, Australia' is listed on Schedule 5 of the Bourke LEP (Item 28). Toorale is also listed on NPWS Historic Heritage Inventory (HHI) and covers Built Heritage, Archaeological Resources and Landscape. The Darling River is listed on Schedule 5 of the Bourke LEP (Item 10).

The property is a mixture of National Park and State Conservation Area tenures and was acquired for its natural conservation values, which include examples of the poorly represented Darling Riverine Plains. Also incorporated within the landscape is a combination of significant cultural heritage values, both indigenous and non-indigenous. The property is a new addition to the Office of Environment and Heritage (OEH) estate purchased in 2008.

1.2 Study area location

Toorale is located approximately 65 km southwest of Bourke in north western NSW and is managed by OEH, National Parks and Wildlife Service (NPWS). Toorale encompasses a combined area of approximately 85,251 ha and experiences a semi-arid climate (Figures 1 & 2). The property is associated with a number of creeks and billabongs connected to the Warrego and Darling Rivers. Homestead Dam and Peebles dam are located within the boundaries of the National Park (Figure 1).

1.3 Proposal

The NSW Office of Environment and Heritage (OEH) is managing the Toorale Water Infrastructure Project on behalf of the Commonwealth Government to achieve outcomes sought by both the NSW and Commonwealth Governments. Within the broader Toorale Water Infrastructure Project, decommissioning works at Peebles Dam and maintenance/repair work at Homestead Dam (Phase 1 works) have been prioritised and form the basis of this Review of Environmental Factors (REF).

The works at Homestead Dam involve the temporary reinstatement of an earthen embankment which was breached during a flood event in 2012. The infill is to be of a similar design to the previous embankment under the existing works approval. Local material or imported material from the Peebles Dam site will be used and the existing outlet pipes will be recommissioned.

Peebles Dam is to be decommissioned by removing a 300 m portion of the embankment at the main Warrego River location (Figure 11). The embankment will be removed to the existing waterway bed level, to allow the Warrego River flows to pass through to the Darling River and to allow high flow events in the Darling River to back up into the Warrego River. Spoil may be used in the construction of Homestead Dam or deposited within existing borrow pits close to the site (Figure 2).

Existing infrastructure at Peebles Dam will be relocated and reused by NPWS Bourke Area (pipes, gates and operating platform). However, an exact future purpose has not yet been determined and infrastructure will be stored at Toorale.

1.4 Methodology

This Heritage Impact Statement has been prepared with reference to the NPWS Guidelines for historic heritage approvals (OEH & NPWS 2016), the NSW Heritage Manual 'Statements of Heritage Impact' (Heritage Office & Department of Planning 2002) and 'Assessing Heritage Significance' (Heritage Office & Department of Planning 2001) guidelines.

The subject proposal has also been assessed in relation to the Burke Local Environmental Plan 2012, the State Environmental Planning Policy (Infrastructure) 2007 and the Toorale Conservation Management Plan 2013. The philosophy and process adopted is that guided by the Australia ICOMOS Burra Charter 1999.

1.5 Author identification

This report has been prepared by ELA Archaeologists Lorien Perchard and Caitlin Marsh and reviewed by Karyn McLeod, ELA Principal Heritage Consultant, (BA Hons [Archaeology] University of Sydney, MA [Cultural Heritage] Deakin University).

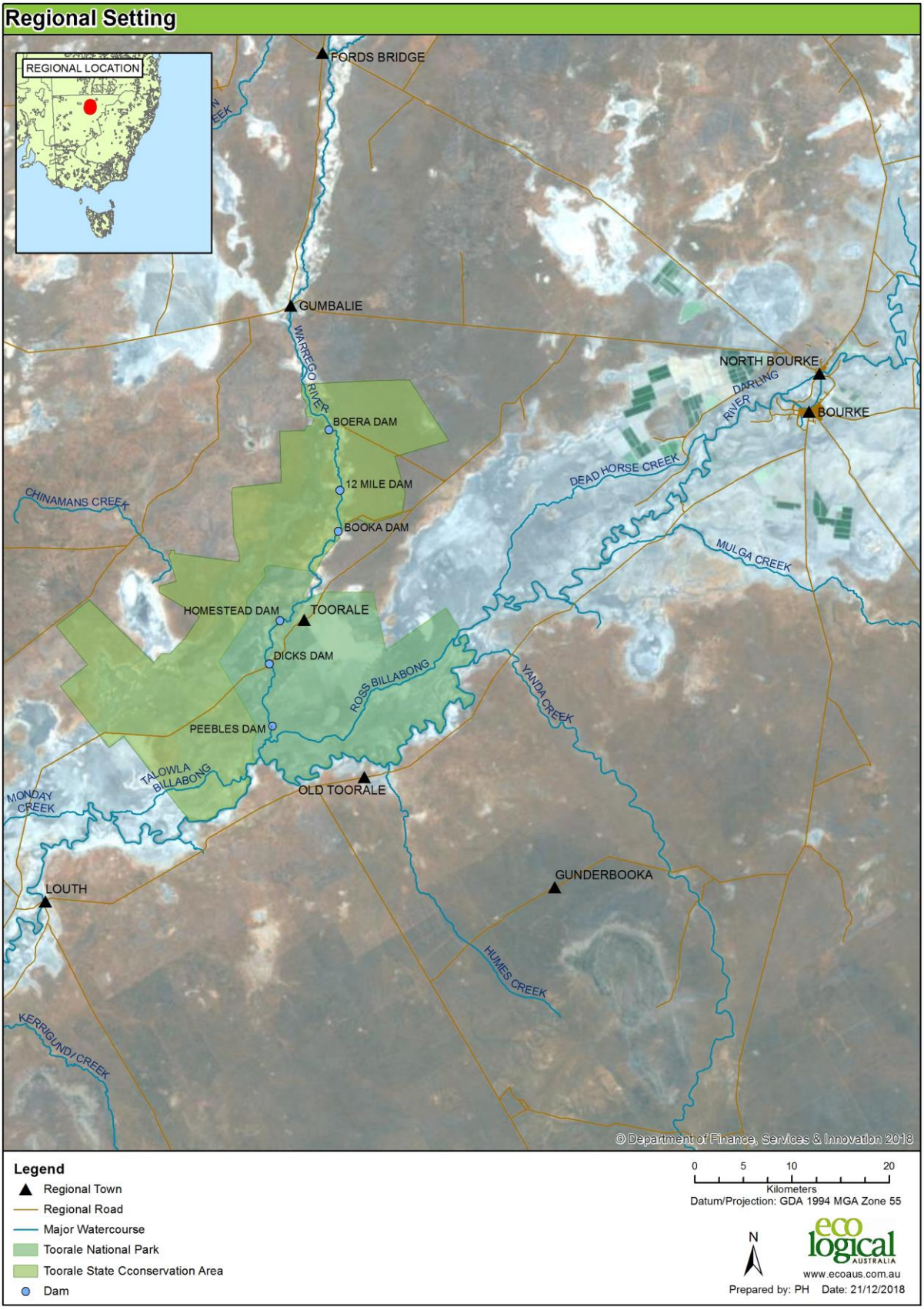

Figure 1: Location of the study area, regional setting

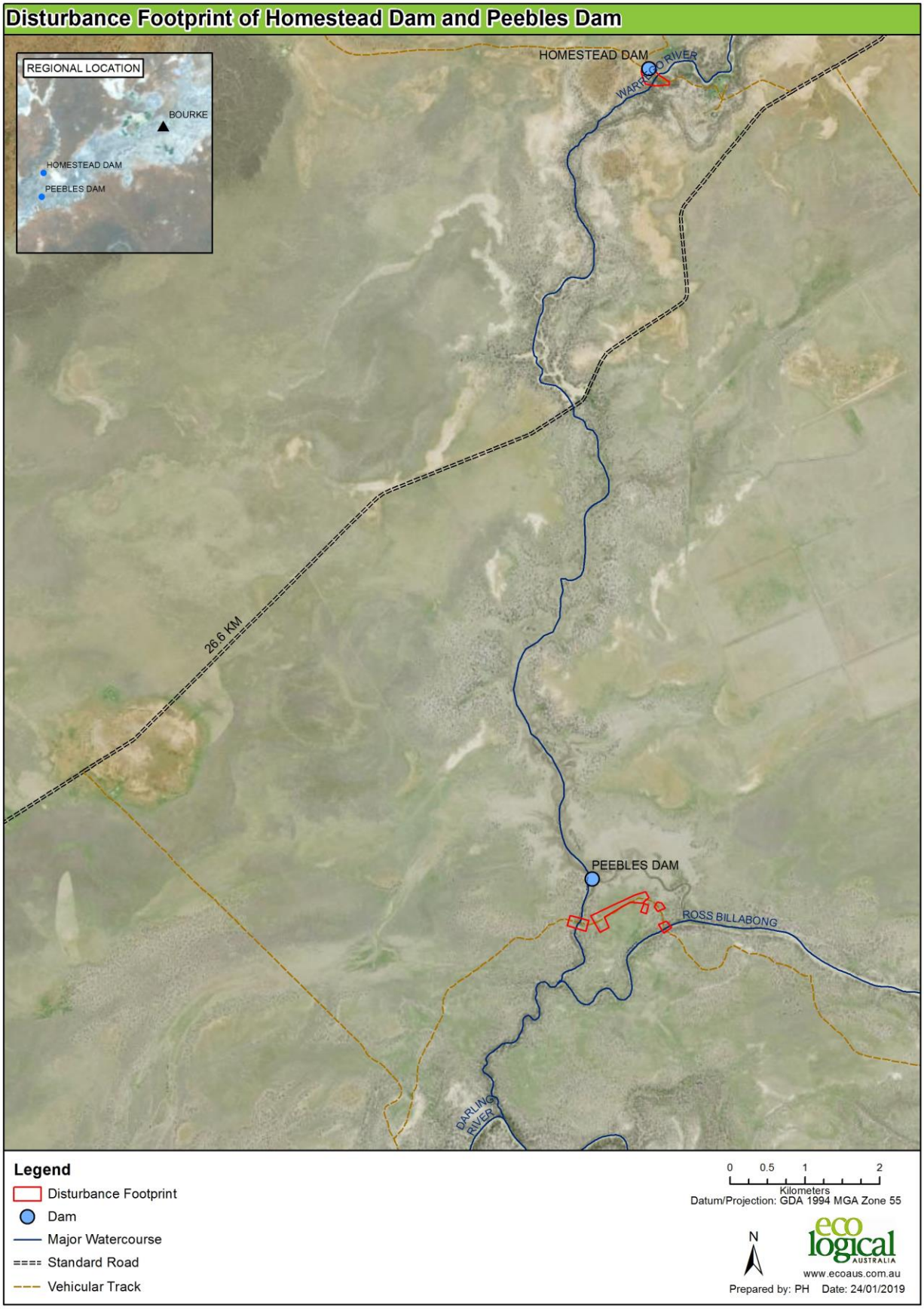

Figure 2 Location of the proposed works (red)

2. Site context

2.1 Site history

The Toorale Station has been a sheep run since all the riverfront was taken up and leased in 1857 by W. B. Tooth. The property, straddling the southern reaches of the Warrego River and its junction with the Darling River, meant that major water capture and diversion works could be carried out. Historically, Toorale has made a significant contribution at a local, State and Federal-level as a large pastoral enterprise. There were three dams within Toorale on the Warrego by 1860, there were ten dams around the turn of the century, and at its zenith by 1924 there were thirteen dams on the Warrego within the Toorale property. There are still seven dams within the property on the Warrego today which are more or less intact (HHI 2013).

In the late nineteenth century, the property was owned by (Sir) Samuel Wilson (from 1871 -1880) followed by his nephew (Sir) Samuel McCaughey (from 1880-1912). Both Wilson and McCaughey had a strong interest in, and a major aptitude for civil engineering works associated with water capture and management. Their considerable wealth, accumulated from wool production, allowed them to undertake these massive projects. The construction of the Boera Dam and Floodwaters Scheme c.1882 by McCaughey is one of the most massive nineteenth century civil engineering and water management constructions known to be undertaken by a private individual on a remote property in New South Wales. The modified flow regimes associated with the Boera Dam resulted in a tenfold increase in flood frequency across the Western Floodplain and the creation of a diverse wetland, which is an important breeding habitat for colonial water birds (Shepherd 2013).

The subsequent owners, Robinson and Vincent, were both trained as property managers by McCaughey and effectively carried on his approach to management of the property until 1924, including building numerous tanks and sinking bores (HHI 2013).

Falling wool prices and variable weather conditions (floods and droughts) in the 20th century meant that the old buildings from the 1870s and 1880s were retained, maintained and re-used. The property appears to have been largely intact in terms of retaining many of the early (post 1870) buildings and much of the machinery and plant, including working steam engines until around 1969 (HHI 2013).

2.2 Site description

Detailed pedestrian survey of both dams and the Toorale Homestead and its surrounds was undertaken over three days (28-30 May 2018) by a qualified and experienced ELA Archaeologist and heritage consultant. The dam structure and associated water management infrastructure at Homestead Dam and Peebles Dam has been photographed. Historic heritage site inspections undertaken by ELA did not identify any historically significant features or fabric associated with the section of Peebles Dam wall that shall be removed or the section of Homestead Dam that will be repaired.

Homestead Dam

Homestead Dam is a 540 m embankment 30 km downstream from Boera Dam. Homestead Dam was constructed in the 1870s to provide water for stock and domestic purposes following the construction of the Homestead property (Shepard 2013). The embankment of Homestead Dam consists of bare earth

(silt and clay) with no grass cover or protection from weathering processes. A levee runs along the high-water level to protect the historic Toorale Homestead and outbuildings from elevated water levels caused by the main embankment. This levee is currently reinforced by sandbags in several locations. A bywash is located on the eastern side of the dam. Two 1200 mm diameter regulator pipes have been installed through the embankment at the original river bed level.

The embankments around Homestead Dam are currently stable, with evidence of previous erosion. Flooding as early as 1880 carried away portions of the dam infrastructure, which was replaced by July 1880 (HHI 2013:21). The Dam was breached during flooding in 2012 and has not been repaired. The breach is 100 m west of the regulator pipes and has significantly reduced the storage capacity of Homestead Dam. It has also decreased historic, cultural, ecological and visitor amenity at the site. Currently a small body of water is retained within the storage controlled by an existing low-level road causeway located downstream of the original dam wall, with a crest level of 97.5 m AHD.

Figure 3: View of Homestead Dam embankment south of the homestead

Figure 4: Homestead Dam view south

Figure 5: Embankment adjacent to the homestead

Figure 6: View of the homestead from the embankment

Peebles Dam

Peebles Dam is the southernmost Dam on the Warrego River, located approximately 45 km downstream of Boera Dam. A low-level version of the Dam was constructed in the 1870s to divert water into Ross Billabong from the Warrego River to supply the woolshed and wool scour. The higher version of the

Dam was constructed in 1986 as part of Duncans Wall, a 2840 m embankment (Shepard HHIR 2013). The enhanced storage area provided water supplies to the former station's main irrigation area. Peebles Dam, Duncan's Wall and the Darling River levee also constrain large flows in the Darling River from moving upstream into the Warrego, so these structures operate in both directions.

The current infrastructure is not part of the 19th century water management scheme and is likely to date to the 1980s when the embankment was raised in association with Duncan's Wall (HHI 2013:45). A 750 mm diameter regulator pipe was installed in a smaller channel off the main Warrego River channel, and a further two 1200 mm regulator pipes were installed in the main channel in 2002 *(*HHI 2013*)*. A bywash is located at the eastern end of Duncan's Wall. Over time, Peebles Dam has undergone several failures and rebuilds, and is currently in a failed state after being breached during flooding in 2012 and has not been repaired. The breach in Duncan's Wall affects the storage capacity of the weir pool at Peebles Dam. The embankment appears of a similar nature and in similar condition to the embankments on the other upstream storages.

Figure 7: Peebles Dam embankment

Figure 8: Infrastructure associated with Peebles Dam, northern side

Figure 9: Infrastructure associated with Peebles Dam, southern side

Figure 10: eroded section embankment

3. Heritage Impact Assessment

3.1 Listing

- Toorale is listed as a heritage item listed under Schedule 5 of the Bourke Local Environmental Plan 2012 (item 28).
- Toorale is listed on NPWS Historic Heritage Inventory (HHI) and includes Built Heritage, Archaeological Resources and Landscape.
- The Darling River is listed on Schedule 5 of the Bourke LEP (Item 10).

3.2 Statement of Significance

The statement of significance and a physical description of the locally listed Toorale Homestead is provided below.

Statement of significance

> The homestead of 'Toorale' represents well the prosperity and challenge of remote rural 'Australian's' pastoral settlers. The National Trust on their visit of August 1986 stated: 'Toorale' is a remarkable example of a large western homestead of unpretentious appearance yet with an interior of surprisingly sophisticated details. The house is remarkable too for its size, and spacious atrium, the scale and variety of outbuildings, the extensive collection of rural equipment within its curtilage, that make the complex of outstanding significance.

Physical description

> Toorale homestead is both magnificent and unusual. Built primarily of ‘lath and plaster' walls internally and ripple iron cladding externally, it contained 27 large rooms. A formal section of the house for the owners at the south is connected directly to a generous central hall 18m x 6m (atrium) with all the service rooms arranged around it containing stores, kitchens, servants accommodation and wash rooms. The 4m high hall is lit by coloured glass roof lights, and a generous verandah surrounds the whole homestead flanked by enormous Phoenix palm trees, creating an ‘oasis' setting.
>
> Once beautifully finished internally, today only remnants of the elaborate wall papers (dating from the late 19th and early 20th C) remain, but most of the delicately patterned Wunderlich ceilings are still intact, and the broad panelled solid timber doors, with fanlights and side lights reflected the wealth and prosperity of the good wool seasons before the drought of 1895. Toorale's single storey building features a large gabled section roof behind, a smaller hipped section. The roof is of corrugated iron, and there are original ogee gutters and timber eaves. Verandahs on all sides of the building have been partially enclosed. The front door is a large four-panel door with bolection mouldings, semi-circular Georgian fan and sidelights. There were several very ornate marble fireplaces, including one exceptional one in coloured marble; one of the fireplaces was removed to the Royal Hotel (now The Port of Bourke) in Bourke. Ceilings in the house are very high (3 metres or more). The long hallway leading from the front door to the atrium features a square fanlight and coloured sidelights, while there are fine plaster motifs on the arch above the door. From the atrium, three panels of coloured glass and corresponding roof lights are visible. Roof timbers are of heavy sawn timber construction. In the structure there is some termite damage. The remains of the

> laundry are located in the northeast corner of the house and include copper troughs. The small cellar is entered by stairs off the northern verandah. Outside the main house the old garden is still defined by concrete edgings, a galvanised pipe rose frame to the west and south of the building and some original, old fashioned roses. To the north of the house is a meat house on stumps and with a hipped and gabled corrugated iron roof. The sides are gauzed and the original mechanism for hanging meat remains. there is also a small store. and complex contains numerous other outbuildings. (SHI listing https://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=1220008).

Clearly this description is focussed on the homestead building and not the dams, other built structures or surrounding property/landscape. The current Conservation Management Plan (CMP) for Toorale (Sheppard 2013) concludes that there are four precincts considered to possess very significant historic fabric, these are:

- The Toorale Homestead Precinct;
- The Old Toorale Woolshed Precinct;
- The Boera Precinct (i.e. the Boera Dam & Floodwaters Scheme), and
- The Nissen & Quonset Huts Shearing Sheds Precinct.

The CMP (Shepherd 2013) states that each of these precincts meet the criteria for State Heritage listing. However, the precinct and property as a whole is not the subject of an interim heritage order, nor has it been added to the State Heritage Register in accordance with the *Heritage Act 1977*.

Significance of the Dams

The CMP includes both Homestead and Peebles Dams as part of the Boera Dam Floodwaters Scheme. Despite the fact that both Homestead and Peebles Dams are small components of a much larger water management scheme, the CMP concludes that all water management infrastructure at Toorale contributes to the potential State significance of the whole site as they constitute a significant technological achievement for the time. No dams are identified as individually significant. The CMP also states that the most significant phase of construction for the earthworks which form the dams occurred when Samuel McCaughey took over in 1880. Both Homestead and Peebles dams were constructed prior to this time for purposes not specifically associated with floodplain watering. The Dams and water management in general across the entire Toorale property has constantly evolved and has been modified through time to adapt to new technologies, uses and farming practices.

The CMP divides the current Toorale National Park & Conservation Area into 11 heritage precincts. The Historic Toorale Homestead Precinct includes Homestead Dam which is associated with the heritage significance of the standing Homestead. The Dam was constructed for domestic use and is not noted in the CMP as a significant item on its own right, nor is it discussed as part of Toorale's listing. The heritage curtilage of the Toorale Homestead and Outbuildings local listing extends across some of Toorale National Park and the State Conservation Area and is not confined to the homestead and its immediate surroundings. Peebles Dam is located outside Toorale's listed heritage curtilage (Figure 11).

Both dams have a long history of construction and modification (Shepherd 2013. Due to continuous alteration over the years, dams have little research potential and therefore have local or no historical archaeological significance.

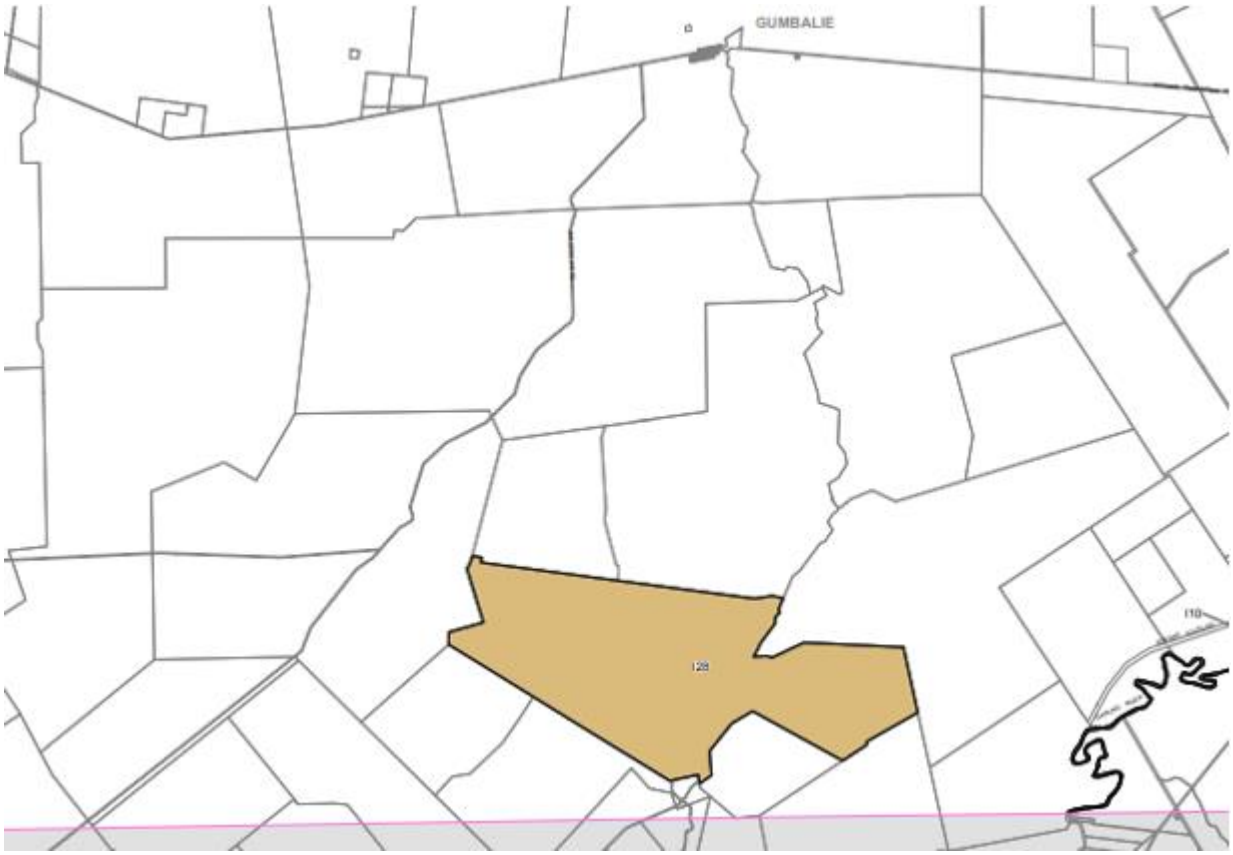

Figure 11 Toorale Homestead and Outbuildings heritage curtilage listed on the Bourke LEP (Heritage map 5)

4. Statutory Controls

4.1 Heritage Act 1977

Under section 140 of the *Heritage Act 1977* (Heritage Act) a person must not disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damage or destroyed unless the disturbance or excavation is carried out in accordance with an excavation permit. A relic is any deposit, artefact, object or material that relates to the settlement of the area that comprises NSW, not being Aboriginal settlement, and is of State or local heritage significance.

Section 140 does not apply to a relic that is subject to an interim heritage order made by the Minister or a listing on the State Heritage Register (SHR). Works to items listed on the SHR are subject to approval by the Heritage Council under Section 60 of the Heritage Act.

4.2 National Parks and Wildlife Act 1974 (NPW Act)

Moderate or major activity within a National Park where the site is listed in the Historic Heritage Information Management System (HHIMS) as state significant but not yet listed on the state heritage register require the preparation of a Review of Environmental Factors (REF).

(i) No application is required to the Heritage Council of NSW unless a project involves excavation.

(ii) Written notification is required to the Heritage Council of NSW for demolition.

(iii) An Aboriginal Heritage Impact Permit (AHIP) may also be required if work has the potential to harm an Aboriginal object or place.

Aboriginal objects and places in NSW are afforded protection under the NPW Act regardless of whether they are registered on the Aboriginal Heritage Information Management System (AHIMS) register or not. Strict penalties apply for harm to an Aboriginal object or place without a defence under the Act. Under Section 87 of the Act there are five defences to causing harm to an Aboriginal object:

- The harm was authorised under an AHIP.
- By exercising due diligence and being able to demonstrate this.
- The actions compiled with a code of practice as described in the *National Parks and Wildlife Regulation 2009*, for example, undertaking test excavation in accordance with the '*Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW*'.
- It was a low-impact activity, or omission under the regulation, or where there was no knowledge of an Aboriginal object already present.
- Was an exemption under Section 87A, for example emergency fire-fighting act or bush fire hazard reduction work within the meaning of the *Rural Fires Act 1997*.

If an AHIP application is required, OEH necessitates that it is supported by an Aboriginal Cultural Heritage Assessment (ACHA) prepared in accordance with the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2010), and a copy of approval for the development or infrastructure issued under Part 4 or Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

4.3 Environmental Planning and Assessment Act 1979 (EP&A Act)

The proponent of the project is the NSW Government acting through the OEH. Under section 5.1 of the EP&A Act, certain government entities are deemed to be a determining authority and it is assumed that this project shall be assessed under Part 5 of the EP&A Act. The project aligns with a number of activities permissible without consent under the *State Environmental Planning Policy (Infrastructure) 2007* (ISEP). Further detail regarding the ISEPP is given in Section 4.4.

Notwithstanding this, under section 5.5 of the EP&A Act, a determining authority has the duty to fully consider the environmental impact of an activity and is required to "take into account to the fullest extent possible all matters affecting, or likely to affect the environment" arising from the proposal. This is facilitated through the current REF, the purpose of which is to identify, assess and determine the significance of potential environmental impacts, as well as mitigating actions and responsibilities to minimise potential impacts.

The proposed works for both Homestead Dam and Peebles Dam will be assessed under Part 5 of the EP&A Act. This Part applies for infrastructure projects approved by the local council or a State agency undertaking the project. No excavation permit is required from the Heritage Council.

Development consent from council is not required, however for a locally listed heritage item, written notice to the Local Council is required to carry out a development, including demolition, with consideration of any response received within 21 days. To comply with this, OEH shall provide a copy of the REF and any specific CMP, heritage assessment or impact assessment to the Bourke Shire Council. Consultation with the local community and local stakeholders is also recommended.

4.4 State Environmental Planning Policy (Infrastructure) 2007 (ISEPP)

The aim of this Policy is to facilitate the effective delivery of infrastructure across NSW by identifying whether certain types of infrastructure require consent, can be carried out without consent or are exempt development. In the absence of a PoM adopted by the Minister, clause 8 of the ISEPP provides that, in the event of an inconsistency between it and any other environmental planning instrument, including an LEP, the ISEPP will prevail.

Pursuant to clause 127(m) of the ISEPP, development for the purpose of maintenance or replacement of components of water supply systems that does not increase capacity (or increases capacity only to a minimal extent) may be carried out by or on behalf of a public authority as exempt development. However, the development must in connection with a water supply system and comply with clause 20 and involve no greater soil and vegetation disturbance than necessary and no increase in stormwater drainage and run-off from the site.

Under the *Bourke Local Environmental Plan 2012* (Bourke LEP), a water supply system means any of the following:

a. a water reticulation system,
b. a water storage facility,
c. a water treatment facility,
d. a building or place that is a combination of any of the things referred to in paragraphs (a)–(c)

Therefore, a water storage facility, including a dam, weir or reservoir for the collection and storage of water, is a component of a water supply system. As such, within the meaning of the ISEPP, the proposed modifications at Homestead Dam is considered to be maintenance and/or replacement of existing water storage facilities.

The removal of the Peebles Dam embankment is permissible under clause 129(1) of the ISEPP, whereby development for the purpose of waterway management activities may be carried out by or on behalf of a public authority without consent. The section of the Peebles Dam embankment is within the main Warrego River channel and is therefore instream management to restore environmental flows for ecological purposes, pursuant to clause 129(b).

Notwithstanding the above, under section 111 of the EP&A Act, a determining authority has the duty to fully consider the environmental impact of an activity and is required to "take into account to the fullest extent possible all matters affecting, or likely to affect the environment" arising from the proposal.

4.4.1 Burke Local Environmental Plan 2012

The objectives of Heritage conservation in the Bourke LEP 2012 are to conserve the environmental heritage of Bourke including the fabric, settings, views and heritage significance of heritage items and heritage conservation areas, archaeological sites, Aboriginal objects and Aboriginal places of heritage significance.

Uses authorised under the NPW Act are permitted without consent. However, in the absence of a PoM adopted by the Minister, clause 8 of the ISEPP provides that, in the event of an inconsistency between it and any other environmental planning instrument, including an LEP, the ISEPP will prevail (Section 4.4).

Table 1 LEP clauses

Clause	Discussion
2) Requirement for consent Development consent is required for any of the following: demolishing or moving any of the following or altering the exterior of any of the following (including, in the case of a building, making changes to its detail, fabric, finish or appearance): (i) a heritage item, (ii) an Aboriginal object, (iii) a building, work, relic or tree within a heritage conservation area, altering a heritage item that is a building by making structural changes to its interior or by making changes to anything inside the item that is specified in Schedule 5 in relation to the item, disturbing or excavating an archaeological site while knowing, or having reasonable cause to suspect, that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed, disturbing or excavating an Aboriginal place of heritage significance,	The Homestead Dam Development Footprint is located within the curtilage of a listed local heritage item. Pursuant to clause 127(m) of the ISEPP, the activity is permitted without Development Consent.

Clause	Discussion
erecting a building on land: i on which a heritage item is located or that is within a heritage conservation area, or ii on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance, - subdividing land: on which a heritage item is located or that is within (i) a heritage conservation area, or; (ii) on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance.	
(5) Heritage assessment The consent authority may, before granting consent to any development: on land on which a heritage item is located, or on land that is within a heritage conservation area, or on land that is within the vicinity of land referred to in paragraph (a) or (b), Require a heritage management document to be prepared that assesses the extent to which the carrying out of the proposed development would affect the heritage significance of the heritage item or heritage conservation area concerned.	Pursuant to clause 127(m) of the ISEPP, the activity is permitted without Development Consent. This REF and Heritage Impact Assessment fulfils this clause as the proposed development is within the curtilage of a heritage item.

5. Impacts and mitigation

5.1 Impacts

Homestead Dam

The proposed works are to repair the previously breached dam wall consistent with the existing works approval and to reinstate Homestead Dam to a state that is consistent with its recognised heritage values. Material from Peebles Dam may be used to fill the breach at Homestead Dam. The Toorale Homestead is located over 1 km from the Homestead Dam repair works footprint.

- There are no potential direct impacts to heritage values associated with Toorale Homestead Precinct posed by the proposed reinstatement of Homestead Dam. Establishment of 98.5 m AHD water levels in Homestead Dam will enhance the significance of the Homestead precinct by retaining a reasonably constant water level. Re-establishment of existing historic water management infrastructure is a positive heritage outcome for the historic Toorale Homestead setting and the local ecosystem.
- There will be no archaeological impact as local materials or spoil from Peebles Dam will be added to the fill the breach and no excavation is proposed.
- The works area is 1 km to the west of the Homestead and materials required for repair of the Dam will be trucked on existing roads outside the immediate Homestead Precinct. Indirect impacts such as temporary noise, dust and disturbance in the precinct will be minor or non-existent.

Peebles Dam

The proposed works are to increase the capacity to deliver flows to the lower Warrego River by removing a portion of the Peebles Dam embankment to allow Warrego River flows to pass through to the Darling River. The Old Toorale Woolshed Precinct is located adjacent to Ross Billabong, which is associated with Peebles Dam. It is located approximately 5.5 km from the Peebles works footprint.

- The dam is already breached to the north. Allowing Warrego River flows to pass through to the Darling River along its original course is a positive ecological outcome.
- Material from the embankment will be used to repair the Homestead Dam and/or be returned to nearby borrow pits.
- Much of the current embankment was constructed in the 1980s when it became part of the main irrigation storage water system for Toorale (Shepard HHIR 2013:45) and the existing pipes, gates and operating platform date to this time. These items have become mostly obsolete since the dam was breached.
- There will be no archaeological impact as it not considered that the embankment will contain a resource that has archaeological research potential. Documentation and information regarding the construction of the dams is known and it is unlikely that additional information will be obtainable.
- Removal of part of the embankment will not have a materially detrimental effect on the heritage significance of the Boera Dam and Floodwaters Scheme, the Woolshed Precinct or Toorale as a whole.

- There are no potential direct or indirect impacts to heritage values associated with the woolsheds as they are located approximately 5.5 km away. Temporary noise, dust and disturbance will not impact on any significant heritage values.

Figure 12 Peebles Dam Location of embankment to be removed and spoil placement (Alluvium Detail Design Drawing 24/08/18)

The CMP recommended that the procedures for managing the site be consistent with the management of the site as a State Heritage item, however this contradicts the *The NPWS Guidelines for historic heritage approvals*. Policy relevant to dams and water management in the CMP is as follows.

CMP Policy	Response
7.5.2 Fabric Management of Water Infrastructure Partial decommissioning of historic water infrastructure where necessary will where possible be carried out in a sensitive manner so that the majority of the Dam or tank remains to identify its location, size and shape and evidence the construction techniques used. As historic water infrastructure is modified or decommissioned the opportunity will be taken to identify and record any unusual or obviously historic construction techniques and materials.	While the proposal will result in the removal or modification of part of the embankment and water management infrastructure at Peebles Dam, none of the directly impacted infrastructure has been assessed as individually significant and dates to the 20th century. Furthermore, the physical structure at Peebles Dam has been breached, rebuilt and modified throughout its existence up to the end of the end of Clyde Agriculture's ownership (2008). The embankment at Peebles Dam has been breached since 2012. Only a small portion of the dam will be removed along the original stream bed and the majority of the Dam will remain to identify its location, size and shape and evidence the construction techniques used. Evidence of unusual or obviously historic construction techniques and materials is unlikely as the breach has been inspected and geo-testing has been undertaken with consistent results.

5.2 Heritage Office guidelines

The proposed works are addressed in relation to relevant questions posed in the Heritage Office & Department of Planning guidelines (2001).

Table 2 Heritage Office guidelines

Question	Discussion
The following aspects of the proposal respect or enhance the heritage significance of the item or conservation area for the following reasons:	The re-instatement of the breach in the embankment at Homestead Dam will repair potential detrimental impacts to the heritage significance of the Toorale Homestead as the original form of the dam wall will be restored. The non-repair of Homestead Dam was noted within the CMP as potentially contravening 'Minimum Standards of Maintenance' provisions under the *State Heritage Act 1977* (Shepherd 2013:104). Therefore, the works to repair the Homestead Dam site will enhance the heritage significance of the area as it will reinstate an element of the modified landscape to better reflect its previous state, helping to restore the historic Toorale Homestead setting and the local ecosystem.
The following aspects of the proposal could detrimentally impact on heritage significance. The reasons are explained as well as the measures to be taken to minimise impacts:	Removal of part of the embankment at Peebles Dam will not have a materially detrimental effect on the heritage significance of the Boera Dam and Floodwaters Scheme, the Woolshed Precinct or Toorale as a whole. Peebles Dam has already been breached and is no longer required for the water management of the larger Toorale Homestead
The following sympathetic solutions have been considered and discounted for the following reasons:	This proposal at Homestead Dam is a temporary measure.
Partial Demolition Is the demolition essential for the heritage item to function? Are important features of the item affected by the demolition (e.g. fireplaces in buildings)? Is the resolution to partially demolish sympathetic to the heritage significance of the item? If the partial demolition is a result of the condition of the fabric, is it certain that the fabric cannot be repaired?	Removal of part of the embankment at Peebles Dam will not affect the heritage significance of the Boera Dam and Floodwaters Scheme or its continued functioning. It is not a significant item in its own right. No important features will be removed. The positive environmental outcomes outweigh any minor heritage impacts.
Minor additions How is the impact of the addition on the heritage significance of the item to be minimised? Can the additional area be located within an existing structure? If no, why not? Will the additions visually dominate the heritage item? Is the addition sited on any known or potentially significant archaeological deposits? If so, have alternative positions for the additions been considered? Are the additions sympathetic to the heritage item? In what way (e.g. form, proportions, design)?	Addition of materials to Homestead Dam to fix the breach will not impact heritage values associated with the dam itself or Toorale Homestead Precinct. Re-establishment of existing historic water management infrastructure is a positive heritage outcome for the historic Toorale Homestead setting and the local ecosystem. There will be no archaeological impact as local materials or spoil from Peebles Dam will be added to the fill the breach and no excavation is proposed. NPWS has invested significant amount of money to conserve and repair the historic heritage in this precinct and this work would enhance that investment.

5.3 Mitigation

It is anticipated that the removal of of Peebles Dam wall will result in altered flooding regimes in the lowest reaches of the Warrego River catchment which will be more representative of natural flow regimes associated with the historic context of the Old Toorale Woolshed Precinct. Notwithstanding this, it is recommended that the proponent implement ongoing surveillance and monitoring of water levels and riparian vegetation within Ross Billabong in the vicinity of the Toorale Woolshed to determine potential changes to vegetation as a result of the decommissioning of Peebles Dam and develop and implement a response plan should vegetation condition deteriorate in such a manner as to negatively impact heritage amenity values associated with the Shearers Quarters and Woolshed.

The removal of part of Peebles Dam constitutes further modification of the Boera Dam & Floodwaters Scheme, which is considered consistent with the past adaptive management principles that underpin the scheme. To ensure that a continuous history of the Scheme is maintained it is recommended that a pre and post works photographic record be compiled (that meets OEH requirements for such recording).

As historic water infrastructure is modified or decommissioned the opportunity will be taken to identify and record any unusual or obviously historic construction techniques and materials' (Shepherd 2013:129).

Reuse or interpretation of any existing pipes or water management infrastructure that require removal shall be considered. The current infrastructure is not part of the 19th century water management scheme and is likely to date to the 1980s when the embankment was raised in association with Duncan's Wall (HHI 2013:45).

Post-works grading, will minimise any potential impacts to the access tracks between the two sites.

Historic features and landscapes within and beyond the heritage precincts will, where practical, be interpreted.

Any fences damaged or need replacing due to the proposed works must be retained or maintained of a similar appearance and style.

To ensure that a continuous history of the Scheme is maintained it is recommended that a pre and post works photographic record be compiled (that meets OEH requirements for such recording).

Brief project team on unexpected finds and discovery of human remains process at induction.

6. Conclusion and Recommendations

CONCLUSIONS

Based on the information provided above, it is concluded that the proposed works will result a positive impact on historic heritage values associated with the Toorale Homestead Precinct, and no significant impact to other historic precincts associated with the site.

The non-repair of Homestead Dam was noted within the CMP as potentially contravening 'Minimum Standards of Maintenance' provisions under the *State Heritage Act 1977* (Shepherd 2013:104). Therefore, the works to repair the Homestead Dam site will enhance the heritage significance of the area as it will reinstate an element of the modified landscape to better reflect its previous state, helping to restore the historic Toorale Homestead setting and the local ecosystem.

Removal of the within-channel section of Peebles Dam embankment will not impact the overall significance of the Boera Dam & Floodwaters Scheme or Toorale as a whole. The remaining portions of the embankment will be visible and able to be interpreted if required.

Removal of part of Peebles Dam embankment will result in altered flooding regimes in the lowest reaches of the Warrego river catchment, however these will be more representative of natural flow regimes than those associated with full development of the Boera Dam & Floodwaters Scheme and likely more similar to conditions associated with the historic context of the Old Toorale Woolshed Precinct.

The proposal seeks to retain and enhance environmental outcomes associated with the ongoing operation of the Boera Dam & Floodwaters Scheme. Implementation of actions associated with the reinstatement of Homestead Dam and the partial removal of Peebles Dam demonstrates concurrence with the objectives of the CMP.

The proposed decommission of the Peebles Dam has been discussed with the Toorale JMC and the removal of the Peebles Dam was deemed acceptable, due to the lack of Aboriginal or historical heritage material in the area (Biosis 2016:56).

RECOMMENDATIONS

As historic water infrastructure is modified or decommissioned the opportunity will be taken to identify and record any unusual or obviously historic construction techniques and materials' (Shepherd 2013:129).

Reuse or interpretation of any existing pipes or water management infrastructure that require removal shall be considered. The current infrastructure is not part of the 19th century water management scheme and is likely to date to the 1980s when the embankment was raised in association with Duncan's Wall (HHI 2013:45).

Post-works grading, will minimise any potential impacts to the access tracks between the two sites.

Historic features and landscapes within and beyond the heritage precincts will, where practical, be interpreted.

Any fences damaged or need replacing due to the proposed works must be retained or maintained of a similar appearance and style.

To ensure that a continuous history of the Scheme is maintained it is recommended that a pre and post works photographic record be compiled (that meets OEH requirements for such recording).

Brief project team on unexpected finds and discovery of human remains process at induction.

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