



Public Works
Advisory



Bungendore Floodplain Risk Management Plan Review of Environmental Factors

Report No: ISR18046

June 2018

Prepared for Queanbeyan-Palerang Regional Council



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Document Control

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Declaration

This Review of Environmental Factors (REF) has been prepared by Public Works Advisory, Department of Finance, Services and Innovation on behalf of Queanbeyan-Palerang Regional Council. The report presents the assessment of potential impacts that may result from activities associated with the proposal to carry out floodplain risk management (FRM) works at Bungendore. The FRM works include the upgrade of the existing Turallo Terrace levee, including the realignment of two sections of the levee; a new overflow channel and riverbank reshaping and clearing works at the confluence of Halfway and Turallo Creeks at Bungendore, NSW.

Queanbeyan-Palerang Regional Council is a public authority and a determining authority as defined in the *Environmental Planning & Assessment Act 1979* (EP&A Act). The proposal satisfies the definition of an activity under the Act, and as such Queanbeyan-Palerang Regional Council must assess and consider the environmental impacts of the proposal before determining whether to proceed.

This REF has been prepared in accordance with Sections 5.5 and 5.7 of the EP&A Act and Clause 228 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Reg). It provides a true and fair assessment of the proposed activity in relation to its likely effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposed activity.

On the basis of this REF it is concluded that:

- (1) The proposed activity is not likely to have a significant impact on the environment and therefore an Environmental Impact Statement is not required.
- (2) The proposed activity is not likely to significantly affect threatened species, populations, ecological communities, or critical habitat. Therefore, a Species Impact Statement (SIS) is not required.
- (3) The proposed Activity is not likely to affect Commonwealth land or significantly affect Matters of National Environmental Significance, and is not located on Commonwealth land.

The proposed activity is recommended for approval subject to implementation of measures to avoid, minimise or manage environmental impacts listed in this REF.

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Verification and Determination

Verifier

I have examined this REF and the Declaration by the Kristen Parmeter (the author) and accept the report on behalf of Queanbeyan-Palerang Regional Council (the proponent).

Name	
Designation	
Organisation	
Signature	

Determination

I determine that the activity is approved and may proceed.

Name	
Designation	
Organisation	Queanbeyan-Palerang Regional Council
Signature	

Table of Contents

	PAGE
DECLARATION	III
VERIFICATION AND DETERMINATION	IV
TABLE OF CONTENTS	V
LIST OF ABBREVIATIONS	VII
1 INTRODUCTION	1
1.1 Background.....	1
1.2 Proposal Objectives	1
1.3 Overview of the Proposed Works	1
1.4 Land Ownership.....	2
2 STATUTORY PLANNING FRAMEWORK.....	5
2.1 Environmental Planning Instruments.....	5
2.2 Relevant Legislation.....	6
2.3 Relevant Guidelines	11
2.4 Summary of Statutory Approvals.....	12
2.5 Consultation	12
3 NEED FOR THE PROPOSAL	15
3.1 Project Justification	15
3.2 Options Development.....	15
4 SCOPE OF THE PROPOSAL	17
4.1 Description of the Proposed Works	17
4.2 Construction Methodology.....	19
4.3 Construction Considerations	20
4.4 Operational Issues	21
5 ENVIRONMENTAL ASSESSMENT.....	22
5.1 Assessment Methodology	22
5.2 Location and Land Use	22
5.3 Soil and Water Management.....	25
5.4 Flooding	30
5.5 Ecology.....	34
5.6 Aboriginal Cultural Heritage	40
5.7 Historic Heritage	46
5.8 Noise and Vibration.....	48
5.9 Air Quality	51
5.10 Traffic and Access	52
5.11 Waste Management.....	53
5.12 Visual Amenity	55
5.13 Utilities and Infrastructure.....	55
5.14 Greenhouse Gas Emissions.....	56
5.15 Socio-economic	56
5.16 Climate Change	57
6 ENVIRONMENTAL MANAGEMENT.....	58
6.1 Construction Environmental Management Plan.....	58
6.2 Environmental Management Measures	59
7 CONCLUSION.....	73

8 REFERENCES	75
APPENDIX A - CONSIDERATION OF CLAUSE 228.....	76
APPENDIX B – FLORA AND FAUNA ASSESSMENT	79
APPENDIX C – ABORIGINAL AND HISTORICAL ARCHAEOLOGICAL ASSESSMENT.....	80
APPENDIX D – CONSULTATION LETTERS.....	81

LIST OF TABLES

	PAGE
Table 1-1 Land Tenure.....	2
Table 2-1 Land Zoning	5
Table 2-2 Summary of Approvals and Requirements	12
Table 2-1 Agency Consultation	13
Table 5-1 Construction Equipment Sound Power Level.....	49
Table 6-1 Construction Environmental Management Plan Structure	58

LIST OF FIGURES

	PAGE
Figure 1-1 Proposed Bungendore floodplain risk management works areas	1
Figure 1-2 View of a section of the existing Turallo Terrace Levee, looking west	1
Figure 1-3 View of the western section of proposed overflow channel area, looking north-east	2
Figure 1-4 View of the eastern section of proposed overflow channel area, looking north-east	2
Figure 1-5 View of the proposed re-shaping vegetation clearing area at the confluence of Turallo and Halfway Creeks, looking in a westerly direction	3
Figure 2-1 Palerang LEP 2014 land zoning extract	6
Figure 4-1 Location of re-shaping and vegetation clearing works at the confluence of Turallo and Halfway Creeks.	18
Figure 4-2 Location of Turallo Terrace Levee upgrade and realignment works	18
Figure 4-3 Location of proposed Turallo Creek overflow channel across paddock land.....	19
Figure 5-1 Comparison of peak 100 year recurrence flood extents with and without Option S4B flood management measures	32
Figure 5-2 variation in peak 100 year recurrence flood levels due to the incorporation of Option S4B.	33
Figure 5-3 Vegetation mapping of the study region and location of Black Gums	39
Figure 5-4 Location of BunPADA and BunPADB.....	43
Figure 5-5 AHIP area in flood overflow channel area at Bungendore	44
Figure 5-6 Recorded heritage items in Bungendore including Bungendore Common listed under the Palerang LEP 2014.....	47

List of Abbreviations

AEP	Annual exceedance probability
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ARI	Average recurrence interval
ASS	Acid Sulfate Soils
BC Act	<i>Biodiversity Conservation Act 2016</i>
CEMP	Construction Environmental Management Plan
DEE	Department of the Environment and Energy (Commonwealth)
DoI	Department of Industry
DPI	Department of Primary Industries
EEC	Endangered Ecological Community
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000</i>
EPA	Environment Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
FRM	Floodplain Risk Management
FRMP	Floodplain Risk Management Plan
FRMS	Floodplain Risk Management Study
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
NPW Act	<i>National Parks and Wildlife Act 1974</i>
OEH	Office of Environment and Heritage
PAD	Potential Archaeological Deposit
PWA	Public Works Advisory
QPRC	Queanbeyan - Palerang Regional Council
RAP	Registered Aboriginal Parties
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy
SWMP	Soil and Water Management Plan
TMP	Traffic Management Plan
WM Act	<i>Water Management Act 2000</i>

1 Introduction

1.1 Background

The town of Bungendore is located in the southern tablelands region of NSW, approximately 40 km north-east of Canberra and 220km south-west of Sydney.

Bungendore is located on the banks of Turallo and Halfway Creeks which are tributaries that drain to the southern shoreline of Lake George to the north. Major flooding has occurred at Bungendore on a number of occasions over the last 75 years.

Worley Parsons (2014b) developed a number of flood mitigation measures as part of a floodplain risk management plan (FRMP) for the town of Bungendore as part of the New South Wales Government's Floodplain Management Program. The floodplain risk management (FRM) measures to be implemented are the most beneficial for meeting environmental, social and economic objectives for the township and catchment.

Public Works Advisory has been engaged by Queanbeyan-Palerang Regional Council (QPRC) to prepare a Review of Environmental Factors (REF) for a proposal to carry out a package of floodplain risk management works, including the upgrade and realignment of a section of the existing Turallo Terrace levee; the construction of a new overflow channel; and excavation and clearing works at the confluence of Halfway and Turallo Creeks.

1.2 Proposal Objectives

The objective of the proposal is to manage existing, future and residual flood risks to protect the town of Bungendore from damage due to flooding from future flood events.

The proposed flood management measures form an integral part of the FRM plan developed for Bungendore by QPRC to reduce the risk for loss of life and property associated with flood events at Bungendore.

1.3 Overview of the Proposed Works

QPRC is proposing to carry out a package of floodplain risk management works in Bungendore. The proposed FRM works comprises three main components of the selected Option (S4B) which are outlined below:

- Removal of dense vegetation and creek re-shaping at the confluence of the Turallo and Halfway Creeks;
- Upgrade and partial realignment of the existing Turallo Terrace levee; and
- Construction of an overflow channel across Tarago Road.

These flood management measures are part of the Floodplain Risk Management Strategy (FRMS), recommended for implementation in the Bungendore FRMP developed for QPRC by Worley Parsons (2014a and 2014b, respectively).

An aerial overview of the components of the proposed FRM works is shown in Figure 1-1. Photographs of sections of the three FRM works areas are provided in Figure 1-2 to Figure 1-5.

1.4 Land Ownership

Land tenure for the Bungendore FRM works areas includes Council road reserves, private landholdings and public land as summarised in Table 1-1 below:

Table 1-1 Land Tenure

Land Parcel	Authority/ Landowner
Levee Upgrade and Realignment	
Majara Street unformed road reserve	QPRC
Lot 701 DP 96329	QPRC with part Crown reserve clause (DoI - Lands & Water)
Lot 701 DP 96328	QPRC with part Crown reserve clause (DoI - Lands & Water)
Butmaroo Street unformed road reserve	QPRC
Ellendon Street unformed road reserve	QPRC
Lot 1 DP 46300	QPRC with part Crown reserve clause
Lot 2 DP 46300	Freehold
Lot 3 DP 46300	QPRC with part Crown reserve clause
Lot 4 DP 46300	QPRC with part Crown reserve clause
Overflow Channel	
Lot 21 DP 1176100	Freehold
Lot 7006 DP 1052668 (Travelling Stock Reserve)	DoI - Lands & Water/ Local Land Services
Tarago Road reserve	QPRC
Lot 2 DP 1119227	Freehold
Turallo and Halfway Creeks Confluence Clearing and Bank Reshaping	
Lot 7004 DP 1056515 (Travelling Stock Reserve)	DoI - Lands & Water/ Local Land Services
Lot 7004 DP 96237	QPRC with part Crown reserve clause
Lot 701 DP 1027106	QPRC with part Crown reserve clause
Lot 2 DP 548291	Freehold
Lot 7005 DP 96237	QPRC with part Crown reserve clause

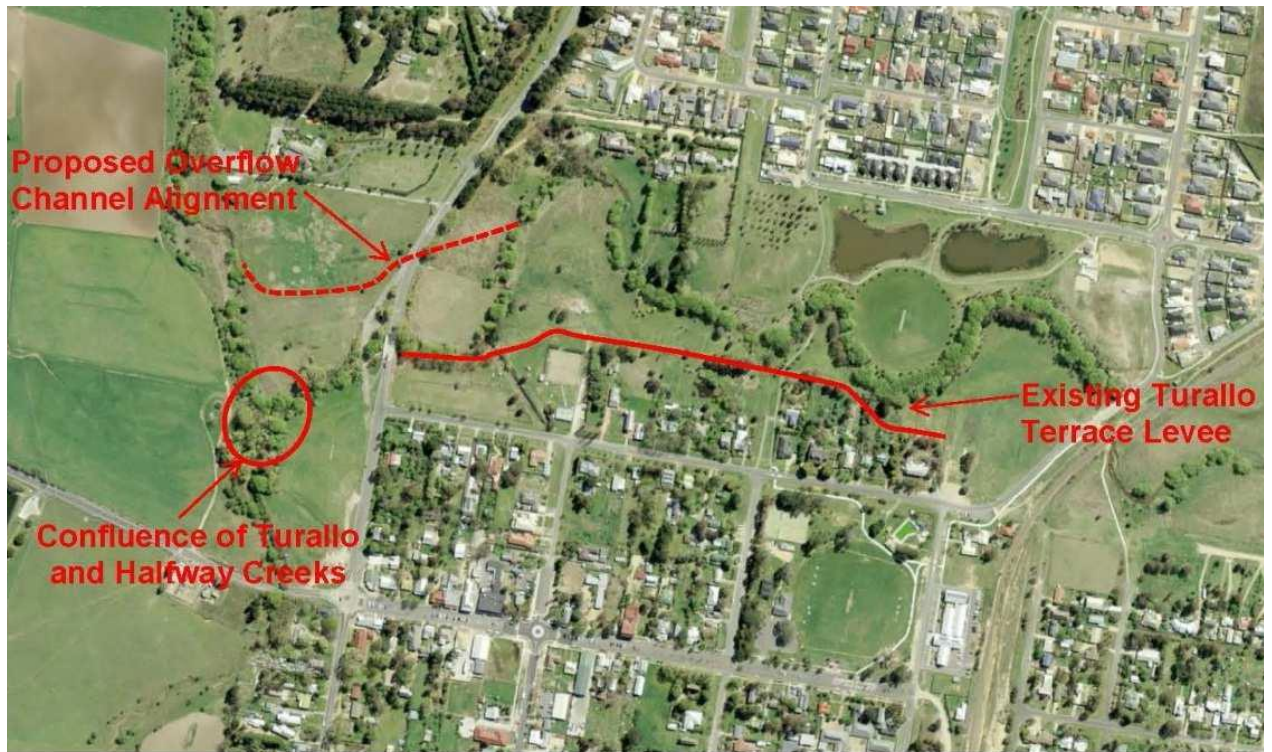


Figure 1-1 Proposed Bungendore floodplain risk management works areas

Source: PWA, 2018



Figure 1-2 View of a section of the existing Turallo Terrace Levee, looking west



Figure 1-3 View of the western section of proposed overflow channel area, looking north-east



Figure 1-4 View of the eastern section of proposed overflow channel area, looking north-east



Figure 1-5 View of the proposed re-shaping vegetation clearing area at the confluence of Turallo and Halfway Creeks, looking in a westerly direction

2 Statutory Planning Framework

This section presents the statutory planning and strategic policy context for the proposal.

2.1 Environmental Planning Instruments

2.1.1 Palerang Local Environmental Plan 2014

The proposed floodplain risk management works are located within the Queanbeyan-Palerang Local Government Area (LGA). The proposed works would traverse a number of land use zones under the *Palerang Local Environmental Plan 2014* (LEP), as listed in Table 2-1 and shown in Figure 2-1.

However, *State Environmental Planning Policy (Infrastructure) 2007* is the relevant environmental planning instrument for the proposal and is discussed in Section 2.1.2. Clause 5.12 (1) of the Palerang LEP 2014 states that the LEP *does not restrict or prohibit, or enable the restriction or prohibition of, the carrying out of any development, by or on behalf of a public authority, that is permitted to be carried out with or without development consent, or that is exempt development, under State Environmental Planning Policy (Infrastructure) 2007.*

Table 2-1 Land Zoning

Scheme Component	Zoning	Permissibility under LEP
Levee upgrade and realignment	R2 - Low Density Residential	Flood mitigation works permissible with consent
	RE1 - Public Recreation	Flood mitigation works permissible with consent
	RE2 - Private Recreation	Flood mitigation works permissible with consent
	SP1 - Special Activities: Pound	Flood mitigation works prohibited
Overflow Channel	RE1 - Public Recreation	Flood mitigation works permissible with consent
	R5 - Large Lot Residential	Flood mitigation works permissible with consent
Turallo and Halfway Creek Confluence Vegetation Clearing/ Bank Reshaping Works	RE1 - Public Recreation	Flood mitigation works permissible with consent

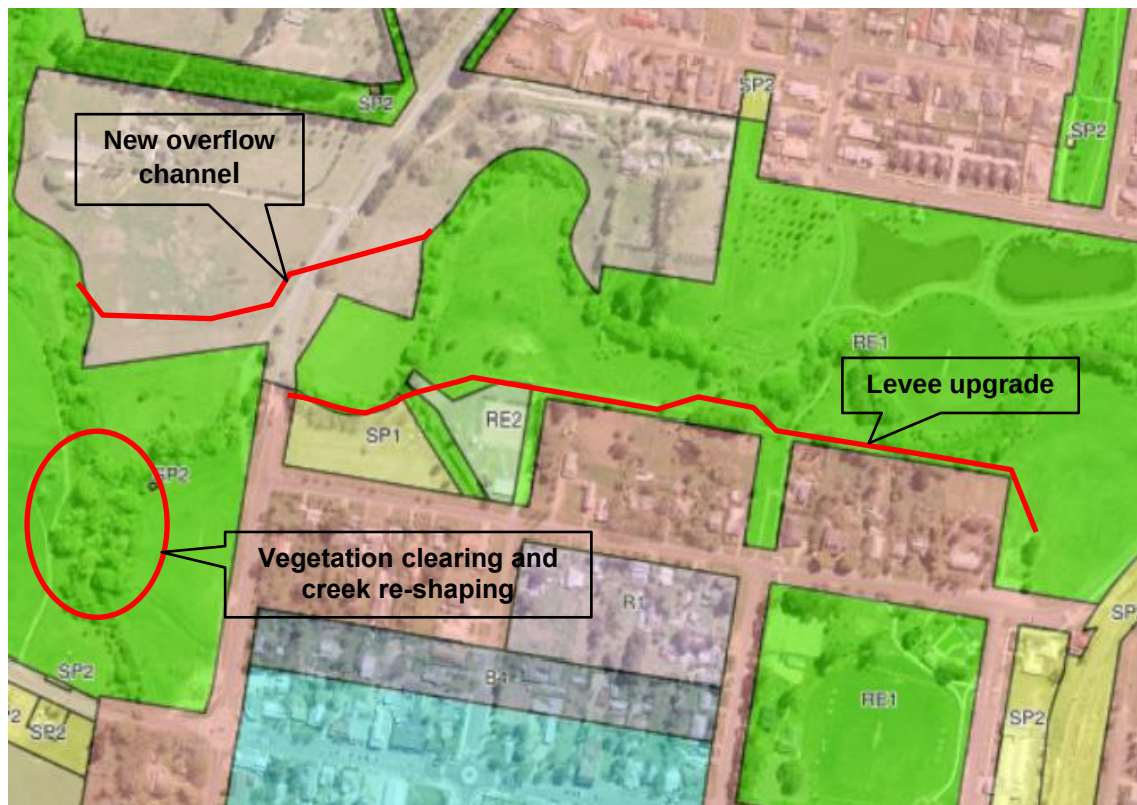


Figure 2-1 Palerang LEP 2014 land zoning extract

Source: NSW Planning Portal, accessed April 2018

2.1.2 State Environmental Planning Policy (Infrastructure) 2007

The SEPP (Infrastructure) 2007 aims to assist in the effective delivery of public infrastructure across the State by improving certainty and regulatory efficiency through consistent planning assessment and approvals regime for public infrastructure and services and through the clear definition of environmental assessment and approval process for public infrastructure and services facilities.

Clause 50 states that development for the purpose of flood mitigation work may be carried out by or on behalf of a public authority without consent on any land. Flood mitigation work is defined as “*work designed and constructed for the express purpose of mitigating flood impacts. It involves changing the characteristics of flood behaviour to alter the level, location, volume, speed or timing of flood waters to mitigate flood impacts. Types of works may include excavation, construction or enlargement of any fill, wall or levee that will alter riverine flood behaviour, local overland flooding, or tidal action so as to mitigate flood impacts.*”

As the proposal is defined as flood mitigation works undertaken by QPRC, the works can be undertaken without development consent.

2.2 Relevant Legislation

2.2.1 Environmental Planning and Assessment Act 1979 (NSW)

The relevant environmental planning instrument for the proposal is SEPP (Infrastructure) 2007 which removes the requirement to obtain development consent. Therefore, the proposal has been assessed under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). QPRC is the proponent and the determining authority for the development.

This REF has been prepared in accordance with Section 5.5 of the EP&A Act, which requires that the proponent take into account to the fullest extent possible all matters affecting or likely to affect the environment due to the proposed activity. Consideration of the factors listed under Clause 228 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) has been used to assist in assessing the significance of the proposal, and is provided in Appendix A.

2.2.2 Roads Act 1993 (NSW)

Under Section 138 of the *Roads Act 1993* a person must not “erect a structure or carry out a work in, on or over a public road.” other than with the consent of the appropriate roads authority.

However, Schedule 2 Section 5(1) of the *Roads Act 1993* does not require a public authority to obtain a roads authority's consent to exercise the public authority's functions in, on or over an unclassified road other than a Crown road. Council is the roads authority for roads impacted by the proposed works within Bungendore, and by undertaking these works would be exercising their function as the flood management authority. As such no approval under the *Roads Act 1993* would be required.

2.2.3 Crown Lands Act 1989

Some components of the FRM works would be installed within public land. Section 155 (1) of the *Crown Lands Act 1989* states that a person shall not, without lawful authority, erect a structure on, or clear, dig up or cultivate public land. As such, the proposed works within Crown land would require authorisation by a lease, licence or other permit from the NSW Crown Lands Division within the NSW Department of Industry – Lands and Water (DoI – Lands & Water).

2.2.4 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides for the statutory protection of Aboriginal cultural heritage places, objects and features. One of the objects of the NPW Act is the conservation of places, objects and features of significance to Aboriginal people (Section 2A). The NPW Act provides for the management of both Aboriginal Objects and Aboriginal Places.

Aboriginal Objects and Aboriginal Places are protected under Part 6 of the NPW Act and there are legislative penalties if a person harms or desecrates an Aboriginal Place or Object (s. 86). Harm to an Aboriginal Place or Aboriginal Object includes any act or omission that destroys, defaces or damages the object or place, or, in relation to an Aboriginal object, moves the object from the land on which it had been situated.

However, harm to an Aboriginal Object that is ‘trivial or negligible’ does not constitute an offence. Also, it is a defence against prosecution for unintentionally harming Aboriginal Objects if due diligence had been exercised to determine that no Aboriginal object would be harmed, or the harm or desecration was authorised by an Aboriginal heritage impact permit (AHIP).

An Aboriginal Cultural Heritage Assessment Report (ACHAR) undertaken for the proposal identified a number of Aboriginal artefacts recorded within the proposed overflow channel alignment (See Section 5.6 of this report) which are protected under the NPW Act. The ACHAR concluded that an Aboriginal Heritage Impact Permit (AHIP) under Section 90 of the NPW Act would be required to undertake the overflow channel works.

2.2.5 Heritage Act 1977

The *Heritage Act 1977* protects the State's natural and cultural heritage and contains measures to protect archaeological remains. More specifically, it provides protection for European/historic relics and sites.

An Aboriginal Due Diligence and Historic Heritage Assessment undertaken by Past Traces (Section 5.7 and Appendix C) identified a locally significant historic heritage item registered under the Palerang LEP located within Bungendore in the vicinity of the levee upgrade works. However, it is anticipated that the works can be carried out with Council approval to avoid impacting the identified heritage item. No approval under the *Heritage Act 1977* is required.

2.2.6 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) protects species of threatened flora and fauna, endangered populations and endangered ecological communities and their habitats in NSW. It also lists Key Threatening Process that adversely affects threatened species, populations or ecological communities or that may cause species, populations or ecological communities that are not threatened to become threatened.

One vulnerable plant listed on the BC Act had been recorded in the works areas; this being the Black Gum (*Eucalyptus aggregata*). However, a flora and fauna assessment undertaken for the proposal concluded that there would be no significant impact to threatened flora or fauna species or their habitat, endangered populations or endangered ecological communities of State conservation significance, provided that the mitigation measures proposed are implemented (see Section 5.5 and Appendix B). No approval under the BC Act is therefore required.

2.2.7 Water Management Act 2000

Section 91D(1) of the *Water Management Act 2000* (WM Act) states that a person who constructs or uses a flood work, and who does not hold a flood work approval for that work, is guilty of an offence.

Although the proposed work meets the definition of flood work under the WM Act, Clause 41C(1) of the *Water Management (General) Regulation 2011* states that Local Councils are exempt in relation to the construction or use of a flood work if the construction or use of the work is carried out under a development authorisation granted by a council, and the work is situated in or on a place that is located within a managed designated high risk flood area, or any other place (unless it is located within an unmanaged designated high risk flood area). As the works are being undertaken by a Local Council within a managed high risk flood area, a flood work approval is therefore not required.

Section 91E of the WM Act states that a person must not carry out a controlled activity in, on or under waterfront land otherwise than in accordance with a controlled activity approval. Although the proposed work could meet the definition of a controlled activity under the Act, Clause 38 of the *Water Management (General) Regulation 2011* states that Public Authorities are exempt in relation to all controlled activities that they carry out in, on or under waterfront land. As the works are being undertaken by a public authority, a controlled activity approval is therefore not required. The works however would need to be consistent with relevant NSW Office of Water (NOW) guidelines (see Section 2.3.1 below).

Section 91F(1) of the WM Act states that a person who carries out an aquifer interference activity without an aquifer interference approval for the activity is guilty of an offence. There are no exemptions for this as there are for controlled activities or flood work approvals in the *Water Management (General) Regulation 2011*. If groundwater is encountered during construction of the overflow channel, DoI - Lands & Water would need to be consulted to determine whether an aquifer interference approval is required (see Section 5.3.1).

2.2.8 Fisheries Management Act 1994

The objects of the *Fisheries Management Act 1994* (FM Act) are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations.

It is an offence under the FM Act to harm any fish or marine vegetation of a threatened species, population or ecological community without a licence. It is also an offence to damage critical habitat or the habitat of a threatened species population or ecological community without a licence.

Section 200 of the FM Act states that a local government authority must not carry out dredging or reclamation works in 'water land' except under the authority of a permit issued by the Minister. "Dredging work" includes removal of material from water land that is prescribed by the regulations. Regulation 263 of the *Fisheries Management (General) Regulation 2010* prescribes the following work as dredging work for the purposes of section 198A of the FM Act:

- (a) *work that involves the removal of woody debris, snags, gravel beds, cobbles, rocks, boulders, rock bars or aquatic vegetation from water land,*
- (b) *work that involves the removal of any other material from water land that disturbs, moves or harms woody debris, snags, gravel beds, cobbles, rocks, boulders, rock bars or aquatic vegetation.*

Aquatic vegetation means native vegetation that inhabits freshwater.

Water land is defined under Act to mean *land submerged by water:*

- (a) *whether permanently or intermittently, or*
- (b) *whether forming an artificial or natural body of water,*

and includes wetlands and any other land prescribed by the regulations as water land to which this Division applies.

The proposed vegetation clearing works at the confluence of Turallo and Halfway Creeks would take place on land considered to be 'water land' as it is subject to intermittent or permanent inundation. Accordingly, a Section 200 permit under the FM Act would be required prior to commencing works.

In addition, any works which temporarily or permanently block fish passage would require a permit from DPI, in accordance with Section 219 of the FM Act. However, the works are not anticipated to block fish passage.

The installation of instream structures, the degradation of native riparian vegetation along New South Wales water courses and the removal of large woody debris from New South Wales rivers and streams are listed as a key threatening process under Schedule 6 of the FM Act. The key threatening processes associated with the proposal and any potential impacts to threatened species, populations or endangered ecological communities have been assessed as part of this environmental assessment (see Section 5.5)

2.2.9 Protection of the Environment Operations Act 1997

The Office of Environment and Heritage (OEH) is responsible for the administration of the *Protection of the Environment Operations Act 1997* (POEO Act). The POEO Act regulates air, noise, land and water pollution in NSW. Activities listed under Schedule 1 of the POEO Act are scheduled activities which require an environmental protection licence. The proposed flood mitigation works are not a scheduled activity and therefore an Environmental Protection Licence would not be required for this proposal. The works will be undertaken so as not to cause pollution of the environment.

Section 120 of the POEO Act makes it an offence to pollute waters. It is considered that the construction and operation of the flood mitigation works can be carried out without causing water pollution and therefore a licence would not be required. The EPA is the Appropriate Regulatory Authority as the work is being undertaken by a public authority.

2.2.10 Protection of the Environment Operations (Waste) Regulation 2005

The *Protection of the Environment Operations (Waste) Regulation 2005* sets out the provisions with regards to non-licensed waste activities and non-licensed waste transporting, in relation to the way in which waste must be stored, transported, and the reporting and record-keeping requirements. The disposal of construction waste including spoil and operational water by-products would be required to comply with this regulation.

2.2.11 Biosecurity Act 2015

The *Biosecurity Act 2015* repeals the *Noxious Weeds Act 1993*, which previously provided regulatory controls and powers to manage noxious weeds in NSW. The *Biosecurity Act 2015* guides the management of weeds at the regional level throughout NSW. Under the Act, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant who knows or ought to know of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable. Individual land holders and managers are required under the Act to control priority weeds for their area according to the relevant biosecurity toolset.

Two priority weed species were identified within the works areas (refer to Section 5.5)

2.2.12 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for Commonwealth involvement in development assessment and approval in circumstances where there exist 'matters of national environmental significance'. Matters of national environmental significance include:

- world heritage properties
- national heritage places
- wetlands of international importance
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas

- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development

A Flora and Fauna Assessment undertaken by Lesryk Environmental for the proposal identified that one threatened flora species, the *Black Gum*, listed as vulnerable under the EPBC Act and one fauna species, the Australian Reed-Warbler, listed as marine under the EPBC Act are recorded in the vicinity of the works area (See Section 5.5 and Appendix B). However, it is considered that the proposal is unlikely to significantly affect these threatened species, therefore would not require referral to the Minister for the Environment and Energy under this Act. No vegetation consistent with EPBC Act listed endangered ecological communities was recorded within, or close to, the study area.

No other matters of national environmental significance as listed under the EPBC Act would be impacted by the proposal.

2.3 Relevant Guidelines

2.3.1 NSW Guidelines for Controlled Activities on Waterfront Land

Department of Industry – Lands & Water (formerly the NSW Office of Water) has developed a number of guidelines for controlled activities listed under the WM Act. Although the project is exempt from the need to obtain a controlled activity approval under the WM Act (see Section 2.2.7), consideration has been given to these guidelines as relevant to the works.

The *Natural Resources Access Regulator Act 2017* commenced partly in December 2017 and partly in April 2018. It establishes a body corporate known as the Natural Resources Access Regulator to ensure effective, efficient, transparent and accountable compliance and enforcement measures for the natural resources management legislation. Their responsibilities include preparing policies, procedures and strategies for natural resource legislation (including the WM Act). They have updated the guideline for controlled activities on waterfront land in riparian corridors. The below guidelines are considered be applicable to the proposed works:

- *The Controlled Activities on Waterfront Land – Guidelines for instream works on waterfront land* (NOW, 2012)
- *Guidelines for Controlled Activities on Waterfront Land - riparian corridors* (DoI - Natural Resources Access Regulator, 2018).

2.3.2 New South Wales Government's Flood Prone Land Policy

The primary objective of the New South Wales Government's Flood Prone Land Policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible.

The *Floodplain Development Manual: the management of flood liable land* (NSW Government 2005) (the Manual) is provided to assist councils to meet their obligations through the preparation of floodplain risk management plans. The Manual also documents the process for plan preparation, implementation and review. It is considered that the proposed Bungendore FRM works are consistent with this policy and manual.

2.4 Summary of Statutory Approvals

A summary of the approvals / permits that may be required for the proposal are provided in Table 2-2.

Table 2-2 Summary of Approvals and Requirements

Agency	Requirements	Reference
Queanbeyan – Palerang Regional Council	Determination of the proposal	Part 5 of EP&A Act
Department of Industry – Lands & Water	Approval to carry out works on Crown land, including land held as part of a Licence for Grazing, Travelling Stock and Water.	s155 of Crown Lands Act
Department of Industry – Lands & Water	Possible Aquifer Interference Approval if groundwater is found when undertaking the overflow channel	S91F of WM Act
OEI	Aboriginal Heritage Impact Permit	s90 of NPW Act
DPI Fisheries	Permit for dredging and reclamation works in water land Permit for blockage of fish passage (if required for vegetation clearing works)	s200 of FM Act s219 of FM Act
Private landowners	Landowner approval (where works are located on private land)	N/A

2.5 Consultation

A number of government agencies were consulted during the preparation of the REF. A list of agencies contacted and a summary of their response is provided in Table 2-1 below. Copies of the responses received are provided in Appendix D.

Table 2-1 Agency Consultation

Agency	Summary of Comments	Addressed in REF
DPI Fisheries	DPI Fisheries advised of the below approval requirements for works within waterways: • Dredging and reclamation: Any dredging or reclamation in a waterway (below the high bank) (e.g. pipeline crossings) will require approval from DPI Fisheries. If the works are authorised by a public authority, the public authority is required under section 199 of the FM Act to consult with DPI Fisheries • Removal or movement of Large Woody Debris (snags) or boulders: Works that involve removal or movement of large woody debris or snags require approval from DPI Fisheries. DPI Fisheries advised the REF should include information on the following: • Location of works • Description of works to be undertaken, including proposed methodology. • Description and condition of riparian vegetation within the footprint. • Description and condition of aquatic habitat located within or adjacent to the footprint. • Description and condition water quality located within the footprint. • Analysis of any interactions of the proposed works with aquatic environments, riparian habitats and water quality. • Analysis of impact of overflow channel construction on water flows within the waterways • Safeguards to mitigate any impacts upon aquatic environments, riparian habitats and water quality. • Potential impacts on any aquatic threatened species, populations and ecological communities listed under the <i>FM Act</i> and safeguards to mitigate any potential impacts. • Details of proposed revegetation of adjacent riparian buffer areas.	Section 4 Section 5.5 To be carried in detailed design Section 5.5

Agency	Summary of Comments	Addressed in REF
	Details of the proposed creek reshaping and rehabilitation of aquatic habitats.	
	A copy of the REF is requested to be provided to DPI Fisheries for review and comment.	To be considered by QPRC
Office of Environment and Heritage (OEH)	OEH provided a list of Environmental Assessment Requirements for the project that relate to Aboriginal cultural heritage, biodiversity and flooding. Floodplain Risk Management: As this project relates to works proposed in council's adopted Bungendore Floodplain Risk Management Plan, the Review of Environmental Factors (REF) should canvass how the evolving design of the works meet the objectives set out in the Plan. Biodiversity: The REF must assess the ecological impacts associated with the proposed works in accordance with the recently commenced <i>Biodiversity Conservation Act 2016</i>. Aboriginal cultural heritage: The REF must assess how the proposed works may impact on Aboriginal cultural heritage values. Due to the high likelihood of Aboriginal objects, a full archaeological assessment in accordance with our guidelines should be undertaken to inform the REF.	Section 5.4 and 5.16 Section 5.5 Section 5.6
Department of Industry - Lands and Water	No response	N/A
Ngambri Local Aboriginal Lands Council	No response	N/A
Local Land Services - South East Region	No response	N/A

3 Need for the Proposal

This section provides the need and justification for the proposal.

3.1 Project Justification

Major flooding has occurred on a number of occasions at Bungendore over the last 75 years. The most severe floods occurred in 1934, June 1956, August 1974, and in 1988. The 1934 flood is regarded as being the largest, although it is understood that the resulting damage was similar to that incurred during the 1956 and 1974 floods (Worley Parsons, 2014a).

The existing flood problem affecting Bungendore was documented in the 'Bungendore Flood Study' (Patterson Britton & Partners, 2002 in Worley Parsons, 2014a). The report determined that flooding of the streams that drain through the village can result in damage to both public and private property. Severe flooding, particularly overnight and in response to intense rainfall in the catchment, could present as a major risk for loss of life and property among those who reside near the creeks (Worley Parsons, 2014a).

In response to the flood risk in Bungendore, the Bungendore FRM Implementation Plan has been developed for QPRC in order to manage existing, future and residual flood risks in Bungendore. The flood plan has been prepared based on the NSW Government's *The Floodplain Development Manual: the management of flood liable land* (NSW Government 2005). The Manual documents the process for plan preparation, implementation and review.

The first three key stages of the process involved the completion of the Bungendore Floodplain Risk Management Study (FRMS) and Bungendore Floodplain Risk Management Plan (FRMP) by Worley Parsons in 2014. Public Works Advisory (PWA) was then commissioned by QPRC in 2017 to undertake the investigation of flooding issues and concept design of mitigation works for Bungendore in order to manage existing, future and residual flood risks in Bungendore.

3.2 Options Development

As discussed above, the first three stages of the Bungendore FRM Implementation Plan process were carried out by Worley Parsons in 2014 with the completion of the Bungendore Floodplain Risk Management Study (FRMS) and Bungendore Floodplain Risk Management Plan (FRMP).

Following the completion of Bungendore FRMS and FRMP by Worley Parsons (2014), Council identified three Flood Modification Measures as the preferred solutions, for further investigation and design. The below three measures are part of the FRMS, named S4B, recommended for implementation in the Bungendore FRMP. This flood management option has been identified as the most cost-effective solution that will result in a reduction in existing flood damages in Bungendore.

1. Removal of dense vegetation and creek re-shaping at the confluence of Turallo and Halfway Creeks

This flood mitigation measure includes the removal of vegetation at the confluence of Turallo and Halfway Creeks and the reshaping of the creeks, which would enhance the capacity for floodwaters to escape more rapidly from the village reach of Turallo Creek. Furthermore, excavation of overbank areas at the confluence would provide additional capacity when floodwaters exceed the channel capacity.

2. Upgrade of the existing Turallo Terrace levee (no extension)

This flood damage reduction measure involves upgrading of the earth embankment Turallo Terrace Levee to increase crest elevation above the peak 1% annual exceedance probability (AEP) flood level, including a freeboard of 0.5 m. The proposed levee upgrade will follow the existing levee alignment. However, there are two sections of the levee where re-alignment is proposed.

3. Construction of an overflow channel across Tarago Road

This measure would allow floodwaters to bypass the Tarago Road bridge crossing of the creek during major events. The higher flows would be diverted across Tarago Road upstream of the bridge crossing so that they re-entered the creek downstream of the confluence of Turallo and Halfway Creeks.

The Bungendore FRM Implementation Plan Preliminary Concept Design Report prepared by Public Works Advisory (2018) was subsequently carried out as the final stage of the process, including developed concept design, in order to implement the flood risk mitigation works in Bungendore.

4 Scope of the Proposal

This section provides the description of the proposal which is assessed in this REF. Information in this section is taken directly from the Bungendore FRM Implementation Plan Preliminary Concept Design Report – Stage 1 (PWA, 2018)

4.1 Description of the Proposed Works

As part of the Bungendore FRMP works, QPRC proposes to carry out the below package of works:

4.1.1 Clearing and creek re-shaping at the confluence of Turallo and Halfway Creeks

Vegetation clearing and river bank re-shaping excavation works are proposed at the confluence of Turallo and Halfway Creeks. Re-shaping works will involve stripping of all vegetation and re-grading the creeks' banks. The proposed locations of the creeks' confluence re-shaping are shown in Figure 4-1. The works are divided into two sections; the northern side (Confluence 1) which encompasses the northern and eastern banks of the Turallo Creek, and the western side/bank of Halfway Creek (Confluence 2). Confluence 1 is approximately 110m in length while Confluence 2 is approximately 85m in length.

The northern re-shaping area is located within a grassed paddock with some occasional shrubs and trees. The ground is relatively flat with a gentle slope towards the creek bank. The creek's bank batter is heavily overgrown with blackberry bush, weeds and grasses. The depths of cuts will vary from negligible to up to approximately 3m.

The western re-shaping area is located within a terraced slope/creek bank. The accessible section of the area is a grassed and relatively flat paddock. The rest of the area (towards the creek) is moderately vegetated with trees and shrubs. The depths of cuts in this area will vary from approximately 0.8m to 1.9m.

Post clearing and reshaping works, revegetation including a reinforced grass cover has been proposed to prevent future erosion of the excavated areas.

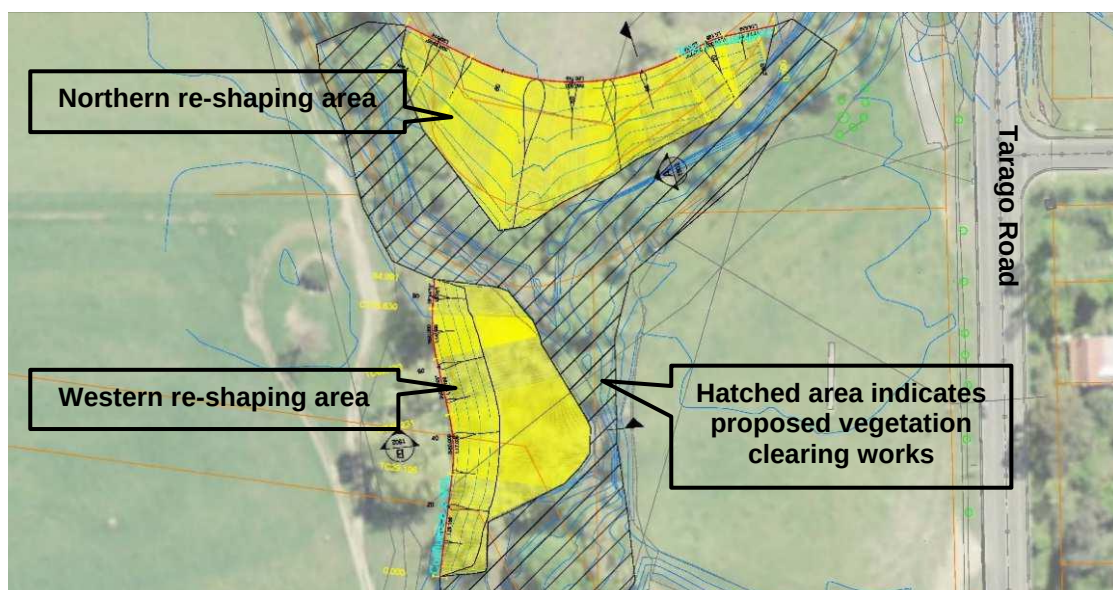


Figure 4-1 Location of re-shaping and vegetation clearing works at the confluence of Turallo and Halfway Creeks.

Source: PWA, 2018

4.1.2 Upgrade and realignment of existing Turallo Terrace Levee

The levee is approximately 840m in length, commencing at the railway embankment (Ch0m) on the western side of Turallo Terrace and terminating at the bridge abutment in Molonglo Street (Ch840.41m). Based on QPRC request, upgrade of the first Ch120m of the levee upgrade has not been proposed.

The proposed levee upgrade alignment is shown in Figure 4-2. The upgraded levee will comprise a typical crest width of about 3m with outer batter (properties side) of 1(V):3(H) and inner batter (creek's side) of 1(V):4(H). The proposed levee crest design height gradually reduces from RL 693.4m (Ch0m) to RL 691m (Ch840m). Existing soft spots in the subgrade will be lined with geotextile and replaced with engineered fill. The levee crest will be lined with geotextile and then covered with topsoil and grass to the required design crest height, the batters will be covered with topsoil to the required design grade and then grassed.

The proposed levee upgrade will follow the existing levee alignment; however, there are sections of the levee where realignments will be carried out. These are where the existing levee is located within private properties (approximate Ch120m to Ch280m) and where significant mature trees are located on the levee batters (approximate Ch400m to Ch450m).

The section of levee realignment around the private properties, will comprise an earthen bank with a concrete retaining wall section where there is limited room between the property fence line and the creek. The other deviation of the existing levee alignment, where significant mature trees are located on the levee batters will comprise an earthen bank.

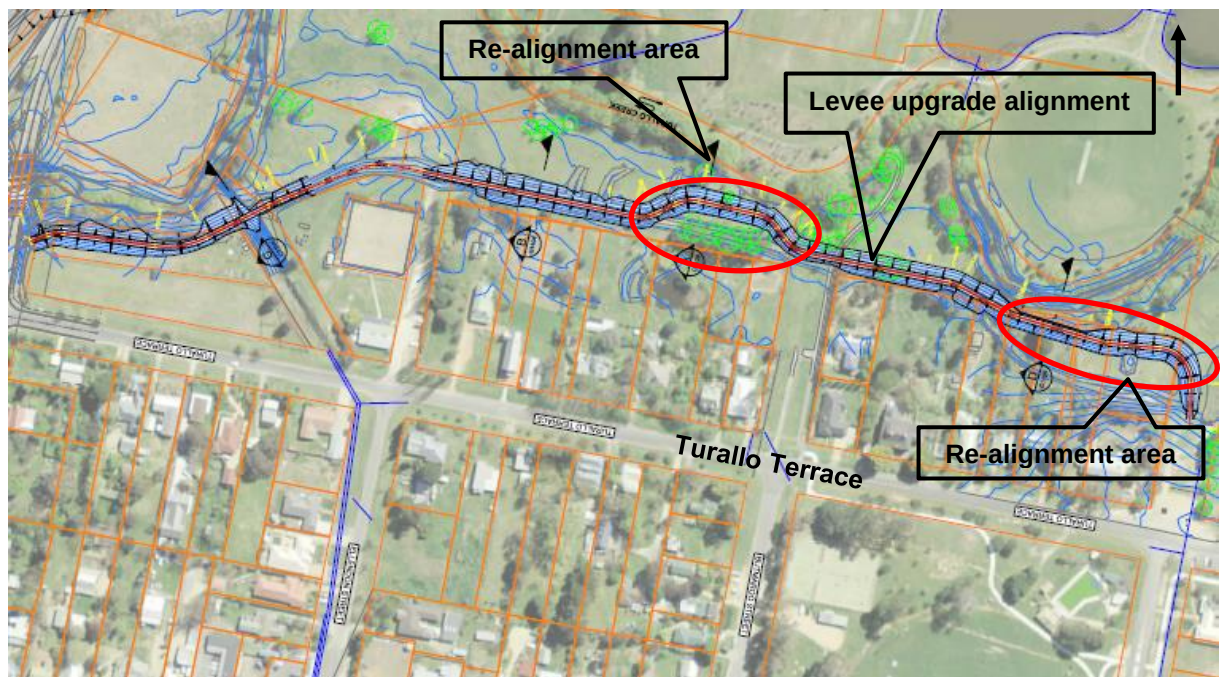


Figure 4-2 Location of TuralloTerrace Levee upgrade and realignment works

Source: PWA, 2018

4.1.3 Overflow Channel

The proposed Turallo Creek overflow channel will be located within relatively flat paddocks to the north and north-east of the confluence of the Turallo and Halfway Creeks. The overflow channel has a design length of approximately 379m. The location of the proposed overflow channel is provided in Figure 4-3.

The proposed channel will have reinforced grass-lined batters and the channel floor will be lined with rip-rap or reinforced grass. The channel will have a trapezoidal cross section, with a 4.5m to 6.2m wide floor and cut batters of 1V:3H. The overflow channel will pass under the existing Tarago Road where a set of twin box culverts is proposed. The culverts will be founded approximately 2.5m below existing surface levels. Considering the existing surface levels, the batter offset from the channel centreline will locally reach to 14m. The excavation depths to the proposed invert levels of the channel floor will range between 2.3m to 4.2m depending on existing ground surface levels.

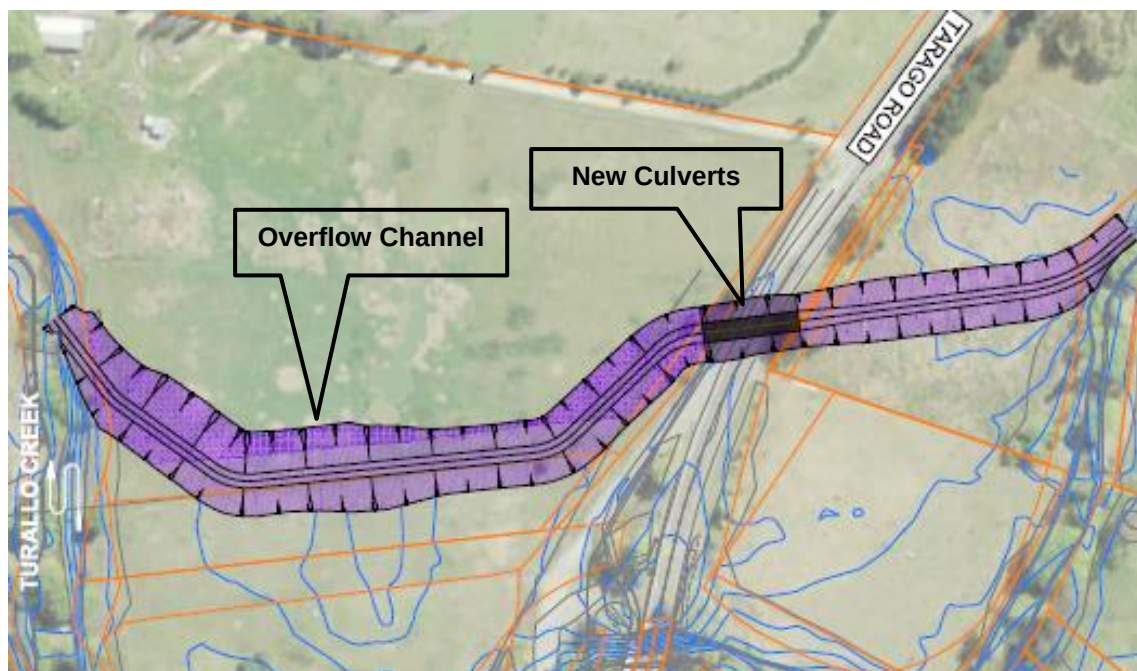


Figure 4-3 Location of proposed Turallo Creek overflow channel across paddock land.
Source: PWA, 2018

4.2 Construction Methodology

The following provides a summary of the likely construction activities. The construction methodology would be confirmed by the contractor and detailed in the Construction Environmental Management Plan (CEMP).

Site Establishment:

- Establish construction compound and laydown areas.
- Establish a separate access to the Vegetation Clearing and Creek's Confluence Reshaping work area, to the Turallo Terrace Levee work area and the Channel Overflow work area. An access to the work areas shall occur within existing cleared paths where possible, although some trimming or clearing of vegetation may be required. The works should be undertaken in manner that minimises disturbance.

- Establish erosion and sediment controls, including in stream controls.

Confluence and Overflow Channel works

- Vegetation removal to progressively move along the confluence and the channel;
- All noxious and exotic weeds would be appropriately managed and removed for off-site disposal;
- All debris such as plastic bags, bottles, foam containers and other litter shall be removed;
- Rehabilitation of the confluence area and the channel bed and banks using suitably qualified and experienced bush regeneration contractors.

Levee works

The embankment fill for the proposed raising of the levee crest will be sourced from the excavations required for the new overflow channel and supplemented by materials stripped from the creek re-shaping at the confluence of the Turallo and Halfway Creeks.

The levee would be dressed with topsoil certified as weed free.

Site dis-establishment

- Removal of all construction equipment,
- General site clean-up.

4.2.1 Construction Equipment

The following construction equipment is likely to be required to undertake the works:

- Hydraulic excavator for vegetation clearing, works within the confluence and channel areas;
- Small trucks carrying construction materials,
- Large trucks to transport imported material and excavated material to and from the site;
- Concrete mixer for culvert's foundation;
- Backhoe / excavator equipment to construct levee; and
- Passenger vehicles to transport construction workers.

4.3 Construction Considerations

4.3.1 Construction Environmental Management Plan

The proposed works would be undertaken in accordance with a Construction Environmental Management Plan (CEMP) prepared by the construction contractor and approved by QPRC prior to the commencement of works.

The CEMP would incorporate site specific management plans and would reflect all the mitigation measures identified in this REF, additional mitigation measures identified as a result of the contractor's risk assessment and construction methodology and any conditions of the project determination and other licences/approvals.

4.3.2 Construction Site layout/ Compound

The contractor would establish a compound area to accommodate construction facilities for the duration of the construction period. The compound area would accommodate the following facilities.

- Toilets
- Materials storage area
- Site Office
- Fuel storage

4.3.3 Construction Timeframe and Working Hours

The construction works are predicted to take up to six months.

The *Interim Construction Noise Guidelines* (DECC 2009) outlines recommended standard construction working hours as:

- Monday to Friday 7am to 6pm
- Saturdays 8am to 1pm
- No work on Sundays or public holidays.

The construction would comply with these recommended hours.

4.4 Operational Issues

Maintenance of Turallo and Halfway Creeks confluence area, the Turallo Terrace levee and the overflow channel areas would form part of QPRC's overall maintenance program within the LGA and in accordance with current Vegetation Management Plan.

Ongoing management procedures would include:

- Annual removal of foreign material such as plastic bags, bottles, foam containers and other litter (does not include leaf litter, branches or logs).
- Weed control undertaken at frequencies specified by the Vegetation Management Plan by an experienced and qualified Bush Regeneration Contractor or Bush Regeneration Staff. Weed control would occur using standard bush regeneration techniques such as hand weeding or use of Glyphosate based herbicides.
- Slashing of indigenous herbland or reedland by qualified Bush Regeneration Contractor or Bush Regeneration Staff. Slashing would be undertaken after the species has flowered and set seed. No herbicide shall be used in association with slashing to allow indigenous species to regenerate from root stock, rhizomes or seed. Slashing would occur using hand operated mechanical equipment. Organic debris material would be removed from the sites.

5 Environmental Assessment

This section identifies and characterises the likely potential impacts associated with the construction and operational phases of the project. Where considered necessary, feasible mitigation measures are identified. Environmental management procedures based on these mitigation measures are outlined in Section 6.

5.1 Assessment Methodology

The key objectives of this assessment are to:

- Identify those facets of the environment likely to be affected by the proposal during construction and operation;
- Identify the sensitivity of the site;
- Identify and characterise the associated impacts; and
- Identify and evaluate feasible mitigation measures for the identified impacts.

Section 3 of the *Proponents Guidelines for the Review of Environmental Factors* (DECCW, 2011) has been used to assist in the identification of issues for assessment in this REF.

Environmental issues of potential relevance to the proposal include:

- Land use
- Soil and water management
- Flooding
- Ecology
- Heritage (Aboriginal and historic)
- Noise and vibration
- Air quality
- Traffic and access
- Waste management
- Visual amenity
- Utilities and infrastructure
- Greenhouse gas emissions
- Socio-economic
- Climate Change

5.2 Location and Land Use

The Bungendore township is located in the southern tablelands region of NSW approximately 40 km north-east of Canberra and 220km south-west of Sydney. Bungendore is located on the banks of Turallo and Halfway Creeks, which are tributaries that drain to the southern

shoreline of Lake George which is located approximately 7km to the north. Photographs of the FRM works areas are shown in Figure 1-2 to Figure 1-5.

The Turallo Terrace levee at Bungendore covers a distance of approximately 840m. The existing levee is an earthen mound that is approximately 1m high and 650m in length, and is located south of Turallo Creek. The levee top is approximately 3m wide, while its base is about 6m wide.

The eastern most extent of the existing levee upgrade area runs in a north-westerly direction through private properties within No. 56 to 64 Turallo Terrace where a pre-school and residential properties are present (Chainage 140-280m). From this point, the levee heads due west, and generally runs parallel to the rear private property fence lines within vacant public land where an informal public walking path is located on the levee crest. The levee batters are generally grassed, with an exposed levee crest due to public use as a pedestrian footpath. Occasional individual planted trees are located along this section of the levee, including a section where two lines of mature native trees are present along the inner and outer levee batters (between approximate Ch400m and Ch450m).

The levee continues in a westerly direction behind the northern fence line of private residential properties on public land, through a grassed drainage channel area. The levee then runs in a south-westerly direction behind the Bungendore Bowling Club property (at approximately Ch580m), and then heads west behind garden allotment land before its terminating point at the Molonglo Street bridge abutment.

The vegetation clearing and re-shaping works at the confluence of Turallo and Halfway Creeks comprises two works areas. The northern re-shaping area is located within a grassed paddock on private land with some occasional shrubs and trees. The ground is relatively flat, sloping gently towards the creek bank. The creek bank is heavily overgrown with blackberry bush, weeds and grasses. The western re-shaping area is located within a terraced slope/creek bank. The accessible section of the area is a grassed and relatively flat paddock and Travelling Stock Reserve. The rest of the area adjacent to the creek is moderately vegetated with trees and shrubs.

The proposed overflow channel will to be located within relatively flat paddock land to the north and north-east of the confluence of the Turallo and Halfway Creeks within two rural private properties and a section of Travelling Stock Reserve. The paddocks are separated by Tarago Road. The paddock on the eastern side of Tarago Road is relatively flat and sparsely grassed. The creek bank and the western property fence are lined with occasional or stands of mature trees. The paddock to the west of Tarago Road is grassed and is also relatively flat. There are occasional mature trees located around the paddock boundary immediately adjacent to the road crossing and along the creek bank. The initial straight alignment of the proposed overflow channel was revised through this area at the request of the property owner to avoid cutting through the middle of the paddock, and relocated further south towards the property's boundary.

5.2.1 Impact Assessment

No levee upgrade works are proposed for the first 120m of the existing levee between the railway lines and Turallo Terrace. The proposed levee upgrade area is predominantly located on public land and the eastern-most section of the levee upgrade area located between No.

56 to 64 Turallo Terrace within private land will be re-aligned to the north with a new section of the levee constructed on public land (approximate Ch 140m to Chainage 280m). The second proposed levee realignment area is currently located within public land. However, the levee realignment in this area is proposed in order to retain the two rows of mature native trees present on the levee crest (between Ch400m and Ch450m). Therefore, no impact to private land is anticipated associated with the levee upgrade or realignment construction works. Furthermore, it is not anticipated that the levee upgrade and realignment would impact on surrounding land use, as the levee is predominantly located within vacant public land including Council reserves, a small area of Travelling Stock Reserve and Crown land area.

The associated Bungendore FRM works including the new overflow channel and creek confluence vegetation clearing and re-shaping would be located within grassed paddocks and overgrown vacant land which includes public land, private land and a section of Travelling Stock Reserve. The initial straight alignment of the proposed overflow channel was revised through this area at the request of the property owner to avoid cutting through the middle of the paddock, and relocated further south towards the property's boundary. As such, the overflow channel and creek confluence clearing and re-shaping works are also not anticipated to impact on the surrounding existing land use.

Council would be required to obtain the necessary approval and/or licences from the Department of Industry – Lands and Water (DoI – Lands & Water) division for the FRM works taking place within Crown land including Travelling Stock Reserve area. Furthermore, where required, appropriate approval and/or authority must be obtained from landowners for works within private land.

The operation of the new overflow channel, cleared and reshaped creek confluence and the upgraded and realigned levee would address the existing Probable Maximum Flood (PMF) risk impacts in Bungendore and would be similar to the existing levee, and therefore would not significantly affect current land use practices of adjoining land. In consultation with the relevant agencies, the works have been designed so as not to interfere with the provision of services (such as water and electricity supply and telecommunication), or the maintenance of assets (such as roads, and bridges).

Overall, the construction works associated with the proposed Bungendore FRM works may cause some temporary disruption to adjoining private landowners, to local roads and to the residents of the township. However, due to the temporary nature of the works and the location of the levee, these impacts are not anticipated to be significant, assuming implementation of the mitigation measures listed in 5.2.2. Mitigation measures to minimise impacts from traffic, noise, air quality and waste generation are also provided in other sections of this REF.

5.2.2 Mitigation

- Consultation should be undertaken with DoI – Lands & Water with regard to any construction works proposed on Crown Land, and all required approvals would be obtained prior to construction activities commencing.
- Approval from landowners other than Council would be obtained where required, prior to construction works commencing.
- Negotiations would be undertaken with private landowners where access through private land is required. The outcomes of any access arrangements would be documented in a CEMP prior to construction commencing.

- Consultation would be undertaken with all affected landowners for the potential impact on land uses during construction and any safeguards or mitigation measures that need to be implemented during the works.
- The contractor would be required to ensure the necessary care and maintenance of private and Crown land facilities and operations including fences and gates. However, if any damage does occur to property it would be restored to a condition equivalent to the original condition.
- Temporary fencing and gates would be installed where necessary to exclude animals from the work sites. Any temporary fencing or gates no longer required would be removed at the completion of the construction works.
- Restoration of the areas disturbed during construction would be undertaken.

5.3 Soil and Water Management

Two permanent water bodies, these being Turallo Creek and Halfway Creek are present within the Bungendore FRM works area. The waterways are located along the northern and western boundaries of the township, respectively. Turallo and Halfway Creeks flow in a north/north-westerly direction, draining into Lake George which is located approximately 7km north of the site. Two dams are located within Bungendore Common, north of Turallo Creek.

The following description of sub-surface conditions in the proposed FRM works areas has been taken from the Bungendore Floodplain Risk Management Plan Implementation – Concept Design Phase Geotechnical Investigation Report (Public Works Advisory, 2018).

The Canberra 1:100,000 Geological Series Sheet SI/55-11 (Second Edition, 1996) indicates the FRM works area is located within thick deposits of Quaternary alluvium, comprising gravel, sand, silty clay and black organic clay.

Visual assessment of the existing levee banks undertaken as part of the geotechnical inspection not detect any slope stability issues nor any batter erosion, with the levee bank batters being well vegetated. The geotechnical investigation of the levee alignment found that the levee embankment fill overlies cohesive in-situ alluvial sediments. The fill generally comprises medium to high plasticity sandy silty clay and sandy clayey silts with varying concentrations of gravel, locally with embedded cobbles and rare boulders. The natural subgrade generally comprises sandy clayey silts of low to medium plasticity and sandy silty clays of medium plasticity, followed by silty clayey sand and silty sandy gravel to borehole termination depths of 3m. The levee realignment areas were not assessed as part of the geotechnical investigation. However, the subsurface profiles are likely to comprise alluvial sandy clayey silts overlying sands with varying concentrations of silt and locally, with some gravel. The alluvium is expected to be of stiff consistency.

In the Turallo and Halfway Creeks confluence reshaping works areas, the geotechnical investigation indicated that the subsurface profiles within the two works areas and between discrete borehole locations varied with respect to material types, layer thicknesses and their distribution. The sites lie within thick deposits of alluvial sediments which appear to be complexly interbedded. In the northern area, the subsurface profile comprises a sequence of fine grained, cohesive sediments for the full depth of drilling of 3m. The sequence consists of sandy clayey silt topsoil, followed by a sandy clayey silt sub-soil horizon to a depth of 0.7m. The next stratigraphic successions are clayey silt/silty clay with sand or fine grained silty sand, and then sandy clayey silt or silty clay with embedded quartz gravel to borehole investigation

termination depth of 3m. In the western works area, the subsurface profile is dominated by finer grained sediments. It comprises slightly sandy silty clays to a depth of 1.3m, followed by sandy silty clay, which grades in lenses to clayey silty sand, to a depth of 2.4m. The next stratigraphic successions comprise silty sand to a depth of 3.1m, clayey sandy gravel (to a depth of 3.4m overlying clayey sandy silt to borehole termination depths of 4m.

The overflow channel area is generally located within thick deposits of alluvial sediments which persist for the full depths of drilling of up to 4m. The alluvium comprises a variety of fine grained sediments overlying coarse grained sediments. Sandy silts with varying clay content of low to medium plasticity dominate the upper parts of the soil profiles while coarser grained, sand and gravels in sandy silt matrix, sediments generally occur at depth.

Groundwater

Groundwater was not encountered within the depths of drilling along the levee alignment, with the exception of two boreholes located at the western end of the levee alignment, where the presence of laterised lenses and black spotting (iron or manganese staining) suggest groundwater movement through the soil profile.

Groundwater was not encountered in any of the boreholes located in the creek confluence bank reshaping area within the 4m maximum depth of drilling.

In the overflow channel area, groundwater was encountered in all boreholes at depths of between 2.4m and 3.2m, apart from one borehole where it was not encountered within the depth of drilling of 3m. However, it should be noted that groundwater levels and presence of seepage are subject to prevailing weather conditions and may vary from those recorded at the time of the investigation. In the immediate vicinity of the creek channel, assuming a hydraulic connection, groundwater levels are likely to fluctuate with the water levels in the creek.

5.3.1 Impact Assessment

The geotechnical investigation concluded that the existing levee bank can be incorporated into the proposed raised levee embankment. The new embankment fill may be placed directly onto the existing banks subject to the subgrade preparation procedure outlined in the Geotechnical Investigation report (PWA, 2018).

Ground disturbance from the removal of trees, ground stripping, grading, excavation of the levee upgrade and realignment and from vehicle movements around the site is anticipated as part of the construction works. Stockpiles of fill and topsoil would also be established throughout the construction period in areas located away from waterways. The main mitigation measures to protect against water quality impacts to Turallo and Halfway Creeks would be through the installation and maintenance of effective sediment and erosion control measures. The contractor would be required to develop sediment and erosion control measures in accordance with "The Blue Book" (NSW Landcom, 2004) to detail management measures to prevent soil erosion and water quality issues during the works.

Excavation required for the reshaping of the Turallo and Halfway Creek confluence within alluvial sediments should readily be achievable by equipment such as hydraulic excavators using conventional earth moving. Within the northern confluence creek bank reshaping works area, the depths of cuts are anticipated to vary from negligible to up to approximately 3m. Within the western confluence creek bank reshaping works area, the depths of cuts will vary from approximately 0.8m to 1.9m. The sediments, due to high silt and fine sand contents, low plasticity properties and dispersive characteristics, are potentially highly erosive. The

confluence reshaping works would involve instream vegetation removal and excavation with the potential for water quality impacts due to sediment disturbance, which could increase turbidity and nutrients within the waterway. All disturbed areas would be rehabilitated post construction works. This may include mulching, weed control and maintenance in order to adequately restore the integrity of Turallo and Halfway Creeks. The instream works would be monitored and sediment controls maintained until creeks are suitably stabilised.

Post vegetation clearing and reshaping works, there is likely to be increased turbidity during initial flow events due to the removal of vegetation and ground disturbance within the creeks. The extent of turbidity would depend on the velocity of flows, however given the generally low velocity flow of the creeks this is not expected to be significant. The resultant turbidity is likely to be temporary in nature, provided instream controls are maintained and monitored.

The *Controlled Activities on Waterfront Land – Guidelines for instream works on waterfront land* (NOW, 2012) and *Guidelines for Controlled Activities on Waterfront Land - riparian corridors* (DoI - Natural Resources Access Regulator, (2018) are considered relevant to the proposal. The guidelines state that the design and construction of works or activities within a watercourse or adjoining waterfront land should protect and enhance water flow, water quality, stream ecology and existing riparian vegetation, and establish and preserve the integrity of riparian corridors. Impacts on the hydrologic, hydraulic and geomorphic functions of a watercourse should also be minimised. It is considered that the proposed works including removal of exotic weeds as part of the vegetation clearing process and the bank reshaping works would be consistent with this guideline.

In the overflow channel area excavations will be within relatively soft alluvial sediments. Therefore, excavation to required depths is anticipated to be carried out using conventional earth moving equipment such as hydraulic excavators. During periods of inclement weather, the cut batters of the overflow channel are expected to be subjected to rutting erosion due to rainfall runoff. Overflow channel stabilisation (bed and slopes) would be dependent on detailed design considerations. According to *Managing Urban Stormwater Soils and Construction* (Landcom 2004) (commonly referred to as the Blue Book) plants are recommended for use in channel stabilisation works where the channel is subject to a concentrated flow. To prevent formation of runnels and progressive slope degradation suitable remedial slope protection measures need to be provided. As a minimum, depending on flood velocities, the cut batters should be grassed.

If groundwater is encountered during the construction works, it would need to be managed so that it does not result in pollution, including sedimentation. Groundwater devoid of sediment or contaminants would be disposed of in a way that does not cause erosion. Groundwater may need to be suitably settled (i.e. using baffle tanks or similar) or filtered prior to being dispersed over vegetated ground surfaces. DoI - Lands & Water would need to be consulted if groundwater is encountered during construction to determine whether approval is required under the *Water Management Act 2000* such as for an aquifer interference approval under Section 91.

Overall, it is assessed that the impacts of ground disturbance associated with the FRM construction works can be adequately managed through the implementation of appropriate soil and water management mitigation measures provided in Section 5.3.2. Therefore, the overall impact is assessed to be low.

The levee upgrade, creek confluence clearing and bank reshaping and overflow channel works areas would be inspected post-construction to ensure all areas of disturbance are appropriately stabilised and erosion and sediment loss is not occurring. Provided the sites are stabilised no impacts to soil and water are expected post construction.

5.3.2 Mitigation

- The contractor's compound is to be located within cleared land and not within the riparian corridor.
- The detailed design is to be undertaken consistent with the following guidelines
 - *Controlled Activities on Waterfront Land - Guidelines for instream works on waterfront land* (NSW Office of Water, 2012)
 - *Guidelines for Controlled Activities on Waterfront Land - riparian corridors* (DoI - Natural Resources Access Regulator, (2018))
- A detailed Soil and Water Management Plan (SWMP) shall be prepared as part of the CEMP. The SWMP would describe the site specific measures to be implemented for all works areas, in accordance with the guidelines outlined in the 2004 Landcom publication *Managing Urban Stormwater: Soils and Construction*, 4th edition ("The Blue Book") and *Volume 2a Installation of Services*. The SWMP would need to be site specific and would need to address the following issues to prevent erosion, sediment loss and water quality impacts:
 - Minimisation of disturbance to soil and water adjacent to, and within, all watercourses in the works area.
 - Identification of site specific sediment and erosion control measures wherever erosion is likely to occur, including around the drilling entry and exit points.
 - Identification of any environmentally sensitive areas on or near construction sites to ensure runoff is diverted away from sensitive areas.
 - Requirements for vegetation clearing to be kept to a minimum to be able to achieve the objectives of the FRM works.
 - Retention of all surface runoff on-site and where possible stormwater from off site would be diverted around the construction site.
 - Backfilling and stabilising of trenches once pipelines are installed.
 - Location of construction compounds (at least 50m from any drainage lines).
 - Location and management of stockpiles, such as locating stockpiles away from any drainage lines near the works areas.
 - Regular inspection of all erosion and sediment controls, especially when rain is expected and directly after any rain events.
- Any excess spoil would be reused onsite or removed off site for disposal in accordance with EPA requirements
- Works should not be scheduled when heavy rainfall is forecast and works involving soil disturbance should not take place during heavy rainfall periods, other than work necessary to stabilise the site.

- A site-specific spill management plan would be prepared and include the following requirements:
 - Emergency spill kits are to be kept at the site (vehicle kits).
 - Refueling of machinery to be undertaken in a dedicated area within the construction compound appropriately protected as outlined in the spill management plan.
 - Any chemicals and fuels are to be stored in a bunded area at least 50 metres from any waterway or drainage line.
 - Any hazardous materials stored on site would be stored in the compounds and within impervious and bunded enclosures capable of storing 120% of the volume of material stored there.
 - Workers would be trained in the spill management plan and the use of the spill kits.
- The CEMP would incorporate a pollution incident response management plan that defines appropriate procedures for notification of pollution incidents to the required authorities in accordance with s. 147 to 153 of the POEO Act and requires response actions to be implemented in order to address any risks such as incidents posed to the environment, property or surrounding communities.
- Adequate procedures would be established and detailed in the CEMP, including notification requirements to the EPA, for incidents that cause material harm to the environment.
- Workers are to be made aware of the provisions of Section 120 of the POEO Act with regards to water pollution
- Groundwater devoid of sediment or contaminants would be disposed of in a way that does not cause erosion. Groundwater may need to be suitably settled (i.e. using baffle tanks or similar) or filtered prior to being dispersed over vegetated ground surfaces. If groundwater is encountered during construction works, DoI - Lands & Water would need to be consulted to determine whether approval is required under the *Water Management Act 2000* such as for an aquifer interference approval under Section 91.
- Mitigation measures to manage groundwater (should it be encountered during construction) would be incorporated into the CEMP which is to address the following issues in relation to groundwater:
 - Dewatering techniques during excavation;
 - Measures to ensure groundwater quality is not impacted during construction;
 - Techniques to settle, treat or filter groundwater encountered during excavation works i.e. diverting groundwater through baffle tanks or filter membranes; and
 - Appropriate treatment and monitoring regimes should be established in the event that groundwater flows come to the surface, including disposal of groundwater in such a way as to prevent adverse impacts (such as erosion and water pollution). Groundwater should not be discharged to a waterway during construction.
- All areas where ground disturbance has occurred would be stabilised following completion of works to ensure there is no erosion hazard and restored to their pre-construction condition. This would involve, where required, reshaping the ground surface, covering it with topsoil excavated from the site and re-establishing an appropriate vegetation cover (this may include respreading dead accumulated or cleared vegetation where possible).

5.4 Flooding

Monthly rainfall figures from the Queanbeyan Bowling Club indicates that the annual average rainfall in the region is approximately 594.3mm, with the greatest falls being experienced during October (Bureau of Meteorology 2018). Average temperatures range from a July minimum of -0.2°C to a January high of 29.0°C (Bureau of Meteorology 2018).

The below information on the existing flood conditions and infrastructure at Bungendore has been taken directly from the Bungendore Floodplain Risk Management Plan prepared by Worley Parsons (2014b).

Major flooding at Bungendore has occurred on a number of occasions over the last 75 years. The most severe floods occurred in 1934, June 1956, August 1974, and in 1988. The 1934 flood is regarded as being the largest, although it is understood that the resulting damage was similar to that incurred during the 1956 and 1974 floods.

Both Turallo and Halfway Creeks overtop their banks in floods as minor as the 1 year recurrence event. The majority of the flow carried by Turallo Creek in a 1 year recurrence flood travels overland along the floodplain that adjoins the creek banks. The limited capacity of the Turallo Creek channel is particularly evident upstream of the railway which acts as a levee and causes floodwaters to 'back up'. As a result, floodwaters inundate Turallo Terrace between Powell Street and Mecca Lane in events rarer than the 5 year recurrence flood.

An existing earth levee, known as the Turallo Terrace Levee, extends along sections of the southern creek banks between the railway and the Tarago Road crossing of Turallo Creek. The levee, for the most part, prevents floodwaters from entering the village in events up to and including the 20 year recurrence flood, although the northern end of Butmaroo Street becomes submerged in most floods where floodwaters overtop the creek banks. Significantly, the levee is overtopped in rarer events and relatively fast flowing floodwaters from Turallo Creek discharge across the levee in a south-westerly direction during events of the magnitude of the 100 year recurrence flood. Modelling shows that floodwaters inundate the northern end of Ellendon and Butmaroo Streets and extend across to Molonglo Street and Halfway Creek.

Dwellings and buildings within the village that would be threatened by flooding are generally those located nearest to the southern bank of Turallo Creek and the eastern bank of Halfway Creek. It is estimated that 29 buildings are potentially threatened by floodwaters in events of the magnitude of the 100 year recurrence flood. In a 20 year recurrence event, a total of 10 buildings would be threatened by floodwaters. Whereas, in a 5 year recurrence event, only 4 buildings would be threatened. The number of properties susceptible to flooding is substantially higher with up to 61 properties predicted to be inundated at the peak of the 100 year recurrence flood. Even in the 5 year recurrence flood, approximately 20 properties would be at threat.

The total flood damage estimate for each design flood event was combined with the probability of occurrence to determine an Average Annual Damage (AAD) cost for existing conditions. The results of this analysis determined the average annual damage for the Village of Bungendore to be about \$438,180. The inundation of potentially flood affected properties in the occurrence of 100 year average recurrence interval (ARI) event is estimated to result in damages on the order of \$3.1M.

The New South Wales Government's Flood Prone Land Policy has been implemented to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising

ecologically positive methods wherever possible. The Floodplain Development Manual: the management of flood liable land (NSW Government 2005), assists Councils to meet their obligations through the preparation of floodplain risk management plans. Accordingly, Worley Parsons prepared the Bungendore FRMS (Worley Parsons, 2014a) and Bungendore FRMP (Worley Parsons 2014b) in accordance with the recommended process for plan preparation, implementation and review provided in The Floodplain Development Manual, in order to manage flood risks in Bungendore (PWA, 2018). A range of potential floodplain management strategies were considered by Council's Committee as part of the Bungendore FRMS. These were assessed in terms of the reduction in flood damages that would be afforded as measured by reduced floodwater depths, increased flood warning advice and increased levels of flood protection for vulnerable areas of the town.

5.4.1 Impact Assessment

Six potential flood modification measures options were evaluated part of an options assessment. Option S4B, which includes the proposed levee upgrade, overflow channel and creek confluence vegetation clearing and bank reshaping works, has been identified as the most cost-effective floodplain management solution that will result in a reduction in existing flood damages in Bungendore (Worley Parsons, 2014b)).

Flood modelling carried out by Worley Parsons (2014a) as part of the FRMS was used to simulate flood behaviour with each of the proposed options in place. A map of predicted changes in peak flood levels and flow velocities allowed determination of the impact that each proposed management option was likely to have on existing flood behaviour and characteristics. Accordingly, the predicted hydraulic benefit of Option S4B on 100 year recurrence flood extents was modelled and the impact of Option S4B was quantified by developing flood extent difference mapping, as shown in Figure 5-1 .

Figure 5-2 shows the variation in peak 100 year recurrence flood levels due to the incorporation of Option 'S4B' flood management measures and demonstrates the potential impacts of the works. The significant majority of the Bungendore flood study area will have a reduction in potential flood levels for the 100 year recurrence event. Overall, the modelling indicated a maximum flood level decrease of 0.31 metres was predicted to occur with the implementation of Option S4B.

The design and any anticipated or proposed construction techniques for the proposed FRM works will be managed to minimise the risk of damage to environmentally sensitive areas including trees of significance to the community, and any other infrastructure or services. Furthermore, the design has been undertaken in conjunction with and consideration of the findings of geotechnical and environmental investigations carried out for the proposed works, and have been coordinated not only to produce a quality design but also for the design to be completed efficiently without the need for an excessive rework (PWA, 2018).

During construction, weather forecasts would be checked regularly so that in the event of flooding, construction works in affected areas will cease and equipment will be stored in a safe location. Works will not recommence until floodwaters have receded

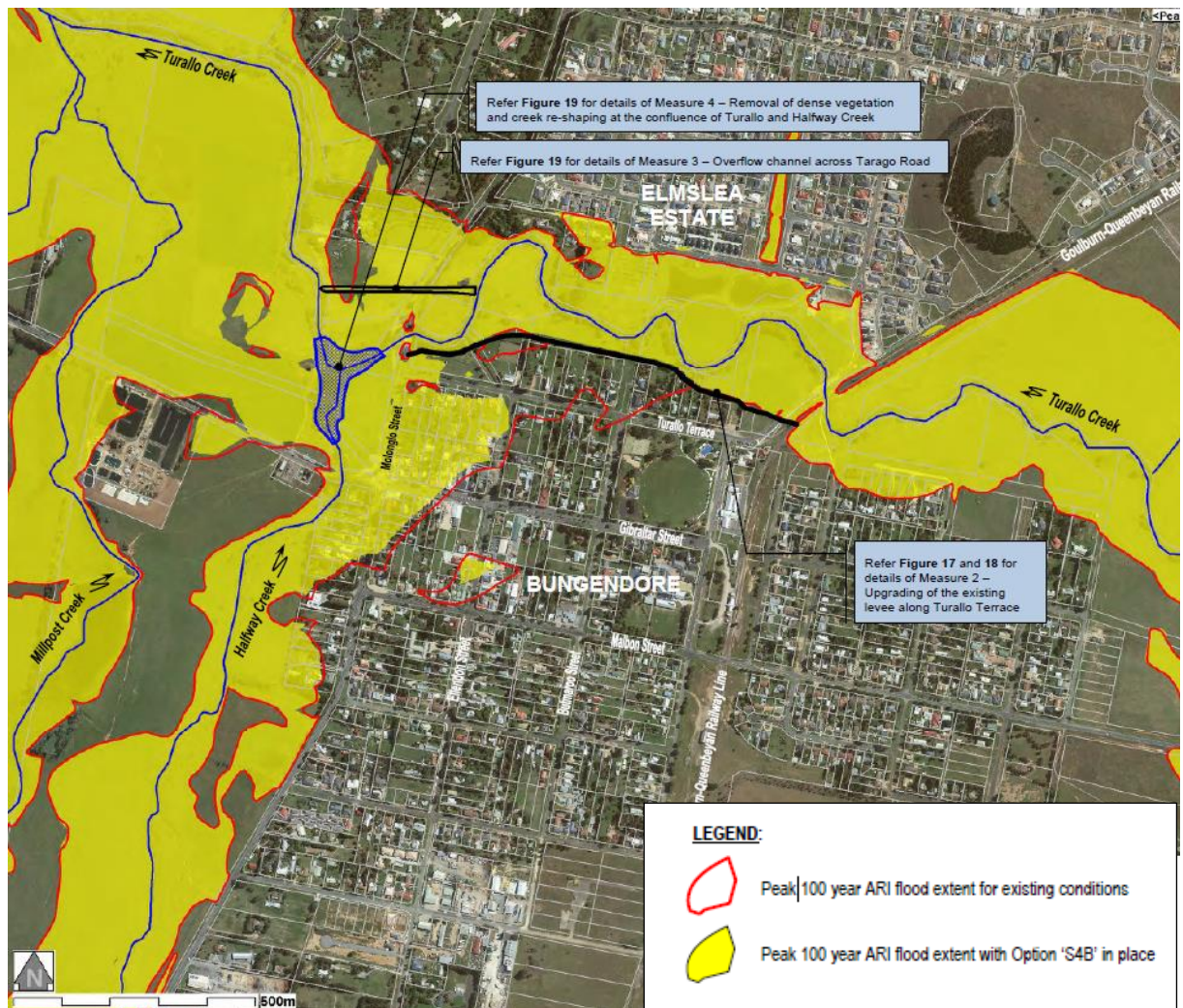


Figure 5-1 Comparison of peak 100 year recurrence flood extents with and without Option S4B flood management measures

Source: Worley Parsons, 2014a



Figure 5-2 variation in peak 100 year recurrence flood levels due to the incorporation of Option S4B.

Source: Worley Parsons, 2014a

5.4.2 Mitigation

- The contractor would develop a monitoring and flood response plan to detail procedures for monitoring rainfall (stormwater) and waterway flows and to identify subsequent response actions that would be taken to ensure the protection of personnel, equipment and water quality during the construction works.
- In the event of flooding, construction works in affected areas would cease and would not commence until floodwaters have receded. Weather forecasts would be checked regularly so that equipment and materials in flood areas can be secured prior to heavy rainfall events.
- Council to work with the State Emergency Service to develop a contingency plan for all events up to the PMF and to update the Palerang Flood Emergency Sub Plan (2013) from the Bungendore FRMS and Bungendore FRM Plan.

5.5 Ecology

The following assessment of ecological impacts has been summarised from the Ecological Assessment prepared by Lesryk Environmental. A copy of the report is provided in Appendix B.

The proposal area is indicated as having no biometrically mapped native vegetation. 'Plantation exotic' is the nearest mapped vegetation community to the study area, occurring approximately 50m north of the proposed overflow channel (see Figure 5-3).

A review of the Department of the Environment and Energy (DEE) and OEH databases identified 11 threatened plants and 36 threatened animals listed under the EPBC Act and/or the schedules of the BC Act that have been previously recorded, or are considered to have habitat, in the study region.

A field investigation of the proposal works areas was carried out by staff of Lesryk Environmental on 23 October 2017. As components of the proposal will include the disturbance of sections of the Turallo and Halfway Creeks, a qualitative aquatic assessment was also conducted in accordance with the NSW Fisheries Aquatic Environmental Assessment requirements.

Vegetation Communities

The Field investigation found that the proposal works area consists of three vegetation communities:

- grassland
- exotic woodland
- native and introduced plantings.

No Endangered Ecological Communities listed under the BC Act or EPBC Act were recorded within, or close to, the proposal works area investigated.

Grassland dominates the study area and consists of predominantly introduced grasses, herbs and forbs. The grassland appears to be regularly maintained, the species generally being about 10 cm in height. The grassland is of no conservation value.

The exotic woodland occurs at the confluence of Turallo and Halfway Creeks. Apart from some planted Eucalypts, the trees here consist of planted exotic species such as White Willow, *Malus* sp., English Oak (*Quercus robur*) and a *Populus* sp. that reach 10m in height. A high density layer of Blackberry and Fennel (*Foeniculum vulgare*) occurs in association with the northern edge of this woodland stand and reaches 1.5m in height. The exotic woodland is of no conservation value.

Native and introduced plantings occur throughout the study area, but are most common along the levee bank where they have been planted in rows either side of the walkway and reach a height of 15m. Common species include the introduced Desert Ash (*Fraxinus angustifolia* subsp. *angustifolia*) and the native River Peppermint (*Eucalyptus elata*) and Black Gum (*Eucalyptus aggregata*). English Oak dominates the western end of the levee area. A medium density layer of Cocksfoot and English Oak seedlings reach a height of 15cm. These native and introduced plantings do not collectively represent an ecological community of any conservation value.

Flora

A number of plants, the majority of which are introduced species, were recorded during the field survey. One plant, Black Gum (*Eucalyptus aggregata*), listed as vulnerable under the EPBC and BC Acts was recorded. Up to 17 individuals of this plant were observed, these being identified atop the levy in the eastern half of the subject site (Figure 5-3). Given their location, uniform age and spacing (the majority of plants occurring as linear strips each individual being approximately 3m apart), the Black Gums are presumed to have been planted. Though unlikely to be directly or indirectly disturbed, to further consider the impact(s) the proposal may have on Black Gum, assessments drawing on the criteria provided under the EPBC Act's Significant Impact Guidelines and Part 7, Section 7.3 of the BC Act was undertaken.

Targeted searches for the remaining threatened plants known to occur within the study region were undertaken; however, none were recorded. Given the highly disturbed and modified nature of the subject site, as well as the locality's land use history, the area is not considered to contain suitable habitat for any of the remaining threatened plants previously recorded within the surrounding region. It is considered unlikely that any of those listed threatened species would be present within the subject site such that the undertaking of the proposal would have a significant effect on the viability of a local population.

Fauna

By the completion of the field investigation one mammal, 33 birds, three reptiles and three amphibians had been recorded within, or in the vicinity of, the subject site. In addition, several introduced animals were also detected. Of those species detected, one, the Australian Reed-Warbler, is listed as marine under the EPBC Act. Apart from the Australian Reed-Warbler, no threatened species listed under the EPBC, BC or FM Acts were identified within, or in proximity to, the study area, nor were any considered likely to occur as a resident population. No threatened fish listed under the EPBC or FM Acts are considered to occupy, or occur upstream of, the subject site.

The Australian Reed-Warbler (listed as marine under the EPBC Act) was heard calling from reed beds that occur in association with the two wetlands that are present north of Turallo Creek, south of McMahon Drive. The wetlands appear to be artificially constructs, neither of which would be disturbed by the scope of works proposed.

Although Turallo and Halfway Creeks are mapped as Key Fish Habitat, the section of the aquatic environment to be impacted is not considered to be of value to any fish of conservation concern. Two species listed under the EPBC and/or FM Act have been previously recorded in the study region). Whilst this is the case, neither the Macquarie Perch (*Macquaria australasica*) (EPBC and FM Acts) nor the Murray Cod (*Maccullochella peelii*) (FM Act) are considered likely to occur within those sections of Turallo and Halfway Creeks that are to be disturbed as part of the scope of works proposed.

Habitat

Three habitat types available to native fauna were recorded within the proposal area, these being:

- modified environment
- riparian woodland
- aquatic environment.

No rocks, rock outcropping, caves, ledges or crevices are present within the proposal works area.

The modified environment incorporates the majority of the study area and includes the majority of the levee area and the overflow channel. These areas are primarily dominated by exotic grassland and planted native and introduced trees. None of the trees were noted to be hollow-bearing. Apart from some leaf litter, the presence of ground debris is at a minimum. No large logs or fallen branches were observed within this habitat.

The riparian woodland occurs as a stand of trees at the confluence of Turallo and Halfway Creeks. This habitat supports trees that reach 10m in height, none of which are hollow-bearing. The understorey is either cleared or consists of isolated shrubs/saplings to 1.5m. A high-density patch of Blackberry and Fennel is present, and ground cover consists of a medium to high density layer of exotic grasses that are 1m high. No large logs or fallen branches were observed within this habitat.

Two creeks are present within the proposal works area, these being Turallo and Halfway Creeks. Both Turallo and Halfway Creeks are mapped as Key Fish Habitat.

At the confluence of these two creek lines where the work is proposed, the width of the creek is 4m to 5m. The creek contained water that was not flowing at the time of the field investigation, and visually appeared to be of poor quality. No obvious aquatic vegetation is present, though some woody debris was observed. The confluence area of the two creeks supports earthen beds and banks and is lined predominantly by exotic trees (i.e. Willow, English Oak and Poplar) that reach 10m in height; the canopy being generally continuous. Exotic grasses and weeds are also present and reach a height of 0.5m.

At this location, Turallo and Halfway Creeks are considered 1st order streams. However, would be considered a Class 3 waterway with reference to the Fairfull and Witheridge (2003) classification system. Class 3 waterways are identified as offering potential fish refuge, breeding or feeding areas.

Priority Weeds and Weeds of State and National Significance

Of the introduced plant species recorded during the field survey, two weed species listed under Schedule 3 of the NSW Biosecurity Regulation 2017 were recorded within the proposal works area:

- Blackberry (*Rubus fruticosus* agg. spp.)
- White Willow (*Salix alba*)

These two weeds are also listed as a 'priority weed' in the South East NSW region. Blackberry and White Willow are also included on the list of Weeds of National Significance, which is part of a combined State and Commonwealth initiative to combat invasive species.

Key Threatening Processes (KTP)

The 'Degradation of native riparian vegetation along NSW water courses' has been listed as a KTP under Schedule 6 of the FM Act. This threatening process applies to all NSW waterways, not only those where listed threatened species are present. As some riparian vegetation will be removed, it is considered that the proposal will contribute to this KTP. The 'removal of large woody debris' has which is also listed as a KTP under Schedule 6 of the FM Act. Similarly, the

proposal may also contribute to this KTP due to the potential for the removal of woody debris from the waterways as party of the creek confluence clearing works.

5.5.1 Impact Assessment

Vegetation Communities

The extent of disturbance/modification expected to occur, based on a worst-case scenario, would be 2.45ha, this comprised of:

- 1.15 ha for the levee (720m by 16m)
- 1.13 ha at the confluence of Turallo and Halfway Creeks
- 0.17 ha for the installation of the overflow channel (110m by 15m).

Threatened Flora

The alignment of the levee has been modified in this area (being located further north of the original alignment, away from the existing levee and into the adjacent cleared grassland) thereby retaining the Black Gum stand (Figure 5-3). As such, the plants will be retained and will be present post-works.

With reference to the criteria provided under the EPBC Act's Significant Impact Guidelines and Part 7, Section 7.3 of the BC Act (commonly referred to as the five part test). Assessments undertaken for the Black Gum found the proposal is unlikely to have a significant effect on Black Gum, or its habitats.

Threatened Fauna

As the proposed works are not located within the Commonwealth marine area, this being from 3 to 200 nautical miles from the coast, no assessment for the Australian Reed-Warbler using the guidelines relevant to the Commonwealth marine environment was carried out on this species. As such, the Australian Reed-Warbler is not a matter of national concern in the context of the proposal.

The disturbance and (temporary) modification of the Turallo Creek and Halfway Creek confluence is unlikely to affect any native aquatic fauna that may utilise or traverse along either of these water bodies.

Habitat

The native fauna species recorded during the field investigation are protected, as defined by the NPW Act, but considered to be common to abundant throughout the surrounding region. Within the surrounding region, these species have been recorded in association with a range of woodland and forest habitats, as well as urban environments. The species recorded would not be solely reliant upon those habitats present within, or in close proximity to, the subject site, such that the removal or short-term/temporary disturbance of these would threaten the 'local' occurrence of these animals. The species recorded are all expected to be present within both the study area and surrounding locality post-work.

Post-establishment of the levee it is expected that it will be either grassed or planted with locally occurring native species. As such, resources suitable for the life-cycle requirements of those species recorded (such as foraging area) will be present in the long-term.

The activities undertaken within the aquatic environment as part of the proposal, would not involve an overall reduction in water quality, the temporary or permanent obstruction of fish passage or the use of explosives and other dangerous substances. The proposed creek confluence clearing and reshaping works includes the enhancement of the confluence area through the removal of weed species. As such, post-development, the resources offered by this habitat type for those species expected, particularly any fish (i.e. Eels [*Anguila spp.*]) that may traverse along it, are considered to remain and to be improved. The works will not establish any barriers to fish movements, or isolate any of their habitat areas. Post-treatment, fish would still be able to traverse along Turallo and Halfway Creeks.

No major areas of aquatic habitat are to be removed, modified or disturbed. The work is not considered to result in any fish species, aquatic-associated animals or their populations becoming extinct in the locality. Based on an assessment of those habitats observed in association with the sections of Turallo and Halfway Creeks investigated, it is not considered that any threatened fish would be present as resident populations within either of these water bodies. Therefore, giving consideration to the assessment criteria ('seven part test') provided under Part 7A, Division 6, Subdivision 1 of the FM Act, it is considered that the proposal would not have a significant impact on any threatened aquatic species, their populations, ecological communities or habitats. As such, the preparation of a SIS that further considers the impacts of the proposal on fish is not required.

Priority Weeds and Weeds of State and National Significance

Where Blackberry and White Willow occur on site, they must be controlled to result in their suppression. This should be done at the commencement of work to avoid the further spread of these plants.

KTP

In relation to the KTP of 'Degradation of native riparian vegetation along NSW water courses', given the small area of primarily exotic riparian vegetation that will be disturbed, and the opportunities for regeneration post-disturbance, the scale of work is minimal. Furthermore, the removal of this vegetation is not expected to cause instability of the creek's banks or reduce the quality of the water within them. Removal of weeds and revegetation of the banks with native species is likely to have a positive impact on the creek line and its riparian vegetation. As such, the work is not considered to contribute significantly to this KTP.

In consideration of the 'Removal of large woody debris' KTP; whilst some of the woody debris observed may be inadvertently removed when clearing the vegetation, the scale of this is minimal. As such, the proposal is not expected to contribute significantly to this KTP.

The Lesryk flora and fauna assessment concluded that the proposal need not be referred to the Federal Minister for the Environment and Energy for further consideration or approval, nor is the preparation of an SIS that further assesses and considers the scope of work proposed required. As such, with adherence to the mitigation measures provided in Section 5.5.2, no ecological constraints to the proposed development proceeding as planned were identified, nor considered likely to occur. The adoption of the mitigation measures provided below will ensure that the proposed works are undertaken in an ecologically sustainable manner.

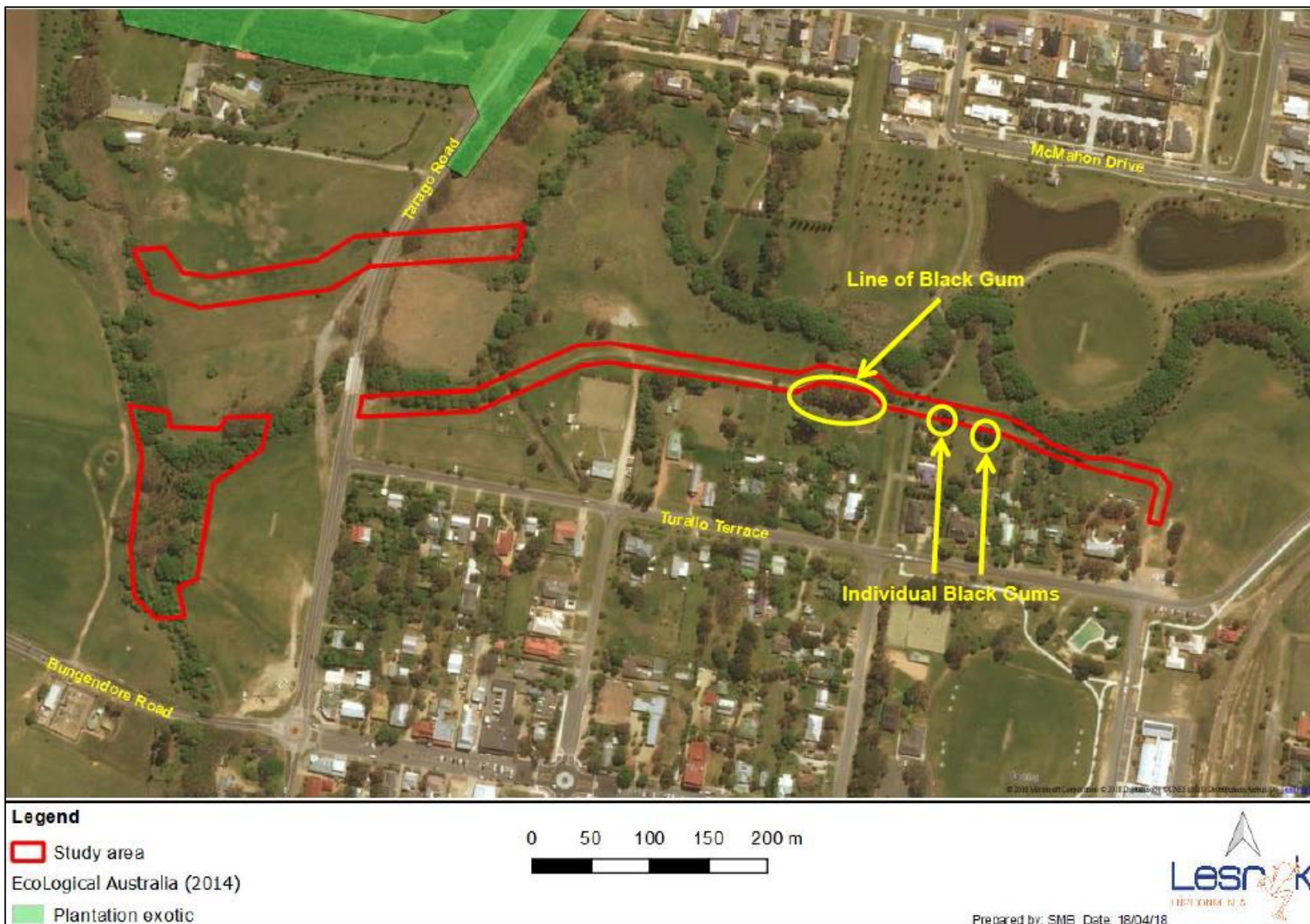


Figure 5-3 Vegetation mapping of the study region and location of Black Gums

Source: Lesryk Environmental, 2018

5.5.2 Mitigation Measures

- Consultation should be undertaken with DPI Fisheries with regard to any construction works proposed in water land, and required approvals obtained for any dredging and reclamation works in water land prior to construction commencing.
- The proposed overflow channel should not result in the disturbance of any native trees or shrubs.
- Vegetation clearing should be limited to the minimum required to successfully complete the proposal.
- Limits of clearing should be provided to the construction contractor and identified both on site maps/plans and on site.
- Given their State and Federal status, though planted, indirect impacts to the viability of the stand of Black Gum individuals should be avoided.
- The location of those Black Gum individuals to be retained should be provided to the construction contractor and identified both on site maps/plans and on site. All individuals within the study area should be temporarily fenced and protected.
- Where vegetation is removed from the creek bank, this should be replaced with locally occurring native plants.
- Any woody debris removed from the creek line as part of the proposal should be collected and placed back in the creek line post-work.
- Vehicles and machinery should be stored and parked in those treeless areas.
- Any animals injured during the clearing works should be collected and taken to a local veterinarian or wildlife carer.
- In accordance with the *Biosecurity Act 2015*, those weeds identified on site must be controlled to result in their suppression, in particular Blackberry and White Willow.

5.6 Aboriginal Cultural Heritage

The following assessment of Aboriginal cultural heritage impacts has been summarised from the Bungendore Floodplain Mitigation Channel - Heritage (Aboriginal and Historical) Assessment Report prepared by Past Traces Heritage Consultants, in June 2018 (Appendix C). Representatives of Registered Aboriginal Parties (RAPs) including Ngambri LALC, Buru Ngunawal Aboriginal Corporation and Didge Ngunnawal Aboriginal Corporation accompanied the Past Traces representative during the completion of the targeted field investigation.

Predictive Model and Archaeological Potential

The levee, creek confluence clearing and reshaping and overflow channel works areas of the project area all lie within the Turallo Creek Floodplain which consists of Quaternary alluvium (gravel, sand, silty clays). The landscape in the proposal works areas is best characterised as gently sloping to level floodplain, with gently undulating to flat lower slopes and creek flats along the banks of Turallo Creek. There is only minor topographic variation within the land for the proposed development.

The spatial distribution of Aboriginal sites in the local area suggests that the area of Turallo Creek would have been a focus for Aboriginal groups present in the area. The lower densities of sites and artefacts found in previous studies of Turallo Creek is most likely a result of Aboriginal people moving through these areas for travel to Lake George and food gathering, but not returning frequently to any one site or staying for a long term basis. However, the soils

present in the proposal area are alluvial and are not likely based on previous excavations along Turallo Creek to contain high density or stratified deposits which are found in the sand swales and shoreline relict deposits associated with Lake George.

The area of the current flood levee bank on the southern side of Turallo Creek within the Village of Bungendore has been impacted by past construction associated with the access trail and levee but has been retained as green verge and flood mitigation area. The proposed overflow channel crosses an area of floodplain between two sections of Turallo Creek which is currently used for pastoral grazing and potato cropping. Landforms were assessed to contain moderate potential for subsurface deposits based on proximity to Turallo Creek.

Database Search and Field Survey

An extensive search of the AHIMS database (Client service number 309804) resulted in no previously recorded sites within the project area and a further 10 within a 1km radius.

As a result of the field survey undertaken across the proposal area in November 2017 as part of the initial due diligence assessment, two new areas of PAD, as detailed below, were identified in the area of the proposed overflow channel which required subsurface testing to determine the presence, extent and significance of subsurface deposits.

With the exception of the two areas of PAD, as a result of the field survey it was concluded that it is unlikely that any unidentified cultural heritage sites are located within the proposal works areas, due to the high level of ground surface visibility present across the proposal works area at the time of field survey and the highly disturbed nature of most of the project area.

The two areas of PAD within the proposal works area (BunPADA and BunPADB) consist of two small terraces (level areas) in association with Turallo Creek. The location of the two PADS is shown in Figure 5-4.

BunPADA

This area of PAD was located on the proposed overflow channel alignment west of Tarago Road, on a level area of creek flats adjacent to Turallo Creek. The area of PAD is large measuring approximately 1100m² of which 73% is proposed to be impacted under the current flood channel plans. The area of PAD to the east has been subjected to continuous ploughing for potato cultivation and ripping which would have disturbed soils in the top 25- 30cm zone. This area was assessed to hold potential due to its location between Turallo Creek and an area of raised terrace to the west of the proposed alignment. It was considered that potential was moderate. The soils in this area appear alluvial with sparse grass coverage. Areas of exposure were confined to small areas of surface wash erosion.

A program of nine test pits was plotted along the flood channel alignment at 10m intervals and excavated to the underlying clay strata or maximum practical depth in a 50cm x 50cm test pit.

A total of 11 artefacts were recovered across BunPADA from six of the nine excavated test pits. The artefacts were consistently located within the 20-30cm strata within an orange/light brown silty loam. Artefacts recovered included small quartz flakes (debitage) and angular shatter.

BunPADB

Located on the proposed overflow channel alignment, east of Tarago Road, this area of PAD was located on a low, level area of terrace adjacent to the western bank of Turallo Creek. The area of PAD measured approximately 50m x 15m from the central point and was considered to hold moderate potential to contain subsurface deposits.

Two lines of test pits including a total of seven test pits were laid out along the proposed flood channel alignment at 5m intervals. All of the test pits within BunPADB ceased on the underlying strata below the fine alluvial silt at an approximate depth of 40cm.

A total of 3 artefacts were recovered across BunPADB from three of the excavated test pits. Artefacts included a small flaked piece of quartz and two small retouched quartz flakes.

Overall, the test pitting programme indicated that low density cultural deposits are present at both areas of PAD. The test pits returned very low artefact numbers (usually 1 per 0.25m). All of the artefacts were constructed of quartz and consisted of flakes, flaked pieces and angular shatter. No cores, retouch artefacts, formal tool types were identified.

The stratigraphy was consistent with that shown on soil and geology mapping (Halfway Creek soil landscape) and consisting of alluvial silts/sands/clays (loam). These alluvial silts are the results of floodplain events along the Turallo Creek. The test pits and proposed project are not located in an area of Aeolian sands, relict shorelines or sand strandline deposits from Lake George.

Sites BF1 and BF2

Based on the location of artefacts recovered from the two PADs during the archaeological investigation of the overflow channel area; two new Aboriginal Sites identified as BF1 (covering a 50m x 20m area) and BF2 (extending for 40m x 10m), were recorded within the location of BunPADA and BunPADB, respectively. These sites cover the test pits that contained artefacts with a 10m buffer. Both sites are considered to have low cultural and low scientific significance.

5.6.1 Impact Assessment

Due to the nature of the development, direct impacts will occur to the two newly identified Aboriginal sites (BF1 and BF2) resulting in the destruction of the sites. The stone artefact sites located within the overflow channel area represent common site types found throughout New South Wales and consist of common materials and artefact types. The recorded sites are considered to hold low cultural and scientific values. Recording of these sites will assist in regional studies aimed at assessing Aboriginal usage of the landscape but they do not hold a local or regional level of significance warranting conservation.

For the proposed works to occur, harm to the identified sites within the impact area cannot be avoided as the development footprint will extend across all of the Aboriginal sites impact area. The small size of the surface areas and the low significance of the sites does not make them suitable for exclusion from the area of impact in the form of a conservation area. The nature of the sites being common, consisting of common artefact types and materials and being low in significance does not warrant this class of treatment to ensure their preservation.

As the artefacts were located subsurface, and are currently awaiting reburial in the test pits, a mitigation strategy of reburial in an area of no impact close to the original location has been deemed the most culturally appropriate option. As a result, it has been recommended that an AHIP be applied for covering the area of the two impacted Aboriginal heritage sites which will include a return to country protocol, developed in consultation with the RAPs for the project. If an AHIP is not granted then the artefacts should be reburied at the bottom of their individual test pits in accordance with the Code of Practice requirements.

Accordingly, the heritage assessment has concluded that if the heritage sites (BF1 and BF2) are to be impacted, an Aboriginal Heritage Impact Permit (AHIP) approved by NSW Office of

Environment and Heritage (OEH) covering the area identified in Figure 5-5, which represents the location of sites BF1 and BF2, will be required prior to the commencement of works.

Based on results of the archaeological assessment and consultation with the RAPs, the following recommendations have been developed with regards to Aboriginal Cultural Heritage values located within the proposal works areas. Following the implementation of the below mitigation measures in Section 5.6.2, the proposed FRM works may proceed without significant impact to Aboriginal cultural heritage.



Figure 5-4 Location of BunPADA and BunPADB

Source: Past Traces Heritage Consultants, 2018



Figure 5-5 AHIP area in flood overflow channel area at Bungendore

Source: Past Traces Heritage Consultants, 2018

5.6.2 Mitigation

- If the Aboriginal heritage sites (BF1 and BF2) are to be impacted, an Aboriginal Heritage Impact Permit (AHIP) approved by NSW Office of Environment and Heritage (OEH) covering the AHIP area identified in Figure 5-5 will be required prior to the commencement of works.
- The recovered artefacts in temporary storage should be reburied in accordance with the Return to Country Protocol (RTC) developed in consultation with the RAPs for the project. The RTC will be a condition of the AHIP approval and will be submitted with the AHIP application to OEH as supporting documentation.
- If an AHIP is not granted then the artefacts should be reburied at the bottom of their individual test pits in accordance with the Code of Practice requirements.
- Construction crew inductions should be provided to workers on the project as to the location of the recorded sites and their legislature under the NPW Act.
- All Aboriginal objects are protected under the NSW *National Parks and Wildlife Act 1974*. It is an offence to disturb an Aboriginal site without a consent permit issued by the Office of Environment and Heritage. Should any Aboriginal objects be encountered during works then works must cease and the find should not be moved until assessed by a qualified archaeologist.
- In the unlikely event that human remains are discovered during the construction, all work must cease. OEH, the local police and the appropriate LALC should be notified. Further

assessment would be undertaken to determine if the remains are Aboriginal or non-Aboriginal.

- Further archaeological assessment would be required if the proposal activity extends beyond the area of the current investigation. This would include consultation with the RAPs for the proposal and may include further field survey.
- Continued consultation with the RAPs for the project should be undertaken. RAPs should be informed of any major changes in proposal design or scope, further investigations or finds.
- No further investigations are required should the AHIP be approved, except in the event that unanticipated Aboriginal Objects and/or human remains are unearthed during any phase of the proposed works.
- Should any other objects or Aboriginal sites be identified during the course of construction the Unanticipated Finds Protocol should be followed:

Unanticipated Finds Protocol:

- All ground surface disturbance in the area of the finds should cease immediately once the finds are uncovered.
- The discoverer of the find(s) would notify machinery operators in the immediate vicinity of the find(s) so that work can be halted; and the Principal's Authorised Person would be informed of the find(s).
- If there is substantial doubt regarding an Aboriginal origin for the finds, then gain a qualified opinion from an archaeologist as soon as possible. This can circumvent proceeding further along the protocol for items which turn out not to be archaeological. If a quick opinion cannot be gained, or the identification is positive, then proceed to the next step.
- Immediately notify the following authorities or personnel of the discovery:
 - OEH; and
 - Relevant Aboriginal Community Representatives.
- Facilitate, in co-operation with the appropriate authorities and relevant Aboriginal community representatives:
 - The recording and assessment of the finds;
 - Fulfilling any legal constraints arising from the find(s). This would include complying with OEH directions; and
 - The development and conduct of appropriate management strategies. Strategies would depend on consultation with stakeholders and the assessment of the significance of the find(s).
- Where the find(s) are determined to be Aboriginal Objects, any re-commencement of construction related ground surface disturbance may only resume in the area of the find(s) following compliance with any consequential legal requirements and gaining written approval from OEH (as required).

5.7 Historic Heritage

The following assessment of historic heritage impacts has been summarised from the Aboriginal and Historical Heritage Due Diligence Assessment (November, 2017) and Bungendore Floodplain Mitigation Channel - Heritage (Aboriginal and Historical) Assessment (June, 2018) reports prepared by Past Traces Heritage Consultants (Appendix C).

A desktop search of National, Commonwealth and state heritage listings and the Palerang LEP 2014 identified one heritage item (Bungendore Commons I243) located in the vicinity of the proposed FRM works. The Bungendore Commons covers the area of Turallo Terrace where the existing and proposed levee is located, as shown in Figure 5-6. This listing requires the area to be maintained as open space and in accordance with the Bungendore Heritage Conservation Strategy to reinforce the semi-rural character and function of the reserve providing a green edge to the village.

The levee bank along the southern side of Turallo Terrace, runs to the rear of houses, many of which were established in the 1880s. St Mary's Catholic Church was established in 1862 along Turallo Terrace along with the building of the residence, convent and nunnery. None of these historical buildings or residences will be directly impacted by the proposal as they are located outside of the levee works area.

No new historic heritage sites were identified within the project area during site inspection carried out as part of the heritage assessment. Based on the field survey a listing of local significance is applicable to the site, no regional or state significance appears to be present. (Past Traces, 2017 and 2018).



Figure 5-6 Recorded heritage items in Bungendore including Bungendore Common listed under the Palerang LEP 2014

Source: NSW Planning Portal, 2018

5.7.1 Impact Assessment

The eastern area of the proposed levee works along the Turallo Terrace are within the boundary of the Bungendore Commons, which is listed under Schedule 5 of the Palerang LEP 2014 (Item No. I243) will be impacted by the proposed works. However, the works do not affect any material fabric that relates to the historical significance.

The works are confined to a small area of the heritage listed Bungendore Commons area and the heritage assessment concluded that the proposed levee works will not impact on any of the identified heritage values of the area and the Turallo Creek reserve and Bungendore Commons will retain their characteristics and function, providing a green verge and open public access areas for recreational activities. However, prior to commencing works, approval from QPRC will be required, as the works will impact a locally listed heritage area. Following approval from Council, no further historical heritage constraints apply to the proposal.

The adoption of the mitigation measures below will ensure that the proposed works are undertaken in a manner as to not impact historic heritage values.

5.7.2 Mitigation

- No works are to occur in the Bungendore Commons heritage listed area prior to Council approval of works.
- All land-disturbing activities must be confined within the assessed proposal area. Should project impacts change such that the area to be impacted is altered then additional assessment will be required.
 - As part of an induction, in the unlikely event that any historical relics or sites are identified workers should be aware of their responsibilities under the provisions of the *Heritage Act 1977*. In this event all works must cease and the area be protected until a qualified archaeologist inspects the site and provides management advice in consultation with the Heritage Division, OEH.

5.8 Noise and Vibration

The area surrounding the FRM works is a mixture of low density residential, rural properties and open public recreational areas. Noise monitoring was not undertaken as part of the REF, however background noise levels along the alignment are likely to be from 35-40 dB(A) in the township and surrounding rural area.

There are a number of residential properties located in close proximity immediately to the south of the proposed levee upgrade alignment on Turallo Terrace, the distance to the nearest residential receptor is approximately 50 metres from the levee works alignment. Additional residential receptors located approximately 150m east of the creek confluence works and approximately 200m to the north of the proposed overflow channel site.

5.8.1 Impact Assessment

Construction

The typical A-weighted sound power levels for equipment which may be required to undertake the construction works are listed in Table 5-1 below (it is noted that this list is not definitive and these levels are taken from the *Australian Standard AS2436-2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*).

Table 5-1 Construction Equipment Sound Power Level

Equipment	Typical Sound Power Levels (dB)	Sound Pressure Level at 50m distance (dB(A))	Sound Pressure Level at 100m distance (dB(A))
Excavator/ Backhoe	118	76	70
Truck	117	75	69
Light vehicles	106	64	58
Jackhammer	121	78	72
Rock breaker	118	76	70
Machine mounted drill	116	73	67
Compressor (silenced)	101	59	53
Concrete agitator truck	109	67	61

Notes:

1. The method specified in AS2436 suggests that errors are introduced for distances greater than 100m from the sound source.

The total duration of construction works is anticipated to be up to six months. However, construction of the levee upgrade would progress relatively rapidly along the levee alignment and thereby minimise noise and vibration impacts at any one location. The creek confluence clearing and reshaping works and the overflow channel works are not located in the immediate vicinity of sensitive noise receivers and are of shorter duration than the levee works, therefore are not anticipated to result in significant noise impacts to surrounding sensitive noise receivers.

Under the *Interim Construction Noise Guideline* (DECCW, 2009) construction noise criteria for residences where the construction duration is greater than three weeks is the rating background noise plus 10dB(A), the noise management level for Bungendore township would be 50dB(A). Based on the typical sound power levels in Table 5-1 and using the methodology in the *Australian Standard Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites* and the *Interim Noise Construction Guideline*, the maximum predicted noise levels at the closest residences during construction may exceed the recommended noise affected level as well as the highly affected noise level (75 dB(A)) above which there may be strong community reaction to noise (DECCW, 2009). The use of the construction equipment listed in Table 5-1 also has the potential to cause some vibration impacts, although it should be noted that no blasting would be undertaken during the works.

The *Interim Construction Noise Guideline* states that, where the predicted noise level is greater than the noise affected level, all feasible and reasonable work practices should be applied to

meet the noise affected level. Furthermore, all potentially impacted adjoining properties should be informed of the nature of the works, the expected noise levels and duration, as well as contact details. Where the noise level is above the highly affected noise level, the determining authority (in this case, Council) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences); and if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Control measures to minimise noise impacts would be implemented during construction as part of the contractor's Construction Environmental Management Plan (CEMP), which would be required to be submitted for approval prior to commencement of works. This should include consideration of Tables 4-10 of the *Interim Construction Noise Guideline*, which present a summary of options for work practices with lower noise impact.

The CEMP for the works would address site specific issues, including noise reduction practices, so as to minimise impacts to adjoining properties. Given the temporary nature of the works and the restriction of construction hours in accordance with normal daytime construction hours as specified by the EPA, noise impacts resulting from the works are not expected to be significant.

5.8.2 Mitigation

- Prior to the commencement of construction works the contractor shall consult with residential premises likely to be affected by, or in the immediate vicinity of, the proposed works to determine any community concerns and provide advice as to where concerns can be directed. If during consultation community concerns are not readily resolved by agreement, Council staff are to be contacted who will endeavour to assist in resolving any outstanding issues of concern.
- Works would be undertaken during normal work hours i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays; and no work would be undertaken on Sundays, Public Holidays or outside these work hours without notification to the affected community and EPA. Notification would provide the following details:
 - The locations and types of surrounding receivers likely to be affected;
 - The nature of the proposed works;
 - The noise characteristics of any powered equipment likely to be used;
 - Measures to be taken to reduce noise emissions; and
 - Any other information EPA may request.
 - All reasonable practical steps shall be undertaken to reduce noise and vibration from the site.
- Control measures to minimise noise and vibration impacts on adjoining land would be implemented during construction as part of the contractor's CEMP, which would require review by QPRC prior to commencement of works. The CEMP would address site specific issues, including limited work hours and noise and vibration reduction practices, taking into consideration DECCW's *Interim Construction Noise Guideline* (in particular Tables 4 – 10) and *Assessing Vibration: A Technical Guideline* (in particular mitigation measures in Section 3). Mitigation measures to minimise noise and vibration impacts would include:

- Optimum siting of work areas, vehicle and plant parking areas, materials stockpiles and equipment storage areas in locations where potential acoustic and vibration impacts would be minimised;
- Regular maintenance of all plant and machinery used for the project;
- Identify locations where construction noise and vibration is most intrusive and develop strategies to reduce impacts for these areas.

5.9 Air Quality

Air quality is expected to be good due to the semi-rural location, with the main influence on air quality in the area being vehicle emissions associated with moderate to low traffic volumes within Bungendore. There is one point source of air pollution in the vicinity of the project sites (Bungendore Sand). In high wind events, dust can be a major source of air particulates.

5.9.1 Impact Assessment

The main impact to air quality during construction would be expected to arise from the generation of airborne localised dust associated with earthworks and from trucks transporting materials to and from the works sites. Given the proximity of the work areas to nearby residents, any dust generated as part of the construction works could result in temporary impacts to neighbouring landowners. Dust suppression methods would be applied where required to prevent dust being transported off site.

Local air quality may be affected by emissions from construction traffic. These emissions would, however, occur only intermittently, and are expected to be minor and temporary. It would be unlikely that they would contribute to a permanent detectable reduction in local air quality.

With implementation of the recommended mitigation measures, potential air quality impacts during construction are considered minor and unlikely to be significant.

5.9.2 Mitigation

- Construction vehicles and equipment would be suitably serviced within the six-month period prior to commencement of construction activities and all necessary maintenance undertaken during the construction period to meet EPA air quality requirements.
- The excessive use of vehicles and powered construction equipment would be avoided.
- All construction machinery would be turned off when not in use to minimise emissions.
- Construction contractors would monitor dust generation potential.
- Dust suppression methods including the use of water carts would be applied where required (i.e. on windy days when earthworks and vehicle movements are generating dust).
- Any stockpiled spoil/fill would be protected to minimise dust generation to avoid sediment moving offsite.
- Vehicles transporting spoil from the sites would be covered.
- Bare surfaces are to be vegetated or stabilised as soon as possible.

5.10 Traffic and Access

Existing traffic levels in the surrounding road network are considered to be moderate to low. Access to the worksites would be via surrounding local streets in Bungendore.

5.10.1 Impact Assessment

The majority of the works areas would be accessed using existing roads and tracks. Clearing of undisturbed vegetation for the creation of a new access roads would not be required for the works.

The construction works are likely to cause some minor inconvenience for pedestrian access to the existing levee area and to private property access. For the duration of the proposed works there would be an increase in vehicle movements using local road networks for delivery of materials, the arrival and departure of construction workers, equipment delivery and the removal of waste.

Access to individual properties would be maintained as far as possible. The community would be notified in advance of the proposed construction work program and advised of any issues, including where works affect access to individual properties and public recreation areas.

Works would progress along the levee alignment; therefore, there would not be impacts in the same area of the levee for the entire construction duration. Construction works would have a longer duration at the overflow channel and confluence vegetation and reshaping clearing area compared to the works at any one location along the levee upgrade alignment. Any impacts are not anticipated to be significant due to the overflow channel and creek confluence clearing works taking place on private land and a reserve area that is currently inaccessible to the general public due to the existing dense overgrown vegetation.

The relocation of select spoil from the overflow channel area to the levee upgrade works area would generate truck movements through the Bungendore township. Truck movements would occur over a short distance via Tarago Road/ Molonglo Street and Turallo Terrace. Reuse of spoil from the overflow channel works to construct the levee provides an opportunity to reduce the overall distance of truck movements travelled.

Whilst some inconvenience to local residences would be expected during construction, works would be carried out so as to minimise interruption to access for adjoining landowners in Bungendore and surrounding area, and the limited duration of the works in any one area would assist in reducing the impacts. Traffic related impacts would be mitigated through the development of a traffic management plan, which would include traffic controls and community consultation to minimise impacts to other road users, as well as access arrangements for residents and pedestrians. The anticipated increased traffic movements due to construction vehicles would be short term and relatively infrequent, and therefore are not expected to result in a significant impact on the road network.

5.10.2 Mitigation

- The contractor would prepare a Traffic Management Plan (TMP) as part of the CEMP, to be reviewed by QPRC prior to commencement of works. The Traffic Management Plan would include measures to minimise traffic impacts ensure public safety and would be prepared in accordance with *RTA's Traffic Control at Work Sites Manual, Issued June 2010*, and *Australian Standard 1742.3 - 2009 Traffic Control for Works on Roads*. The

TMP would detail mitigation measures to manage traffic related issues associated with the construction works including:

- All materials deliveries are to avoid school zones during school bus hours, i.e. 7.30am to 9.30am and 3pm to 5pm;
 - Appropriate and site specific pedestrian management.
- Prior to the commencement of construction works the contractor shall consult with residential premises likely to be affected by truck movements, or in the immediate vicinity of the proposed works to determine any community concerns and provide advice as to where concerns can be directed. If during consultation community concerns are not readily resolved by agreement, Council staff are to be contacted who will endeavour to assist in resolving any outstanding issues of concern.
- Any disturbance to landowners as a result of vehicle movements and noise would be minimised by adhering to the working hours outlined in Section 4.3.3. The contractor would avoid any inconvenience to residences/landowners.
- Where driveways or pedestrian access are to be obstructed, affected property owners/nearby residents to be provide at least 2 days' notice.
- Any temporary compounds and their access roads required for the works would be located so as to minimise disturbance to the existing environment. Following completion of the works the temporary compounds and roads would be removed, topsoil provided and re-grassed. Existing tracks and paths would be restored to their condition prior to works.
- Roads must be re-instated in accordance with Council's Construction Manual or as directed by Council staff.
- Trucks would not access the sites in weather conditions that would cause damage to properties or the environment.
- All sealed roads would be kept clean and free of dust and mud at all times. Where material is tracked onto sealed roads at any time, it would be removed immediately so that road pavements are kept safe and trafficable.
- Any temporary access tracks required for the works would be located so as to minimise disturbance to the existing environment. Following completion of the works the temporary tracks would be removed, topsoil provided and re-grassed.
- All construction traffic would comply with all applicable traffic laws and regulations. All construction vehicles would comply with the speed limits set for the roads accessing the sites.

5.11 Waste Management

5.11.1 Impact Assessment

The construction of the proposal would result in waste in the form of excess spoil, cleared vegetation and general building wastes such as packaging, off cuts, excess materials and workers' wastes such as drinks containers, food scraps, etc. Portable toilets would be provided for workers. Surplus spoil that is suitable for use as engineered fill would be reused for construction of the levee upgrade reducing the need to dispose of soil offsite. Any cut native vegetation will be mulched and reused on site where possible. Any spoil not able to be re-used

as engineered fill would be disposed off-site. All weeds are to be managed in accordance with site specific weed management measures to be included in the CEMP. All other waste material generated by the works would be removed from site post construction.

To ensure that environmental harm does not occur as a result of uncontrolled or inappropriate collection, transport and disposal the relevant provisions of the following Acts would be implemented:

- *Waste Avoidance and Resource Recovery Act 2001*
- *Protection of the Environment Operations Act 1997*
- *Protection of the Environment Operations (Waste) Regulation 2014*

Some ongoing vegetation and weed removal would be required post construction along the levee alignment and would be undertaken in accordance with the Council's Vegetation Management Plan.

The waste management and contamination control procedures and/or measures listed below would be implemented for the proposed works.

5.11.2 Mitigation

- The contractor undertaking the works would detail waste management procedures in a Waste Management Plan to be incorporated into the CEMP. The contractor is to assume responsibility for the appropriate disposal of any waste generated. Adequate procedures should be established and detailed in the CEMP, including notification requirements to EPA, for incidents that cause material harm to the environment. The WMP would also follow the resource management hierarchy principles embodied in the *Waste Avoidance and Resource Recovery Act 2001*. Namely, to:
 - avoid unnecessary resource consumption;
 - recover resources (including reuse, reprocessing, recycling and energy recovery); and
 - dispose (as a last resort).
- The construction contractor is to ensure that waste generated by the works is transported to a place that can lawfully accept it as per Section 143 of the *Protection of the Environment Operations Act 1997*.
- No batched concrete mixing plants would be established in the works areas. Any required concrete would be mixed off-site and transported to the construction area.
- Following completion of the works, excess concrete would be removed off-site for recycling.
- If any contaminated material is encountered during earthworks, work shall cease, the site secured and a safe work method statement(s) and appropriate practices shall be implemented. Any contaminated material would be classified first and then stored, transported and disposed of in accordance with EPA requirements at an EPA licensed waste facility.
- The EPA is to be notified immediately of any pollution incidents or harm to the environment (as defined under Part 5.7 of the POEO Act).

- Cleared vegetation (devoid of weeds) would be mulched and re-used on site as part of site stabilisation and revegetation. Excess mulch would be removed off site and disposed of in accordance with EPA requirements.
- Any material removed from the waterways that is to be temporarily deposited or stockpiled on land is to be located well away from the waterway and to be contained by appropriate sediment control devices as outlined in the *Managing Urban Stormwater: Soils and Construction* (4th Edition Landcom, 2004).
- If practicable, surplus excavated materials/fill would be reused onsite as part of rehabilitation and restoration works. Any surplus spoil disposed of in this manner would be seeded to minimise the likelihood of it being transported offsite through wind or water action.

5.12 Visual Amenity

5.12.1 Impact Assessment

There would be minor visual impacts during construction of the proposal due to the presence of construction equipment. However, this would generally only occur for short periods at any one location as construction of the levee upgrade progresses along the alignment, with slightly longer impacts during construction of the overflow channel and creek confluence clearing and reshaping. However, this impact is not anticipated to be significant due to the temporary nature of the construction works.

The removal of grass cover would be required for the construction of the levee, the overflow channel and the creek confluence clearing and reshaping works. However, these visual impacts would be temporary and are unlikely to be significant as revegetation of these areas would take place, post-works.

There would be a visual impact within the levee upgrade area post-construction due to the change in the height of the levee crest. However, the increase in height is not anticipated to significantly obscure views to Turallo Creek and the surrounding area for residents, as the residences are located some distance from the creek and fences currently bound these properties. Members of the public in the levee area access the creek area along a pedestrian path along the crest of the levee, therefore pedestrian views and access along the levee area would not be altered. The overflow channel will be located within an existing cleared paddock area and is not anticipated to have a significant visual impact during operation, as it will be a subsurface gentle gradient grassed channel feature in the paddock landscape.

5.12.2 Mitigation

- The clearing of vegetation would be kept to the minimum required for the works
- Construction compounds and areas for the parking of vehicles and storing of equipment would be located in cleared areas wherever possible.

5.13 Utilities and Infrastructure

5.13.1 Impact Assessment

Relevant authorities will be consulted further regarding the design requirements, where works are located in close proximity to, or have the potential to impact on existing services and

infrastructure. Those requirements would be incorporated into the design of the proposed infrastructure.

5.13.2 Mitigation

- Utilities and services which may be impacted by the proposal would be accurately located prior to commencement of works.
- Utility and service providers would be consulted prior to the commencement of and during construction works in the event that impacts on any utilities and services by the proposal are likely.

5.14 Greenhouse Gas Emissions

5.14.1 Impact Assessment

Construction vehicles and machinery would generate greenhouse gas emissions during the works. The greenhouse gas emissions generated from the construction of the proposal would not be expected to be significant.

5.14.2 Mitigation

No mitigation measures are proposed.

5.15 Socio-economic

5.15.1 Impact Assessment

Any reduction in the quality of the environment during construction will be of a short term and temporary nature, with minor disruption and disturbance to local residents and surrounding businesses during construction. The proposed works will also provide a socio-economic benefit during construction due to the creation of temporary employment in the area.

The proposed FRM infrastructure will not result in a significant or long term reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality. Following completion of the construction activities there will be no change in general land uses within the works areas. The operation of the flood risk management infrastructure on completion of the proposed works will have a beneficial impact as it will improve flood safety and mitigate against potential risk to person and property associated with flood events in Bungendore.

5.15.2 Mitigation

- Carry out construction in compliance with the requirements of SafeWork NSW and the provisions of the *Work Health and Safety Act 2011* and *Work Health and Safety Regulation 2017*, to ensure the safety of staff and members of the public.
- In accordance with SafeWork NSW requirements, all plant and equipment used in construction work must comply with the relevant Australian Standards and manufacturer specifications.
- Community complaints received as a result of construction will be recorded in a complaints register and attended to promptly. On receiving a complaint, works will be reviewed to determine whether issues relating to the complaint can be avoided or minimised. Feedback will be provided to the complainant explaining what remedial actions were taken.

5.16 Climate Change

NSW Government has published a number of documents which provide guidance to account for climate change impacts on flooding. Under the *NSW Government Floodplain Development Manual* 2005 the effect of Climate Change must to be considered in the floodplain risk management process. Accordingly, flood modelling was run by Worley Parsons (2014a) with a consideration of climate change based on the adoption of a 10% increase in rainfall intensity on peak flows in the 100 year recurrence event. The potential impacts of climate change on sea levels was considered to not apply to the proposal, due to the significant distance of Bungendore inland from the coast line of NSW.

5.16.1 Impact Assessment

Construction

No climate change impacts are anticipated during the construction period.

Operation

In the context of Bungendore, it was considered appropriate to focus on a 10% increase in rainfall intensity given the current projection for the increase in rainfall intensity for the Murrumbidgee area is 5%. The flood model was varied by +/- 10% during the sensitivity analyses of the adopted 100 year ARI flood event (Worley Parsons, 2014a).

Modelling used to simulate the adopted climate change scenario indicated that flood level increases are predicted to range between 0.03 metres to 0.17 metres throughout the Bungendore flood study area. Within the Bungendore township, flood level increases are predicted to range between 0.10 metres and 0.11 metres. The modelling found that any variance in flood levels due to climate change would easily be accommodated by the 1m freeboard recommended for the upgraded levee crest level (Worley Parsons, 2014a).

5.16.2 Mitigation

No mitigation measures are proposed

6 Environmental Management

6.1 Construction Environmental Management Plan

Preparation of a Construction Management Plan (CEMP) is mandatory for all projects undertaken by or on behalf of government agencies or where funding is being provided by the government.

The CEMP would be developed to ensure that appropriate environmental management practices are followed during a project's construction and/or operation. Queanbeyan-Palerang Regional Council would review the CEMP for this proposal, which should include the following elements, as described in the Guideline for the Preparation of Environmental Management Plans (DIPNR, 2004):

Table 6-1 Construction Environmental Management Plan Structure

Background	- Introduction to the document - Description of the proposal and project details - The context for the CEMP in regards to the overall project - The CEMP objectives - The contractor's environmental policy
Environmental Management	- Environmental management structure of the organisation and specific team responsibilities with respect to the CEMP and its implementation - Approval and licensing requirements relevant to the project - Reporting requirements - Environmental training - Emergency contacts and response
Implementation	- A project specific risk assessment - A detailed list of environmental management safeguards and controls - CEMP sub plans for specific environmental controls - A detailed schedule assigning responsibility to each environmental management activity and control
Monitor and Review	- Environmental monitoring - Environmental auditing - Corrective action - CEMP review and document control procedures

The CEMP would include a risk assessment which ensures that the safeguards identified in this REF, as well as any others that are considered relevant, are effectively translated into actual construction techniques and environmental management activities, controls and

monitoring/verification to prevent or minimise environmental impacts. The CEMP should also identify the requirements for compliance with relevant legislation and any other regulatory requirements to ensure environmental safeguards described throughout this REF are implemented. The environmental management objectives and supporting actions presented in this section are intended to assist in this process.

The following details the environmental objectives during construction and the proposed mitigation to be included in the CEMP. This list is not definitive, and additional measures detailed as part of the determination of the project and conditions of any other approvals must also be included.

Safeguards for ongoing management are also listed below and are to be implemented by Council.

6.2 Environmental Management Measures

Implementation of the mitigation measures outlined below would be undertaken during a number of phases of the project. These phases comprise:

- Detailed design – refinement of the design details
- Pre-construction – prior to the contractor arriving on site to carry out the works
- Construction – during construction phase
- Operation – post construction

6.2.1 Land Use

Objective

- Minimise impacts to surrounding land users during construction and operation

Actions

Action/Phase	Responsibility
Pre-construction	
Consultation should be undertaken with DoI – Lands & Water with regard to any construction works proposed on Crown Land, and all required approvals would be obtained prior to construction activities commencing.	QPRC / Contractor
Approval from landowners other than Council would be obtained where required, prior to construction works commencing.	QPRC / Contractor
Consultation would be undertaken with all affected landowners for the potential impact on land uses during construction and any safeguards or mitigation measures that need to be implemented during the works.	QPRC / Contractor
Construction	
The contractor would be required to ensure the necessary care and maintenance of private and Crown land facilities and operations including	Contractor

Action/Phase	Responsibility
fences and gates. However, if any damage does occur to property it would be restored to a condition equivalent to the original condition.	
Temporary fencing and gates would be installed where necessary to exclude animals from the work sites. Any temporary fencing or gates no longer required would be removed at the completion of the construction works.	Contractor
Restoration of the areas disturbed during construction would be undertaken.	Contractor

6.2.2 Water Quality, Erosion and Sediment Control and Flooding

Objective

- To effectively manage sediment and erosion control during the construction stage of the project.
- Prevention/minimisation of impacts to the waterways during the construction works.
- To effectively manage flooding during the construction stage of the project.

Actions

Action/Phase	Responsibility
Pre-construction	
The detailed design is to be undertaken consistent with the following guidelines • <i>Controlled Activities on Waterfront Land - Guidelines for instream works on waterfront land</i> (NSW Office of Water, 2012) • <i>Guidelines for Controlled Activities on Waterfront Land - riparian corridors</i> (DoI - Natural Resources Access Regulator, (2018))	PWA/QPRC
The contractor's compound is to be located within cleared land and not within the riparian corridor.	Contractor
A detailed Soil and Water Management Plan (SWMP) shall be prepared as part of the CEMP. The SWMP would describe the site specific measures to be implemented for all works areas, in accordance with the guidelines outlined in the 2004 Landcom publication <i>Managing Urban Stormwater: Soils and Construction</i>, 4th edition ("The Blue Book") and <i>Volume 2a Installation of Services</i>. The SWMP would need to be site specific and would need to address the following issues to prevent erosion, sediment loss and water quality impacts: • Minimisation of disturbance to soil and water adjacent to, and within, all watercourses in the works area. • Identification of site specific sediment and erosion control measures wherever erosion is likely to occur, including around the drilling entry and exit points.	Contractor

Action/Phase	Responsibility
• Identification of any environmentally sensitive areas on or near construction sites to ensure runoff is diverted away from sensitive areas. • Requirements for vegetation clearing to be kept to a minimum to be able to achieve the objectives of the FRM works. • Retention of all surface runoff on-site and where possible stormwater from off site would be diverted around the construction site. • Backfilling and stabilising of trenches once pipelines are installed. • Location of construction compounds (at least 50m from any drainage lines). • Location and management of stockpiles, such as locating stockpiles away from any drainage lines near the works areas. • Regular inspection of all erosion and sediment controls, especially when rain is expected and directly after any rain events.	
The CEMP would incorporate a pollution incident response management plan that defines appropriate procedures for notification of pollution incidents to the required authorities in accordance with s. 147 to 153 of the POEO Act and requires response actions to be implemented in order to address any risks such as incidents posed to the environment, property or surrounding communities.	Contractor
Adequate procedures would be established and detailed in the CEMP, including notification requirements to the EPA, for incidents that cause material harm to the environment.	Contractor
A site-specific spill management plan would be prepared and include the following requirements: • Emergency spill kits are to be kept at the site (vehicle kits). • Refueling of machinery to be undertaken in a dedicated area within the construction compound appropriately protected as outlined in the spill management plan. • Any chemicals and fuels are to be stored in a bunded area at least 50 metres from any waterway or drainage line. • Any hazardous materials stored on site would be stored in the compounds and within impervious and bunded enclosures capable of storing 120% of the volume of material stored there. • Workers would be trained in the spill management plan and the use of the spill kits.	Contractor
The contractor would develop a monitoring and flood response plan to detail procedures for monitoring rainfall (stormwater) and waterway flows and to identify subsequent response actions that would be taken to ensure the	Contractor

Action/Phase	Responsibility
protection of personnel, equipment and water quality during the construction works.	
Council to work with the State Emergency Service to develop a contingency plan for all events up to the PMF and to update the Palerang Flood Emergency Sub Plan (2013) from the Bungendore FRMS and Bungendore FRM Plan.	QPRC
Construction	
Workers are to be made aware of the provisions of Section 120 of the POEO Act with regards to water pollution.	Contractor
Any excess spoil would be reused onsite or removed off site for disposal in accordance with EPA requirements	Contractor
Works should not be scheduled when heavy rainfall is forecast and works involving soil disturbance should not take place during heavy rainfall periods, other than work necessary to stabilise the site.	Contractor
Groundwater devoid of sediment or contaminants would be disposed of in a way that does not cause erosion. Groundwater may need to be suitably settled (i.e. using baffle tanks or similar) or filtered prior to being dispersed over vegetated ground surfaces. If groundwater is encountered during construction works, DoI - Lands & Water would need to be consulted to determine whether approval is required under the <i>Water Management Act</i> 2000 such as for an aquifer interference approval under Section 91.	Contractor
Mitigation measures to manage groundwater (should it be encountered during construction) would be incorporated into the CEMP which is to address the following issues in relation to groundwater: • Dewatering techniques during excavation; • Measures to ensure groundwater quality is not impacted during construction; • Techniques to settle, treat or filter groundwater encountered during excavation works i.e. diverting groundwater through baffle tanks or filter membranes; and • Appropriate treatment and monitoring regimes should be established in the event that groundwater flows come to the surface, including disposal of groundwater in such a way as to prevent adverse impacts (such as erosion and water pollution). Groundwater should not be discharged to a waterway during construction.	Contractor
All areas where ground disturbance has occurred would be stabilised following completion of works to ensure there is no erosion hazard and restored to their pre-construction condition. This would involve, where required, reshaping the ground surface, covering it with topsoil excavated from the site and re-	Contractor

Action/Phase	Responsibility
establishing an appropriate vegetation cover (this may include resspreading dead accumulated or cleared vegetation where possible).	
In the event of flooding, construction works in affected areas would cease and would not commence until floodwaters have receded. Weather forecasts would be checked regularly so that equipment and materials in flood areas can be secured prior to heavy rainfall events.	Contractor

6.2.3 Ecology

Objective

- Avoidance/minimisation of impacts to flora and fauna
- Minimise unnecessary clearing of vegetation
- Avoid weed invasion
- Prevention/minimisation of impacts to drainage lines

Actions

Action/Phase	Responsibility
Pre-construction	
Consultation should be undertaken with DPI Fisheries with regard to any construction works proposed in water land, and required approvals obtained for any dredging and reclamation works in water land prior to construction commencing.	QPRC
Construction	
The proposed overflow channel should not result in the disturbance of any native trees or shrubs.	Contractor
Vegetation clearing should be limited to the minimum required to successfully complete the proposal.	Contractor
Limits of clearing should be provided to the construction contractor and identified both on site maps/plans and on site.	Contractor
Given their State and Federal status, though planted, indirect impacts to the viability of the stand of Black Gum individuals should be avoided.	Contractor
The location of those Black Gum individuals to be retained should be provided to the construction contractor and identified both on site maps/plans and on site. All individuals within the study area should be temporarily fenced and protected.	Contractor
Where vegetation is removed from the creek bank, this should be replaced with locally occurring native plants.	Contractor
Any woody debris removed from the creek line as part of the proposal should be collected and placed back in the creek line post-work.	Contractor

Action/Phase	Responsibility
Vehicles and machinery should be stored and parked in those treeless areas.	Contractor
Any animals injured during the clearing works should be collected and taken to a local veterinarian or wildlife carer.	Contractor
In accordance with the <i>Biosecurity Act 2015</i> , those weeds identified on site must be controlled to result in their suppression, in particular Blackberry and White Willow.	Contractor

6.2.4 Aboriginal Cultural Heritage

Objective

- Minimise potential impacts to items and places of Aboriginal cultural heritage due to the works

Actions

Action/Phase	Responsibility
Pre-construction	
If the Aboriginal heritage sites (BF1 and BF2) are to be impacted, an Aboriginal Heritage Impact Permit (AHIP) approved by NSW Office of Environment and Heritage (OEH) covering the AHIP area identified in Figure 5-5 will be required prior to the commencement of works.	QPRC/Contractor
The recovered artefacts in temporary storage should be reburied in accordance with the Return to Country Protocol (RTC) developed in consultation with the RAPs for the project. The RTC will be a condition of the AHIP approval and will be submitted with the AHIP application to OEH as supporting documentation.	QPRC/Contractor
If an AHIP is not granted then the artefacts should be reburied at the bottom of their individual test pits in accordance with the Code of Practice requirements.	QPRC/Contractor
Construction	
Construction crew inductions should be provided to workers on the project as to the location of the recorded sites and their legislature under the NPW Act.	Contractor
All Aboriginal objects are protected under the NSW <i>National Parks and Wildlife Act 1974</i> . It is an offence to disturb an Aboriginal site without a consent permit issued by the Office of Environment and Heritage. Should any Aboriginal objects be encountered during works then works must cease and the find should not be moved until assessed by a qualified archaeologist.	Contractor
In the unlikely event that human remains are discovered during the construction, all work must cease. OEH, the local police and the appropriate LALC should be notified. Further assessment would be undertaken to determine if the remains are Aboriginal or non- Aboriginal.	Contractor

Action/Phase	Responsibility
Further archaeological assessment would be required if the proposal activity extends beyond the area of the current investigation. This would include consultation with the RAPs for the proposal and may include further field survey.	Contractor
Continued consultation with the RAPs for the project should be undertaken. RAPs should be informed of any major changes in proposal design or scope, further investigations or finds.	Contractor
No further investigations are required should the AHIP be approved, except in the event that unanticipated Aboriginal Objects and/or human remains are unearthed during any phase of the proposed works.	Contractor
Should any other objects or Aboriginal sites be identified during the course of construction the Unanticipated Finds Protocol should be followed: Unanticipated Finds Protocol: • All ground surface disturbance in the area of the finds should cease immediately once the finds are uncovered. • The discoverer of the find(s) would notify machinery operators in the immediate vicinity of the find(s) so that work can be halted; and the Principal's Authorised Person would be informed of the find(s). • If there is substantial doubt regarding an Aboriginal origin for the finds, then gain a qualified opinion from an archaeologist as soon as possible. This can circumvent proceeding further along the protocol for items which turn out not to be archaeological. If a quick opinion cannot be gained, or the identification is positive, then proceed to the next step. • Immediately notify the following authorities or personnel of the discovery: – OEH; and – Relevant Aboriginal Community Representatives. • Facilitate, in co-operation with the appropriate authorities and relevant Aboriginal community representatives: – The recording and assessment of the finds; – Fulfilling any legal constraints arising from the find(s). This would include complying with OEH directions; and – The development and conduct of appropriate management strategies. Strategies would depend on consultation with stakeholders and the assessment of the significance of the find(s).	Contractor

Action/Phase	Responsibility
Where the find(s) are determined to be Aboriginal Objects, any re-commencement of construction related ground surface disturbance may only resume in the area of the find(s) following compliance with any consequential legal requirements and gaining written approval from OEH (as required).	Contractor

6.2.5 Historic Heritage

Objective

- Minimise potential impacts to items and places of historic heritage due to the works

Actions

Action/Phase	Responsibility
Pre-construction	
As part of an induction, in the unlikely event that any historical relics or sites are identified workers should be aware of their responsibilities under the provisions of the <i>Heritage Act 1977</i> . In this event all works must cease and the area be protected until a qualified archaeologist inspects the site and provides management advice in consultation with the Heritage Division, OEH.	Contractor
No works are to occur in the Bungendore Commons heritage listed area prior to Council approval of works.	QPRC/ Contractor
Construction	
All land-disturbing activities must be confined within the assessed proposal area. Should project impacts change such that the area to be impacted is altered then additional assessment will be required.	Contractor

6.2.6 Noise and Vibration

Objective

- Compliance with relevant recommendations specified in the Interim Construction Noise Guideline (DECC, 2009).
- Avoidance/minimisation of noise impacts on nearby sensitive noise receivers.

Actions

Action/Phase	Responsibility
Pre-construction	
Prior to the commencement of construction works the contractor shall consult with residential premises likely to be affected by, or in the immediate vicinity of, the proposed works to determine any community concerns and provide advice as to where concerns can be directed. If during consultation	Contractor

Action/Phase	Responsibility
community concerns are not readily resolved by agreement, Council staff are to be contacted who will endeavour to assist in resolving any outstanding issues of concern.	
Construction	
Works would be undertaken during normal work hours i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays; and no work would be undertaken on Sundays, Public Holidays or outside these work hours without notification to the affected community and EPA. Notification would provide the following details: • The locations and types of surrounding receivers likely to be affected; • The nature of the proposed works; • The noise characteristics of any powered equipment likely to be used; • Measures to be taken to reduce noise emissions; and • Any other information EPA may request. • All reasonable practical steps shall be undertaken to reduce noise and vibration from the site.	Contractor
Control measures to minimise noise and vibration impacts on adjoining land would be implemented during construction as part of the contractor's CEMP, which would require review by QPRC prior to commencement of works. The CEMP would address site specific issues, including limited work hours and noise and vibration reduction practices, taking into consideration DECCW's <i>Interim Construction Noise Guideline</i> (in particular Tables 4 – 10) and <i>Assessing Vibration: A Technical Guideline</i> (in particular mitigation measures in Section 3). Mitigation measures to minimise noise and vibration impacts would include: • Optimum siting of work areas, vehicle and plant parking areas, materials stockpiles and equipment storage areas in locations where potential acoustic and vibration impacts would be minimised; • Regular maintenance of all plant and machinery used for the project; • Identify locations where construction noise and vibration is most intrusive and develop strategies to reduce impacts for these areas.	Contractor

6.2.7 Air Quality

Objective

- Avoidance/minimisation of off-site dust nuisance to neighbouring residences and the community.
- Minimisation of air quality impacts resulting from machinery and vehicle emissions.

Actions

Action/Phase	Responsibility
Pre-construction	
Construction vehicles and equipment would be suitably serviced within the six-month period prior to commencement of construction activities and all necessary maintenance undertaken during the construction period to meet EPA air quality requirements.	Contractor
Construction	
The excessive use of vehicles and powered construction equipment would be avoided.	Contractor
All construction machinery would be turned off when not in use to minimise emissions.	Contractor
Construction contractors would monitor dust generation potential.	Contractor
Dust suppression methods including the use of water carts would be applied where required (i.e. on windy days when earthworks and vehicle movements are generating dust).	Contractor
Any stockpiled spoil/fill would be protected to minimise dust generation to avoid sediment moving offsite.	Contractor
Vehicles transporting spoil from the sites would be covered.	Contractor
Bare surfaces are to be vegetated or stabilised as soon as possible.	Contractor

6.2.8 Traffic and Access

Objective

- Ensure that construction vehicles do not cause excessive inconvenience to road and pedestrian users.
- Ensure the safety of road users and construction personnel for the duration of the works.
- Minimise the pollution impacts resulting from the use of vehicles during construction.

Actions

Action/Phase	Responsibility
Pre-construction	
The contractor would prepare a Traffic Management Plan (TMP) as part of the CEMP, to be reviewed by QPRC prior to commencement of works. The Traffic Management Plan would include measures to minimise traffic impacts ensure public safety and would be prepared in accordance with <i>RTA's Traffic Control at Work Sites Manual, Issued June 2010, and Australian Standard 1742.3 - 2009 Traffic Control for Works on Roads</i>. The TMP would detail mitigation measures to manage traffic related issues associated with the construction works including: • All materials deliveries are to avoid school zones during school bus hours, i.e. 7.30am to 9.30am and 3pm to 5pm; • Appropriate and site specific pedestrian management.	Contractor
Prior to the commencement of construction works the contractor shall consult with residential premises likely to be affected by truck movements, or in the immediate vicinity of the proposed works to determine any community concerns and provide advice as to where concerns can be directed. If during consultation community concerns are not readily resolved by agreement, Council staff are to be contacted who will endeavour to assist in resolving any outstanding issues of concern.	QPRC /Contractor
Construction	
Any disturbance to landowners as a result of vehicle movements and noise would be minimised by adhering to the working hours outlined in Section 4.3.3. The contractor would avoid any inconvenience to residences/landowners.	Contractor
Where driveways or pedestrian access are to be obstructed, affected property owners/nearby residents to be provide at least 2 days' notice.	Contractor
Any temporary compounds and their access roads required for the works would be located so as to minimise disturbance to the existing environment. Following completion of the works the temporary compounds and roads would be removed, topsoil provided and re-grassed. Existing tracks and paths would be restored to their condition prior to works.	Contractor
Roads must be re-instated in accordance with Council's Construction Manual or as directed by Council staff.	Contractor
Trucks would not access the sites in weather conditions that would cause damage to properties or the environment.	Contractor
All sealed roads would be kept clean and free of dust and mud at all times. Where material is tracked onto sealed roads at any time, it would be removed immediately so that road pavements are kept safe and trafficable.	Contractor
Any temporary access tracks required for the works would be located so as to minimise disturbance to the existing environment. Following completion of	Contractor

Action/Phase	Responsibility
the works the temporary tracks would be removed, topsoil provided and re-grassed.	
All construction traffic would comply with all applicable traffic laws and regulations. All construction vehicles would comply with the speed limits set for the roads accessing the sites	Contractor

6.2.9 Waste Management

Objective

- Compliance the provisions of the *Protection of the Environment Operations (Waste) Regulation 2014*.
- Maximise reuse/recycling of waste material and minimise waste disposed of to landfill.

Actions

Action/Phase	Responsibility
Construction	
The contractor undertaking the works would detail waste management procedures in a Waste Management Plan to be incorporated into the CEMP. The contractor is to assume responsibility for the appropriate disposal of any waste generated. Adequate procedures should be established and detailed in the CEMP, including notification requirements to EPA, for incidents that cause material harm to the environment. The WMP would also follow the resource management hierarchy principles embodied in the <i>Waste Avoidance and Resource Recovery Act 2001</i> . Namely, to: • avoid unnecessary resource consumption; • recover resources (including reuse, reprocessing, recycling and energy recovery); and • dispose (as a last resort).	Contractor
The construction contractor is to ensure that waste generated by the works is transported to a place that can lawfully accept it as per Section 143 of the <i>Protection of the Environment Operations Act 1997</i> .	Contractor
No batched concrete mixing plants would be established in the works areas. Any required concrete would be mixed off-site and transported to the construction area.	Contractor
Following completion of the works, excess concrete would be removed off-site for recycling.	Contractor
If any contaminated material is encountered during earthworks, work shall cease, the site secured and a safe work method statement(s) and appropriate practices shall be implemented. Any contaminated material would be	Contractor

Action/Phase	Responsibility
classified first and then stored, transported and disposed of in accordance with EPA requirements at an EPA licensed waste facility.	
The EPA is to be notified immediately of any pollution incidents or harm to the environment (as defined under Part 5.7 of the POEO Act).	Contractor
Cleared vegetation (devoid of weeds) would be mulched and re-used on site as part of site stabilisation and revegetation. Excess mulch would be removed off site and disposed of in accordance with EPA requirements.	Contractor
Any material removed from the waterways that is to be temporarily deposited or stockpiled on land is to be located well away from the waterway and to be contained by appropriate sediment control devices as outlined in the <i>Managing Urban Stormwater: Soils and Construction</i> (4th Edition Landcom, 2004).	Contractor
If practicable, surplus excavated materials/fill would be reused onsite as part of rehabilitation and restoration works. Any surplus spoil disposed of in this manner would be seeded to minimise the likelihood of it being transported offsite through wind or water action.	Contractor

6.2.10 Visual Amenity

Objective

- Protect the visual amenity of the locality for neighbouring land users and the local community.

Actions

Action/Phase	Responsibility
Construction	
The clearing of vegetation would be kept to the minimum required for the works.	Contractor
Construction compounds and areas for the parking of vehicles and storing of equipment would be located in cleared areas wherever possible.	Contractor

6.2.11 Utilities and Infrastructure

Objective

- Prevention/minimisation of impacts to utilities and services infrastructure during the construction works.

Actions

Action/Phase	Responsibility
Construction	
Utilities and services which may be impacted by the proposal would be accurately located prior to commencement of works.	Contractor
Utility and service providers would be consulted prior to the commencement of and during construction works in the event that impacts on any utilities and services by the proposal are likely.	Contractor

6.2.12 Socio economic

Objective

- Prevention/minimisation of socio economic impacts during the construction works.

Actions

Action/Phase	Responsibility
Construction	
Carry out construction in compliance with the requirements of SafeWork NSW and the provisions of the <i>Work Health and Safety Act 2011</i> and <i>Work Health and Safety Regulation 2017</i> , to ensure the safety of staff and members of the public.	Contractor
In accordance with SafeWork NSW requirements, all plant and equipment used in construction work must comply with the relevant Australian Standards and manufacturer specifications.	Contractor
Community complaints received as a result of construction will be recorded in a complaints register and attended to promptly. On receiving a complaint, works will be reviewed to determine whether issues relating to the complaint can be avoided or minimised. Feedback will be provided to the complainant explaining what remedial actions were taken.	Contractor

7 Conclusion

The proposed FRM works to provide an increased level of protection to Bungendore from damage due to flooding from future flood events.

The proposal would potentially cause short term impacts such as increased noise and traffic and a reduction in community amenity for the nearby residents and users of local streets during the construction phase. However, these impacts are considered to be minor and temporary.

There would be a need to remove some vegetation for the proposed works. However, the proposal would be unlikely to significantly affect any listed threatened species, fauna populations or communities, provided appropriate mitigation measures are implemented.

An ACHAR of the proposal has identified two Aboriginal sites and has concluded that an AHIP from OEH will be required for the proposed overflow channel works. No significant impacts to historic heritage are anticipated associated with the proposed works.

This REF has been prepared in accordance with Sections 5.5 and 5.7 of the *Environmental Planning and Assessment Act 1979* and Clause 228 of the *Environmental Planning and Assessment Regulation 2000*. It provides a true and fair assessment of the proposed activity in relation to its likely effects on the environment.

On the basis of the information presented in this REF it is concluded that:

- (1) The proposed activity is not likely to have a significant impact on the environment and therefore an Environmental Impact Statement is not required.
- (2) The proposed activity is not likely to significantly affect threatened species, populations, ecological communities, or critical habitat. Therefore, a Species Impact Statement (SIS) is not required
- (3) The proposed activity is not likely to affect any Commonwealth land, is not being carried out on Commonwealth land, or significantly affect any Matters of National Environmental Significance.

The proposed activity is recommended for approval subject to implementation of the measures to avoid, minimise or manage environmental impacts listed in this REF.

8 References

- Australian Standard AS2436-1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites*
- Bureau of Meteorology (2018), *Monthly climate statistics - Summary Statistics QUEANBEYAN BOWLING CLUB*, accessed on 24 April 2018, <http://www.bom.gov.au/climate/averages/tables/cw_070072.shtml>
- DECC (2008), *Waste Classification Guidelines*
- DECCW (2009), *Interim Construction Noise Guideline*
- Department of Industry (2018), *Guidelines for controlled activities on waterfront land—Riparian corridors*
- Lesryk Environmental (2018), *Flora and Fauna survey and assessment. Floodplain risk management implementation, Bungendore, NSW*
- Past Traces (2017) *Aboriginal and Historical Due Diligence Assessment Report –Bungendore Floodplain Works*
- Past Traces (2018), *Bungendore Floodplain Mitigation Channel - Heritage (Aboriginal and Historical) Assessment Report*
- Patterson Britton & Partners (2002), *Bungendore Flood Study*; prepared for Yarrawlumla Shire Council
- Public Works Advisory (2018), *Bungendore FRM Implementation Plan Preliminary Concept Design Report – Stage I*, Report Number: ISR17061
- Worley Parsons (2014a), *Bungendore Floodplain Risk Management Study - Issue No. 6 – Final Report*
- Worley Parsons (2014b), *Bungendore Floodplain Risk Management Plan – Issue 4*

Appendix A - Consideration of Clause 228

Clause 228 of the EP&A Regulation 2000 indicates, for purposes of Part 5 of the Act, the factors that must be taken into account when consideration is being given to the likely impact of an activity on the environment.

A determining authority is only required to consider the following matters where an EIS has been prepared for a Part 5 activity under the EP&A Act. However, the following information is provided to assist determining authorities in making determinations consistent with those made for an activity requiring preparation of an EIS.

The various factors and findings following environmental assessment are presented below.

(a) any environmental impact on a community,

There is the potential for some minor noise, dust and traffic impacts during construction.

(b) any transformation of a locality,

The proposed construction of levee upgrade and overflow channel would result in a minor transformation of recreational area, grazing paddocks and disturbed shrubland with the additional flood mitigation infrastructure. This would be consistent with the adjoining land uses and would not result in a significant transformation of the locality.

(c) any environmental impact on the ecosystems of the locality,

Some minor clearing of vegetation would be required along the levee alignment and creek confluence clearing and reshaping areas. No significant impact to threatened species or ecological communities is anticipated. Measures have been proposed to ensure that any impacts are minor and temporary.

(d) any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality,

None identified. Recreational use of the levee area, post upgrade works would not be impacted.

(e) any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations,

The works would impact on identified Aboriginal objects which have all been assessed as having low archaeological heritage value. The required AHIP would be obtained for the impacts to the sites.

(f) any impact on the habitat of protected fauna (within the meaning of the National Parks and Wildlife Act 1974),

None identified.

(g) any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air,

None identified.

(h) any long-term effects on the environment,

None identified

(i) any degradation of the quality of the environment,

Temporary degradation may occur during the works due to excavation and associated dust impacts.

(j) any risk to the safety of the environment,

None identified.

(k) any reduction in the range of beneficial uses of the environment,

There would not be any reduction in the range of beneficial uses of the environment, with the Bungendore FRM works to provide additional flood protection.

(l) any pollution of the environment,

There is the potential for some minor and temporary noise and air pollution during the construction works. With the implementation of appropriate mitigation measures during construction there would be no long term or significant pollution of the environment.

(m) any environmental problems associated with the disposal of waste,

None identified

(n) any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply,

None identified.

(o) any cumulative environmental effect with other existing or likely future activities,

None identified.

(p) any impact on coastal processes and coastal hazards, including those under projected climate change conditions.

Not relevant to this proposal.

Appendix B – Flora and Fauna Assessment

Appendix C – Aboriginal and Historical Archaeological Assessment

Appendix D – Consultation Letters
