Department of Climate Change, Energy, the Environment and Water

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Wilson Anabranch Offtake

Review of Environmental Factors

NSW Department of Climate Change, Energy, the Environment and Water | October 2024

Acknowledgement of Country

The Department of Climate Change, Energy, the Environment and Water acknowledges that it stands on Aboriginal land. We acknowledge the Traditional Custodians of the land and we show our respect for Elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

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B	August 2024	C Cadman M Zhong V Fink S Mepham	E Lichkus
C Final	September 2024	S Mepham	E Lichkus
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Declaration

This Review of Environmental Factors (REF) has been prepared by 3Rivers, a joint venture between Jacobs Group (Australia) and GHD on behalf of the NSW Department of Climate Change, Energy, the Environment and Water - Water Division (NSW DCCEEW). The REF has been prepared to assess the environmental impacts to satisfy the requirements of Division 5.1 of the Environmental Planning and Assessment Act 1979 (EP&A Act) and considers the factors listed in clause 171 of the Environmental Planning & Assessment Regulation 2021 (EP&A Regs).

The REF provides a true and fair assessment of the proposed activity in relation to its likely effects on the environment. It examines and takes into account to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposed activity.

Based on the information provided in the REF, it is concluded that:

(1) the proposed activity is not likely to have a significant impact on the environment, and an Environmental Impact Statement is not required.

(2) The proposed activity is not likely to significantly affect threatened species or ecological communities or their habitat or be carried out in a declared area of outstanding biodiversity value. A Species Impact Statement (SIS) is not required.

(3) The proposed activity is not likely to significantly affect any Matters of National Environmental Significance, nor is the activity being carried out on or is it likely to impact Commonwealth land.

Based on the information presented in this REF, it is concluded that by adopting the safeguards identified in this assessment, it is unlikely that there would be significant adverse environmental impacts associated with the project. Subject to the adoption of the measures to avoid, minimise or manage environmental impacts listed in this REF, the proposed activity is recommended for approval.

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Certification

I, Julian Ardas, have examined this REF and the Declaration by the authors and accept the report on behalf of the Department of Climate Change, Energy, the Environment and Water.

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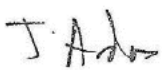

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22 October 2024

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1 Introduction

1.1 Background

The Yanco Creek System is located in the New South Wales (NSW) Riverina and comprises a creek and floodplain system that commences from the Murrumbidgee River at Yanco Weir located about 20 kilometres (km) west of Narrandera. It is a complex, braided system of interconnecting creeks and anabranches flowing east to west, eventually meeting the Edward River (part of the Murray River system) at Moulamein (Department of Primary Industries, 2015). The main branches of the system include the Yanco, Colombo, Billabong and Forest creeks.

Prior to the 1850s, Yanco Creek only connected with the Murrumbidgee River during floods and Billabong Creek was regularly reduced to deeper waterholes in summer. From the 1850s onwards, the creek underwent modifications over time to enable water delivery for stock and domestic use and irrigation and it became a perennially flowing system.

Today, the system supports numerous irrigation offtakes and canals, irrigation areas and water pumps. The creek also has numerous structures and flow blockages. Some of the structures are actively used to redirect flow and create weir pools that are used for irrigation or domestic use however, some are defunct and no longer serve a purpose.

The Yanco Creek Modernisation Project (YCMP) which forms part of the commitments within the Sustainable Diversion Limit Adjustment Mechanism (SDLAM) program as further discussed in section 2.1, involves infrastructure upgrades and new installations to improve water management within the Yanco Creek System. The construction and upgrade of the Wilson Anabranch Offtake infrastructure is one of the sub-projects of the YCMP being delivered by the NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW).

The construction, upgrade and operation of the Wilson Anabranch Offtake is the subject of this Review of Environmental Factors (REF) and referred to as **the project** within this document.

Further information on the project is provided section 1.2 and section 3.

1.2 Project overview

The Wilson Anabranch system is an approximately 12 km long watercourse, located directly downstream of the Mundoora Anabranch and flowing parallel with the Yanco Creek to the south of the anabranch. During low flows, water enters the Wilson Anabranch through the Wilson Anabranch Offtake structure (when open) and passes along a defined channel. The downstream end of the Wilson Anabranch consists of a 1 km length of broadened watercourse lagoon that has well established ecological value and waterbird habitat, contained at the downstream end by a privately owned block bank. There are multiple culverts across the anabranch over its length.

The existing Wilson Anabranch Offtake structure is located on private land and consists of a single 750 millimetre (mm) diameter concrete pipe with a penstock gate located on a trafficable block bank, manually operated to allow flow for up to five months of the year from 1 April to 31 August and during announced access periods from 1 September to 31 March.

There is currently no metering of the water through the existing offtake structure.

The primary purpose of the project is to upgrade the offtake infrastructure to measure the flow of water into the Wilson Anabranch watercourse and to allow for improved fish passage. Flow measurement is important for billing managed environmental events; particularly for events that occur in the lower flow ranges during the irrigation season.

WaterNSW is proposed to own, operate and maintain the structure.

The location of the project is shown in Figure 1.1, and the project's assessment areas are shown in Figure 1.2. Further detail on each component of the project is provided in section 3.

1.3 Purpose of this document

The purpose of this REF is to describe the project, document the likely impacts on the environment, and detail measures to mitigate impacts that cannot be avoided. The REF is the key document which the NSW DCCEEW would use to discharge its duty under section 5.5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), including taking into account those factors listed under clause 171 of the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation) (see Appendix A Clause 171 Environmental Factors Checklist).

The findings of the REF would be considered when assessing:

- Whether the project is likely to have a significant impact on the environment and therefore the requirement for an Environmental Impact Statement (EIS) to be prepared and approval sought from Minister for Planning and Public Spaces under division 5.2 of the EP&A Act.
- The significance of any impact on threatened species as defined by the Biodiversity Conservation Act 2016 (BC Act) and the Fisheries Management Act 1994 (FM Act) (referred to in section 1.7 of the EP&A Act) and therefore the requirement for a Species Impact Statement (SIS) or a Biodiversity Development Assessment Report (BDAR).
- The potential for the project to significantly impact on Matters of National Environmental Significance (MNES) or Commonwealth land and the requirement to make a referral to the Australian Government Department of Agriculture, Water and the Environment for a decision by the Commonwealth Minister for the Environment and Energy on whether assessment and approval is required under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Figure 1.1 Location of the project

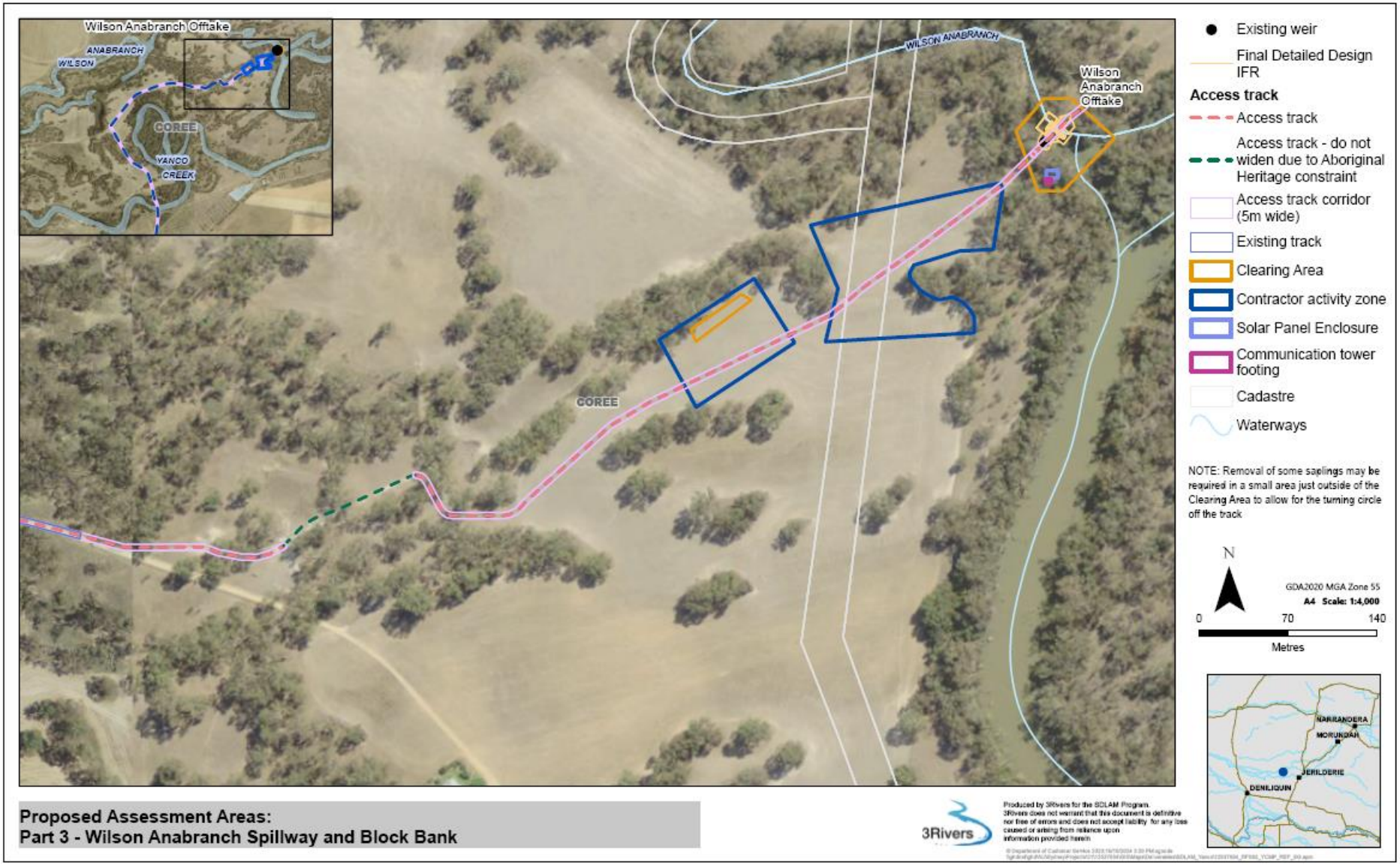

Figure 1.2 Project assessment areas

2 Project need and justification

2.1 Background to the project

2.1.1 The Murray-Darling Basin Plan

The Federation drought (between 1895 and 1902) provided a catalyst to bring the states together to agree on the management of the Murray River. The River Murray Waters Agreement, involving the governments of NSW, Victoria, South Australia, and the Australian Government, commenced in 1915. The formation of the River Murray Commission followed in 1917.

The first Murray-Darling Basin Agreement, which established the Murray-Darling Basin Commission, was reached in 1987. The Millennium drought, which occurred from 1997 to 2009 in much of southern Australia, led to an increased understanding of environmental management constraints and water management requirements. This highlighted the limits and weaknesses of how water in the Murray-Darling Basin (the Basin) was managed and highlighted the need for continuing reform. In response, the *Water Act 2007* (Cth) (the Water Act) was enacted.

As a requirement of the Water Act, the Murray-Darling Basin Authority (MDBA) was formed. The MDBA was required to develop a plan to manage how much water could be used by industries and communities in the Basin. The Basin Plan was adopted in November 2012. The aim of the Basin Plan is to bring the Basin back to a healthier and sustainable level, while continuing to support farming and other industries for the benefit of the Australian population. The Basin Plan sets the amount of water that can be taken from the Basin each year.

There are several key components of water management in the Murray-Darling Basin, which work as an integrated package:

- water entitlements – a permanent share/allocation of water within a catchment
- water trade – the ability to sell water entitlements and/or allocations
- water resource plans – management plans that define how water in a catchment can be used sustainably
- sustainable diversion limits – how much water can be used in the Murray-Darling Basin while leaving enough water for the environment
- monitoring and accounting
- compliance.

2.1.2 The sustainable diversion limits and adjustment mechanism

The Basin Plan sets sustainable diversion limits (SDL) for each catchment or group of catchments. The SDLs set were lower than the amount of water that was being used at the time. As a consequence, water has to be recovered to meet the limit. Across the Basin the additional amount of water needed to meet the SDLs and improve river and wetland health is an average of 2,750 GL per year. It is estimated that 2,107 GL of water had been recovered by September 2021.

To provide flexibility, the Basin Plan includes a mechanism (the SDLAM) to adjust the SDLs to achieve equivalent social, economic and environmental outcomes with less water recovery. The SDLAM program allows the SDLs to be adjusted within defined limits to offset the remaining gap between extractions and the desired 2,750 GL of water saving. The ability to do this, and make additional water available for communities, is subject to the implementing a range of projects, which include:

- supply projects – improving the efficiency of how water is delivered to the environment
- efficiency projects – projects or activities that change water use practices and save water for the environment
- constraints projects – projects that aim to overcome some of the physical barriers and river management practices that impact the ability to move environmental water around the Basin.

In 2017, the Australian, NSW, South Australian and Victorian governments notified a package of supply and efficiency measure projects, of which NSW was the proposed lead or co-proponent jurisdiction for 22 projects. In early 2019, NSW signed a funding schedule with the Australian Government to undertake detailed planning for a number of these projects under the SDLAM Program. In September 2021 an agreement was reached to accelerate the funding for a certain number of these projects, including the YCMP.

This strategy provides a program-level approach to those projects within the NSW Government's SDLAM program.

SDLAM projects

Supply projects provide the opportunity to efficiently deliver water for the environment, balancing environmental water requirements with the needs of other water users. Supply projects must deliver equivalent or better environmental outcomes compared to those achieved under current Basin Plan settings, using less water. The water can then remain in the river for consumptive uses.

Supply projects are able to offset a quantity of water, which would otherwise need to be recovered from the Basin to a maximum volume of 605 GL. The projects seek to provide equivalent environmental outcomes with a reduced volume of water and reduce the amount of water that needs to be recovered to meet the SDLs. Project examples include environmental works, building or improving river or water management structures, changes to river operations, and works to reduce evaporation losses. Modelling of the supply projects indicates that implementing the projects would save up to 605 GL of water. This estimated saving has been incorporated into an amendment of the Basin Plan.

Constraints projects aim to overcome some of the physical barriers that impact delivering water in the system. Constraints projects can include changes to physical features such as crossings and bridges. They can also change river operating practices and rules. They could provide environmental water managers more flexibility in releasing and moving water through the system.

An assessment of the status of the SDLAM projects undertaken by the Murray– Darling Basin Authority in 2022, identified a shortfall of 190 to 315 GL/year from the expected 605 GL/year contribution as a result of project delays. As such, the NSW Government has brought forward its remaining SDLAM projects through the NSW SDLAM Acceleration Program (the Acceleration Program). The Acceleration Program, which has received $330 million in funding, will remove barriers and streamline construction funding to allow the delivery of five projects by December 2026. It will deliver up to 45 GL of the outstanding amount of water needed to reach the 605 GL target required by the Basin Plan each year, delivering strong ecological outcomes for the Basin.

The YCMP is being delivered as a supply measure under the SDLAM Acceleration Program.

Yanco Creek Modernisation Project

The YCMP involves infrastructure upgrades and new installations to improve water management as part of SDLAM program commitments. The objectives of the YCMP as defined in the *Yanco Creek Modernisation Project – Project Execution Plan v1.0* (DPE Water) August 2021 include:

- water savings through modernisation works involving replacement and/or modification of existing weirs, modification and/or removal of infrastructure to reduce transmission losses, access to alternative supply points, installation of new technology for monitoring and control, and the ability to divert operational surplus flows in Forest Creek near Warriston Weir back to the Billabong Creek via Piccaninny Creek
- improved fish passage and ability to provide environmental flow regimes
- renewal of water supply infrastructure and improved level of service to end-users.

The proposed upgrade of the Wilson Anabranch Offtake is one of the sub-projects of the YCMP program and is the subject of this REF.

2.2 Proposal objectives

The primary purpose of the project is to replace the existing infrastructure at Wilson Anabranch Offtake, which is currently in poor condition, with a new regulator which would monitor and regulate the flow of water from Yanco Creek into Wilson Anabranch and improve fish passage compared to existing conditions.

2.3 Options and alternatives considered

2.3.1 Yanco Creek Modernisation Project

The YCMP includes a suite of proposals to deliver the desired overall environmental outcomes of the project. These proposals have been developed through several rounds of option investigation and stakeholder engagement.

A combination of options for the YCMP was first documented in the 2015 Business case for modernising supply systems for effluent creeks - Murrumbidgee River (DPI 2015). Since then, the options have been refined and further options have been developed with stakeholder input, to assist in identifying preferred options and design elements for further investigation. The evaluation was centred around ongoing community engagement and the application of a multi-criteria analysis approach incorporating both quantitative and qualitative data. Details of the options evaluation are contained in the NSW SDLAM Options Evaluation Framework and the User Guide for the NSW SDLAM Options Evaluation Framework (Alluvium, 2022).

2.3.2 Design development

The concept design for the project has been subject to the following design development process:

- Safety in Design workshop held on 23 February 2022 (combined with Parts 1 and 4)
- rescoped Basis of Design workshop held on 14 April 2022 with key stakeholders including Water Infrastructure NSW (WINSW) (now NSW DCCEEW), Fisheries and WaterNSW
- Options report issued to NSW DCCEEW on 23 August 2022
- submission of draft concept design drawings to DFG on 31 August 2022
- submission of draft concept design report to DFG on 6 September 2022
- receipt and completion of DFG comments and engagement with relevant stakeholders to clarify intent of comments
- meeting with DFG on 4 October 2022 to agree on approach to addressing comments
- update of draft concept design to final concept based on agreed approach
- final concept design issued to WaterNSW in early December 2022
- the DFG endorsed the draft detailed design on 13 September 2023.

2.3.3 Options assessment

The three primary options for the design of the Wilson Anabranch Offtake are presented in Table 2.1.

Table 2.1 Design options for Wilson Anabranch Offtake

Option	Description	Option assessment
Complete replacement of the existing offtake	Involves the removal of the existing structure at Wilson Anabranch and replacing it with a new structure consisting of a box culvert regulator	• Allows for flow measurement • Improved downstream fish passage • Single construction footprint • Requires a larger area of vegetation removal • Replaces degraded infrastructure
Add a Magflow meter to the existing offtake	Retrofit flow measurement to the existing structure	• Smallest construction footprint relative to the other options assessed • Allows for flow measurement • No change to fish passage capabilities • Degraded infrastructure remains unchanged.
Do nothing option	Water flow through Wilson Anabranch would continue to go unmeasured	• Flows would remain unmeasured • Reduced ability to efficiently deliver environmental water to Wilson Anabranch • No change to fish passage capabilities

2.4 Preferred option

- Option 3, 'do nothing', was discounted as the preferred option for the project as it would continue to allow unmeasured water flow through Wilson Anabranch, reducing the ability to deliver environmental flows downstream.
- Option 2 involves adding a Magflow meter to the existing Wilson Anabranch Offtake structure. This option was discounted as the preferred option for the project due to it being an addition to an outdated structure with risks to measurement accuracy, as well as it would not support improved fish passage.
- The preferred option, Option 1, is a new box culvert regulator on the existing block bank (Wilson Anabranch Offtake). The preferred option has been designed to avoid and minimise impacts to the environment to the extent practicable and meets the objectives of the project, and the overall YCMP.

3 Description of the project

3.1 Overview

The existing offtake at Wilson Anabranch would be removed and replaced with a new regulator. Construction would involve:

- constructing a new box culvert offtake and flow rate control works with a lay-flat gate regulator with the following design features:
  - a 1200 mm wide and 1200 mm high reinforced concrete box culvert, approximately 10 metres (m) long
  - flow meter incorporated into the gate mechanism.
  - plunge pool at the downstream end of the culvert, through use of a lowered culvert invert to improve downstream depth
  - existing block bank to be upgraded to proposed design profile of new regulator
  - rock beaching erosion protection at the inlet and outlet of the regulator
  - cast insitu headwalls fitted to the upstream end of the culvert and cast insitu endwalls fitted to the downstream end of the culvert
  - downstream fish passage facilitated by the use of a box culvert, the lay flat gate and the plunge pool downstream of the gate
  - upstream fish passage facilitated by the box culvert and the lay flat gate during unregulated flow events when the gate is fully opened, provided hydraulic gradients are conducive to this when the gate is operated fully open
  - upstream fish passage facilitated by the box culvert when the gate is operated fully open
  - bulkhead slots embedded in the concrete superstructure both upstream and downstream of the layflat gate
  - precast metal walkway and handrails for access to the gate
  - removable trash rack to reduce potential for trash load through gate and box culvert
  - solar power supply with solar panels and batteries on site
- removing the existing pipe culvert and gate at the project location.

Communication and network connectivity is currently being investigated and it is likely a new communications mast would be installed as part of the project, which would be approximately 30 m tall.

An overview of the project is provided in Figure 1.2 and the proposed construction arrangement is depicted in Figure 3.1 and Figure 3.2 below. Further information regarding the proposed operating regime of the structure is provided in section 3.5.

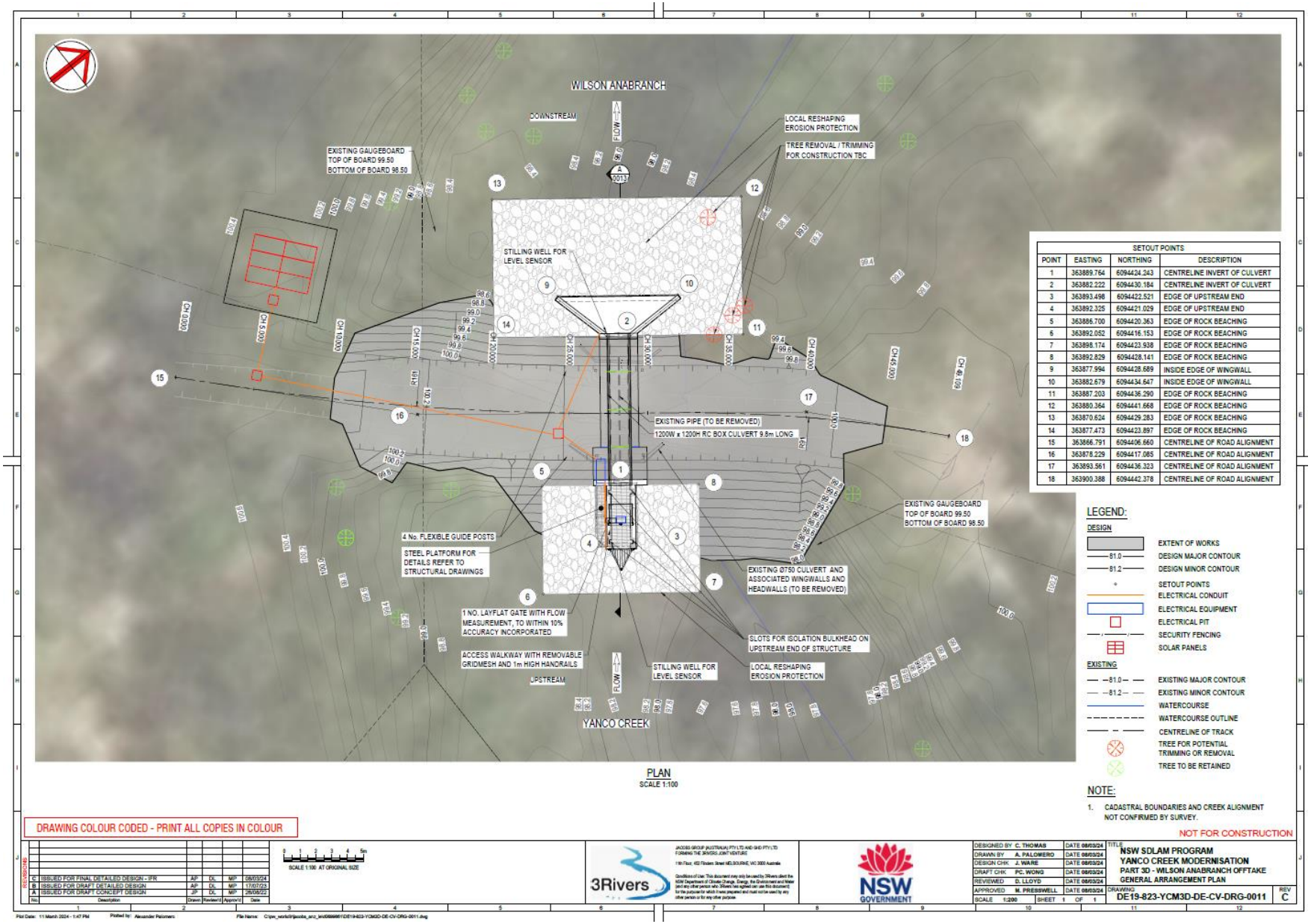

Figure 3.1 General arrangement plan

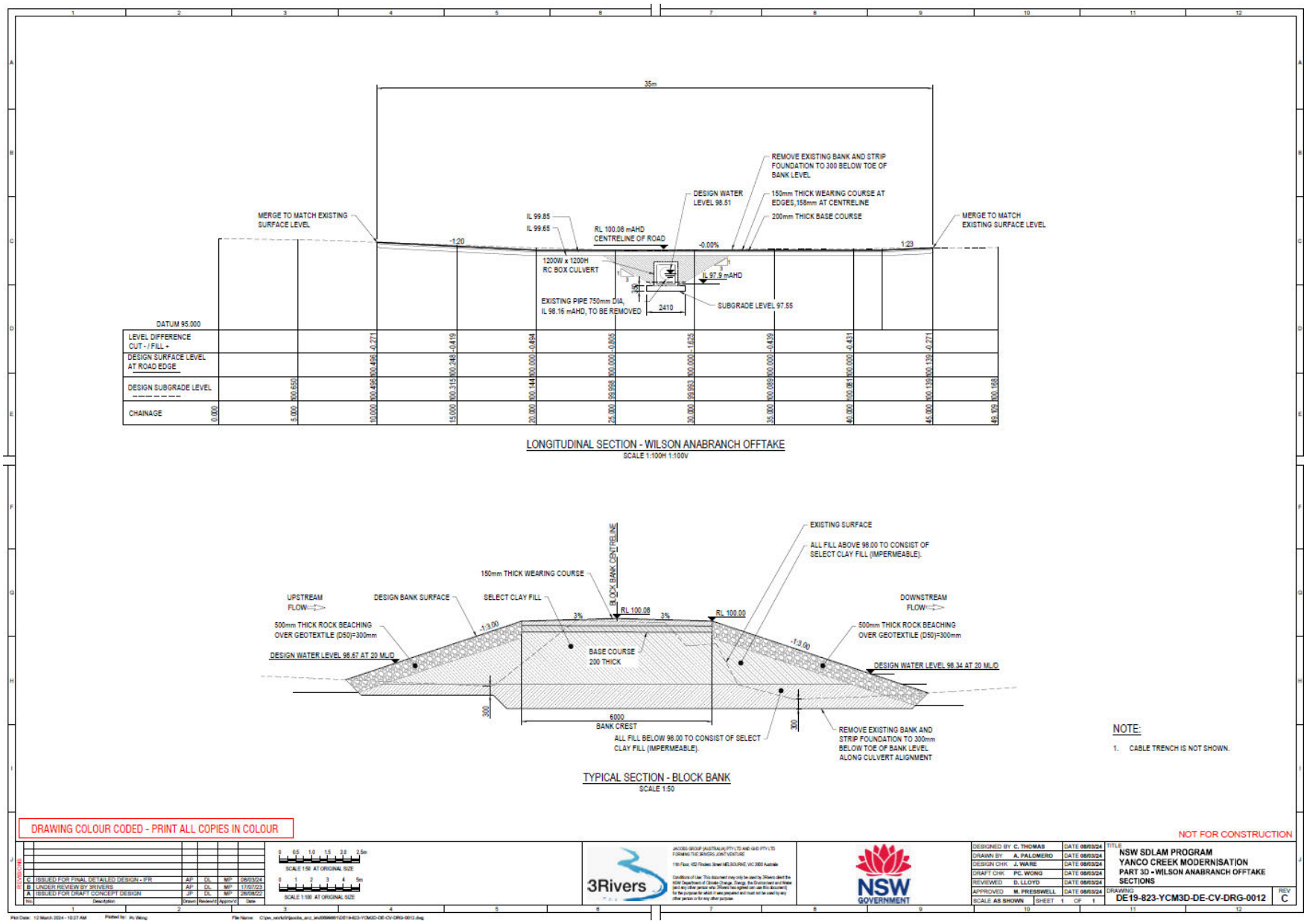

Figure 3.2 Regulator structural section

3.1.1 Definitions

For the purposes of this REF, the following terms have been used:

- The '**project**' refers to the proposed works required to undertake Part 3 of the YCMP (Wilson Anabranch Offtake regulator)
- The '**project area'** includes:
  - **Clearing Area:** Areas required to construct the proposed infrastructure. Within this area it is assumed that all vegetation and habitat would be removed, however, this is a conservative assumption and contractors should be encouraged to avoid removal where they can (through the proposed mitigation measures, see section 8.3).

    Excavated material from the Clearing Area around the construction works may be reused as part of the projects, such as for the construction of water retaining structures, where the material is suitable for achieving compaction and complies with applicable requirements. If material is not suitable or where additional material is required, the construction of the projects would also require the importation of material (clay) from a nearby site, known as the 'borrow site'.
  - **Contractor Activity Zone**: Locations outside of the 'Clearing Area' that would be used for construction purposes e.g. laydown, site sheds, parking. Assumed topsoil would need to be removed / cleared, with some re-grading to create level areas and grubbing and clearing of small shrubs /grasses. Trimming of trees may be required.
  - **Access tracks**: Tracks required for construction and operation of the project. All access tracks would be up to 5 m wide and may include some upgrade works (such as surfacing and tree trimming)
  - **Borrow site**: Located within the Clearing Area in the southwestern Contractor Activity Zone (refer to Figure 1.2). Proposed works at the borrow site include excavating material with the final quantities of suitable borrow material required determined during detailed design. At completion of works, the borrow site would be backfilled with surplus clean fill which is unsuitable for project construction, then reprofiled to a consistent surface level to form a local landscape depression. Topsoil would be reinstated across the borrow site to encourage vegetation re-growth.

3.2 Location of the project

3.2.1 Locality

The project area is located in a rural landscape within the Murray Region of NSW, approximately 30 km east of the Conargo township and 20 km northwest of Jerilderie. The project area is within the Edward River Local Government Area (LGA) and is surrounded by neighbouring towns, including Coree, Hartwood, and Moonbria.

3.2.2 Ownership

The project is located in the Parish of Wononga, County of Townsend, and Land District of Deniliquin. The new offtake is proposed to be installed on lot 167/-/DP756349, with a new access track in the same lot, connecting to North Coree Road, Coree, via an existing track through lots 168/-/DP756349,169/-/DP756349, 171/-/DP756349, 172/-/DP756349, 170/-/DP756349 and 22/-/DP756289. The two Contractor Activity Zones would be located on lots 167/-/DP756349, 5/-/DP252173 and 168/-/DP756349. Refer to Figure 1.1 for the project location.

Table 3.1 outlines the key project area identifiers and information. Refer to Figure 4.1 for a map of the project areas surrounding land tenure and zoning information.

Table 3.1 Project Location

Identifier	Location description
Regulator ownership	The existing regulator is owned and operated by WaterNSW. The new regulator would also be owned and operated by WaterNSW.
Lot and DP	**Clearing Area and Contractors Activity Zone:** • Lot 167, DP756349 • Lot 168, DP756349 • Lot 5, DP252173
	Access track: • Part Lot 168, DP756349 • Part Lot 169, DP756349 • Part Lot 171, DP756349 • Part Lot 172, DP756349 • Part Lot 170, DP756349 • Part Lot 22, DP756289
Street address	North Coree Road Coree 2710
Ownership	**Clearing Area and Contractors Activity Zone:** All lots are private land, including: • Part Lot 167, DP756349 • Part Lot 168, DP756349 • Part Lot 5, DP252173 • Part Lot 168, DP756349 • Part Lot 169, DP756349 • Part Lot 171, DP756349 • Part Lot 172, DP756349

Identifier	Location description
	• Part Lot 170, DP756349 • Part Lot 22, DP756289 **Borrow site** – The borrow site proposed for the project is located on private land within the Clearing Area of the Contractor Activity Zone in proximity to where the material would be used for the construction of the project infrastructure.
	Local road North Coree Road.
Land use zoning	RU1 Primary Production under the Conargo Local Environmental Plan 2013

3.2.3 Description of the project area

The project area is located within the Murray Region in southwest NSW approximately 30 km east of Conargo and 20 km northwest of the Jerilderie township. Located within the Edward River LGA, the project area's surroundings are predominantly characterised by RU1 Primary Production land use zoning with several large rural blocks used for livestock grazing and cropping.

The regional landscape is visually characterised by flat open plains with scattered trees (refer to Figure 3.3).

Figure 3.3 Visual landscape surrounding project area

The banks of Wilson Anabranch are characterised by riparian vegetation with some trees inundated by the water channel (refer to Figure 3.4).

State vegetation mapping, i.e. the NSW State Vegetation Type Map (SVTM), acknowledges the following Plant Community Types (PCTs) to occur within the study area:

- PCT 2: River Red Gum-sedge dominated very tall open forest in frequently flooded forest wetland along major rivers and floodplains in south-western NSW (DPE 2023d)
- PCT 5: River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion and PCT 44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion (DPE 2023d).

The existing Wilson Anabranch Offtake structure consists of a single 750 mm diameter reinforced concrete pipe with a penstock gate located on a trafficable block bank and manually operated to allow flow for five months of the year from 1 April to 31 August and during announced access periods from 1 September to 31 March.

Figure 3.4 Wilson Anabranch watercourse

3.3 Construction works

The exact nature of works involved in the construction of the project may differ depending on the site-specific conditions identified during geotechnical investigations and those that are present at the time of construction (i.e. weather conditions). However, detailed construction methods, including consideration of site-specific requirements, would be outlined in a Construction Environmental Management Plan (CEMP) developed for the project in accordance with the safeguards listed in section 8.3.

3.3.1 Construction

Construction would generally follow the following steps:

- Mobilise site facilities and construct hardstand (150 mm thick, should a crane be required). Any topsoil to be removed and stored separately for reuse.
- Upgrade the existing access track which may include some light grading, resurfacing and compaction. Tree trimming may be required.
- Undertake clearing and grubbing activities and vegetation removal.
- Install silt fence across the waterway (downstream and upstream) and establish erosion and sediment controls.
- Install earthen cofferdam (if required) on connecting channel upstream and potentially downstream depending on tailwater levels/seasonal risk.
- Dewater the construction zone within the cofferdam, by installing sump and dewatering pump and temporary bypass pump and pipe (if required).
- Undertake removal / demolition of existing culvert (disposal to a suitable licensed facility).
- Undertake excavation / earthworks for upgrading the block bank.
- Prepare blinding layer for culvert and gate.
- Install culvert (pre-cast), gate (pre-cast / prefabricated unit) and headwall (in-situ).
- Install in-situ concrete cut offs.
- Backfill around culvert / gate, possibly using cement stabilised sand).
- Place and compact new block bank using impermeable clay fill material.
- Re-shape bank and creek bed.
- Place geotextile and erosion protection rock beaching.
- Topsoil and revegetate disturbed area.
- Install galvanised iron grid-mesh walkway and handrails.
- Install gate solar power/ controls / flow measurement (proprietary system).
- Commission gate (as per manufacturer / WaterNSW requirements).
- Flood / remove earth bank cofferdams.
- Tidy site and demobilise.

Construction of the project may require a cofferdam to provide for works within the watercourse when water is present, or to protect the works against high flows. In this event, it is expected that the contractor may construct an earthen cofferdam and the works area would be dewatered. The cofferdam construction method would be confirmed by the construction contractor and would factor in water depths, river flows, water velocity and ground conditions at the time of the works. If a cofferdam is required, it would be located in the identified Clearing Area.

The approval for the cofferdam construction method would be attained by NSW DCCEEW. Potential management plans associated with coffer dam construction, management and demobilisation is to be included in the CEMP (or as a sub-plan).

3.3.2 Proposed construction equipment

Plant and equipment likely to be used during construction may include, but is not limited to, the following:

- tipper trucks
- excavators
- compaction roller
- water cart
- front end loader
- concrete ready-mix truck
- semi-trailer
- light vehicles.

3.3.3 Proposed workforce

It is expected that a workforce of about three to 10 personnel would be required at different stages of construction.

3.3.4 Construction hours and duration

Subject to receiving approval, it is expected that construction would commence in mid-2025 and take approximately 2 to 3 months to complete.

The construction of the project would generally take place during standard construction hours or as agreed with the landowner. Standard construction hours are outlined in the Construction Noise and Vibration Guideline (CNVG) (NSW Roads and Maritime Service, 2016) as follows:

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

3.3.5 Traffic and access

During construction, there would be daily heavy vehicles movements during mobilisation and demobilisation. Once construction has commenced, vehicle movements to and from the site would consist generally of personal vehicles and deliveries when required.

Construction and operations access to the proposed Wilson Anabranch Offtake regulator is proposed to be via a local track off North Coree Road.

It is expected that some upgrade works would be required to provide access during construction. This may include some light grading, resurfacing and compaction. Tree trimming may be required. It is assumed that all tracks would be 5 m wide.

3.4 Ancillary facilities

The borrow site proposed for the project is located on private land within the Clearing Area of the Contractor Activity Zone in proximity to where the material would be used for the construction of the project infrastructure.

Proposed works at the borrow site include excavating material. Stockpiling of fill material would occur either adjacent to where it is excavated or at laydown areas within the Contractor Activity Zone. Clay material would be stockpiled for conditioning, which is the process by which the material is made ready for use in construction. Temporary storage of smaller quantities of material would occur within the infrastructure Contractor Activity Zone as the materials are used during construction.

At completion of works, the borrow site would be backfilled with surplus clean fill which is unsuitable for project construction, then reprofiled to a consistent surface level to form a local landscape depression. Topsoil would be reinstated across the borrow site to encourage vegetation re-growth.

Construction compounds may comprise of portable toilets and site office sheds.

3.5 Operation

3.5.1 Legislative basis

Water Sharing Plans

Water sharing plans are made under section 50 of the *Water Management Act, 2000*. The plans set the rules for how water is managed and allocated to support sustainable environmental, social, cultural, and economic outcomes.

Water sharing plans establish the allocation of water with provisions that address following aspects:

- Provide water for the environment by protecting a proportion of the water available for fundamental ecosystem health and includes specific environmental rules (planned environmental water).
- Establish adaptive environmental water (EWA accounts) which is water that can be used at the direction of the environmental water manager within the plan rules. Held Environmental Water is entitlement which can arise from water recovery projects or by buying water licences. This water can be used at the discretion of the environmental water manager.
- Protect the water required to meet basic landholder rights.
- Set annual limits on water extractions to ensure that water extractions do not increase and therefore erode the water for the environment or the security of supply to water users.

- Determine what type of additional licences can be granted such as local water utility access licences (for town water supplies) and Aboriginal cultural access licences.
- Determine how water is to be shared among the different types of licensed users by setting the priorities of supply.
- Provide flexibility for licence holders in the way they can manage their water accounts.
- Specify rules in groundwater plans to minimise impacts on other groundwater users, dependent ecosystems, water quality and the stability of the aquifer.
- Specify the rules for water trading or dealings.

The *Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016* applies to the Murrumbidgee Regulated River Water Source comprising the regulated rivers within the Murrumbidgee Western Water Source and the Lower Billabong Anabranch Water Source. This applies to the regulated Yanco Creek and defines the rules under which WaterNSW is permitted to provide water to Yanco Creek for water users, including the environment.

Environmental Watering Plans

The entrance to the Wilson Anabranch is situated approximately 35 km upstream (by river) of the confluence of Yanco and Billabong creeks. The anabranch inlet is off the Mundoora Anabranch just upstream of the return of the Mundoora Anabranch to Yanco Creek. As Yanco Creek is blocked by the McCaughey Block Dam to the east, the Mundoora Anabranch is the flow path for regulated flows in Yanco Creek between Morundah and the confluence with Billabong Creek downstream.

Environmental water held by both the Commonwealth and NSW has been delivered into the Yanco-Colombo-Billabong creeks system for over ten years. This is a legislated requirement combined with administrative arrangements for the assessment and management of environmental watering actions. *Chapter 8: Environmental watering plan* of the Basin Plan guides the planning and use of water for the environment across the Basin.

The Commonwealth Environmental Water Holder (CEWH) and state environmental water holders in the Basin make decisions about when and where to use their allocated water to achieve specific and measurable environmental outcomes. Water holders consider the needs of ecosystems and how much water is forecast to be available to the river to decide what kind of watering activities will best support the health and condition of water dependent ecosystems across the Basin.

To achieve the objectives of Chapter 8, the MDBA develops the Basin-wide environmental watering strategy and annual priorities for water for the environment. The MDBA works with Basin governments and communities to coordinate the planning, prioritisation and use of water for the environment. Priorities are set by the MDBA and Basin governments by following the guidance provided in Schedule 7 of the Basin Plan and the Basin-wide environmental watering strategy.

The CEWH is an independent statutory position that owns and manages most entitlements to water for the environment in the Basin. The CEWH is supported by the Commonwealth Environmental Water Office (CEWO). The CEWH provides water for the environment consistent with the requirements of the Basin-wide environmental watering strategy and Chapter 8, and considers the annual priorities developed by the MDBA (Basin-wide) and Basin state governments (regional or catchment scale). Each year the CEWO considers and plans for how it will manage Commonwealth water for the environment. This is documented in annual water management plans.

Each Basin government develops regional long-term environmental watering plans (regional long-term plans) for each surface water resource plan area. The Murrumbidgee Long-Term Water Plan (MLTWP) is one of nine developed for NSW river systems as required under the Murray-Darling Basin Plan. The MLTWP is divided into Planning Units (PU) that provide local-scale information about ecological values and objectives, and environmental water requirements to meet these. Relevant to the YCMP are the following:

- PU11: Colombo & Billabong creeks – covers Cheverells Creek Offtake and Hartwood
- PU12: Lower Yanco Creek to lower Billabong Creek – covers Cheverells Creek and Wilson Anabranch
- PU13: Lower Billabong and intersecting streams – covers Forest Creek, Wanganella Swamp and Wanganella Weir.

Every year, the MDBA publishes Basin annual environmental watering priorities (Basin annual priorities). These priorities draw from the Basin-wide environmental watering strategy, regional long-term plans and regional annual priorities to identify which environmental assets should receive water for the upcoming year.

The MDBA works with Basin governments to identify which priorities are important for the Basin as a whole system, by consulting with holders and managers of water for the environment, scientists and other experts, river operators, relevant committees, and First Nations people.

Every year, Basin state governments identify environmental watering priorities for each of their surface water resource plan areas. These build on long-term watering plans and align with the Basin annual priorities. State priorities are delivered by statutory agencies responsible for providing water for the environment.

Basin state governments develop their annual priorities based on consultation with environmental water holders and managers, scientists and other experts, river operators, and local communities, including First Nations people.

3.5.2 Design capacity and general operating principles

The design capacity of the proposed regulator is detailed in Table 3.2 below.

Table 3.2 Design capacity of the Wilson Anabranch Offtake

Infrastructure	Design capacity	Design levels
Wilson Anabranch Offtake regulator	20 ML per day	98.34 m AHD (downstream) 98.57 m AHD (upstream) (levels provided are based on free-flowing conditions/no backwater)

The operation of the proposed Wilson Anabranch Offtake regulator would be based on the *Yanco Creek System Operations Plan* (as at November 2023). At the time of preparation of this REF, the *Yanco Creek System Operations Plan* is in draft form. The draft operations plan continues to be developed in collaboration with WaterNSW and DCCEEW's Licensing Team (particularly in relation to the Governance section of the plan). Should there be changes made to the operational approach,

principles or limits, then further assessment would need to be undertaken to determine the implications for this REF and supporting specialist assessments.

The plan is to form part of the requirements of the water supply work approval issued to WaterNSW for the Murrumbidgee regulated river water source. These operations have been considered and form the basis of this assessment, as provided below.

General operating principles:

- To be operated consistent with the rules developed as part of the Water for Rivers water savings project for this location.
- Environmental water orders can be lodged for outside of the normal operating periods detailed below. Normal water delivery charges apply during these periods.

Table 3.3 Wilson Anabranch Offtake operating periods

Time period	Wilson Anabranch Offtake
1 April to 31 August (5 months)	Open (fully open as much as possible)*
1 September to 31 March (7 months)	Closed excluding supplementary access periods
Announced supplementary water access periods for the section of the Yanco Creek that includes Wilson Anabranch Offtake	Open (fully open as much as possible)*
Environmental water orders	As per advice from environmental water managers

* While the intention is for the regulator to remain fully open to allow two-way fish passage through the regulator, this may not be possible at all times. Due to site constraints, there may be times when the regulation gate will not be fully open, including when flow measurement is required for billing purposes and where fully opening the regulation gate results in adverse third-party impacts downstream. (e.g. overtopping of private access culverts).

- This means a new operational flow constraint for Wilson Anabranch during normal regulated conditions may need to be established as new information becomes available
- If the regulation gate is initially opened too quickly, it is unclear what may occur at the downstream privately owned access culverts that have a smaller flow capacity until the Wilson Anabranch system progressively fills up and reaches equilibrium.
- HECRAS modelling completed by 3Rivers suggests there will be no third party impacts once the Wilson Anabranch System has filled up and reached equilibrium.

Normal regulated flow operational limits:

As per general operating principles and advice from environmental water managers.

As the size of the new box culvert and regulator gate is larger than the previous pipe offtake that it replaced, consideration should be given to progressively opening the regulator gate up over a period of two or more days to allow more time for tailwater levels on the downstream side of the regulator to rise and reduce the rate of flow through the structure.

When accurate flow measurement is not required for billing purposes, when possible fully open the regulator gate to enable two way native fish passage through the structure. At times this may not be possible if fully opening the regulator gate results in adverse third party impacts downstream

(e.g. overtopping of private access culverts). Third party impacts would be mitigated in accordance with the Operation Plan.

Description of change:

The regulator would generally be operated as per the current operational regime regime (regular flow five months of the year, plus the occasional environmental flow releases). However, the new infrastructure would provide greater control and measurement of water entering the anabranch over a potentially higher range of flows. The new regulator would also provide greater flexibility to environmental water managers to ensure that environmental water is delivered in accordance with the management plans developed by environmental managers (e.g. Commonwealth Environmental Water Office Water Management Plan 2022-23). The new regulator would enable conditions more conducive to fish passage through the use of the box culvert arrangement, an overshot gate and lower resulting velocities.

3.5.3 Monitoring and Review

The intended outcome of the project is to connect the Wilson Anabranch Offtake regulator to the WaterNSW SCADA system for opening, closing, and controlling flows to meet environmental flow requests for controlled release. It would also provide measurement of flow to record consumption against entitlement.

The impact of water for the environment is regularly monitored and reviewed to ensure that it is effectively working towards the overall environmental objectives for the Basin.

The CEWH has entered into a formal partnership agreement with the NSW DCCEEW, as NSW's environmental water holder, which outlines the way in which the CEWH and staff of the CEWO would work with NSW DCCEEW to coordinate the management of environmental water.

Monitoring of daily discharge and fish passage would be undertaken in accordance with the safeguards as identified in section 6.5.4.

3.6 Timing and staging

Subject to receiving approval, it is expected that construction would commence in mid-2025 and take approximately 2 to 3 months to complete.

3.7 Estimated Development Cost

Given the nature of the works, it is estimated that the approved project would have an estimated development cost of around $1,000,000.

Detailed costings for the proposed works would be determined during future stages of the project.

3.8 Public utility adjustment

The project would not impact any public utilities and no public utility adjustment would be required.

3.9 Land access and acquisition

3.9.1 Construction

Access for construction and land required to construct the proposed works would be negotiated and agreed with individual landowners.

3.9.2 Operation

DCCEEW is responsible for the acquisition (i.e. purchase) of land at the site of the new Wilson Anabranch Offtake and an access easement from North Coree Road to the new offtake. It is then planned to transfer the ownership of these acquisitions to WaterNSW at a later date. It is also planned for WaterNSW to own and operate the new Wilson Anabranch Offtake.

4 Legislative context

4.1 NSW legislation

4.1.1 Environmental Planning and Assessment Act 1979

The EP&A Act and its associated regulation provide the framework for assessing the environmental impacts of proposed developments in NSW. The EP&A Act allows for the creation of Environmental Planning Instruments (EPIs) including Local Environmental Plans (LEPs) and State Environmental Planning Policies (SEPPs). The applicable EPIs and the EP&A Regulation made under the EP&A Act collectively determine the relevant planning approval pathway and the associated environmental assessment requirements for proposed development activities.

This REF has been prepared with consideration of section 171 of the EP&A Regulation (summarised in Appendix A Clause 171 Environmental Factors Checklist), the *Biodiversity Conservation Act 2016*, the *Fisheries Management Act 1994*, and the *Environment Protection and Biodiversity Conservation Act 1999*. In doing so, the REF helps to fulfil the requirements of section 5.5 of the EP&A Act that the NSW DCCEEW would examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

4.1.2 State Environmental Planning Policy (Transport and Infrastructure) 2021

Chapter 2 of the *State Environmental Planning Policy (Transport and Infrastructure) 2021* (Transport and Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across the State. It does this by prescribing what infrastructure related works can be carried out without development consent (and the assessment requirements that apply to such development), as well as those that are exempt or complying development.

Division 24 applies to water supply systems, which (according to clause 2.157) have the same meaning for the for the purposes of the Transport and Infrastructure SEPP as in the Standard Instrument – Principal Local Environmental Plan (2006 EPI 155a) (the Standard Instrument). Water supply systems are defined by the Standard Instrument as follows:

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

Water storage facilities are defined by the Standard Instrument as meaning '*...a dam, weir or reservoir for the collection and storage of water and includes associated monitoring or gauging equipment*'.

The proposed activity is a water storage facility for the purposes of the Transport and Infrastructure SEPP. Division 24 of the Transport and Infrastructure SEPP, Subsection 2.159(2) provides that development for the purpose of water storage facilities may be carried out without consent if it is carried out by, or on behalf of, a public authority on land in Zone RU1 Primary Production, Zone RU2 Rural Landscape, Zone SP1 Special Activities, Zone SP2 Infrastructure or an equivalent land use zone.

The relevant local environment plan is the Conargo LEP 2013. The project area is zoned RU1 Primary Production under the Conargo LEP. The proponent is a public authority; therefore, the project is permissible without development consent under Part 4 of the EP&A Act.

4.1.3 State Environmental Planning Policy (Planning Systems) 2021

In accordance with *State Environmental Planning Policy (Planning Systems)* 2021 (Planning Systems SEPP) development is declared to be State Significant Infrastructure (SSI) under section 2.13 if it is permissible without development consent and specified in Schedule 3. Development may also be declared to be SSI under section 2.14 (for development specified in Schedule 4) or as critical SSI under section 2.15 (for development specified in Schedule 5). The project is not listed in either Schedules 4 or 5.

Schedule 3 of the Planning Systems SEPP defines two categories of development that may be relevant to the project:

- infrastructure or other development that would require an EIS to be obtained under Part 5 of the Act (section 1 (1))
- water storage facilities that have a capital investment value of more than $30M (Schedule 3, clause 4(1)).

Planning approval for development in the above categories would be subject to Part 5, Division 5.2 of the EP&A Act. The Minister for Planning and Public Spaces is the approval authority for such SSI. An EIS is required to accompany the application for approval of the development.

The project is considered 'development permitted without consent' under Section 2.158 of the Transport and Infrastructure SEPP.

As the project does not require an EIS to be prepared and has an estimated development cost below $1,000,000, it does not fall within the above categories of Schedule 3 of the Planning Systems SEPP, and the project is not considered SSI.

4.1.4 State Environmental Planning Policy (Biodiversity and Conservation) 2021

Koala habitat protection in Chapter 3 and Chapter 4 of the Biodiversity and Conservation SEPP contains provisions for development control of koala habitats, koala plans of management and other environmental planning measures formerly administered under the State Environmental Planning Policy (Koala Habitat Protection) 2020 and (State Environmental Planning Policy (Koala Habitat Protection) 2021 respectively. The development control provisions of Chapter 3 do not apply to this project as a development application is not required to be submitted for approval. The provisions of Chapter 4 do not apply to the project as the provisions do not apply to land within Zone RU1 and

Edward River Council is not a nominated local government area (section 4.4(3)(d)). However, Koalas and Koala habitat have been considered in the biodiversity assessment.

Whilst these creeks enter the Murray River system, Wilson Anabranch is not within the mapped River Murray lands or subject to the provisions of Chapter 5 of the Biodiversity and Conservation SEPP.

4.1.5 Riverina Murray Regional Plan 2041

The project is located within the Murray Region of the broader Riverina Bioregion of NSW. The *Riverina Murray Regional Plan 2041* is a 20-year land use plan providing the targeted delivery of strategic outcomes brought together by a culmination of various councils local strategic planning statements. Objective one of the Plan identifies multiple environmental aims, including:

- Objective 1: Protect, connect, and enhance biodiversity throughout the region.
  - inform land use decision-making throughout the development process
  - avoid and minimise biodiversity loss
  - identify land for environmental conservation, including on land zoned for development
  - manage the intersection between the *Biodiversity Conservation Act 2016* (BC Act) and the EP&A Act to achieve the objectives of both.

As discussed in section 2.2, the YCMP involves infrastructure upgrades with the overall aims of improving water management, increasing water savings, improving fish passage, and providing improved environmental flow regimes. The YCMP objectives are therefore consistent with the Riverina Murray Regional Plan 2041 *Objective 1* Environmental aims.

4.1.6 Conargo Local Environmental Plan 2013

The project is located within the Edward River LGA. The relevant local planning instrument for the project is the Conargo LEP 2013. The land use zoning of land at the location of the project is Zone RU1 Primary Production (refer to Figure 4.1).

The objectives of the RU1 Primary Production zone are:

- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
- *To encourage diversity in primary industry enterprises and systems appropriate for the area.*
- *To minimise the fragmentation and alienation of resource lands.*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones.*
- *To allow for the development of processing and service industries relating to primary production.*
- *To encourage tourist and visitor accommodation that does not have an adverse impact on agricultural activities.*
- *To allow for the development of non-agricultural land uses that are compatible with the character of the zone.*

- *To permit small-scale rural tourism uses associated with primary production and environmental conservation that have minimal impact on primary production and the scenic amenity of the area.*
- *To provide opportunities for employment-generating development that adds value to local agricultural production and integrates with tourism.*

Under the Conargo LEP '*water supply systems*', which include water storage facilities, are permitted with consent in Zone RU1. As detailed in section 4.1.2, development for the purpose of water storage facilities may be carried out by, or on behalf of, a public authority without development consent on land zoned RU1 Primary Production under the provisions of the Transport and Infrastructure SEPP.

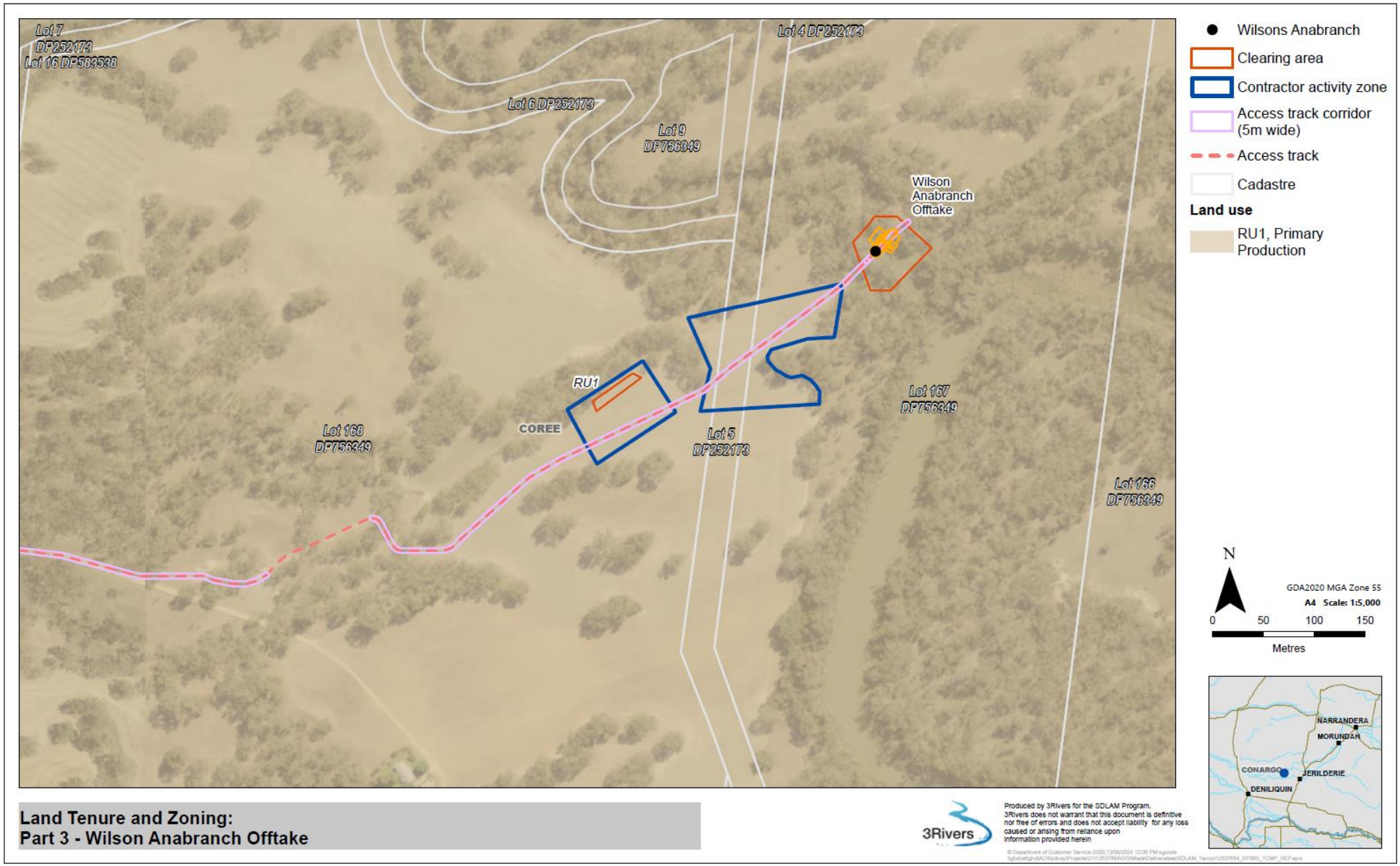

Figure 4.1 Land tenure and zoning

4.1.7 Assessment under the Environmental Planning and Assessment Act 1979

Environmental impact assessment of the project is to be considered under Part 5, Division 5.1 of the EP&A Act. The NSW DCCEEW is the determining authority for the project and would examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the project (s.5.5(1) of the EP&A Act).

The EP&A Regulation identifies the list of factors that must be taken into account concerning the impact of the project on the environment (cl.228(2)) relating to environmental assessment under Part 5 of the EP&A Act. Appendix A Clause 171 Environmental Factors Checklist considers the potential impacts of the project against these factors.

The NSW DCCEEW has prepared this REF to document its assessment of the project and to ascertain whether the project is likely to significantly affect the environment. Where the project is found to be likely to significantly affect the environment, an EIS would be prepared.

Based on the outcomes of the environmental assessment undertaken in this REF, the project is not likely to have a significant impact on the environment, and an EIS is not required.

4.2 Other New South Wales legislation

Approval requirements under other NSW legislation that are relevant to the project are outlined below in Table 4.1.

Table 4.1 Other relevant NSW legislation

Act	Requirement	Relevance to the project
Protection of the Environment Operations Act 1997 (POEO Act)	An Environment Protection Licence (EPL) is required for scheduled activities or scheduled development work. Licences may also be issued for activities that are not listed in Schedule 1 of the POEO Act but are likely to cause pollution of water. These activities are referred to as 'non-scheduled activities'.	The project does not involve a 'scheduled activity' under Schedule 1 of the POEO Act, nor would it likely cause the pollution of water. Accordingly, an EPL is not required for the project.
Roads Act 1993 (Roads Act)	Approval under section 138(1) for carrying out works (in, on or over), digging up or disturbing a public road.	The project does not propose to impact on, or carry out work on or over, a public road and therefore would not need to seek the necessary approvals under the Roads Act.

Act	Requirement	Relevance to the project
National Parks and Wildlife Act 1974	**General** Development may be carried out on land reserved under the National Parks and Wildlife Act (NPW Act) only if it is authorised by or under that Act. **Aboriginal heritage** An Aboriginal heritage impact permit (AHIP) under section 90 to harm or desecrate an Aboriginal heritage object.	The land is not reserved under the NPW Act. Section 6.8 assesses the potential for impact on items of Aboriginal heritage. An AHIP would be required for the project prior to construction to collect and relocate and/or rebury the two items identified within the study area.
Water Management Act 2000 (WM Act)	Water use approvals under section 89 authorise its holder to use water for a particular purpose, such as irrigation, at a particular location. A water management work approval (consisting of water supply work, drainage work and flood work approvals) under section 90. Section 90(2) provides that a water supply work approval authorises the construction and use of a water supply work at a specified location. An activity approval under section 91. Section 91(1) provides that there are two kinds of activity approvals, namely, controlled activity approvals (for works in, on or under waterfront land) and aquifer interference approvals.	The project involves replacing the existing inlet structure with a new upgraded regulator at Wilson Anabranch. As the project would involve impounding water, the works would require a water supply work approval in accordance with section 90 (2). The project meets the definition of a controlled activity and possibly an aquifer interference activity. However, sections 91E (4)(a) and 91F(4)(a) remove the requirements for controlled activity approvals as WaterNSW would obtain a water supply work approval. The guidelines for controlled activity approvals under the Water Management Act are not specifically relevant to the project because a water supply approval would be sought. It is likely that this REF would be used to support the information and assessment requirements for a water supply work approval.
Heritage Act 1977	Approval under section 57(1) for works to a place, building, work, relic, moveable object, precinct, or land listed on the State Heritage Register. An excavation permit under section 139 to disturb or excavate any land containing or likely to contain a relic.	The project is considered unlikely to impact upon any items of non-Aboriginal heritage (refer to section 6.9).

Act	Requirement	Relevance to the project
Fisheries Management Act 1994	**Dredging and reclamation** Before carrying out dredging or reclamation work a public authority (other than a local government authority) must give the Minister notice in writing of the proposed work (section 199(1)(a)) and consider any matters that are raised by the Minister within 21 days of the notice (section 199(1)(b)). **Fish passage** Section 218(5) provides that a public authority that proposes to construct, alter or modify a weir on a waterway (or to approve of any such construction, alteration or modification) must notify the Minister of the project, and must, if the Minister so requests, include as part of the works a suitable fishway or fish bypass. Section 219 prohibits the blocking of fish passage without a permit.	The project involves replacing the existing inlet structure with a new upgraded regulator at Wilson Anabranch. The project would facilitate downstream fish passage via the lay flat gate and plunge pool. When fully opened the layflat gate and box culvert allow for improved upstream fish passage compared to the existing pipe and penstock gate. The proposed works would meet the definition of dredging and reclamation works (moving or removing material on water land). The NSW DCCEEW is not a local council and therefore is required to provide written notice to the Minister for Fisheries of the project and consider any matters raised within 21 days of notice being given. The project involves the construction of a new regulator which may alter the current operation of fish passage at the existing culvert. Therefore, the NSW DCCEEW is required to notify the Minister for Fisheries of the proposed works, under section 199 (dredging and reclamation) of the FM Act. Notification of the project would also be made to the Minister for Fisheries in accordance with section 218(5). Consultation with NSW Fisheries would continue to confirm the proposed provision of fish passage at the site. The provisions of section 219 do not apply as the activity is permitted by other Acts (EP&A Act and WM Act) (s219(5)(a)).

Act	Requirement	Relevance to the project
Crown Land Management Act 2016	The *Crown Land Management Act 2016* provides for the ownership, use and management of Crown land in NSW. A licence is required to occupy and use Crown land for a specified purpose and term. The NSW DCCEEW exercises the functions of the Water Administration Ministerial Corporation and therefore the powers of a Constructing Authority under the *Public Works and Procurement Act 1912*. NSW DCCEEW is not required to obtain a licence to occupy of use Crown land for the project. NSW Crown Lands advises that authorities that exercise powers of entry should be mindful of Indigenous rights that apply to Crown land.	The project does not occupy any Crown land; therefore a licence is not required.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth's EPBC Act prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected areas and species, populations and communities and heritage items.

The approval of the Commonwealth Minister of Agriculture, Water and the Environment is required for an action which has, would have, or is likely to have, a significant impact on MNES. These matters include:

- world heritage properties
- national heritage places
- listed threatened species and communities
- listed migratory species
- Ramsar wetlands of international importance
- Commonwealth marine environment
- the Great Barrier Reef Marine Park
- nuclear actions
- a water resource, in relation to coal seam gas development and large coal mining development.

The expected impact of the project on MNES is discussed in section 7. The assessment of the projects impact on MNES including nationally listed threatened species, ecological communities and migratory species, found that there is unlikely to be a significant impact on MNES. The project is not located on Commonwealth land.

4.3.2 Native Title Act 1993

Native title is the recognition that Aboriginal and Torres Strait Islander people have rights and interests to land and waters according to their traditional law and customs as set out in Australian Law. Native title is governed by the *Native Title Act 1993* (NT Act).

Native title may include rights and interests to:

- live on the area and erect shelters and structures
- access the area for traditional purposes, like camping or for ceremonies
- visit and protect important places and sites hunt, fish and gather food or traditional resources like bush medicines, water, ochre and wood
- teach law, custom and engage in cultural activities.

Native title applications are made to the Federal Court under the NT Act for a determination, or decision about native title in a particular area.

The NT Act defines processes for dealing with 'future acts' or a project to deal with land in a way that affects native title rights and interests. Future act processes are based on the principle that in general, acts affecting native title will only be valid if they can also be done on freehold land. These processes give effect to the principle that in appropriate cases, these acts should only be done after every reasonable effort has been made to secure the agreement of the native title holders.

An Indigenous Land Use Agreement established under the NT Act, is a voluntary agreement between native title parties and other people or bodies about the use and management of areas of land and/or waters. It can be made over areas where native title has been determined to exist in at least part of the area, where a native title claim has been made or no native title claim has been made.

A desktop search undertaken on 11 October 2023 of the National Native Title Register identified three cases made for native title within the Edward River Council LGA. Two were under the Deniliquin Local Aboriginal Land Council (2001 & 2007) and one under Yorta Yorta (1998). The outcome for all three were that '*native title does not exist*' (National Native Title Tribunal 2023).

4.4 Summary of licences and approvals

The project is development for the purpose of a water supply system and is being carried out by or on behalf of a public authority. Under clause 2.158 of the Transport and Infrastructure SEPP the project is permissible without consent. The project is not State significant infrastructure or State significant development. The project can be assessed under Division 5.1 of the EP&A Act.

The NSW DCCEEW is the proponent and determining authority for the project. This REF fulfils the NSW DCCEEW's obligations under section 5.5 of the EP&A Act including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

Any licences or approvals identified in this legislative context section as required by the project are summarised below in Table 4.2.

Table 4.2 Summary of licences and approvals

Act	Relevant agency	Required licence/approval/notification
Water Management Act 2000	WaterNSW (with the assistance of NSW DCCEEW)	Section 90 water supply works approval.
Fisheries Management Act 1994	NSW Department of Primary Industries—Fisheries	**Written notice** of dredging and reclamation work. **Written notice** of proposal to modify a weir on a waterway.
Crown Land Management Act 2016	Crown Lands	No licence is required. NSW DCCEEW has notified and in consultation with Crown Lands.
National Parks and Wildlife Act 1974	Heritage NSW	An AHIP for two items of Aboriginal heritage identified within the study area is required.

5 Consultation

5.1 Community and stakeholder consultation

NSW DCCEEW has undertaken extensive community and stakeholder engagement through the strategic assessment, concept design and investigation phases of the project.

Table 5.1 identifies the key stakeholders that NSW DCCEEW engaged with during these phases. NSW DCCEEW would continue to consult with these stakeholders during the pre-construction and construction phases of the proposed project.

WaterNSW were provided a copy of the draft REF and comments received were reviewed and the REF was updated. Comments provided by WaterNSW related to the need to include further detail on the REF on ownership and operation of proposed assets, access arrangements, reinstatement requirements, safeguards, maintenance requirements and reporting. Comments relating to licencing and funding arrangements are considered best dealt with in consultation with NSW DCCEEW and WaterNSW.

Table 5.1 Key stakeholder groups

Government stakeholders	Community
• NSW Government Ministers • NSW Government agencies and bodies including: NSW DCCEEW NSW DPI Fisheries NSW Public Works Authority WaterNSW Water Administration Ministerial Corporation • Australian Government Ministers • Australian Government agencies including: DCCEEW MDBA • Members of Parliament - state and federal for Murray and Farrer areas • Public landholders • Public asset owners • Local councils including Murrumbidgee Council, Edward River Council and Federation Council	• Nations – Yorta Yorta, Wiradjuri, Wemba Wemba Berapa Berapa • Local Aboriginal Lands Council's – Deniliquin and Cummergunja, • Registered Aboriginal Parties • 5 townships including Morundah, Jerilderie, Conargo, Wanganella and Moulamein • Community and interest groups including environmental groups, advocacy groups, fishing groups, farming groups, recreational groups and water user groups • Private landholders • Private asset owners • Industry and local business • Media

The key stakeholder groups were consulted with via stakeholder engagement activities during the YCMP program.

Table 5.2 details a summary of the key stakeholder engagement activities undertaken for the YCMP program.

Table 5.2 Summary of key engagement activities for the YCMP program

Engagement/communication channel	Purpose	Target audience	Timing	Output summary
Stakeholder Advisory Group (SAG) (formerly Community Advisory Group (CAG))	To be a key communication channel for the proposed project, particularly when COVID-19 restrictions limited face-to-face engagements. The group allows members and their community groups to share information and discuss concerns.	Advisory group members, their community groups, government bodies	Every 3 months, or as needed	26 meetings held
Community information sessions	To provide key details of the proposed project, benefits, needs, timings and contact details.	Wider community and key stakeholders	As required	5 online sessions, plus 10 in person sessions
Fact sheets	To provide key details of the proposed project, benefits, needs, timings and contact details	Wider community	To support key milestones	360 downloads of project overview fact sheet from the project webpage since February 2023
Phone calls, emails and short message service (SMS)	To contact community members and stakeholders directly and advise of timely information	Community members, stakeholders, government bodies	To support key milestones	Over 203 phone calls and text messages and over 2,273 emails.
Meetings	To discuss details and concerns about the proposed project, held in person or online	Community members, stakeholders, government bodies	As required	14 Technical Advisory Group meetings and 7 Design Focus Group meetings held

Engagement/communication channel	Purpose	Target audience	Timing	Output summary
Project webpage **https://dpie.nsw.gov.au/yanco-creek-modernisation-project**	To provide key details of the proposed project, benefits, needs, timings and contact details	Wider community	Regularly updated	1,800+ webpage visitors since February 2023
Advertisements – print, radio, online	To inform the community about information sessions – these channels are trusted sources of information in the community	Wider community	To support community information sessions	Ad campaigns run in: • September 2021 • March 2022 • September 2022
Electronic direct mail	To share updates and engagement opportunities as the proposed project progressed through planning stages.	Subscribers	To support key milestones	Electronic direct mails sent to 100+ subscribers: • September 2021 • March 2022 • August 2022 • November 2022 • September 2023 • March 2024 • May 2024
Water enquiries phone line and project inbox **1300 662 077** **yanco.sdlprogram@dpie.nsw.gov.au**	Provides a free and accessible point of contact for questions and feedback	All stakeholders and community	Ongoing	Responded to as received

Engagement/communication channel	Purpose	Target audience	Timing	Output summary
Maps / diagrams	A visual way of communicating about the proposed project and its benefits Published on project webpage	Wider community	To support key milestones	600 interactive map users on project webpage since February 2023
Surveys	An accessible platform for stakeholders and the broader community to provide feedback and input on the project.	Community members, stakeholders	As required	Field Surveys Aquatic Surveys Fauna Surveys Flora Surveys Cultural Heritage Surveys Geotechnical Surveys Ecological Surveys

5.1.1 Stakeholder Advisory Group

A CAG was established in 2019 to represent the Yanco Creek system. In 2020, this group was converted to the SAG to align with department policy, allowing sitting fees for members. The group has served as a key conduit for relaying broader community feedback.

The group has representation from the following community groups/organisations:

- Yanco Creek and Tributaries Advisory Council (YACTAC)
- Creek Country Alliance
- Tourism
- Murrumbidgee Field Naturalists
- NSW Farmers Association
- Recreational Fishing Clubs
- First Nations
- Federation Council
- Edward River Council
- Murrumbidgee Council
- WaterNSW
- DPI Fisheries
- Environment and Heritage Group
- Commonwealth Environmental Water Office.

5.1.2 Technical Advisory Group

The Technical Advisory Group (TAG) was established to provide technical input on the project's options and design. It consists of representatives from both private and public organisations, including:

- DPI Fisheries
- Murray Irrigation Limited
- Commonwealth Environmental Water Office
- Coleambally Irrigation
- MDBA
- YACTAC
- 3Rivers.

5.2 Statutory consultation – NSW legislation

Transport and Infrastructure SEPP consultation

Part 2.2, Division 1 of the Transport and Infrastructure SEPP contains provisions for consultation with public authorities prior to the commencement of certain types of development. Table 5.3 lists the consultation requirements under the Transport and Infrastructure SEPP.

Table 5.3 Transport and Infrastructure SEPP Consultation

Is consultation required the Transport and Infrastructure SEPP?	Yes	No
Will the proposed activity have a substantial impact on stormwater management services provided by a council? If 'yes', notification to Council is required.	☐	☒
Is the proposed activity likely to generate traffic to an extent that will strain the capacity of the road system in a local government area? If 'yes', notification to Council is required.	☐	☒
Will the proposed activity involve connection to, and a substantial impact on the capacity of, any part of a sewerage system owned by a council? If 'yes', notification to Council is required.	☐	☒
Will the proposed activity involve connection to, and use of a substantial volume of water from, any part of a water supply system owned by a council? If 'yes', notification to Council is required.	☐	☒
Will the proposed activity involve the installation of a temporary structure on, or the enclosing of, a public place that is under a council's management or control that is likely to cause a disruption to pedestrian or vehicular traffic that is not minor or inconsequential? If 'yes', notification to Council is required.	☐	☒
Will the proposed activity involve excavation that is not minor or inconsequential of the surface of, or a footpath adjacent to, a road for which a council is the roads authority under the *Roads Act 1993* (if the public authority that is carrying out the development, or on whose behalf it is being carried out, is not responsible for the maintenance of the road or footpath)? If 'yes', notification to Council is required.	☐	☒
Is the proposed activity likely to affect the heritage significance of a local heritage item, or of a heritage conservation area, that is not also a State heritage item, in a way that is more than minor or inconsequential? If 'yes', notification to Council is required.	☐	☒
Is the proposed activity located on flood liable land? If so, will the works change flooding patterns to more than a minor extent? If 'yes', notification to Council is required.	☐	☒
Is the proposed activity land that is within a coastal vulnerability area and is inconsistent with a certified coastal management program that applies to that land? If 'yes', notification to Council is required.	☐	☒

Is consultation required the Transport and Infrastructure SEPP?	Yes	No
Is the proposed activity located on flood liable land and permissible without development consent under the following provision of Part 2.3 of the Transport and Infrastructure SEPP: (a) Division 1 (Air transport facilities), (b) Division 2 (Correctional centres and correctional complexes), (c) Division 6 (Emergency services facilities and bush fire hazard reduction), (d) Division 10 (Health services facilities), (e) Division 14 (Public administration buildings and buildings of the Crown), (f) Division 15 (Railways), (g) Division 16 (Research and monitoring stations), (h) Division 17 (Roads and traffic), (i) Division 20 (Stormwater management systems). * This section does not apply in relation to the carrying out of minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance. If 'yes', consultation with the State Emergency Service is required.	☐	☒
Is the proposed activity located adjacent to a national park, nature reserve or other area reserved under the *National Parks and Wildlife Act 1974*, or on land acquired under that Act? If 'yes', consultation with the National Parks is required.	☐	☒
Is the proposed activity located on land in Zone E1 National Parks and Nature Reserves? If 'yes', consultation with the National Parks is required.	☐	☒
Does the proposed activity include a fixed or floating structure in or over navigable waters? If 'yes', notification to Roads and Maritime Services is required.	☐	☒
Will the proposed activity increase the amount of artificial light in the night sky within the dark sky region as identified on the dark sky region map? ? If 'yes', notification to the Director of the Observatory is required.	☐	☒
Is the proposed activity located on defence communications facility buffer land within the meaning of clause 5.15 of the Standard Instrument? If 'yes', notification to the Secretary of the Commonwealth Department of Defence is required.	☐	☒
Is the proposed activity within a mine subsidence district within the meaning of the Mine Subsidence Compensation Act 1961? If 'yes', notification to Subsidence Advisory is required.	☐	☒
Is the proposed activity for a specified purpose within bush fire prone land?	☐	☒
Is the proposed activity located within a forestry area within the meaning of the Forestry Act 2012?	☐	☒

Is consultation required the Transport and Infrastructure SEPP?	Yes	No
Is the proposed activity located in land reserved under the Crown Land Management Act 2016 for a public purpose that, in the opinion of the Planning Secretary, is an environmental protection or nature conservation purpose?	☐	☒
Is the proposed activity located within prescribed State land?	☐	☒
Is the proposed activity located on land zoned for conservation purposes?	☐	☒

Based on the review of consultation requirements undertaken in Table , no consultation under the Transport and Infrastructure SEPP is required for the project.

5.2.1 Biodiversity and Conservation SEPP consultation

Clause 5.10(1) of the Biodiversity and Conservation SEPP provides that, for activities proposed within the riverine land of the River Murray, consultation must be carried out by a public authority before carrying out the development. Clause 5.11(1) defines the general provisions for consultation under the Biodiversity and Conservation SEPP. The applicability of these provisions to the proposed activity is outlined in Table 5.4.

Table 5.4 Biodiversity and Conservation SEPP consultation

Consultation under Biodiversity and Conservation SEPP (clause 5.11(1))	Response
(a) Where development is contrary to the aims, objectives or principles of this Chapter and may have a significant environmental effect along the Murray River–the P&D (Vic), C&NR (Vic) and the adjacent local Council in Victoria must be consulted.	Not applicable - The proposed activity is considered to be consistent with the aims and objectives of Chapter 5 of the Biodiversity and Conservation SEPP and is not expected to have a significant environmental effect along the Murray River.
(b) Where development may affect boating safety–Transport for NSW must be consulted.	Not applicable - The proposed activity would not affect boating safety.

As outlined in Table 5.4, consultation under the Biodiversity and Conservation SEPP is not required for the proposed activity.

5.2.2 Fisheries Management Act 1994

Ongoing consultation with NSW Department of Primary Industries Fisheries (NSW Fisheries), regarding the project has occurred in accordance with the requirements of the FM Act. NSW Fisheries has reviewed the project's draft concept and detailed design. Feedback from NSW Fisheries has been used to update the design to provide suitable fish passage.

In addition, representatives from NSW Fisheries have attended the Technical Advisory Group and the Stakeholder advisory group meetings.

As the proposed activity involves instream works including excavation, dredging and temporary blockage of fish passage, notification and/or approval from NSW Fisheries is required under the FM Act as detailed in section 4.4.

5.3 Consultation with Aboriginal communities

The Yanco Creek system traverses the ancestral lands of the Wiradjuri, Bangerang, Yorta Yorta, Barapa Barapa, and Wamba Wamba peoples. The project's boundaries intersect with the jurisdictions of the Local Aboriginal Land Councils of Leeton, Narrandera, Cummeragunja, and Deniliquin.

A comprehensive Aboriginal Community Engagement Strategy was developed for the YCMP Program to identify and engage appropriate Aboriginal stakeholders. Additionally, an Aboriginal Cultural Strategy was formulated to ensure active participation of First Nations people in project matters affecting their cultural heritage. This strategy has been pivotal in safeguarding cultural practices, language, knowledge, and identity throughout the project's assessment phase.

Specific to the Wilson Anabranch Offtake project, eleven Aboriginal stakeholders, including two Registered Aboriginal Parties (RAPs) have been involved in the preparation of the Aboriginal Cultural Heritage Assessment (ACHA), which involved three community meetings. An on-site meeting was also conducted with the Deniliquin Local Aboriginal Land Council (DLALC) representatives.

Further information on consultation undertaken with the registered Aboriginal stakeholders for the project are provided in section 6.8.

5.4 Ongoing stakeholder and community consultation

The communication and engagement approach for the next phase of the project (pre-construction and construction) would focus on raising stakeholder awareness of the YCMP.

The overall engagement approach would include continuing the close working relationship with the Stakeholder Advisory Group members as champions of the project and advocates for the Yanco Creek system. Regular key stakeholder meetings and directly affected landholder engagement would continue.

There would also be continuing information on the project provided to the broader community relating to construction timing, sequencing and any access disruptions.

Once determined, this REF would be placed on public display for information via the NSW DCCEEW website.

6 Environmental assessment

6.1 Topography, geology, and soils

6.1.1 Existing environment

The project area is located within the Riverina bioregion of southern NSW which is characterised by an extensive network of river channels, flood plains, back plains, swamps, lakes and lunettes from the Quaternary age. At times of extreme flood flow, water from these differing streams will often overlap and cross the fan surfaces, entering the channels of neighbouring streams.

The bed level of Wilson Anabranch at the project site is estimated at around 96 m above sea level. The modern river channels of the Murrumbidgee region predominately consist of sandy soils and more saline heavy grey and brown clays towards the outer perimeter of the floodplains on the higher rarely flooded terraces (Eardley, 1999). Sandy soils also form levees, old channels, dunes and lunettes. Along the Murrumbidgee River stream, soils and water will often increase in salinity.

Red-brown and grey clays in the bioregion support grassland communities that are nationally significant. Calcareous, sandy soils, that tend to be features of adjacent bioregions are also present in the Riverina and support mallee communities (Semple 1990, Porteners 1993, cited in Eardley, 1999).

A search of the Australian Soil Resource Information Systems for the occurrence of Acid Sulfate Soils at the project area was undertaken on 11 October 2023. The search results indicate there is a low probability of occurrence of ASS in the project area.

A geotechnical investigation was undertaken on 1 September 2023 for the project site. Below is a summary of the investigation findings as provided in the Yanco Modernisation Part 3 Detailed Design Report (3Rivers, 2024).

- The existing bank is composed of a Clayey to sandy GRAVEL soil (GC) used as fill material, underlain by a layer of Silty CLAY (CH) soil, also utilized as fill material. Beneath this, there exists an additional layer of Silty CLAY (CH). However, the Emerson class for Silty CLAY (CH) in fill is not available. Consequently, it is recommended to remove the fill material and compact the excavated layer appropriately, and then proceed with placing the new embankment.
- The foundation is deemed appropriate for the embankment and the concrete slab. Considering the index test results from the existing embankment, this material can be used in the construction of the new embankment.
- The stability of embankment fill of the Wilson Anabranch Offtake regulator has been assessed for multiple load cases considering the static loading conditions. The critical case loading identified was with upstream water level at 99.90 m AHD and downstream water level at 97.98 m AHD, with a Factor of Safety just over 1.5 assuming the relative permeability of the Silty Clay layers. Careful control of fill material would be required to ensure stability.

The key outcome from the geotechnical findings was that the soil from the existing embankment is suitable for reuse in the new embankment. The other key outcome was that the soil from the identified borrow site should only be used above 98.0 m AHD, to meet embankment fill stability requirements. As a result of this, the existing embankment material should be used in preference to the soil from the identified borrow site.

6.1.2 Impacts

Construction

The project would disturb the surface of the ground during construction through the removal of vegetation and excavation. Establishing site compounds, transporting equipment and material between the compound and work sites would disturb the land surface, which, if not appropriately managed could lead to erosion and sedimentation of the project area.

Erosion and sediment controls would be outlined in the project CEMP and established prior to the commencement of construction in order to avoid and minimise erosion and sedimentation related impacts.

Fuel and oil associated with construction vehicles, plant and equipment are potential sources of pollution. Any spills could potentially be transported into the creek(s) and impact water quality. Site specific controls to manage the risk of accidental spills or leaks of fuels, oils and chemicals would be outlined in the project CEMP and implemented during construction.

Operation

Operation of the project would not impact topography, geology, or soils, outside of any potential hydrology and erosion impacts as assessed in sections 6.2 and 6.3.

6.1.3 Safeguards

The safeguards proposed to avoid, minimise, or manage potential topography, geology, and soil impacts as a result of the project are included in section 8.3.

6.2 Hydrology and water quality

6.2.1 Existing environment

Hydrology

The project area is part of the broader Yanco Creek System which generally flows south-west from the Murrumbidgee River downstream of Narrandera until it joins the Edward River at Moulamein. It is within the mid-Yanco Creek reach which extends from Yanco Creek's confluence with Colombo Creek near Morundah downstream to its junction with Billabong Creek near Conargo.

Two drainage channels (CCD and DC800) discharge from the Coleambally Irrigation district into this reach of Yanco Creek. Structures restricting flows in mid-Yanco Creek include Tarabah Weir, Nine Mile Dam, and McCaughey Block Dam. The Nine Mile and McCaughey dams completely block the

flow in the original Yanco Creek channel but water is diverted around these via the Mundoora Anabranch which has an off-take structure which is in disrepair and flooded out.

The Wilson Anabranch leaves the Mundoora Anabranch near its confluence with the Yanco Creek and rejoins the Yanco Creek about 11 km downstream. At low flows, water enters the Wilson Anabranch from the Wilson Anabranch Offtake structure (when open) and passes through a defined channel. The system quickly becomes braided in medium and high flow conditions. The downstream end of the Wilson Anabranch contains a 1 km length of broadened watercourse lagoon that has well established ecological value and waterbird habitat, contained by a privately owned block bank. There are multiple culvert crossings over the length of the anabranch. There are several other anabranches to the Wilson Anabranch - it is a diverse and braided network (3 Rivers 2022b).

The existing flow regime of the Wilson Anabranch is highly modified, with the upstream control of flows into Wilson Anabranch preventing low flows from entering during the summer months and offering variability during winter when the offtake is open. The existing aquatic values and habitat have developed in response to the existing conditions.

Water quality

The Basin Plan sets water quality targets and objectives to protect water quality in the Basin's rivers for people and livestock as well as for wetlands and floodplains. The Basin Plan requires environmental water managers to consider water quality targets when making decisions about environmental watering and running the river.

Threats to water quality in the Basin include physical and chemical stressors such as high salinity levels, toxins generated by blue-green algal blooms or inappropriate use of chemicals; high levels of nutrients including phosphorus and nitrogen from agricultural activity, stormwater, and erosion; high and low temperature extremes, and low dissolved oxygen levels.

Water Quality Objectives (WQOs) for the Murray River Catchment, of which Wilson Anabranch is a part, have been nominated in both the Basin Plan (MDBA 2018) and the NSW Water quality and river flow objectives (DECCW 2006) and include maintaining appropriate water quality for environmental, social, cultural and economic activities. The WQOs include protection of aquatic ecosystems, visual amenity, primary and secondary contact recreation, water supply (livestock, irrigation, homestead, drinking water) and aquatic foods (cooked) for which there are nominated guideline values that need to be met.

Whilst there is limited current water quality data available for Wilson Anabranch itself, relatively extensive data does exist for Yanco and Colombo creeks which can be used to gain an appreciation of water quality in the project area. Wilson Anabranch Offtake regulator diverts water from mid-Yanco Creek into Wilson Anabranch.

Existing water quality has been measured over various timeframes and frequencies by various stakeholders. Literature and data sources include:

- Water quality technical report for the Murrumbidgee surface resource plan area (SW9) (NSW DPIE 2020)
- Integrated Hydrological Operations Plan for the Billabong, Yanco and Colombo Creeks – Literature Review (Cooling and Gippel 2018)

- Yanco-Billabong Creek Broad-scale Wetland Monitoring Project: Frog communities of the Yanco-Billabong creek system (Walcott et al, 2018)
- Murrumbidgee valley annual surface water quality report: 2021-2022 (NSW DPE 2022b).

Historical water quality data was collected throughout the Yanco Creek system between 1993 and 2003 at five sites for a number of indicators including Total Suspended Solids (TSS), turbidity, total phosphorus, pH, dissolved oxygen and electrical conductivity (refer to Appendix C Aquatic Ecology and Water Quality Assessment). Three sites were monitored in Yanco Creek upstream of Wilson Anabranch: at offtake, at Morundah and at Yanco Bridge. Monitoring during these times shows that turbidity, TSS and total phosphorus concentrations in Yanco Creek increased with distance downstream. Elevated turbidity and TSS (and subsequently total phosphorus) were likely attributed to stream bank instability and altered flow and flooding regimes. pH levels are generally neutral and conductivity whilst variable was always within acceptable ranges. Dissolved oxygen concentrations decrease with distance downstream often falling below 85% saturation, possibly due to eutrophic conditions.

Yanco Creek was also sampled at two sites between 2007 and 2015 and generally exhibited fair water quality with median results generally within acceptable limits with the exception of turbidity and total phosphorus (Table 6.1) (NSW DPIE 2020). Similar to the monitoring outlined above, values tended to be higher at the downstream site. Although median levels comply, many parameters regularly exceeded guidelines in Yanco Creek.

More recent monitoring of Yanco Creek at the two sites above showed that many variables were similar to those recorded previously, however:

- total phosphorus and total nitrogen were elevated and above guidelines at both sites
- electrical conductivity was elevated and above guidelines at Yanco Bridge
- dissolved oxygen (%) was lower at Morundah, but still within guidelines (NSW DPE 2022b).

Water quality was monitored near the downstream end of Wilson Anabranch in October and December 2017 (Walcott et al, 2018). The following values were recorded:

- Temperature – 26.07 ^{0}C
- Conductivity – 150 uS/cm
- Dissolved oxygen (%) – 120.2%
- Dissolved oxygen (mg/L) – 9.50 mg/L
- pH – 7.36
- Turbidity – 239.17 NTUs
- Depth – 0.25m (Walcott et al. 2018).

Although this monitoring indicates that the wetlands can be warm, with high dissolved oxygen and turbidity, Walcott et al (2018) identified that these water quality values are 'within a normal range for freshwater wetlands.

Table 6.1 Median, 75th Percentile, 90th Percentile (25th and 10th percentiles for dissolved oxygen and pH) and number of samples taken water quality values for Colombo and Yanco Creek between 2007and 2015 (NSW DPIE 2020)

Indicator	Yanco Creek at Yanco Bridge – 28 km north-east of Project				Yanco Creek at Morundah – 79 km north-east of Project				Guideline
	Median	Q75	Q90	N	Median	Q75	Q90	N	
Total nitrogen (mg/L)	0.56	0.72	0.98	65	0.4	0.59	0.9	93	0.6[1]
Total phosphorus (mg/L)	0.074	0.091	0.11	65	0.059	0.07	0.08	94	0.05[1]
Turbidity (NTU)	78	117	142	68	58	72	98	93	35[1]
Total suspended solids (mg/L)	44	55	68	65	51	68	86	92	No guideline
Dissolved oxygen (% saturation)	79	61 (Q25)	49 (Q10)	67	95	86 (Q25)	77 (Q10)	92	80-110%[1]
pH	7.0	6.9 (Q25)	6.7 (Q10)	67	7.3	7.0 (Q25)	6.8 (Q10)	93	6.5-8[1]
Electrical conductivity (µS/cm)	150	175	214	65	132	173	202	92	162 (median)[1]

Note: 1. Basin plan water quality target

The key water quality issues for the Yanco and Colombo Creeks include elevated turbidity, blackwater and presence of blue-green algae (Cooling and Gippel 2018). Elevated turbidity in Yanco Creek, which is generally higher in summer, frequently reached 120ppm (suspended sediment) and has been documented to be an issue for water treatment at Jerilderie. Additionally, elevated turbidity presents a risk to aquatic ecosystems and may also impact on the visual amenity and suitability for recreation (primary and secondary) due to reduced visual clarity. Elevated TSS concentrations could impact on the suitability for consumption of aquatic foods (cooked) which requires TSS in freshwater to be less than 40mg/L (ANZG 2018).

Blackwater events occur during inundation of the floodplains and result in a decline in dissolved oxygen which can result in anoxic conditions and release tannins due to decay of leaf litter creating tea coloured watered which has been recorded in Yanco-Billabong Creek system (NSW DPIE 2020). These changes in water quality can result in significant fish kills and failure to meet nominated WQOs including protection of aquatic ecosystems, visual amenity, recreation, consumption of aquatic foods (cooked) and stock and domestic uses.

Blue-green algal blooms occur due to elevated nutrient concentrations and low flows, particularly in summer. Similarly, to blackwater events, presence of blue green algae can result in failure to meet WQOs, particularly as water contaminated by blue-green algae is toxic to humans and stock.

6.2.2 Impacts

Hydrology

Construction

As described in section 6.2.1 the existing flow regime of Wilson Anabranch is historically highly modified and has periods of no flow.

The construction of the project may require the temporary installation of an earthen bank cofferdam upstream and downstream of the project area. These structures have the potential to alter flows temporarily between Yanco Creek and Wilson Anabranch.

These temporary impacts to the existing flow regime of Wilson Anabranch would depend on the sizing of the cofferdam, how complete the barrier is within the waterway, the timing of the construction, and duration the temporary structure is in place. If the cofferdam is constructed and removed when the existing regulator is normally closed (i.e. 1 September to 31 March), then the cofferdam would not alter flow regimes compared to existing conditions. If the cofferdam is in place at a time when the existing regulator is normally open (i.e. 1 April to 31 August), the flow regime of the anabranch would be altered from existing conditions.

Given a cofferdam may be required, if construction were to occur during the period when the existing regulator is normally open (i.e. 1 April to 31 August), without safeguards it is considered likely that the existing flow regime of the anabranch would be impacted during construction and negative effects to aquatic values and habitats could occur. However, if safeguards and mitigation measures are implemented as outlined in section 8.3, including the need to allow water delivery to Wilson Anabranch for the same number of days within the same calendar year, the potential negative effects on the flow regime within the anabranch would be unlikely to occur during construction.

Operation

Following the completion of construction, the new regulator structure is proposed to be operated in line with the general operating principles described in the Yanco Creek System Operations Plan, (draft as of November 2023). It would generally be operated as per the current operational regime, namely open between 1 April to 31 August and closed between 1 September and 31 March. As such, the hydrological regime would be largely the same as the existing regime. However, the new infrastructure would provide greater control and measurement of environmental water entering the anabranch and would also provide greater flexibility to environmental water managers to deliver environmental water as required and in accordance with the management plans developed by environmental managers (e.g. Commonwealth Environmental Water Office Water Management Plan 2022-23).

Based on the design drawings for the new structure, the proposed 1200 x 1200 box culvert is substantially larger than the 750 mm diameter pipe currently in place, so when fully open it would allow for the conveyance of greater volumes of water at a given time. Changes to the overall anabranch hydrology are expected to be minor and remain similar to what occurred prior to the project. The greater control and measurement of flows would provide opportunities to provide environmental water to the anabranch during spring and summer. Therefore, any potential adverse

hydrological changes to Wilson Anabranch are considered unlikely during the operation phase of the project.

Water quality

Construction

Construction of the project has the potential to result in water quality impacts to downstream environments through:

- vegetation removal exposing soils to weathering processes and increasing the risk of erosion and sedimentation
- earthworks including stripping topsoil, excavations and placement of fill as required. Soils exposed during earthworks have the potential to be mobilised to downstream environments via wind and stormwater runoff
- construction traffic and heavy vehicles could cause ground disturbance that leads to increased risk of erosion and sedimentation.

The potential sources of water quality stressors may be:

- pollutants from accidental spills or leaks of fuels and/or oils from the maintenance, refuelling and use of construction plant equipment and vehicle movement traveling to and from site
- litter and other pollutants associated with establishment and use of construction sites and construction compounds.

Safeguards relating to construction impacts on water quality include:

- Water quality sampling to be obtained from Wilson Anabranch (upstream and downstream of construction activities) prior to construction. This would allow for a more accurate assessment and management of potential impacts during construction.
- Site specific controls to be developed to manage the risk of accidental spills or leaks of fuels, oils and chemicals (such as hydraulic oils), or concrete, during construction. These controls would be documented in the CEMP and would include:
  - Emergency spill response procedure in accordance with the NSW DCCEEW incident management protocols.
  - Site specific controls to reduce the risk of the release of potentially harmful chemicals from spills or leaks entering waterways downstream.
  - Storage of hazardous materials such as oils, chemical and refuelling activities in bunded areas within contractor's temporary work areas.
  - Bunded receptacles for concrete waste including concrete slurries and washout water provided at the work sites to capture, contain, and appropriately dispose of any concrete waste at a suitably licenced waste facility. These would be located as far from waterways as feasible.

Operation

There is potential for accidental spills and leaks of various toxic substances to occur during the operation of the project, primarily related to the use of vehicles within the area and maintenance works. However, by developing a standard Operational Environmental Management Plan as well as the implementation of safeguards (refer to section 8.3), these potential adverse impacts from spillage or leaks are considered to be unlikely.

6.2.3 Safeguards

The safeguards proposed to avoid, minimise, or manage potential impacts on hydrology and water quality as a result of the project are included in section 8.3.

6.3 Groundwater and salinity

6.3.1 Existing environment

Groundwater in the locality of the project is covered by the *Water Sharing Plan for the Murrumbidgee Alluvial Groundwater Sources Order 2020*. The plan covers groundwater within alluvial deposits associated with the Murrumbidgee River, including its tributaries and anabranches from the Jugiong area in the east to Balranald in the west. Two groundwater sources covered by the plan are identified in the locality, being a shallow alluvium and a deep alluvium – the Lower Murrumbidgee Shallow Groundwater Source and the Lower Murrumbidgee Deep Groundwater Source, respectively.

The shallow Shepparton Formation generally consists of yellow and brown poorly sorted sand and clay sediments that extend to depths of between 50 and 70 m below ground level. This aquifer may also be overlain by shallower perched groundwater leaking from recharge sources such as the river. The deeper Calivil Formation and Renmark Group sequences are to a maximum of approximately 170 m deep near Narrandera. For management purposes the sand and clay deposits of these deeper groups are defined as greater that 40 m deep to their base (DPIE 2019, Kumar 2010).

The dominant recharge process into the Lower Murrumbidgee Shallow Alluvium is infiltration from rainfall and irrigation activities, leakage from the Murrumbidgee River and its tributaries and anabranches, and throughflow from the Mid Murrumbidgee Alluvium (located upstream of Narrandera). The connection between the alluvium and surface water in the Lower Murrumbidgee Alluvium is characterised by the loss of surface water from the Murrumbidgee River to the groundwater. The anabranches and distributary channels, such as Wilson Anabranch and Yanco Creek, are also losing surface water to groundwater (DPIE 2019).

The closest groundwater bore to the project site is approximately 1.8 km to the south south-east of the project site (Site ID – GW103435) which is a 32.5 m deep bore hole drilled in 1997. Results from the bore's construction illustrate the sand and clay layers of the Shepparton Formation, with the geological structures classed as upper tertiary to quaternary sediment aquifer.

The closest monitoring bores are distant from the project site at approximately 11.2 km to the south-west and 17.3 km to the north north-east - WaterNSW sites GWMA016 to a depth of 139 m and GWMA002 to a depth of 234 m (WaterNSW 2023). These bores have been regularly monitored for groundwater levels from 2009 to present. At these bores the depth to water below ground level over the period of record was, respectively, a minimum of 16.5 m and 22.3 m.

The closest monitoring bores at which multiple samples of salinity levels have been recorded are 25 km west (GW036053) and 31 km north-east (GW030323) (Bureau of Meteorology 2023). The records from these locations were as follows:

- Site GW036053 – salinity of 170-632 μ S/cm for 15 results from samples taken between 1974-1980 (depth to water was a minimum of 12.3 m)
- Site GW030323 – salinity of 600-1110 μ S/cm for 27 results from samples taken between 1974-2018 (depth to water was a minimum of 15.5 m).

Groundwater Dependant Ecosystems

The Murrumbidgee alluvium is dominated by the Groundwater Dependent Ecosystems (GDE) communities of River Red Gum woodland wetlands, River Red Gum-Lignum wetlands, freshwater wetlands, River Red Gum-Black Box and River Red Gum-Yellow Box woodland wetlands and Cumbungi rushland. These communities are generally characterised by having a high number of threatened species, endangered ecological communities, extensive connected riparian corridors and basin target vegetation species of Black Box, Lignum and River Red Gums. Generally, the GDE communities with high ecological value have large vegetation patches, are highly connected (such as along riparian corridors) and have a high number of threatened species present (DPIE 2019). The water sharing plan identifies high priority GDE in the locality, in the riparian corridors of Wilson Anabranch and Yanco Creek.

The aquatic ecosystems along Wilson Anabranch and associated Yanco Creek have a low potential to be groundwater dependent. The aquatic ecosystems within Wilson Anabranch and Yanco Creek are likely to be primarily inflow dependant. The terrestrial ecosystems generally have high potential to be groundwater dependant.

6.3.2 Impacts

The potential for impact upon groundwater is greatest during the construction phase. During this period the existing block bank, regulator and surrounding areas would be subject to disturbance associated with site preparation, removal of the existing regulator and installation of the new regulator. Construction works may include the removal of groundwater-dependent vegetation during site preparation and excavation for the proposed regulator.

The base of the proposed regulator would sit at the waterway bed level with a cut off wall extending a further 1 m into the waterway bed. The shallow nature of these works means that they are unlikely to intersect with the shallow aquifer or alter recharge based on the above information from the locality. However, the construction of these works is likely to intersect with shallow ground water associated with infiltration from Wilson Anabranch and Yanco Creek.

Groundwater in the shallow aquifer from the bores referenced above is, relative to the depth of the proposed works, deep at greater than 12.3 m below the ground surface. The location of the proposed works being within Wilson Anabranch would mean that any groundwater intercepted within the construction area is likely from recent infiltration of surface water beneath the creek bed and into the creek banks. These factors suggest that it is unlikely that there would be any direct or indirect impacts on the aquifers beneath the locality. As such, the project does not meet the definition of an aquifer interference activity requiring approval under section 91(3) of the *Water Management Act 2000*.

During construction and operations a variety of dispersible liquids, including fuels, lubricants and chemicals, would be used which pose a potential pollutant threat to local water quality. The use of these liquids may pose a risk to water quality in the event of a spill or discharge, however the potential for groundwater interaction or contamination is very small. Appropriate mitigation measures would be implemented to avoid and minimise this risk of contamination. Environmental impacts to groundwater during the construction and operational phases are considered very unlikely due to the recorded depth of aquifers in the locality and limited potential for groundwater interaction during the proposed construction and operations.

Long-term changes to salt load in the Murray River are managed through the Basin Salinity Management 2030 (BSM2030) Strategy, under the Murray-Darling Basin Agreement. Accountability for long-term changes in salinity is expressed in terms of change in Murray River salinity at Morgan, South Australia, measured in electrical conductivity (EC). There are agreed procedures that outline the requirements for assessing the salinity effects under the BSM2030 Strategy to ensure equivalent assessment can be made across the Murray-Darling Basin. These include using accredited river salinity models, standard weather conditions and agreed sequencing of actions.

The *Preliminary Salinity Impact Assessment for SDLAM case study projects* (Jacobs, 2023) provides an assessment of the YCMP to determine the need for accountability under BSM2030, as required and in accordance with, the NSW DCCEEW Preliminary Salinity Assessment Procedure (EMS-WG-PRO-04/005). The Jacobs 2023 report estimates the total salinity impact on creeks in the Yanco system to be approximately 0.054 T/day, which converted to an EC impact of 0.067 EC at Morgan. The assessment concludes that the YCMP is not an accountable action (being an insignificant impact (<0.1EC at Morgan)) and there is no need for further analysis under EMS-WG-PRO-04/005.

6.3.3 Safeguards

A CEMP, including site specific erosion and sediment control and spill response would be prepared prior to works commencing to guide the implementation of environmental safeguards to mitigate risks to groundwater quality.

6.4 Terrestrial biodiversity

A Biodiversity Impact Assessment was undertaken and prepared as part of this REF (refer to Appendix B Biodiversity Impact Assessment). It assesses the potential impacts on biodiversity values as a result of the construction and operation of the project, with a particular emphasis on threatened ecological communities, populations and species listed under the NSW BC Act and FM Act, as well as the MNES listed under the Commonwealth EPBC Act.

These findings from the Biodiversity Impact Assessment are summarised below.

6.4.1 Methodology

For the purposes of the Biodiversity Impact Assessment, the following terms in addition to those terms defined in section 3.1.1, were used:

- The '**Study Area**' – the area associated with works. inclusive of the 'Clearing Area' and the 'Construction Activity Zone', which may also be subject to indirect construction impacts.
- The '**Locality**' – the area within a 20 km radius of the project area.

Literature and desktop reviews

A desktop review was undertaken in order to identify the potential for threatened flora and fauna species, populations, and ecological communities listed under the BC Act, FM Act, and EPBC Act occurring within the study area.

The following desktop databases were reviewed prior to conducting field surveys. These databases examined land within the project area as well as the locality:

- BioNet Atlas for records of threatened species listed under the BC Act and EPBC Act which have been recorded within the locality (NSW DCCEEW, 2024, report generated 25/07/2024)
- Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (PMST) for MNES listed under the EPBC Act which may occur in the study area (Cwth DCCEEW, 2024, report created 25/07/2024)
- NSW threatened species profiles (DPE 2023a) and Commonwealth Species Profile and Threats Database (Cwth DCCEEW 2023) for descriptions of the ecology, distribution and habitat requirements of threatened biota
- NSW BioNet Vegetation Classification (VIS 2.1) – Community Identification (DPE, 2023b) to help identify candidate plant community types in the study area
- DPI Fisheries Spatial Portal (DPI 2023)
- existing vegetation mapping of the locality presented in the NSW SVTM (DPE 2023c)
- historical aerial photographs of the study area accessed via the Historical Imagery viewer (NSW Government, 2023)
- priority weed declarations for the Edward River Council LGA (DPI, 2023)
- aerial photography of the study area.

Previous biodiversity studies of the locality were also reviewed including:

- Yanco-Billabong Creek Broad-scale Wetland Monitoring Project: Frog communities of the Yanco-Billabong creek system (Walcott et al 2018)
- Yanco Creek and tributaries: Intensive frog surveys of creek and farm habitats 2019-20 (Turner et al 2020).

Following the desktop assessment and literature review, a 'likelihood of occurrence' assessment was prepared with reference to the habitats contained within the study area. Identification of potential habitat for threatened and migratory species was based on information provided in the species profiles (DPE 2023a, Cwth DCCEEW 2023), recovery plans, journal articles, and the field staff's knowledge of species habitat requirements. The likelihood of occurrence assessment was further refined following field surveys. The likelihood of threatened and migratory biota occurring in the study area was assessed based on presence of records from the locality for the last 20 years (since 2003), species distribution and habitat preferences, and the suitability of potential habitat present in the study area. The results of this assessment are provided in Appendix B of the Biodiversity Impact Assessment report (refer to Appendix B Biodiversity Impact Assessment of this REF) and are summarised below in section 6.4.3.

Field surveys

A preliminary field survey was conducted by GHD ecologists on 9 June 2022. A series of follow-up surveys were conducted on 28 July 2022, 2 March 2023 and 7 March 2023. These field surveys considered a broader study area surrounding the project footprint, which has since been refined to focus on the study area for the purposes of this REF. Refer to Figure 6.1 below for an overview of the survey effort, vegetation zones and habitat resources.

Field surveys focused on the identification of vegetation types, the presence and extent of threatened ecological communities within the study area and an assessment of the value of habitats present for threatened biota.

The following methods were used during field surveys:

- Vegetation mapping – The study area's existing vegetation mapping was verified through on-site field surveys, aerial photograph analysis, and GPS data, which involved categorizing native vegetation into distinct zones based on various factors, including vegetation structure, species composition, soil type, landscape position, and the BioNet Vegetation Classification.
- Targeted flora surveys – Targeted surveys were conducted to assess the presence of threatened flora species within the study area, focusing on species with known distributions, previous local records, and suitable habitat conditions; random meander transects, following Cropper's (1993) methods, were used in impact zones and adjacent vegetation, with particular attention to cryptic species, including an evaluation of habitat suitability for these species.
- Terrestrial fauna surveys, including:
  - Fauna habitat assessments – fauna habitat assessments were conducted in the study area including searches for shelter, roosting, nesting, and foraging areas, as well as the identification of specific habitat features. Prior to fieldwork, habitat criteria for targeted threatened species were established. Assessments involved the search for valuable

resources such as tree hollows, burrows, distinctive scats, tracks, feeding activity evidence, and specific food trees, with findings documented using GPS and photographs.

- Diurnal bird surveys – Diurnal fauna surveys were conducted during a walked random meander throughout the study area. All birds observed and heard were recorded. Opportunistic and incidental observations of birds were recorded during field surveys in conjunction with habitat assessments.
- Spotlighting and call playback – One night of spotlighting and call playback was completed targeting the following species, including the Southern Bell Frog, Bush-stone Curlew, Koala, and threatened forest owls. Methods included walking transects along tracks, scanning trees and hollows, and broadcasting calls using a speaker with a minute gap between calls. Spotlighting and call playback for the Southern Bell Frog followed guidelines from the NSW Survey Guide for Threatened Frogs (DPE 2020).
- AudioMoth detector survey – An AudioMoth device was deployed for two nights near the Wilson Anabranch regulator to monitor the Southern Bell Frog. It recorded from 6pm to 6am between 28 February to 3 March 2023, programmed with a sample rate of 8000 Hz, high gain, and a sleep/record cycle enabled, capturing 120 seconds of audio every 15 minutes using the AudioMoth Configuration App (Version 1.7.1, Open Acoustic Devices).
- Opportunistic observations – Opportunistic and incidental observations of fauna species were recorded at all times during the field surveys. Survey effort was concentrated on suitable areas of habitat, for instance any fallen timber was scanned and/or turned for reptiles and mature trees and dams were scanned for roosting birds. Birds were identified by sight and call.

Survey limitations

The field surveys were not designed to detect all species, but rather to provide an overall assessment of the ecological values within the study area. Some species, such as annual, ephemeral or cryptic flora species and mobile, migratory, transient or cryptic fauna may not have been present or detectable at the time of survey. The survey conducted was suited to the existing condition of the study area in relation to historical and on-going land management. Given the heavy rains and flooding experienced in the summer of 2022-2023, targeted surveys for the Southern Bell Frog were unable to be completed earlier in the season, when the species is most likely to have been active and vocal. Instead, surveys were restricted to late in the season when the species is likely to have already bred and unlikely to be as vocal, as access to the site was unavailable during the prime survey period.

Targeted mammal trapping surveys and nocturnal surveys were outside the scope of the assessment and were not undertaken.

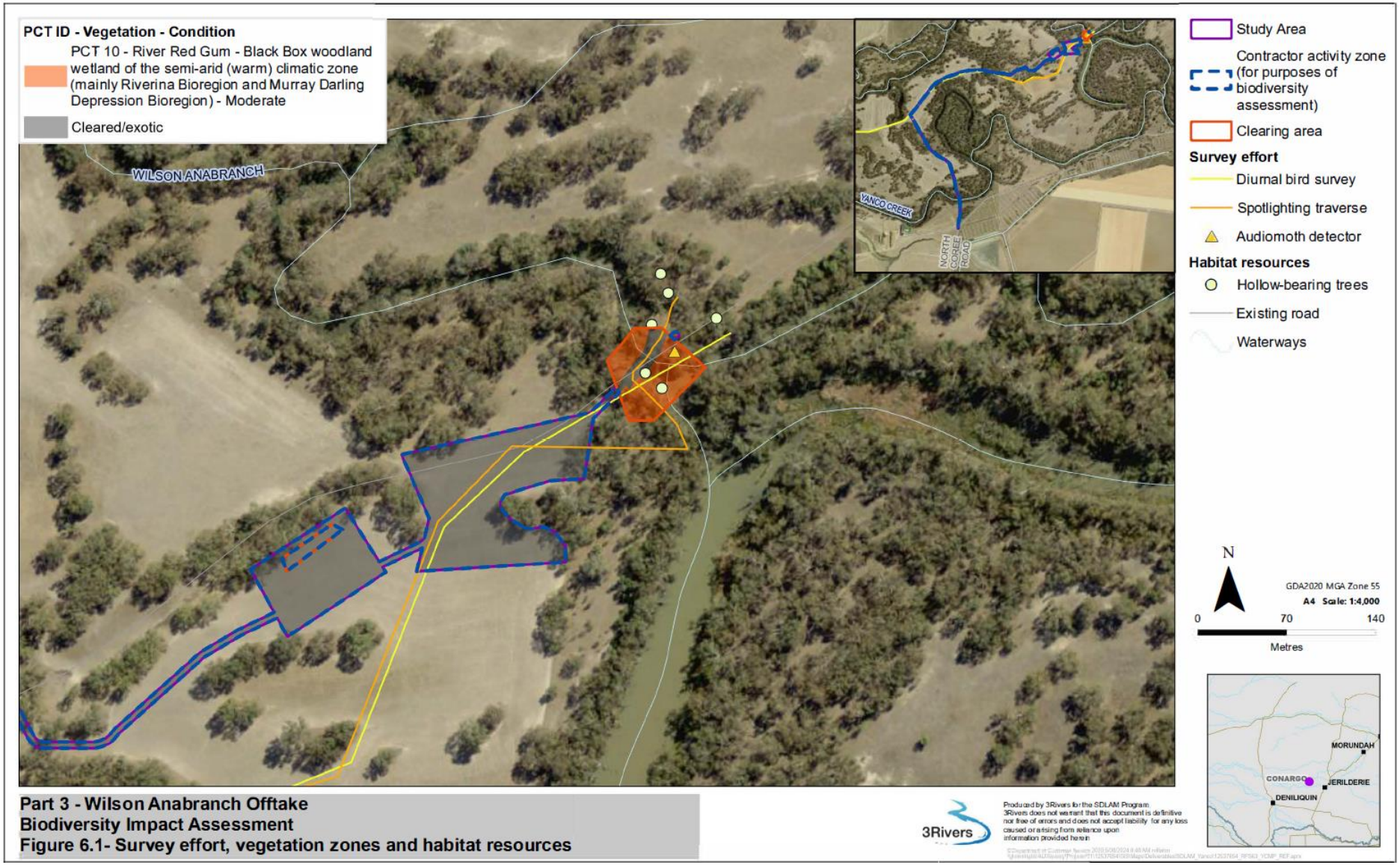

Figure 6.1 Survey effort, vegetation zones and habitat resources

6.4.2 Existing environment

Vegetation

The study area is positioned within the riparian corridor of Wilson Anabranch. The broad study area contains a mixture of intact native vegetation and land with some native vegetation that is used for agricultural production and grazing. Historical aerial imagery shows that cleared land within the study area has been exposed to ploughing and/or agricultural farming. The NSW SVTM acknowledges the following PCTs to occur within the study area:

- PCT 2: River Red Gum-sedge dominated very tall open forest in frequently flooded forest wetland along major rivers and floodplains in south-western NSW (DPE 2023c)
- PCT 5: River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion (DPE 2023c)
- PCT 44: Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion (DPE 2023c).

However, during field surveys the plant community assemblage and structure was ground-truthed and identified only one PCT to occur within the study area:

- PCT 10: River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion).

Table 6.2 provides a detailed description of the PCT identified to be present within the study area. A further comprehensive list of all flora identified within the study area is provided in Appendix A of the Biodiversity Impact Assessment (refer to Appendix B Biodiversity Impact Assessment of this REF).

Table 6.2 Vegetation zones within the study area (DPE 2023b)

PCT	PCT ID	Conservation significance	Description summary	Condition	Landscape position	Image
River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	10	Not listed as a Threatened Ecological Community (TEC)	• This community occurs alongside the banks of Wilson Anabranch within the study area, on low-lying areas often with semi-permanent inundation. • It is representative of a riparian woodland community with a canopy predominantly comprised of *Eucalyptus camaldulensis* (River Red Gum). • The shrub layer is sparse and exclusively comprised of *Acacia salicina* (Native Willow) and *Sclerolaena muricata* (Black Roly Poly). • A sparse cover of native grasses and forbs is present including *Paspalidium jubiflorum*, *Brachyscome paludicola* and *Lobelia concolor* (Poison Pratia). • The understorey has been subject to cattle grazing and is dominated by exotic species such as *Marrubium vulgare* (Horehound), *Lolium perenne* (Ryegrass), Patterson's Curse (*Echium plantagineum*), *Hordium leporinum* (Barley Grass) and White Clover (*Trifolium repens*).	Moderate	Occurs within the riparian corridor along Wilson Anabranch	 Figure 6.2 Vegetation typical of moderate condition PCT 10 within the study area

Priority weeds

Priority weeds listed under the *Biosecurity Act 2015* are those plants with restrictions on their trade and movement and have the potential to negatively impact the NSW environment, economy, and community. No species declared as a priority weed in the Murray Local Land Services Region were identified within the study area (DPI 2023).

Fauna and fauna habitat

Based on the literature and desktop reviews, as well as the field surveys conducted, three primary fauna habitat types were determined to be present within the study area:

- Riverine woodland
- Wetlands and waterways
- Grassland and cleared areas.

Further descriptions of these habitats are provided in Table 6.3 below.

Table 6.3 Fauna habitats in the study area

Habitat type	Description	Typical fauna recorded or likely to occur	Image
Riverine woodland	Riverine woodland in the study area has very good habitat connectivity to other riverine vegetation along Wilson Anabranch and the adjacent Yanco Creek and Lignum Creek. There are extensive riparian corridors dominated by River Red Gum on the floodplains between these creeks, as well as areas of grassy open woodland within a mosaic of cleared agricultural landscapes. These riparian corridors would enable the movement and dispersal of small arboreal and terrestrial mammals between these creeks in the broader study area. Riverine woodland in the study area fringes wetland vegetation and swamps within Wilson Anabranch. Habitat resources are present within all strata. Canopy species include a monotypic stand of River Red Gum (Eucalyptus camaldulensis) which support flowering resources for nectar-feeding fauna species, including honeyeaters, parrots, bats and arboreal mammals. There is a high density of hollow-bearing trees within the study area. These trees include small, medium and large hollows with a range of orientations and landscape positions in both living and dead trees. These hollow-bearing trees are likely to be used as a nesting or denning resources for arboreal mammals, owls and parrots. Large amounts of woody debris are present under a mature canopy, with a moderate leaf litter cover present. The understorey is thick with grass and grass-like vegetation; however, the grassy understorey it is relatively short, possibly as a result of grazing by both native herbivores and domestic livestock.	• Nectarivorous birds: White-naped Honeyeater (*Melithreptus lunatus*), White-plumed Honeyeater (*Ptilotula penicillatus*), Spotted Pardalote (*Pardalotus punctatus*), Yellow Thornbill (*Acanthiza nana*), Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*) • Birds of agricultural landscapes: Galah (*Eolophus roseicapillus*), Little Raven (*Corvus mellori*) and Willie Wagtail (*Rhipidura leucophrys*) • Arboreal mammals: Common Brushtail Possum (*Trichosurus vulpecula*), Sugar Glider (*Petaurus breviceps*) • Forest owls: Southern Boobook (*Ninox novaeseelandiae*) as well as the threatened Barking Owl (*Ninox connivens*) and Masked Owl (*Tyto novaehollandiae*) which whilst not recorded during field surveys, may occur based on the presence of suitable habitat. • Ground-dwelling mammals: Eastern Grey Kangaroo (*Wallabia gigantea*), Swamp Wallaby (*Wallabia bicolor*) and Yellow-footed Antechinus (*Antechinus flavipes*).	 Figure 6.3 Riverine woodland within the study area  Figure 6.4 Riverine woodland within the study area

Habitat type	Description	Typical fauna recorded or likely to occur	Image
	This habitat type is likely to have been impacted in the past during construction of the existing offtake area and access road into the project site. Despite this past disturbance and the ongoing impacts of agricultural activities in surrounding areas, within the study area the canopy is contains large, mature trees. A small dense patch of regenerating River Red Gum was recorded adjacent to the study area and may provide some habitat for species that utilise shrubby midstorey resources.		
Wetlands and waterways	The portion of the Wilson Anabranch waterway intersecting the study area is up to ~40m wide. Within the study area, Wilson Anabranch is heavily vegetated with emergent plants including *Typha spp.*, which may impede flows. Wilson Anabranch also contains overflow channels in the broader study area that contain slower moving brackish water and an abundance of *Lignum* spp. and *Typha spp.* Wilson Anabranch contains both deep and shallow water in the broader locality. Differences in water levels may be due to woody debris impeding water flow. Given these features, wetland habitat in the study area is likely to represent habitat for frogs and wetland birds. Both guilds are likely to breed, forage and take refuge in the cover provided by aquatic vegetation within Wilson Anabranch. Perching habitat for wetland birds is present throughout Wilson Anabranch and includes inundated stags and living mature trees, inundated woody debris as well as overhanging canopies from adjacent River Red Gums. There are also patches of regenerating River Red Gum north of the offtake area that	• Large wading birds including White-necked Heron (*Ardea pacifica*) and Purple Swamphen (*Porphyrio porphyrio*) • Wetland birds that shelter in dense emergent vegetation including Australian Little Bittern (*Ixobrychus dubius*), Buff-banded Rail (*Hypotaenidia philippensis*) and Australian Spotted Crake (*Porzana fluminea*) • Wetlands birds common to disturbed wetlands including Eurasian Coot (*Fulica atra*), Pacific Black Duck (*Anas superciliosa*) and Australian Wood Duck (*Chenonetta jubata*) • Frogs including the Spotted Marsh Frog (*Limnodynastes tasmaniensis*), Perons Tree Frog (*Litoria peronii*), Eastern Sign-bearing Froglet (*Crinia parasignifera*) and Barking	 Figure 6.5 Waterways within the study area

Habitat type	Description	Typical fauna recorded or likely to occur	Image
	are currently inundated and may provide perching habitat for a variety of species. A small patch of *Typha spp*. occurs within the southern portion of the study area (upstream of the existing offtake), however this is unlikely to be used by colonial nesting birds, given its small size and presence of large patches of Typha upstream. Larger patches of *Typha spp*. in this river system at least 100m away may provide nesting habitat for these species in the broader study area.	Marsh Frog (*Limnodynastes flectcheri*). For a high-level assessment of the aquatic environment, including aquatic species and habitat occurring within the study area, refer to section 6.5 of this REF.	 Figure 6.6 Waterways within the study area
Grassland and cleared areas	There are some areas of grassland associated with the existing offtake, as well as within the existing and proposed access track footprints. Grassland habitat within the existing access track and offtake is partially denuded due to consistent vehicle use and maintenance of the track. The Contractor Activity Zone comprises degraded exotic grassland habitat with all species present reduced to short, grazed grasses, as a result of heavy grazing activities. Habitat values within grassland and cleared areas are restricted to foraging resources for granivorous and insectivorous birds as well as macropods. Grassy depression may provide temporary moist refuge habitats for grassland adaptive frogs.	• Macropods including the Eastern Grey Kangaroo (*Macropus giganteus*), Swamp Wallaby (*Wallabia bicolor*) and Common Wallaroo (*Macropus robustus*) • Granivorous birds of grasslands including Eastern Rosella (*Platycercus eximius*), Blue Bonnet (*Northiella haematogaster*) and Sulphur-crested Cockatoo (*Cacatua galerita*) • Insectivorous birds of agricultural areas including Crested Pigeon (*Ocyphaps lophotes*), Grey Fantail (*Rhipidura albiscapa*) and Little Raven (*Corvus mellori*)	 Figure 6.7 Grassland and cleared areas within the study area (including the existing access tracks)

Habitat type	Description	Typical fauna recorded or likely to occur	Image
		• Raptors including Black-shouldered Kite (*Elanus axillaris*), Nankeen Kestrel (*Falco cenchroides*), Whistling Kite (*Haliastur sphenurus*), Wedge-tailed Eagle (*Aquila audax*) and Brown Goshawk (*Accipiter fasciatus*) • Frogs of grassy depressions including the Spotted Marsh Frog (*Limnodynastes tasmaniensis*), Perons Tree Frog (*Litoria peronii*), Eastern Sign-bearing Froglet (*Crinia parasignifera*) and Barking Marsh Frog (*Limnodynastes flectcheri*)	 Figure 6.8 Grassland and cleared areas within the study area (including the existing access tracks)

Migratory fauna species

No migratory species listed under the EPBC Act were observed within the study area during field surveys. However, the desktop assessment identified a number of migratory species predicted to occur within the locality including several that have the potential to occur in the study area, based on the habitats present.

The following migratory species may forage within woodland riparian vegetation within Wilson Anabranch on occasion:

- Satin Flycatcher (*Myiagra cyanoleuca*)
- White-throated Needletail (*Hirundapus caudacutus*)
- Fork-tailed Swift (*Apus pacificus*).

Important habitat for these migratory birds is defined in the significance criteria for listed migratory species (DotE 2013) as follows:

- habitat utilised by a migratory species occasionally or periodically within the region that supports an ecologically significant proportion of the population of the species
- habitat that is of critical importance to the species at particular life-cycle stages
- habitat utilised by a migratory species which is at the limit of the species range
- habitat within an area where the species is declining.

The study area is not considered important habitat for any of these species, according to the significant impact criteria for migratory species (DotE 2013). This is due to the fact that the habitat in the study area would not support an ecologically significant proportion of the population of these species, is not of critical importance to these species at particular life-cycle stages, is not at the limit of these species' ranges, and is not within an area where these species are declining.

Conservation significance

Threatened ecological communities

Vegetation within the study area is not commensurate with any TECs listed under the BC Act or EPBC Act.

The study area is within the natural drainage system of the lower Murray River Catchment and falls within the parameters of the Aquatic ecological community in the natural drainage system of the lower Murray River catchment, which is listed as an Endangered Ecological Community (EEC) under the FM Act.

The Department of Primary Industries (DPI) (2007) notes that "*The Lower Murray aquatic ecological community includes all native fish and aquatic invertebrates within all natural creeks, rivers and associated lagoons, billabongs and lakes of the regulated portions of the Murray, Murrumbidgee and Tumut rivers, as well as all their tributaries and branches*." The listing specifically includes Billabong Creek, Yanco Creek, Colombo Creek and their tributaries. This terrestrial biodiversity assessment has not completed an assessment of impacts associated with the project on this aquatic EEC.

Threatened flora and flora habitats

No individuals or populations of any threatened flora listed under the BC Act or EPBC Act were recorded during the field surveys.

A likelihood of occurrence assessment was completed for the threatened flora species identified during the desktop assessments (NSW DCCEEW 2024, Cwth DCCEEW 2024) and are provided in Appendix B of the Biodiversity Impact Assessment report (see Appendix B Biodiversity Impact Assessment of this REF). Most threatened flora species predicted to occur within the locality are not associated with any habitat values found within the study area, i.e. their specific habitat requirements are not present within the study area. Furthermore, the agricultural land use of the study area and subsequent high cover of exotic plants in the understorey render it less suitable habitat for most threatened plants associated with the locality. Based on this, only one species was found to have a moderate likelihood of occurrence as identified in Table 6.4. All other threatened species identified via the desktop assessment were determined to have a low likelihood of occurrence within the study area.

Table 6.4 Threatened flora that may occur within the locality

Species	Listing	Justification
Swainsona murrayana **Slender Darling Pea**	Vulnerable – BC Act, EPBC Act	Moderate likelihood of occurrence. 32 records of this species occur in the locality. Additionally, the site contains broadly suitable habitat for this species, which is associated with riverine woodland communities.

Threatened fauna and fauna habitats

Based on the desktop assessment and field surveys, a likelihood of occurrence assessment was completed to identify any threatened fauna species that may occur within the study area. Table 6.5 outlines the threatened fauna species which have a 'moderate' or 'high' likelihood of occurrence within the study area.

Table 6.5 Threatened fauna with a 'high' and 'moderate' likelihood of occurrence within the study area

Species	Listing	Justification
Birds		
Dusky Woodswallow *(Artamus cyanopterus cyanopterus)*	Vulnerable – BC Act	Potentially suitable woodland habitat within grassy riparian woodland occurs within study area. Large number of records in locality.
Australasian Bittern *(Botaurus poiciloptilus)*	Endangered – BC Act, EPBC Act	Suitable habitat within dense Typha patches at Wilson Anabranch. No records in locality, however, records clustered ~50 km to NE at Colleambally.

Species	Listing	Justification
Bush Stone-curlew *(Burhinus grallarius)*	Endangered – BC Act	Potentially suitable habitat within grassy riparian woodland occurs within study area. Closest record ~20 km away at Jerilderie.
Spotted Harrier *(Circus assimilis)*	Vulnerable – BC Act	Broadly suitable habitat within grassland and riparian woodland. Low number of records in immediate locality. Cluster of records occur around Steamplains to NW, and Bundure to NE in the broader locality. No large stick nests recorded.
Varied Sittella *(Daphoenositta chrysoptera)*	Vulnerable – BC Act	Broadly suitable habitat in grassy woodlands. Moderate number of records within the locality.
Grey Falcon *(Falco hypoleucos)*	Endangered – BC Act, Vulnerable – EPBC Act	Suitable foraging habitat present along timbered waterways. No large stick nests recorded. Not known from the locality, but may occur in low densities.
Black Falcon *(Falco subniger)*	Vulnerable – BC Act	Suitable foraging habitat present along timbered waterways. No large stick nests recorded. Known to occur throughout the NSW Murrumbidgee Riverina IBRA subregion.
White-bellied Sea-Eagle *(Haliaeetus leucogaster)*	Vulnerable – BC Act	Suitable foraging habitat present along timbered waterways. No large stick nests recorded.
Little Eagle *Hieraaetus morphnoides*	Vulnerable – BC Act	Suitable foraging habitat present along timbered waterways. No large stick nests recorded.
Square-tailed Kite *(Lophoctinia isura)*	Vulnerable – BC Act	Suitable foraging habitat present along timbered waterways. No large stick nests recorded.
Black-chinned Honeyeater *(Melithreptus gularis)*	Vulnerable – BC Act	Broadly suitable habitat in River Red Gum Forest. It is likely to be an occasional visitor passing through to better patches of foraging habitat.
Scarlet Robin *(Petroica boodang)*	Vulnerable – BC Act	Suitable foraging habitat is present. May occur within study area during winter only.
Flame Robin *(Petroica phoenica)*	Vulnerable – BC Act	Recorded ~7 km from study area at Rice Australia Institute. Likely to occur within study area during winter only.

Species	Listing	Justification
Superb Parrot *(Polytelis swainsonii)*	Vulnerable – BC Act, EPBC Act	High number of records in the locality. Study area broadly surrounded by the Murray and Murrumbidgee Rivers in the region which is core breeding habitat. Wilson Anabranch is unlikely to be a core breeding region for the species, however would provide local foraging resources.
Grey-crowned Babbler *(Pomatostomus temporalis temporalis)*	Vulnerable – BC Act	Broadly suitable habitat in grassy woodlands. Large number of records within the locality.
Australian Painted Snipe *(Rostratula australis)*	Endangered – BC Act, EPBC Act	Broadly suitable habitat present within Wilson Anabranch.
Diamond Firetail *(Stagonopleura guttata)*	Vulnerable – BC Act, EPBC Act	Suitable foraging habitat in grassy woodlands. Moderate numbers recorded in the locality. Closest records known from Coree to the south.
Frogs		
Southern Bell Frog *(Litoria raniformis)*	Endangered – BC Act, Vulnerable – EPBC Act	High quality habitat along billabongs and floodplains of the Wilson Anabranch. One record in the locality (NSW DCCEEW 2024). Suitable habitat present within the study area including downstream patches of *Typha* spp. Perching habitat is present on top of woody debris/stags within the waterways.

One threatened fauna species, the Flame Robin (*Petroica phoenicea*), was incidentally observed around 7 km south of the study area during the conducted field surveys. A lone individual was recorded foraging under planted trees and shrubs on the edge of a driveway. This species would be a winter migrant to the study area which would comprise foraging habitat.

6.4.3 Impacts

Although the study area is already disturbed from previous construction works and agricultural uses, the project has the potential to result in direct impacts on native biota and their habitats. There is also the potential for indirect impacts on retained areas of native vegetation adjacent and downstream of the study area. These direct and indirect impacts are discussed in the following sections.

Construction

Vegetation

The project has been designed with the consideration of identified ecological constraints, such as making use of the partially cleared private unsealed track adjoining North Coree Road, as well as locating the borrow site within previously cleared areas. Habitat resources including hollow-bearing trees have been identified and would be avoided where possible.

A conservative worst-case scenario has been assumed for the level of full vegetation removal proposed. Full vegetation removal has been assumed within two distinct Clearing Areas, which includes the proposed infrastructure footprint in the east as well as the location of the borrow site in the west of the study area. This approach allows for flexibility during the detailed design and construction stage. It is therefore likely that construction of the project would result in less impacts than reported here.

The project would require the removal of up to 0.30 hectares (ha) of native vegetation comprising moderate condition River Red Gum - Black Box woodland (PCT 10) and exotic vegetation comprising 0.06 ha at the Clearing Area to the east (for the proposed infrastructure). A further 0.05 ha of vegetation would be removed at the Clearing Area to the west (for the borrow site) also comprising cleared/exotic grassland (refer to Figure 1.2).

The project is also likely to remove two mature, hollow-bearing River Red Gum on the edge of the existing block bank, as well as a dense patch of juvenile River Red Gums from within the waterway and immediately downstream of the existing infrastructure within the Clearing Area to the east.

Refer to Table 6.6 for a detailed outline of the vegetation expected to be cleared as part of the project.

Table 6.6 Approximate area of proposed vegetation clearing

PCT ID	Plant Community Type	Condition	Conservation status	Partial vegetation removal within the Contractor Activity Zone (ha)[1]	Full vegetation removal within the Clearing Areas (ha)
10	River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Moderate	-	-	0.30
-	Cleared/exotic grassland	-	-	2.90	0.11
	Total native vegetation (ha)			-	0.30
	Total (ha)			2.90	0.41

None of the vegetation in the study area is commensurate with a local occurrence of a TEC listed under the BC Act or EPBC Act. Temporary removal or modification of the Clearing Area and Contractor Activity Zone respectively, would not threaten the viability or persistence of these vegetation types, or the flora species within them, within the locality.

No terrestrial threatened ecological communities or known threatened flora individuals or populations would be directly impacted by the project. Environmental safeguards to minimise the clearing of native vegetation and minimise risk of impacts on native biota are presented in section 8.3.

Fauna

The vegetation within the study area has a generally high biodiversity value for native fauna given the habitat complexity of the open riparian woodland adjacent to Wilson Anabranch.

The project impacts are expected to include the removal of understorey vegetation within the Clearing Area and may include the removal of a small number of mature trees, including two hollow-bearing trees adjacent to the offtake, as well as a small patch of saplings within the waterway. The mature trees potentially impacted by the project may provide flowering resources for local fauna populations as well as roosting and breeding microhabitats for birds and arboreal mammals respectively. It is likely that any such species would be capable of vacating the Clearing Area, should they be present at the time of construction and vegetation clearing works.

Tree-dwelling fauna and less mobile terrestrial fauna are at most risk of injury or mortality and include birds that may be nesting in trees, or frogs, small reptiles and invertebrates associated with groundcover vegetation, leaf litter and woody debris. Some potential habitat for threatened species would be impacted, including refuge habitat for Southern Bell Frog within instream aquatic vegetation and within rock wall installations on the edge of the block bank (if present).

The removal of vegetation would create small gaps in habitat for less mobile or shelter-dependant fauna. There are sufficient areas of refuge habitat within retained vegetation adjacent to the project area for any fauna that may be displaced by the project. Pollinator species and less mobile fauna (including small mammals or frogs) would be able to traverse the gaps created during the construction phase, or traverse around the study area, with minimal additional energy costs or risk of predation. Overall, the project would result in a very minor and short-term increase in the degree of fragmentation of habitat at the site and in the locality.

Noise and vibration from construction activities such as vegetation clearing, ground disturbance, machinery and vehicle movements, and general human presence can potentially disturb resident fauna and may disrupt foraging, reproductive or movement behaviours. Impacts from noise and vibration are likely to be minor as they would be localised and temporary.

Operation

The operation of the proposed regulator would be consistent with the requirements to deliver environmental water, the water sharing plan and in accordance with the *Yanco Creek System Operations Plan (draft as of November 2023).*

Providing that the water delivery managers abide by the general operating principles in conjunction with the limits provided in the draft Yanco Creek System Operations Plan, the hydrology of Wilson Anabranch is expected to remain consistent with current. As such, operational impacts to terrestrial biodiversity values are not expected.

Significance of potential impacts to threatened and migratory biota

The project has the potential to result in direct impacts to threatened species and/or their habitats within the Clearing Area. Indirect impacts may also occur downstream from the study area.

The following sections provide an assessment of the likely significance of those impacts on threatened biota that have the potential to occur throughout the locality.

Threatened and migratory species

Flora

No threatened flora species were recorded within the study area, however, associated habitat for one species, the Slender Darling Pea (*Swainsona murrayana*), is present.

Whilst this species was not recorded within the study area, field surveys were conducted outside of the recommended survey period for the Slender Darling Pea. Given the presence of suitable habitat in the form of known vegetation associations (River Red Gum Woodland), and previous records from the locality, a conservative approach was taken, and it was considered that the Slender Darling Pea has a moderate likelihood of occurrence. As such, an assessment of significance was completed for impacts to potential habitat for this species (refer to Appendix B Biodiversity Impact Assessment of this REF). The outcome of the assessment is that the project is unlikely to result in a significant impact on these species, given:

- Permanent clearing would be limited to 0.30 ha of potential habitat within the Clearing Area.
- Based on regional vegetation mapping there are extensive patches of comparable riverine vegetation elsewhere within the locality, including directly adjacent to the project as well as other areas within Wilson Anabranch (DPE 2023b).
- No known or occupied habitat for the species would be removed, nor does any known or occupied habitat exist in close proximity to the Clearing Area.
- The Clearing Area is unlikely to constitute important habitat for the species in the locality.
- The existing block bank in the Clearing Area has been subject to historical soil disturbance, and is unlikely to be natural, making this area low quality potential habitat for the species.

Consequently, a SIS or a BDAR would not be required for impacts on *Swainsona murrayana*.

Impacts on the Slender Darling Pea resulting from the project have also been considered with reference to the *Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999* (DotE 2013). As described above, the project would remove a small amount of broadly suitable habitat for the species. As such, further assessment, or approval under the EPBC Act is not required.

Fauna

An assessment of significance was undertaken for two species due to the presence of suitable habitat within the study area. A summary of this assessments is presented in Table 6.7 below.

Table 6.7 Summary of assessment of significance

Species	Occurrence / distribution	Potential construction and operation impact
Superb Parrot (*Polytelis swainsonii*)	Hollow dependent fauna such as the Superb Parrot have the potential to occur in River Red Gum Woodland within the study area. While no individuals of this species were recorded during surveys, they are known within the locality (DPE 2023a).	The project would remove up to 0.41 ha of potential foraging habitat for the Suburb Parrot, however, the Biodiversity Impact Assessment report concluded that the project is unlikely to have a significant impact on this species given: • Up to 3.31 ha of predominantly cleared/exotic grassland comprising potential foraging habitat would be fully or partially removed by the project. • Impacts to breeding habitat would be limited to the potential removal of two hollow-bearing trees within River Red Gum grassy woodland in the Clearing Area. • The Clearing Area is unlikely to form a core part of its species' home range. • Large number of hollow-bearing trees are present throughout Wilson Anabranch and provide alternate potential roosting and breeding habitat in the locality.
Southern Bell Frog (*Litoria raniformis*)	The species has not been recorded within the locality (NSW DCCEEW 2024), and the study area is connected to other waterways comprising the species within the NSW Riverina region including at Bundure, Broome and Wanganella (A. Turner., pers comm May 15, 2023). The species may take refuge within woody debris and leaf litter in the adjacent riverine woodland.	The project is unlikely to result in a significant impact on the Southern Bell Frog, given: • The species was not recorded despite targeted AudioMoth detector surveys. • The Clearing Area contains a small amount of foraging habitat for the species in open water that may be impacted by the installation of coffer dams. • Impacts resulting from the project would be limited to the removal of a small amount of refuge habitat (0.30 ha) on the block-bank under leaf litter, woody debris and around the rock wall. • Areas of equivalent or better-quality habitat are present throughout Wilson Anabranch particularly where backwater and semi aquatic vegetation is present.

An assessment of significance for the Flame Robin (recorded) and other generalist woodland birds has not been undertaken, given the absence of important habitat resources in the study area (such as breeding habitat), the broad habitat requirements of these species, and the small extent of direct vegetation removal in the Clearing Area, and the small extent of partial removal of potential foraging habitat within the Contractor Activity Zone.

While no migratory species were recorded during the field survey, the Satin Flycatcher (*Myiagra cyanoleuca*), White-throated Needletail (*Hirundapus caudacutus*), Fork-tailed Swift (*Apus pacificus*) and the Latham's Snipe (*Gallinago hardwickii*) may occur within the study area on occasion. The project would not remove any important habitat for these species and would not affect an ecologically significant proportion of a population of these species as defined in the significant impact guidelines (DotE 2013).

The wider Yanco Creek system may provide broadly suitable foraging habitat for a number of migratory wetland birds including Sandpiper species (*Actitis*/*Calidris* spp.), however important mudflat habitat is not present in the study area. The project would not result in significant impact on any migratory species.

6.4.4 Safeguards

The safeguards proposed to avoid, minimise, or manage potential cumulative impacts associated with the project are included in section 8.3.

6.5 Aquatic biodiversity

An Aquatic Ecology and Water Quality assessment was undertaken and prepared as part of this REF (refer to Appendix C Aquatic Ecology and Water Quality Assessment). It assesses the potential impacts the construction and operation phases of the project may have upon the water quality and aquatic ecologic value of the adjoining waterways.

These findings are summarised below.

6.5.1 Methodology

Literature and desktop review

The Aquatic Ecology and Water Quality assessment consisted of a desktop study, involving the review of various databases and previously published studies.

For the purposes of the Aquatic Ecology and Water Quality assessment, the following terms in addition to those terms defined in section 3.1.1, were used:

- Project Area: the Project Area includes the following stream reaches:
  Yanco Creek and Wilson Anabranch within 100 m of the proposed regulator
  Wilson Anabranch between the offtake and its downstream confluence with Yanco Creek
- Study Area: includes all land and waterways within 10 km of the project area. This includes consideration of possible effects beyond the 10 km radius (i.e. Murrumbidgee River upstream and Edward, Wakool and Murray Rivers downstream of the project).

The following databases were used to identify aquatic species with the potential to occur within the study area. The review considered published records, predicted occurrences of aquatic species and habitat distribution models. These sources included:

- Bionet – the Atlas of NSW Wildlife Threatened Species Profile Database (NSW DPE 2023) (accessed July 2023), which was searched for records of aquatic flora and fauna within the study area.
- The Commonwealth EPBC Act PMST (DAWE 2023) (accessed July 2023) was used to determine whether any Protected Matter listed under schedules of the EPBC Act occurred or may occur within a 10 km radius of the project area.
- Atlas of Living Australia (ALA 2023) (accessed July 2023), which was searched for records of aquatic flora and fauna within the study area.
- Key Fish Habitat (KFH) mapping and threatened species distribution mapping (NSW DPI 2023) (accessed July 2023) available on the NSW Fisheries data portal, which were examined to determine aquatic values and potential presence of threatened species in the study area.
- Review of recent scientific literature, technical reports, fish movement models, WaterNSW and Charles Sturt University data, and fish guides were also completed.

The following key ecological studies were also reviewed to inform the desktop assessment:

- McNeil, D, G. and Griffiths, J. (2021). Platypus in the Yanco Creek: Understanding Distribution and Population Status. Report to the Yanco Creek and Tributaries Advisory Council, Jerilderie, NSW
- Sharpe, C. (2018). Trout cod in Yanco Creek; Patterns of spawning, recruitment and population status in 2017/18. Final Report for Murray Local Land Services by CPS Enviro, Irymple Victoria
- Sharpe, C. and Stuart, I. (2015). The Distribution of Trout cod in Yanco and Colombo Creeks. Final Report for Murray Local Land Services by CPS Enviro and Kingfisher Research, Irymple Victoria
- Sharpe, C., Stuart, I. and Vilizzi, L (2013). Billabong, Yanco and Colombo Creek Fish Baseline Project 2012-13. Final Report, for Murray Catchment Management Authority by CPS Environmental Research, Irymple Victoria. July 2013
- Stuart, I. (2022). Yanco Creek fish movement model. Unpublished Client Report. Arthur Rylah Institute for Environmental, DELWP, Heidelberg
- Walcott, A., Wolfenden, B., Hall, A. & Wassens, S. (2018) Yanco-Billabong Creek Broad-scale Wetland Monitoring Project: Frog communities of the Yanco-Billabong creek system. Final Report prepared for Murray Local Land Services. Institute of Land Water and Society, Charles Sturt University, Albury
- Gilligan, D. (2005) Fish communities of the Murrumbidgee catchment: Status and trends. NSW Department of Primary Industries – Fisheries Final Report Series No. 75
- Charles Sturt University (2022) data from a 2022 aquatic and terrestrial fauna survey of the Yanco-Billabong System (unpublished).

Likelihood of occurrence assessment

Based on the desktop study and literature review, a likelihood of occurrence assessment was used to determine the likelihood of each species' presence within the project area. The criteria used for evaluating the likelihood of occurrence for each species is presented in Table 6.8 below.

Table 6.8 Likelihood assessment criteria for threatened species

Likelihood	Criteria
Present	Species recorded within study area based on historical records within the last 30 years.
Likely	Species likely to occur within the Project Area based on proximity and timing of previous records, survey effort in the Project Area and suitability of habitat present.
Possible	Potentially suitable habitat occurs within the study area and species' known range encompasses the study area. Species recorded historically in the study area but not regularly observed within the last 30 years. This category is mainly informed by NSW DPI threatened species distribution modelling.
Unlikely	Species' known range encompasses the study area, but suitable habitat does not occur within the study area or occurs within the study area but with generally low quality and quantity. Species recorded historically in the study area but not within the last 30 years.
Highly Unlikely	No historical records of the species and/or no suitable habitat in the study area.

In addition to the likelihood of occurrence assessment, an assessment was undertaken to determine the relevance and likelihood of key threatening processes listed under the FM Act and the EPBC Act which may occur within the project area. The criteria used for evaluating the likelihood of these threatening processes occurring are presented in Table 6.9.

Table 6.9 Likelihood assessment criteria for listed threatening processes

Likelihood	Criteria
Present	Threatening processes directly observed or recently recorded within the project area, or the project area supports suitable conditions that are likely to encourage and/or exacerbate threatening process.
High	The project area supports suitable conditions that are likely to encourage and/or exacerbate threatening processes.
Moderate	The project area supports suitable conditions that could encourage or exacerbate threatening processes.
Low	Threatening processes are not recorded within the project area, and/or the project area supports conditions that are unlikely to encourage or exacerbate threatening processes.

Refer to Table 6.10 for the likelihood of occurrence assessment findings.

6.5.2 Existing environment

The Aquatic Ecology and Water Quality assessment was based on a desktop assessment and no site inspection was conducted. However, input from the Biodiversity Impact Assessment (Appendix B Biodiversity Impact Assessment was obtained to inform the assessment where relevant.

In general, the anabranch appears to support a braided network of open River Red Gum wetlands (Figure 6.9) which are connected via shallow channels (Figure 6.10). Some wetlands supporting a very open River Red Gum canopy and others much denser with a large number of young River Red Gums. Generally, there is limited aquatic vegetation consisting of small patches of Cumbungi (*Typha spp.).* The exception is the end of the system which at times appears to support extensive cover to floating Azolla. Ground cover and aquatic vegetation is thought to be limited due to the effects of cattle that graze along the anabranch. The wetlands appear to support abundant small woody debris, and some larger woody debris (Figure 6.9). It is unclear how deep the wetlands are, however based on aerial imagery it appears that in wetter years, Wilson Anabranch supports permanent habitat (e.g. 2020-2023), whereas in drier periods it dries out over summer and into autumn (e.g. 2017- early 2020).

It is likely that this habitat would support aquatic fauna such as wetland generalist small bodied native fish, such as Carp-Gudgeons (Hypseleotris spp.) and Murray River Rainbowfish (Melanotaenia fluviatilis) as well as other species such as Eastern Long-necked Turtle (Chelodina longicollis), that utilise slow flowing ephemeral to semi-permanent wetlands.

Figure 6.9 Photographs of wetland habitat along Wilson Anabranch. The wetlands are in order of position along the anabranch starting at the Wilson Anabranch Offtake (top left) and the end of the wetland at the block bank (bottom right). Note the absence of aquatic vegetation except for a small stand of *Typha spp*. in the top left and abundant floating azolla in the bottom right.

Figure 6.10 Shallow habitat connecting wetlands along Wilson Anabranch (left) and small drainage line showing leakage through the terminal block bank.

Key Fish Habitat

Based on a desktop search undertaken in July 2023 of the Fisheries Data Portal (NSW DPI) it was determined that Wilson Anabranch and adjacent sections of the Yanco Creek system are mapped as being a KFH (Murray Darling Basin South) (NSW DPI 2023). Based on criteria set out in relevant NSW DPI guidelines (NSW DPI 2013), the baseline aquatic environment within Wilson Anabranch and neighbouring Yanco Creek has been classified as being characteristic of the following habitat types:

- Type 2 – Moderately sensitive KFH & Class 2 – Moderate fish habitat
- Type 1 – Highly sensitive KFH & Class 2 – Moderate fish habitat.

Given Wilson Anabranch and neighbouring Yanco Creek are mapped as KFH for threatened species such as the Silver Perch and Flathead Galaxias, it is presumed the creeks may also support other threatened species and other important aquatic faunal species that is consistent with the Class 1 (Major), Class 2 (Moderate), Type 1 (highly sensitive) and Type 2 (moderately sensitive) KFH classifications.

Fish Community

Based on the desktop search undertaken in July 2023 of the NSW DPI Fisheries Data Portal, it was determined that the condition of the fish community within Wilson Anabranch is mapped as being 'poor' and Yanco Creek is mapped as being 'very poor' (refer to Figure 6.11) based on the three condition indicators of expectedness, nativeness and recruitment (NSW DPI 2023).

Figure 6.11 Fish community status in Wilson Anabranch and neighbouring Yanco Creek (where orange indicates poor fish community status and red indicates very poor fish community status). The blue dot represents the location of the project area (NSW DPI 2023)

Based on various key ecological studies (refer to section 6.5.1) it was concluded that the native fish community of the upper Yanco Creek system comprises of the:

- Golden Perch (*Macquaria ambigua ambigua*)
- Murray Cod (*Maccullochella peelii*)
- Carp Gudgeon (*Hypseleotris spp.*)
- Murray-Darling Rainbowfish (*Melanotaenia fluviatilis*)
- Australian Smelt (*Retropinna semoni*)
- Trout Cod (*Maccullochella macquariensis*)
- Silver Perch (*Bidyanus bidyanus*)
- Freshwater Catfish (*Tandanus tandanus*)
- Un-specked Hardyhead (*Craterocephalus stercusmuscarum fulvus*).

The non-native (introduced) fish community in the upper and mid-Yanco Creek system comprises of the:

- Gambusia
- Oriental Weatherloach
- Common Carp

- Goldfish
- Redfin.

Other aquatic fauna

Various aquatic fauna species are also considered possible or known to occur within the vicinity of the project area, such as the Murray crayfish (*Euastacus armatus* - FM Act listed Vulnerable) which are mapped in NSW along the very upper stretches of Yanco Creek (NSW DPI 2023).

Additionally, recent sightings (2022) of Rakali (*Hydromys chrysogaster*) have been recorded from Yanco Creek approximately 1.5 km upstream of the Project Area and appear relatively widespread in the Yanco-Billabong Creek system (CSU unpublished data 2022).

The Broad-shelled turtle (*Chelodina expansa*), Eastern long-necked turtle (*Chelodina longicollis*) and the Murray River turtle (*Emydura macquarii*) appear relatively widespread in the Yanco-Billabong Creek system (CSU unpublished data 2022). However, due to Wilson Anabranch appearing ephemeral to semi-permanent, it is unlikely to be regularly utilised by the Broad-shelled turtle and the Murray River turtle. The Eastern long-necked turtle is the only species that is known to utilise ephemeral habitats and Wilson Anabranch presents good quality habitat for the species. This is a widespread species in NSW and is listed as least concern conservation status (Deeth and Coleman 2022).

Threatened species, populations and ecological communities

Based on database searches and available literature, six aquatic species listed under the EPBC Act and/or FM Act are known to occur or may occur within the study area (refer to Table 6.10). No aquatic species listed under the BC Act are known to occur within the search area.

Of the six species identified in Table 6.10, four species have been recorded within the vicinity of the project area:

- Murray Cod (*Maccullochella peelii*)
- Trout Cod (*Maccullochella macquariensis*)
- Silver Perch (*Bidyanus bidyanus*)
- Freshwater Catfish (*Tandanus tandanus*).

Two species (the Flathead Galaxias (*Galaxias rostratus*) and the Macquarie Perch (*Macquaria australasica*) or their habitat may also be present within the vicinity of the project area.

Other threatened species such as the Southern Pygmy Perch (*Nannoperca australis*), Southern Purple Spotted Gudgeon (*Mogurnda adspersa*), Olive Perchlet (*Ambassis agassizii* – western population) and the Murray Crayfish (*Euastacus armatus*) that were likely once present in the study area were not recorded in database records or habitat mapping and are no longer considered likely to be present within the vicinity of the project area.

Likelihood of occurrence assessment findings

The likelihood of occurrence assessment was used to determine the likelihood of each species' presence within the project area based on considerations of habitat present, and the dates and number of previous records of each species. Table 6.10 demonstrates the findings of the threatened species likelihood of occurrence assessment.

Table 6.10 Likelihood of occurrence of listed threatened aquatic species within the project area

Common Name	Species Name	EPBC Act	FM Act	Distribution and preferred habitat	Likelihood of occurrence
Trout Cod	*Maccullochella macquariensis*	E	E	Once widespread in the middle and upper reaches of the Murray, Murrumbidgee and Macquarie River systems, the species' range and abundance have declined significantly since the 1950s. The only remaining natural population is in the Murray River between Yarrawonga Weir and the Gunbower National Park. Populations have been re-established in a number of catchments across its original range, including the middle and upper Murrumbidgee River (Koehn et al. 2019; Lintermans 2023). Trout Cod are a main channel specialist, inhabiting a variety of flowing habitats in the mid to upper reaches of rivers and streams. The species is associated with cover including woody debris or boulders. Habitat preferences for Trout Cod have been well documented in the Murray River and consist of high levels of woody habitat such as hollows and rootmats, located further from the bank (i.e. mid-channel), in deeper, faster-flowing water than other large bodied fish species. Young of year and larvae only appear to use main channel and flowing anabranch channel habitats (Koehn et al. 2020; Lintermans 2023). Upper Yanco Creek supports one of only two known self-sustaining populations of the nationally endangered Trout Cod (Cooling and Gippel 2018). Within Yanco Creek Trout Cod only occur upstream of Tarabah Weir. Upstream of Tarabah Weir, Yanco Creek supports hydrodynamically diverse, fast flowing sections with abundant physical habitat (i.e., high snag density) and is directly connected to the Murrumbidgee River. A small number of Trout Cod have also been collected from Colombo Creek near the offtake from Yanco Creek indicating these fish occur in the upper reaches where driving head creates flowing water conditions. Downstream of	**Unlikely** While Trout Cod are present in the upper Yanco Creek upstream of Tarabah Weir where lotic (flowing) reaches with high snag density remain, downstream of Tarabah Weir habitat for Trout Cod declines markedly and the species has not been recorded. PMST results indicate species may occur within the study area. However, Wilson Anabranch does not support permanent flowing habitat, so even if Trout Cod were present in the study area, the anabranch is unlikely to represent high quality habitat. Trout Cod may occasionally enter the waterways and wetlands of the Wilson Anabranch and associated floodplain during inundation events, but these wetlands do not provide suitable long-term habitat.

Common Name	Species Name	EPBC Act	FM Act	Distribution and preferred habitat	Likelihood of occurrence
				Tarabah Weir, habitat for Trout Cod in Yanco Creek declines markedly (Sharpe and Stuart 2015). Within Yanco Creek, mapped indicative Trout Cod habitat covers the Upper Yanco Creek from the Murrumbidgee River to just upstream of Morundah (NSW DPI 2021b).	
Murray Cod	*Maccullochella peelii*	V	-	Murray Cod are present throughout the majority of larger waterways of the MDB. The Murray Cod occupies much of its historical range, but there have been some local extinctions, with translocated populations established outside its natural range. Murray Cod abundance has declined significantly over the past 100 years, but there is evidence of partial recovery in some areas (Gilligan et al. 2019c; Lintermans 2023). Murray Cod are apex predators that occupy a broad range of habitats from large, turbid, slow flowing rivers to clear rocky streams and billabongs. While they occupy a broad range of flowing and standing waters it is considered a main river channel specialist. In lowland rivers they show a high affinity for structural woody habitat in deeper water, close to banks in areas of flowing water (Koehn et al. 2020; Lintermans 2023). The study area is within the mapped known distribution range in the MDB (DAWE 2023) and has been recorded in the mid-Yanco Creek reach in the vicinity of the project area (Sharpe et al. 2013). However, Murray Cod were only recorded in Billabong Creek during surveys of the Yanco-Billabong Creek system in 2022 which included sites in mid-Yanco Creek (CSU unpublished data 2022). Regular and intense artificial fingerling stocking occurs within the Yanco-Billabong Creek system (Stuart 2022).	**Likely** The Murray Cod were recorded in the mid-Yanco Creek system in 2013, and the species is considered likely to still be present within the Yanco Creek main channel. PMST results indicate species is known to occur within the project area. Wilson Anabranch does not support preferred habitats for Murray Cod, so even if they were present in the study area, the anabranch is unlikely to represent high quality habitat. Murray Cod may occasionally enter the waterways and wetlands of the Wilson Anabranch and associated floodplain during inundation events, but these wetlands do not provide suitable long-term habitat.

Common Name	Species Name	EPBC Act	FM Act	Distribution and preferred habitat	Likelihood of occurrence
Silver Perch	*Bidyanus bidyanus*	CE	V	Silver Perch were once widespread across the lowland rivers of the MDB. However, the species has suffered significant declines in range and abundance. The mid-Murray River downstream of the Yarrawonga Weir supports the highest relative abundance, but abundances have still declined significantly in this reach (Gilligan et al. 2019a; Lintermans 2023). The Silver Perch is found across a variety of habitats in perennial flowing rivers from large fast flowing reaches to slower flowing, turbid lowland areas. It can also be found in impoundments and floodplain lakes, but breeding is low in these environments, as the species requires perennial flowing water to complete its life cycle. This species is often found where there are rapids and races. There is some evidence to suggest that the species is associated with submergent or emergent vegetation, but juveniles prefer open water (Koehn et al. 2020; Lintermans 2023). Silver Perch are very uncommon but occasionally found in Billabong Creek (Sharpe et al. 2013; Stuart 2022). Wilson Anabranch and associated section of Yanco Creek is within the mapped distribution of Silver Perch within the Yanco-Billabong Creek system (NSW DPI 2021b).	**Unlikely** Silver Perch are very uncommon but are occasionally found in Billabong Creek, with a single record from the downstream end of Colombo Creek (Sharpe et al. 2013, CSU unpublished data 2022). Wilson Anabranch and the associated section of Yanco Creek is within the mapped distribution of Silver Perch within the Yanco-Billabong Creek system (NSW DPI 2023), however as noted there are no records of the species from the reach, and habitat is largely unsuitable. Wilson Anabranch does not support preferred habitat for Silver Perch and as such the species is unlikely to regularly occur within Wilson Anabranch.

Common Name	Species Name	EPBC Act	FM Act	Distribution and preferred habitat	Likelihood of occurrence
Freshwater Catfish	*Tandanus tandanus*	-	EP	This species is found in the east coast drainages in NSW and Queensland, and it was once widespread and abundant in the MDB. They have experienced significant declines in range and abundance across much of the MDB and is now rare, with the more abundant riverine populations occurring above impoundments (Gilligan and Clunie 2019; Lintermans 2023). Freshwater Catfish are found in a variety of habitats including rivers, streams, wetlands, lakes, waterholes and wetlands. They are generally found in still or slow flowing waters with complex physical structure including wood, undercut banks, fringing vegetation and abundant aquatic macrophytes (Gilligan and Clunie 2019; Koehn et al. 2020). A remnant population of Freshwater Catfish are also present, mostly in the mid Yanco/Billabong and Forest creek systems (Sharpe et al. 2013). Freshwater Catfish were recorded at two sites on Yanco Creek in 2022 in the vicinity of Bundure approximately 30 km north-east of the project area (CSU unpublished data 2022). Freshwater Catfish can be expected throughout the Yanco system but particularly in the lower Yanco and Billabong creek area (Stuart 2022).	**Likely** Recently captured in the mid Yanco system (CSU unpublished data 2022). Suitable habitat – flowing (lotic) habitat with high snag density, aquatic macrophytes and fringing vegetation – likely present in Yanco Creek at the project area. The species may also utilise the habitat present in Wilson Anabranch; however it is unlikely to constitute high-quality habitat for the species.

Common Name	Species Name	EPBC Act	FM Act	Distribution and preferred habitat	Likelihood of occurrence
Flathead Galaxias	*Galaxias rostratus*	CE	CE	The species was once widespread in the lowland areas of the middle and upper reaches of the southern MDB, but is now restricted to the upper Murray, Mitta Mitta, Kiewa, Ovens, Loddon and Goulburn catchments. It was last collected in the Murrumbidgee River in 1995, and is now considered locally extinct in the catchment. Flathead Galaxias are rarely and inconsistently encountered in these catchments and the species has experienced a severe range and population decline (TSSC 2015; Gilligan et al. 2019b; Lintermans 2023). Little is known of the ecology of Flathead Galaxias. Historically, the species was collected from a variety of habitats including billabongs, lakes, swamps and rivers, usually in still or slow flowing waters. It is a schooling species that congregates midwater. The species is thought to have an association with aquatic vegetation such as ribbon weed (Vallisneria spp.) (Gilligan et al. 2019b; Lintermans 2023). Wilson Anabranch and associated section of Yanco Creek is within the mapped distribution of Flathead Galaxias within the Yanco-Billabong Creek system (NSW DPI 2021b).	**Highly unlikely** Wilson Anabranch and associated section of Yanco Creek is within the mapped distribution of Flathead Galaxias within the Yanco-Billabong System (NSW DPI 2021b). However, there are no records of this species from the Yanco-Billabong creeks system, and the species is considered locally extinct from the Murrumbidgee system and lower Murray catchments in New South Wales.

Common Name	Species Name	EPBC Act	FM Act	Distribution and preferred habitat	Likelihood of occurrence
Macquarie Perch	*Macquaria australasica*	E	E	While Macquarie Perch were once more widespread in the southern MDB, the species is currently typically found in the cool, upper reaches of the Murray–Darling Basin in Vic, NSW and the ACT, including the Murrumbidgee River. Macquarie Perch is a riverine species, that can survive well in impoundments where there is access to suitable riverine habitats for spawning. The species lives in cool, clear waters at well-defined home sites, generally in deep, slow flowing pools with suitable cover (e.g. undercut banks, woody debris, boulders) (Lintermans and Kerezsy 2019; Koehn et al. 2020). There are no records of Macquarie Perch from Yanco and Billabong creeks, and no records downstream of the Gundagai region since at least 1980.	**Highly unlikely** While the PMST stated that "*Species or species habitat may occur within area.*" It is highly unlikely that the species is present in the area, as the species is now considered to inhabit the cooler upper reaches of the Murrumbidgee River and other catchments in the southern MDB. The species has not been recorded downstream of the Gundagai region (~230 km east of the project area) since at least 1980.

Key:
E = Endangered
V = Vulnerable
CE = Critically endangered
EP = Endangered population

Threatened ecological communities

The study area is wholly within the area of the EEC known as the 'aquatic ecological community in the natural drainage system of the Lower Murray River catchment' (Lower Murray River EEC). This EEC is listed under the FM Act and encompasses all natural creeks, rivers and associated lagoons, billabongs, and lakes of the regulated portions of the Murray, Murrumbidgee and Tumut Rivers, as well as their tributaries and branches. This includes the Yanco-Billabong system and all associated waterways, wetlands, lakes, lagoons and drainage channels within the study area (refer to Figure 6.12).

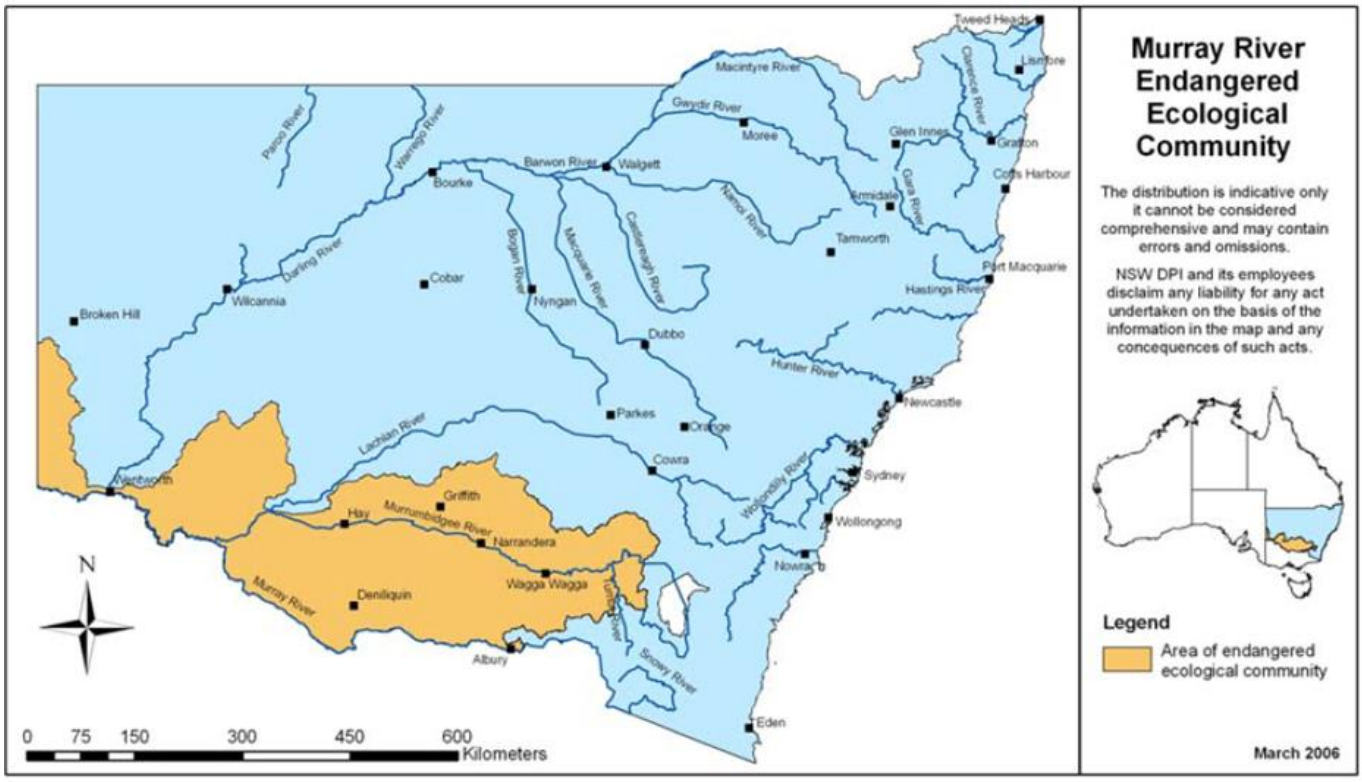

Figure 6.12 Map of Lower Murray River EEC (NSW DPI 2007)

6.5.3 Impacts

Construction

Construction activities as part of the project have the potential to directly and indirectly impact the aquatic species and habitats within Wilson Anabranch and Yanco Creek. The main potential impacts include:

- instream construction activities
- poor water quality (refer to section 6.2.2 for further detail)
- temporary barriers to fish passage
- the temporary relocated, disturbance and degradation of instream habitat features and riparian vegetation.

The construction phase of the project would involve a range of activities including de-snagging, riparian vegetation clearance, earthworks, bank excavation, instream works, concrete works, the establishment of construction laydown areas and access tracks. As detailed below, without the implementation of appropriate management and environmental control measures, these activities have the potential to result in negative impacts to aquatic values.

Measures to avoid, minimise and manage these potential impacts can be found in section 8.3.

Temporary barriers to fish passage

For the construction of the offtake the installation of temporary structures may be required. These include:

- installation of earthen bank cofferdam upstream and downstream
- silt fence across the creek (upstream and downstream) and established erosion and sediment controls.

These structures, although temporary, may have the potential to further prevent the movement of fish and impede on breeding migrations and larval drift between Yanco Creek and Wilson Anabranch.

If the implementation of these structures is undertaken at a time when the existing regulator is normally closed, i.e. 1 September to 31 March (3Rivers 2023b) and natural flows are low, the construction of cofferdams would not impact fish movement compared to the existing conditions. However, if the implementation of these structures is undertaken at the time when the existing regulator is normally open (i.e., 1 April to 31 August) there is a potential for additional impacts to fish passage to occur. Despite this, these potential additional impacts would be short-term (estimated 2 to 3 month construction period).

Nonetheless, in order to avoid and/or minimise additional impacts to fish passage, it is recommended to schedule construction activities within the watercourse during low or no flow periods (i.e. normally between 1 September and 31 March) and to minimise the duration of fish passage restrictions.

Instream works and removal of instream habitat features

It is estimated that up to approximately 0.2 ha of aquatic habitat temporarily affected and 0.02 ha permanently affected. Aquatic habitat affected includes emergent River Red Gums. Small areas of aquatic vegetation and open water. The removal of this aquatic habitat has the potential to impact aquatic fauna as these habitat features are important for a range of fauna that depend upon them for food supply, shelter, spawning and nesting purposes (Koehn et al. 2020). For example, adult and juvenile native fish species such as Murray Cod are known to utilise (i.e. live within or around) these features as preferred habitat (Koehn et al. 2020). Aquatic macroinvertebrates also utilise LWD and instream vegetation for habitat and as direct food resources (Deane et al. 2021). Removal of aquatic habitat features therefore has the potential to result in some habitat and food resource loss for a range of aquatic fauna, and reduced productivity or mortality of adults, larvae and young-of-year native fish species.

Instream construction activities have the potential to directly harm aquatic species if they come in contact with equipment or machinery. Pumping to create a dry work area within the cofferdam may also be required, which could lead to the entrainment of aquatic fauna, particularly fish, with the pump mechanism.

Given that instream works are required during construction, without safeguards it is considered possible for aquatic species to come into contact with equipment or machinery.

Additionally, the mobilisation of sediments during instream works have the potential to result in increased levels of suspended sediment that can lead to direct mortality, reduced growth rates and feeding, an altered diet and behaviour, increased stress and incidence of disease, egg abrasion and reduced bivalve pumping rates (Lloyd 1987; Wilber 2001). Reduced uptake of dissolved oxygen by macroinvertebrates and fish may also occur due to the coating or clogging of gills by fine particles (Kjelland et al. 2015; McKenzie et al. 2020). In addition, reduced light penetration and visibility can limit growth of aquatic vegetation, alter the behaviour of aquatic faunal, and contribute to the development of algal blooms.

However, with the implementation of the safeguards listed in section 8.3, the potential impacts described above would be unlikely to occur.

Removal of riparian vegetation and bank excavation

The construction of the project is anticipated to require the removal of some riparian vegetation (e.g. saplings, grasses, and debris) as well as bank excavation works. Riparian vegetation clearance and bank excavation can result in impacts on aquatic species through the alteration of habitat and effects to water quality if runoff is able to mobilise exposed soils and enter the waterway. Bank excavation may also reduce channel stability (temporarily during construction) which could result in increased bank erosion and subsequent sediment deposition in receiving waterways.

However, with the implementation of the safeguards listed in section 8.3, these potential impacts would be unlikely to occur.

Construction runoff and dewatering

Construction activities may have the potential to impact water quality (refer to section 6.2.2) due to the mobilisation of sediments in stormwater runoff. In addition, runoff from construction areas or the potential discharge of water from within a cofferdam (dewatering) may also result in impacts to downstream flows.

High levels of sediments entering waterways can interfere with the feeding of many species by, for example, reducing the foraging capacity of native fish while favouring exotic species such as the Common Carp (Utne-Palm 2002; Lovett et al. 2007). Mobilised sediment could increase the waterways turbidity which can ultimately clog fishes gills or decrease trophic interactions for aquatic species due to reduce visibility. By increasing turbidity and reducing light penetration, suspended sediments can also limit submerged plant photosynthesis and alter the light regime for phytoplankton (Lovett et al. 2007).

Therefore, construction activities have the potential to indirectly harm or increase mortality for aquatic fauna if poor water quality and mobilised sedimentation occur and begin to flow downstream.

However, given the relatively small-scale and short duration of the proposed construction works these potential impacts are likely to be localised and short-term (i.e., for the proposed duration of construction).

Operation

Barrier to passage of aquatic fauna

Culverts tend to be physical barriers for migrating fish by restricting fish passage through increasing flow velocities, increasing turbulence, and reducing depth through the structure. High water velocities and excessive head loss through culverts are of particular importance to Australian native fish, which are known for their poor swimming capabilities. Culverts can also restrict fish movement because fish avoid the light/dark transition or from debris build-up at the opening.

The proposed structure meets DPI — Fisheries design requirements for downstream fish passage (e.g., plunge pool depth 40% of differential head under low flow conditions). There is some potential for upstream fish passage during unregulated flow events when the gate is fully opened, provided that there is low head loss (and resultant flow velocity) in the reach downstream of the regulator. Two way fish movement would not be possible when the layflat gate is operating to actively regulate flow as the layflat gate would not be fully opened at this time (e.g. would need to be partially closed to limit flows to 20 ML/day at times).

While not allowing fish passage at all times, overall, the new structure would be likely to improve fish passage at the offtake regulator compared to the existing conditions and would not lead to a reduction in connectivity.

MNES Significant Impact Assessments

Under the EPBC Act, the approval of the Commonwealth Minister for the Environment is required for any action that may have a significant impact on MNES. One aquatic species listed under the EPBC Act – Murray Cod (*Maccullochella peelii*) listed as vulnerable - was identified as having possible (likely) likelihood of occurrence within the study area (as per Table 6.10), and potential impacts were assessed against the significant impact criteria for species listed as vulnerable and endangered respectively under the EPBC Act (DoE 2013). For the purpose of this assessment the Yanco Creek population of Murray Cod is considered and important population, as the 'Edward River including most major tributaries' is considered an important population (National Murray Cod Recovery Team 2010).

The significant impact criteria for these MNES are outlined by DoE (2013) and are summarised in Table 6.11.

Table 6.11 EPBC Significant Impact Criteria

Criteria	Critically Endangered and Endangered Species	Vulnerable Species
A	Lead to a long-term decrease in the size of a population	Lead to a long-term decrease in the size of an important population of a species
B	Reduce the area of occupancy of the species	Reduce the area of occupancy of an important population
C	Fragment an existing population into two or more populations	Fragment an existing important population into two or more populations
D	Adversely affect habitat critical to the survival of a species	Adversely affect habitat critical to the survival of a species
E	Disrupt the breeding cycle of a population	Disrupt the breeding cycle of an important population
F	Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
G	Result in harmful invasive species becoming established in the endangered or critically endangered species' habitat	Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
H	Introduce disease that may cause the species to decline	Introduce disease that may cause the species to decline
I	Interfere with the recovery of the species	Interfere with the recovery of the species

In summary, the Significant Impact Assessment determined:

- Construction: in terms of significant impact criteria relating to fish passage or breeding (Criteria C and E) only short-term impacts to passage would occur during construction. In regard to significant impacts criteria relating to habitat (Criteria A, B, D, F) only minor physical habitat changes are expected during in-water construction and these changes would not constitute a significant impact to the species. Construction of the project would be unlikely to introduce invasive species or aquatic pathogens as equipment and vehicle hygiene protocols would be followed (Criteria G and H). As no significant impacts to the above criteria are expected, construction would not interfere with recovery of any MNES species (Criterion I).
- Operation: in terms of significant impact criteria relating to fish passage or breeding (Criteria C and E), impacts to passage would not be made worse during operation. In regard to significant impacts criteria relating to habitat (Criteria A, B, D, F) no physical habitat changes are expected during operation which would constitute a significant impact to the species. Operation of the project would be unlikely to introduce invasive species or aquatic pathogens as equipment and

vehicle hygiene protocols would be followed (Criteria G and H). As no significant impacts to the above criteria are expected, operation would not interfere with recovery of any MNES species (Criterion I).

On the basis of this assessment, the activity is not considered to be a controlled action and a referral to the Commonwealth Minister under the EPBC is not required.

6.5.4 Safeguards

The safeguards proposed to avoid, minimise, or manage potential aquatic ecology impacts associated with the project are included in section 8.3.

6.6 Air quality

6.6.1 Existing environment

The project is located within a sparsely populated area largely dominated by agricultural activities. The ambient air quality in the project area and surrounds is characteristic of rural areas, which are generally low in particulate matter and pollutants. The main factors affecting air quality in the area would be road traffic, agricultural activities and prevailing meteorological conditions. These sources do not contribute significantly to local or regional air quality and emissions would be readily dispersed by the prevailing winds.

A search of the National Pollutant Inventory did not identify any listed facilities within 10 km of the project. The nearest air quality monitoring station is located at Haino Park Feedlot about 32 km south of the project.

The nearest sensitive receiver is a residence located approximately 700 m southwest from the project area. Sensitive receivers within the project vicinity are located approximately 2.2 km and 2.4 km from the project area and are both residences.

6.6.2 Impacts

Construction

The construction of the project would generate dust from activities such as:

- construction traffic on unsealed roads and haulage routes
- vegetation clearing
- rock and concrete crushing
- earthworks including stripping topsoil, excavations, and placement of fill.

Associated impacts on air quality would be localised and temporary in nature (limited to the construction period of two to three months) and are therefore considered unlikely to be significant. These would be managed in accordance with safeguards outlined in section 8.3.Exhaust emissions produced from vehicles, plant and machinery would be low in volume, readily dispersed by winds and would be likely to have only a negligible impact on local air quality emissions.

Operation

Air quality impacts during operation are expected to be minimal as operational arrangements would be unchanged from the current situation. Maintenance activities would only result in minor and occasional vehicle and plant emissions.

6.6.3 Safeguards

Specific safeguards proposed to avoid, minimise or manage potential waste, air quality impacts as a result of the project are included in section 8.3.

6.7 Waste, contamination, and hazards

6.7.1 Existing environment

Contamination

A search of the NSW Environmental Protection Authority Contaminated Land Register undertaken in September 2023 identified two contaminated sites within the Edward River Council LGA. Both these sites are located over 50 km from the project area.

Land surrounding the project area is predominately undeveloped land, suggesting a low likelihood of site contamination.

Hazards

The project area is located within Bushfire Prone Land (Vegetation Category 1). This vegetation category has the highest combustibility and likelihood of forming fully developed fires including heavy ember production. Bushfire risk in the locality is managed under the *Bushfire Risk Management Plan 2009* (BFRMP), prepared by the Mid Murray Bush Fire Management Committee. The aim of the BFRMP is to minimise the risk of adverse impact of bushfires on life, property and the environment.

The project area is subject to flooding. The project would result in minor adjustments to the overall height of the existing block bank. Along its 30 m length there would be an increase in height of around 7 mm at the location of the proposed regulator and a reduction in height of around 100 to 200 mm on either side of the proposed regulator.

6.7.2 Impacts

Construction

Small quantities of waste may be generated by the project which may include waste streams such as:

- green waste from cleared vegetation.
- concrete and rock riprap materials from removal of existing structures
- excess fill material from any excavation of soil and fill embankments

- dried surplus concrete and minor quantities of other surplus construction materials such as timber
- general wastes from construction contractors.

Waste produced during construction would be managed in accordance with the waste management hierarchy and in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014). This provides that waste avoidance is a priority, followed by reuse and recycling/reprocessing, with disposal as a last resort.

Potential ignition sources may be present including construction machinery and vehicles, and the potential for fuel leaks, spills and the storage of any flammable goods. Localised contamination from accidental spills or leaks of fuel, oils and chemicals during construction is considered unlikely. This risk would be managed by safeguards outlined in section 6.7.3.

The project would not involve the handling or generation of hazardous waste. Wherever possible, suitable excavated spoil would be re-used on site for backfilling, landscaping, and other uses. If spoil is unable to be re-used on-site, opportunities for off-site re-use would be investigated. If re-use opportunities are unable to be identified, or the spoil is unsuitable for re-use due to its geotechnical or contamination characteristics, spoil would be tested and classified according to the *Waste Classification Guidelines* (NSW EPA, 2014) and disposed of at an appropriately licensed waste management facility.

Salvaged concrete from demolition of existing structures including the existing culvert would be assessed for suitability of reuse. The project would also further minimise construction waste through:

- sustainable selection of construction materials
- detailed estimation and accurate ordering of quantities of materials required
- balancing earthworks to minimise the demand for imported fill or the need to export/dispose of excess spoil material.

Construction activities would require the use of machinery and equipment, and storage of materials that if not correctly managed and operated could cause a fire to be ignited. If uncontrolled this could extend into adjoining woodlands and grasslands. Construction would be a minor and a temporary source of potential fire risk with standard safeguard measures outlined in the CEMP.

The construction of temporary coffer dams and stockpiles would have a short-term effect on local drainage patterns. The small scale of these works are unlikely to affect the behaviour of flooding in the locality. In the event of flooding during construction safeguards would be implemented to allow early warning of such events so that personnel and equipment are removed from flood risk areas.

Operation

It is expected that only minimal waste and fire risks would be generated during operation, including as a result of maintenance activities.

The minor changes to the height of the block bank combined with the larger capacity regulator are unlikely to alter the effects of local flooding in this locality.

6.7.3 Safeguards

Specific safeguards proposed to avoid, minimise, or manage potential waste, contamination and hazards impacts as a result of the project are included in section 8.3.

6.8 Aboriginal heritage

An Aboriginal Cultural Heritage Assessment Report (ACHAR) was prepared by Austral Archaeology Pty Ltd to identify potential Aboriginal heritage values within the project area and assess potential impacts to these values that the project may have. The ACHAR was prepared to address Requirement 11 of the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010) (the Code of Practice) and details the archaeological assessment that was undertaken for the project area.

The assessment is summarised across the following sections.

6.8.1 Methodology

For the purpose of the ACHAR, the '**Study Area'** comprised the access track, borrow site, Contractor Activity Zone and the offtake itself (refer to Figure 6.13).

The ACHAR has been prepared in accordance with the consultation process specified in the *National Parks and Wildlife Act 1974* (NPW Act) and the *National Parks and Wildlife Regulation 2019*. This has included a four-stage process which has broadly consisted of:

- notification and registration of interest including providing agency letters, advertisement, development of a stakeholder list, and establishment of the Registered Aboriginal Parties (RAPs)
- presentation of information through engagement with the RAPs on the survey methodology and presentation of the proposal and archaeology methodology
- gathering of information about cultural significance through RAPs contributing to culturally appropriate information gathering to determine the cultural significance of Aboriginal objects and places within the study area to input into the development of cultural heritage management options
- review of draft reports and comments provided.

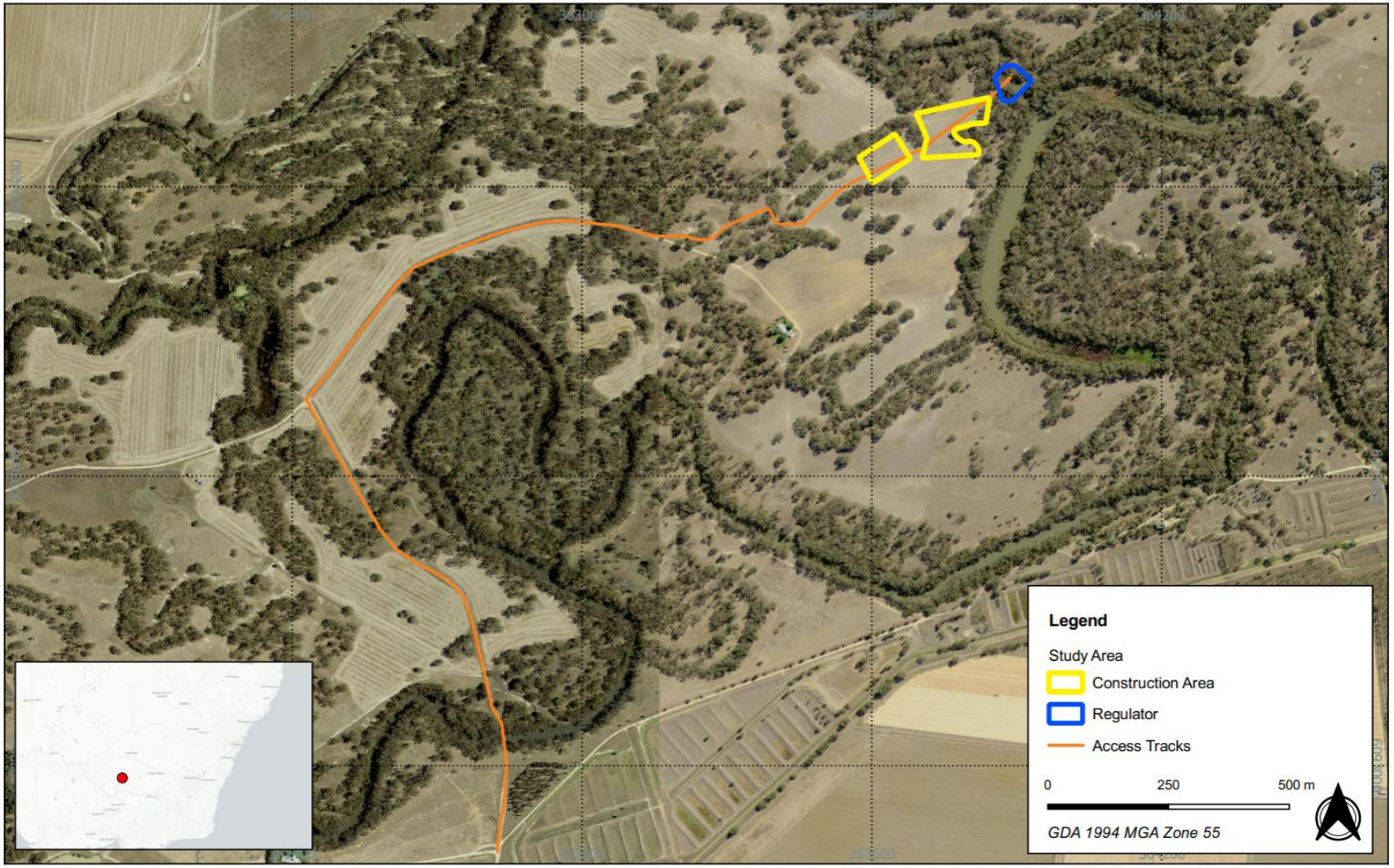

Figure 1.2 - Detailed aerial of the Wilson Anabranch Offtake study area

23039 - Yanco Creek Modernisation Project

Source: NSW LPI Aerial, CartoDB Positron *Drawn by: FOT Date: 2024-07-22*

AUSTRAL ARCHAEOLOGY

Figure 6.13 Project overview and ACHAR study area

The ACHAR consists of a desktop assessment, fieldwork surveys and post fieldwork analysis, and the development of management measures for the protection of Aboriginal cultural heritage (refer to section 6.8.4). The ACHAR was designed to identify and assess the archaeological characteristics of the Study Area. For the purposes of the assessment, archaeological characteristics have been determined to comprise of the following elements:

- registered Aboriginal objects
- likely Aboriginal objects
- archaeological deposits
- potential archaeological deposits
- archaeologically sensitive landforms and areas.

Aboriginal objects are defined by the *National Parks and Wildlife Act 1974* (NPW Act) as:

- Any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction and includes Aboriginal remains. (NPW Act – Part 1, Clause 5(1)).

6.8.2 Existing environment

As discussed in section 1.1, the project is located within the Riverina Region where much of the NSW portion is home to the Wiradjuri people, also known as the 'People of Three Rivers' (Bathurst Regional Council 2023). The rivers and floodplains provided ample resources for local Aboriginal groups in the past.

Desktop assessment

A desktop search of the Aboriginal Heritage Information System (AHIMS) was undertaken as part of this assessment. A search undertaken in June 2023 by Austral Archaeology identified one previously recorded site within 10 km of the study area (refer to Figure 6.14). The site identified is a modified tree.

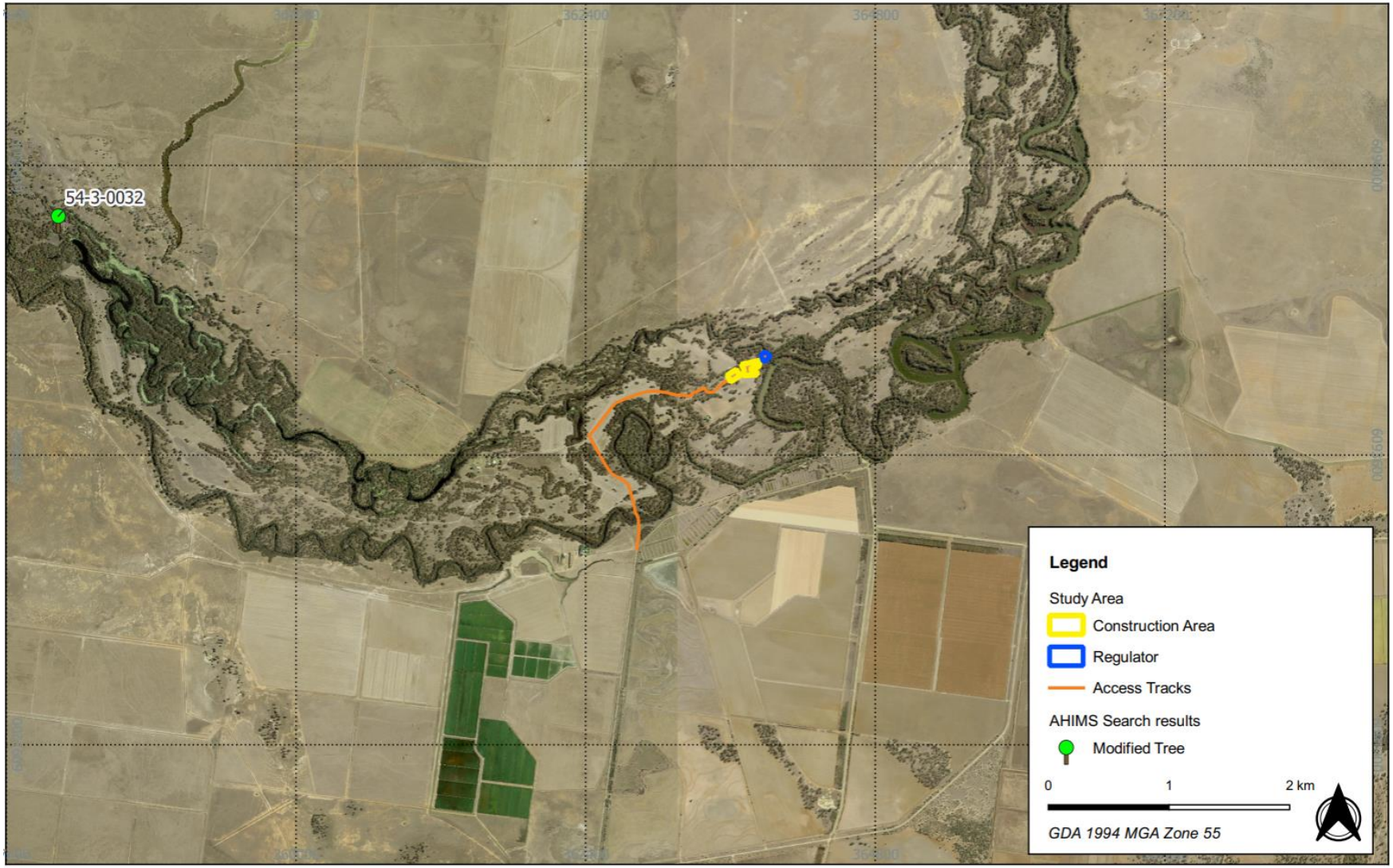

Figure 4.4 - AHIMS Search results of the Wilson Anabranch Offtake study area

23039 - Yanco Creek Modernisation Project

Source: NSW LPI Aerial *Drawn by: FOT Date: 2024-07-22*

AUSTRAL ARCHAEOLOGY

Figure 6.14 AHIMS search result

Field Surveys

In addition to the desktop assessment, an archaeological field survey was conducted by Austral Archaeology Pty Ltd, Cummerangunja Local Aboriginal Land Council and NSW DCCEEW on 9 August 2023. The survey was undertaken in accordance with the approaches outlined in Requirements 5 to 10 of the Code of Practice (DECCW 2011). The archaeological field study objectives were to:

- complete a systematic survey that targets areas that have been identified as having the potential to contain Aboriginal heritage values
- identify and record Aboriginal archaeological sites visible on ground surface and areas of Potential Archaeological Deposits (PAD).

The archaeological field survey identified two sites. The first site was located in a floodplain landform within the Access Track survey unit and consisted of artefact scatter. The second site was located in a flood plain within the Construction Area survey unit and was an isolated artefact. These results are listed in Table 6.2 below and shown within the Study Area in Figure 6.15.

Table 6.12 ACHAR field survey findings

Site name	Feature(s)	Survey Unit	Landform
WAO AS 1	Artefact	Access Track	Floodplain
WAO ISO 1	Artefact	Construction Area	Floodplain

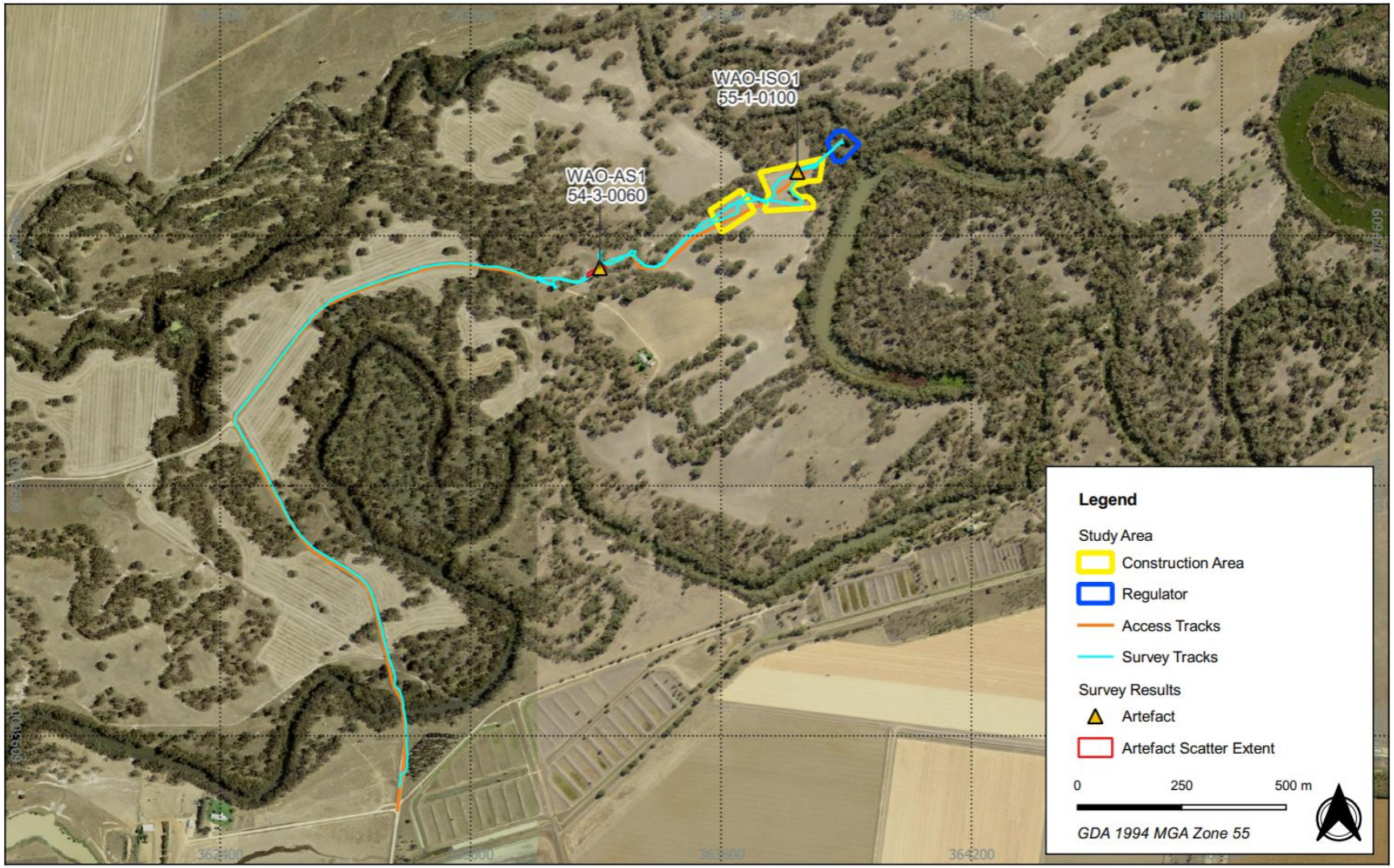

Figure 7.3 - Survey results of the Wilson Anabranch Offtake study area

23039 - Yanco Creek Modernisation Project

Source: NSW LPI Aerial *Drawn by: FOT Date: 2024-07-22*

AUSTRAL ARCHAEOLOGY

Figure 6.15 ACHA survey results

Archaeological context

The following is a summary of the relevant information regarding the archaeological context of the project. Refer to the Archaeological Assessment report in section 4 (refer to Appendix D Aboriginal Heritage Assessment) for further information.

Between the years 1990 and 2022, five regional archaeological studies were conducted in the Murray Valley, Riverine Plain, the Murray River, LGAs across Buronga to Wagga Wagga and the Murrumbidgee sub-region. The site types identified included oven mounds, scarred trees, burials, middens, suspected ceremonial sites, archaeological deposits.

A study of the Upper Murray that included the Riverine Plain, the Lachlan, Murrumbidgee and Murray rivers and their tributaries and anabranches identified 164 sites. The sites consisted of 739 burials which were found most frequently followed by clay pans, levees, and shelters (Littleton 1999).

Between the years 1987 and 2023, 11 local archaeological investigations localised to the project area at Yanco-Billabong catchment and Edward River LGA were conducted. The surveys identified scarred trees, isolated stone artefacts, open campsites, earth mounds, oven mounds, artefact scatter, burials, PADs and occupation sites. One study noted most of the sites it identified were located close to water or at areas of previous water sources (McIntyre 1987).

Ethnohistorical context

The following is a summary of the relevant information regarding the ethnohistorical context of the project. Refer to the Archaeological Assessment report in section 4.1 (refer to Appendix D Aboriginal Heritage Assessment) for further information.

The ethnography of the Riverina region has been described notably by two people, though their maps and descriptions do not necessarily accurately depict the distribution of Aboriginal groups. The study area location is currently considered to be shared land, with representatives from multiple groups attending field work. The study area is located close to the boundaries of traditional lands of three Aboriginal peoples, the Yorta Yorta, Barapa Barapa, and the Jeithi (Tindale 1974). The study area has also been described through the location of Aboriginal language groups, with the study area situated within the boundary of Baraba, Baraba, Yorta Yorta and Waradjuri people (Horton 1994).

The Riverina would have been able to support large populations of Aboriginal people, due to the number of permanent water bodies, and associated food and material resources. These resources would have included materials that were used for the creation of canoes, nets, stone tools, and other items for the collection and transportation of goods (Atkinson & Berryman 1983).

The total population of Aboriginal groups is hard to estimate in the Riverina region. The borders of the Aboriginal people were not static, and the introduction of European diseases caused a decrease in population. It has been estimated at the time of European occupation, that population numbers varied, with some groups noted to have up to 3,000 people. These numbers should not be considered an accurate representation of the total population, as areas considered fertile by the European settlers may not be the same for Traditional Owners (Read 1983).

Predictive statements

The following statements address the likelihood of Aboriginal cultural material being found within the study area, taking into consideration the review of previously recorded sites, archaeological studies conducted in the region:

- The study area is highly likely to contain sites with all features due to it being within 500 m of a hydrological feature.
- The soils of the study are equivalent to the Murray Channels and Floodplains and coarsely cracking clays, where scar trees and earth mounds are most likely to be identified.
- Any levees and/or earth mounds are likely to contain burials.

6.8.3 Impacts

The archaeological survey on 9 August 2023 identified two new cultural heritage sites consisting of an artefact scatter (WAO AS 1 [redacted] and an isolated artefact (WAO ISO 1 [redacted] The two cultural heritage sites are located in the Study Area and are expected to be impacted by the proposed activity.

The site consisting of the artefact scatter is located on the proposed access track and therefore would be affected by the widening and graveling of the road. The second site, an isolated artefact site is located within the contractor's work area and would therefore be affected by vehicle movement and storage of equipment and materials used in construction. An evaluation of harm to the sites identified as part of the ACHA is summarised in Table 6.13 and their location in relation to the study area and Aboriginal Heritage Impact Permit (AHIP) boundary is shown in Figure 6.16.

Table 6.13 ACHA assessment of harm to identified Aboriginal sites

Site Name / AHIMS No.	Type of harm	Degree of harm	Consequence of harm
WAO AS 1 / [redacted]	Direct	Total	Total loss of value
WAO ISO 1 / [redacted]	Direct	Total	Total loss of value

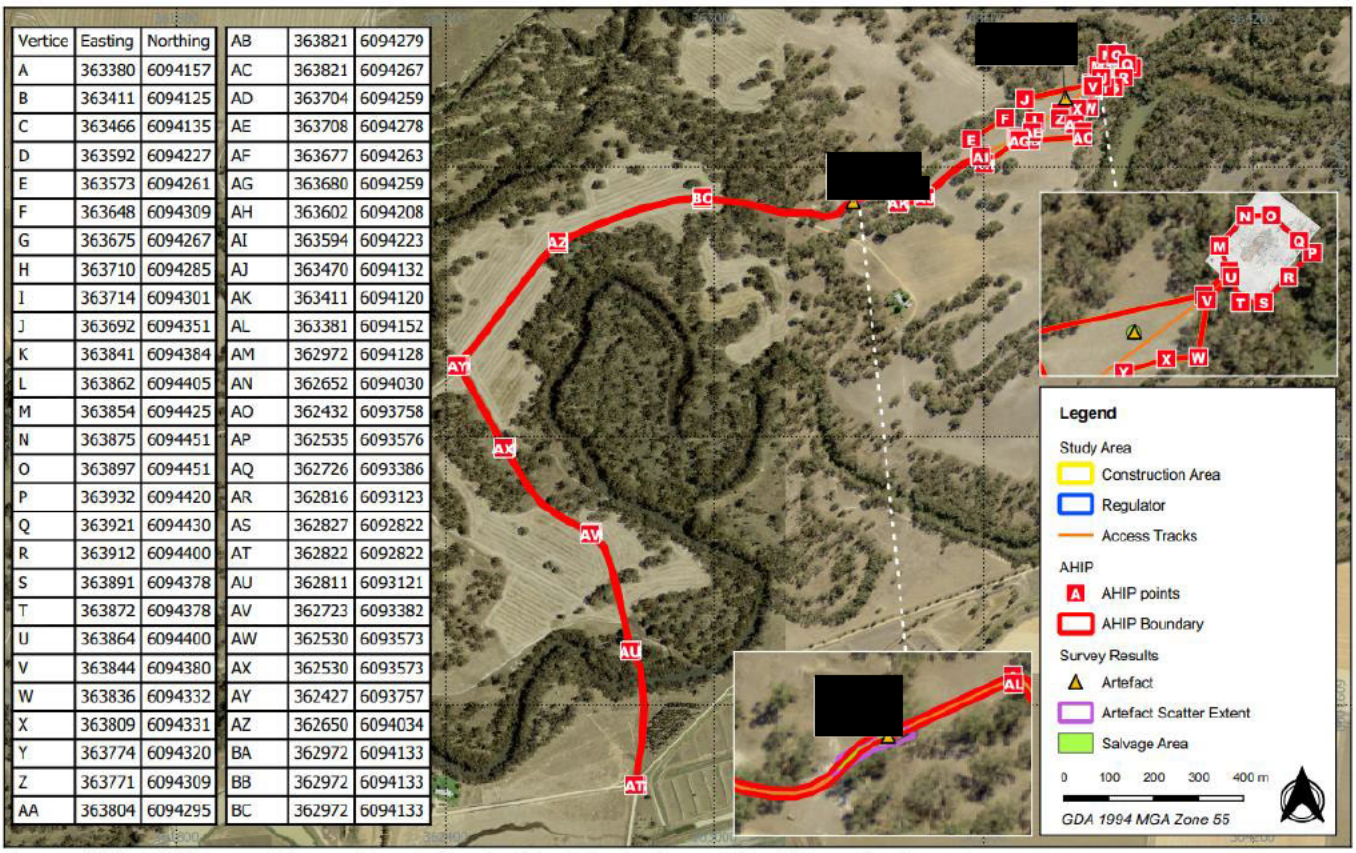

Figure 10.1 - AHIP area of impact in relation to Aboriginal values at the Wilson Anabranch Offtake study area - Overview
23039 - Yanco Creek Modernisation Project
Source: NSW LPI Aerial *Drawn by: FOT Date: 2024-07-29*

AUSTRAL ARCHAEOLOGY

Figure 6.16 AHIP area of impact in relation to Aboriginal values to the proposed study area

6.8.4 Safeguards

The safeguards proposed to avoid, minimise, or manage potential Aboriginal heritage impacts as a result of the project are included in section 8.3.

The two identified sites will be directly impacted by the works due to their location in the study area. To address this, it is recommended that a surface salvage program be undertaken so that the sites are not harmed from the proposed works and are instead relocated to a nearby location. An AHIP will be required to conduct this salvage.

The following safeguards are derived from the findings of the ACHA for the study area:

- Before any works occur, NSW DCCEEW to apply to Heritage NSW for an AHIP to destroy sites WAO AS 1 ([redacted] and WAO ISO 1 ([redacted] These sites are protected under Section 90 of the *NSW National Parks and Wildlife Act 1974* (NPW Act). It is recommended that the following mitigation measures are implemented as part of the AHIP:
  - Aboriginal cultural material at sites WAO AS 1 ([redacted] and WAO ISO 1 ([redacted]) are to be collected prior to any works taking place.
  - All Aboriginal objects collected during the surface salvage program (under the approved AHIP) will be reburied onsite at a nominated location.
- The access track is not to be widened where it intersects with WAO AS 1 ([redacted]).

- The Traditional Owners have requested they have a site monitor present during any ground clearing works in the event of unexpected finds.
- If during the project, unexpected finds or human remains are identified, the safeguard relating to the unexpected finds in section 8.3 must be followed.
- Consultation to inform Aboriginal stakeholders about the management of Aboriginal cultural heritage within the study area would be undertaken throughout the completion of the project.

6.9 Non-Aboriginal heritage

A Non-Aboriginal Heritage Assessment (refer Appendix E Non-Aboriginal Heritage Assessment) was prepared to identify the potential for non-Aboriginal heritage values within the project area and the surrounding region, and to assess potential impacts to these values. The assessment is summarised across the following sections.

For the purpose of this assessment, the study area includes the land required for the construction of the new structure, including two areas for use as Contractor Activity Zones, Clearing Areas, designated land for use as a borrow site, and the footprint for the access track (refer to Figure 1.2).

6.9.1 Methodology

In preparation for the non-Aboriginal heritage assessment, the following registers and databases were searched on 8 June 2023 to identify known heritage items within, or in proximity to, the study area, using a combination of spatial data tools and online databases. These included:

- State Heritage Register
- State Heritage Inventory
- Section 170 Heritage and Conservation Registers (S170)
- Conargo LEP 2013
- National Heritage List
- Commonwealth Heritage List
- World Heritage List
- Register of the National Estate (Non-statutory)
- National Trust of Australia (NSW) Register (NTR) (Non-statutory)
- further historical source material was utilised, such as:
  - NSW State Records and Archives
  - NSW Government's Historical Imagery Viewer
  - State Library of NSW
  - National Library of Australia
  - WaterNSW Archives and Records
  - Local history libraries
  - Historical mapping, e.g. Crown plans purchased from the NSW Land Registry Services.

Additionally, a literature review was undertaken to identify previous historical investigations which have been carried out within the region. This review was undertaken to identify heritage items which are not registered, to understand the nature and extent of any heritage assessment already carried out, to understand and assess any known cumulative impacts, and to prepare a succinct historical summary of the study area.

No site inspection was undertaken in the preparation of the non-Aboriginal heritage assessment, however, site photographs taken by other consultants during this project were utilised.

6.9.2 Existing environment

Based on the desktop assessment and literature review listed in section 6.9.1 it was concluded that there are no registered historical heritage items within the project area, or within a 1 km radius of the project area.

The study area is in a region under-represented in historical studies and heritage assessments. The local authority, Edward River Council, has commenced the Edward River Heritage Study, noting its completion and listings in an LEP are a medium-term priority (Edward River Council 2020).

The project area is located in the Parish of Wononga, County of Townsend, Land District of Deniliquin. It is part of the Riverina agricultural district, which was known as the Murrumbidgee District until the Crown Lands Act (1884) divided NSW into three districts. The study area is part of the Central Division district.

Section 4.3 of the Non-Aboriginal Heritage Assessment (Appendix E Non-Aboriginal Heritage Assessment) provides an in-depth summary of the study areas surrounding historical context, including early exploration, first landholders, and the history of water management within the Murrumbidgee region.

6.9.3 Impacts

This desktop heritage assessment has identified limited heritage constraints within the project area. The project is located on land that has had minimal development, based on historical maps, plans and historical aerial imagery. Of interest is the former alignment of the road that appeared in the earliest available plans from the 1870s and continued to be declared as a road through to the mid-twentieth century. Other potential non-Aboriginal heritage constraints include the existing water infrastructure and the siting of a new access track to the project area. These constraints are discussed below.

Archaeological potential

The former road alignment now forms Lot 5 DP252173, which runs between Yanco Creek and Wilson Anabranch. Although the road has not been in use since the mid-twentieth century, the alignment of the road forms a border between portions 167 and 168, which means that there is historical archaeological potential along its previous route. The use of the road since at least 1870s increases the possibility for historical archaeology to be present along the former alignment. The road in portion 167 was the only road reserve evident on the Wononga Parish Plan enabling travel over Wilson Anabranch south to Yanco Creek and into the Parish of Hartwood. Given the Coree station was located further south on Billabong Creek, it is possible that this road was an important link

between the northern section of the pastoral holding to the home station. It is also possible that the crossings over both waterways may have been places for camping along the route, given the access to water. Later uses of the road are less clear, and the most recent available aerial photograph of the site does not show tracks following the alignment or connecting to it by 1958.

The former alignment of the road intersects with one Contractors Activity Zone and the new access track. As the Contractors Activity Zone and construction of a new access track is not expected to involve any high impact or substantial subsurface works, the potential for historical archaeology in this area can be managed through an unexpected archaeological finds procedure.

Existing water structure

Based on the desktop assessment and literature review, it is assumed based on photographs from a NSW Office of Water report (2014), that the existing pipe culvert at Wilson Anabranch proposed for removal is likely one that was subject to a water licence application in the 1980s (NSW Government Gazette, 30 Mar 1984, p.1821). Although there have been multiple water licences for water infrastructure along Wilson Anabranch, (e.g. pumps, earth block banks and regulators) the descriptions of these locations in the Gazetted licences suggest these are not within the project area.

The likelihood of the existing concrete pipe culvert being of heritage significance is therefore considered to be low, as it was likely constructed in the 1980s and was in poor condition when photographed in 2014, with its current condition unknown.

Access track siting

The access track proposed to be utilised as part of this project would be constructed to meet an existing track which connects to North Coree Road. The section of new track runs through land that has had no evidence of development on historical maps and plans, other than being cleared of trees. It is recommended that if access track alignments change, previous tracks, such as the one evident in the 1986 aerial image be considered, as that provides a route in an area that has already undergone some disturbance from the earlier track.

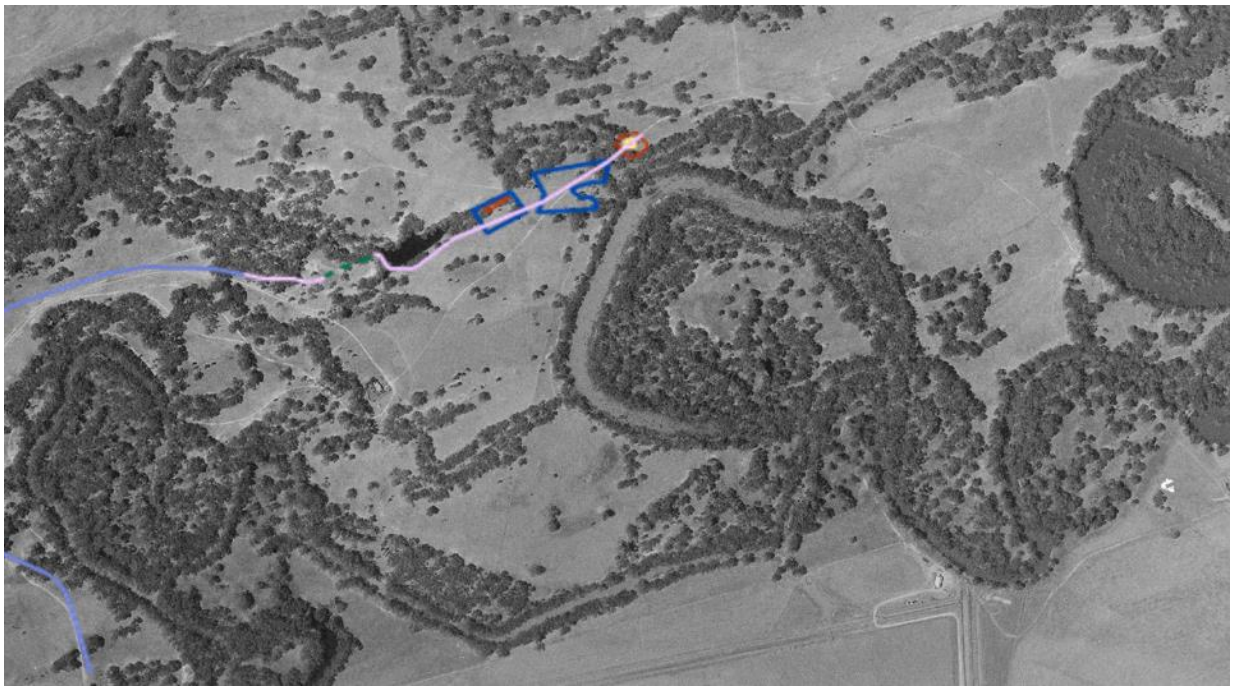

Figure 6.17 Aerial image of the project area, 1986 (NSW Government Spatial Services), showing the approximate location of the project works area (blue and orange boxes), alignment of the new access track (pink) and the path of the existing access track linking to North Coree Road (dark blue).

6.9.4 Safeguards

The scope of the non-Aboriginal heritage assessment was limited to a desktop assessment and literature review where conclusions were based on the historical information available. While it would usually be recommended to expand the research to include additional historical research held in the physical archives of the NSW State Archives, the low potential for historical archaeology associated with the use of the site is considered to be best managed through the use of an unexpected finds protocol.

The non-Aboriginal heritage assessment ultimately concluded that the project consists of activities with a low potential for heritage impacts. As such, the key recommendations arising from the assessment are:

- an unexpected finds protocol should be prepared and implemented to manage any unexpected historical archaeological material uncovered
- requirement for further assessment should the project footprint or access track alignment change.

The safeguards proposed to avoid, minimise, or manage potential historic heritage impacts as a result of the project are included in section 8.3.

6.10 Noise and vibration

6.10.1 Existing environment

The acoustic environment of the study area is typical of a rural area. The main noise sources are related to the natural environment, activities associated with surrounding agricultural land uses and the local roads. The nearest sensitive receivers are three separate homesteads located approximately 700 m, 2.2 km and 2.4 km from the project area. It is expected that ambient noise levels would be generally consistent with typical day/night patterns in a rural noise environment.

6.10.2 Impacts

Construction

There may be localised and temporary noise impacts during construction of the project, and construction noise is likely to be intermittent to nearby sensitive receivers, including a homestead about 700 m away from the project area. However, these noise impacts are expected to be minor and temporary in nature.

The construction of the project would generally take place during standard construction hours or as agreed with the landowner. Standard construction hours are outlined in the Construction Noise and Vibration Guideline (CNVG) (NSW Roads and Maritime Service, 2016) as follows:

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

Operation

There would be minor temporary noise from maintenance activities that are carried out periodically. Operations are expected to be intermittent and short-term, sufficient to open or close the regulator gate. The power and communication features for the project are to be via solar power and are not expected to generate any noise.

6.10.3 Safeguards

There are no specific safeguards proposed to address negligible noise and vibration impacts as a result of the project. Standard construction practices would be followed.

6.11 Traffic and access

6.11.1 Existing environment

A search of the NSW Road Network Classifications (TfNSW, 2023) was undertaken in June 2023 and indicates the road network within the vicinity of the project area consists only of local roads. The project area would be accessed via an existing unnamed track diverging from North Coree Road, 1.9 km southwest from the existing Wilson Anabranch Offtake regulator.

North Coree Road connects with Wilson Road to Jerilderie. The nearest regional roads to the project area are Conargo Road and the Newell Highway at Jerilderie.

6.11.2 Impacts

Construction

Access to the project area would be via a network of local unsealed roads diverging from North Coree Road. An unsealed farm access track then leads to the Wilson Anabranch Offtake regulator. Construction of the project may include upgrades to the existing access track which would involve resurfacing with local stream gravel compacted from 150 mm by a towed roller.

Construction would have a minor temporary impact on local traffic conditions. The rural road network has capacity to accommodate construction vehicles, so traffic impacts during construction are considered to be negligible. No road closures would be required for the works. Construction vehicles would park within the Contractors Activity Zone in the project area.

Operation

Periodic maintenance would be undertaken by WaterNSW which would result in minor traffic increase, but would be within the capacity of the roads.

6.11.3 Safeguards

Specific safeguards proposed to avoid, minimise, or manage potential traffic and access impacts as a result of the project are included in section 8.3.

6.12 Visual

6.12.1 Existing environment

The regional landscape is visually characterised by flat open plains and wide shallow creeks with scattered trees and vegetation along the creek edges. Existing infrastructure at the project area is low profile and largely screened by surrounding trees (refer to section 3.2.3). Construction and operational access to the project area would be via an existing unnamed track diverging from North Coree Road.

The nearest sensitive public receiver would be from North Coree Road, about 1.9 km southwest of the project area. Due to this distance and intervening vegetation, users of North Coree Road would have no views to the project area and any undergoing construction.

6.12.2 Impacts

Construction

Temporary impacts to visual amenity would occur during construction in the immediate vicinity of the project area. These impacts would be due to the presence of construction vehicles and equipment at work sites. Visual impacts are not considered to be significant due to the short duration of the construction period and lack of sensitive receivers that have direct visibility towards the Contractors Activity Zone.

Operation

The proposed infrastructure would only be visible from the immediate vicinity (the project area) and would not be visible from the closest sensitive receiver.

The structure would be similar in appearance of those associated with this type of water infrastructure in the surrounding region.

Therefore, visual impacts are considered to be negligible.

6.12.3 Safeguards

There are no specific safeguards proposed to address negligible visual impacts as a result of the project.

6.13 Socio-economic

6.13.1 Existing environment

The Edward River LGA covers an area of about 8,880 square km. The Edward River LGA has a population of 8,437 (2021 Census), with about 7,862 residing in the city of Deniliquin.

The LGA includes a number of smaller population centres surrounding the city of Deniliquin, including the towns Blighty, Booroorban, Conargo, Mayrung, Morago, Pretty Pine and Wanganella (Edward River Council website, 2016). These small towns and villages access the larger centre of Deniliquin for a range of educational, social, employment and medical services.

In 2016, the main employment industry in the Edward River LGA was agriculture, forestry and fishing, employing 16.5 per cent of the workforce. Other industry sectors which residents work mainly include health care and social assistance, retail trade, manufacturing and construction.

6.13.2 Impacts

Construction

The scope and significance of potential socio-economic impacts during construction would be limited due to the remote context of the project and minimal potential for social impacts to occur. Amenity-related impacts (including air, noise and visual) are addressed in sections 6.6, 6.10 and 6.12 would be considered negligible due to the minor impacts and the lack of sensitive receivers in proximity to the project area.

Construction of the project may provide temporary economic benefits to Jerilderie and other local towns in the surrounding area through sourcing of local jobs and supplies.

Operation

As discussed in section 2.1, the primary purpose of the project is to upgrade the existing offtake infrastructure at Wilson Anabranch in order to measure the flow of water into the watercourse through the main (low-flow) inflow point, as well as to allow for improved fish passage. The project is part of a series of infrastructure upgrades to meet the aims outlined in the Basin Plan in order to overall bring the Murray-Darling Basin back to a healthier and sustainable level, while continuing to support farming and other industries for the benefit of the Australian community. These changes would enhance amenity and improve conditions for aquatic biodiversity within the watercourse, as well as assist in supporting industries across the region.

6.13.3 Safeguards

Specific safeguards proposed to avoid, minimise, or manage potential socio-economic impacts as a result of the project are included in section 8.3.

6.14 Land use

6.14.1 Existing environment

The project is located within the Edward River LGA. The relevant local planning instrument for the project is the Conargo LEP 2013. The land use zoning of land at the location of the project is Zone RU1 Primary Production (refer to Figure 4.1).

6.14.2 Impacts

Section 3.9 describes the land requirements for the project, which includes temporary occupation, permanent acquisition and access for operation and maintenance. Once construction is complete, with the exception of the area required for the infrastructure, the works areas would be reinstated and returned to the former land use. No ongoing land use impacts are anticipated.

6.14.3 Safeguards

There are no specific safeguards proposed to address land use. Agreements and/or lease agreements would be entered into with private landowners as detailed in Section 3.9.

6.15 Cumulative

6.15.1 Existing environment

The project forms part of the overall YCMP which involves infrastructure upgrades and new installations to improve water management across the Yanco Creek system.

The project, known as *Part 3 – Wilson Anabranch Offtake regulator* upgrade is one of several project parts comprising the YCMP. Subject to receiving approval, it is expected that construction would commence in mid-2025 and take 2 to 3 months to complete.

The nearest YCMP project part to the project area is located approximately 8 km southeast at the Billabong Creek and the old hydrometric station (Part 5C). Construction for Part 5C is planned for the first half of 2024 with a 1-week construction timeframe.

A search of the NSW Major Projects website identified 12 other major projects within the vicinity of the Wilson Anabranch Offtake regulator. Details of each of these projects have been included below in Table 6.14.

Table 6.14 Major projects within the vicinity of the Wilson Anabranch Offtake project

Project name	Distance to the project area	Project details	Project timing
Victoria to NSW Interconnector West	16 km north	Construction and operation of a new electrical connection between NSW and Victoria. The connection is proposed to be located across the north of Edward River LGA.	Construction of the project is targeted to commence in 2026 subject to regulatory and applicable planning approvals. Operation is expected to begin in 2028.
Yanco Delta Wind Farm	18 km north	Construction and operation of a wind farm northwest of Jerilderie, NSW. The proposed wind farm will include approximately 210 turbines, a battery energy storage system, solar panels and associated electrical infrastructure.	Construction of the project is targeted to begin in late-2024 subject to planning approval, with an expected duration of 36 months. Operation is expected to begin in 2025 with an operation life of at least 30 years.
Conargo Wind Farm	19 km west	Construction and operation of a 300 megawatt (MW) windfarm.	Construction of the project is targeted to commence in 2027 for up to 24 months. Operation is expected to begin in 2028 or 2029.
Currawarra Solar Farm	28 km southwest	Construction and development of a 195 MW solar farm and associated infrastructure.	Construction timing of the project is not listed. Construction duration is expected to take approximately 18 months.
Dinawan Wind Farm	37 km northeast	Construction and operation of a windfarm with up to 200 wind turbines and associated infrastructure.	Construction timing of the project is not listed. Construction duration is expected to take approximately 60 months.
Dinawan Solar Farm	42 km northeast of the project area	Construction and operation of a solar farm 42 km northeast of the project area. The proposed solar farm will involve the development of a 1,000 MW solar farm with associated infrastructure and battery storage.	Construction is expected to begin in 2025 and will take approximately 18-24 months to complete.

Project name	Distance to the project area	Project details	Project timing
Tarleigh Park Solar Farm	43 km southwest	Construction and operation of a 90 MW solar farm.	Construction timing of the project is not listed. Construction duration is expected to take approximately 12 months.
Deniliquin East Battery Energy Storage System	50 km southwest	Construction and operation of a 100 MW battery energy storage facility with associated infrastructure.	Construction of the project is targeted to commence in 2024 for approximately 12 months subject to regulatory and applicable planning approvals.
Deniliquin Battery Energy Storage System (BESS)	52 km southwest	Construction, operation and decommissioning of a BESS with a capacity of 120 MW and ancillary infrastructure.	Construction of the project is targeted for 2027 for approximately 12 months. Operation is expected to begin in 2028.
Bullawah Wind Farm	69 km northwest	Installation, operation, maintenance and decommissioning of up to 170 wind turbines, Battery Energy Storage System (BESS) facilities, ancillary infrastructure and temporary facilities associated with the construction of the wind farm.	Construction phase of the project is expected to begin in mid to late 2025 and take approximately 24 months.
Booroorban (Saltbush) Wind Farm	71 km northwest	Construction and operation of a 400 MW windfarm, including 70 wind turbines.	Construction of the project is targeted to begin in 2028. Operation is expected to begin in mid-2030.
Pottinger Wind Farm	75 km northwest	Construction and operation of a windfarm with up to 247 wind turbines, battery storage and associated infrastructure.	Construction phase of the project is expected to begin in 2026 and take approximately 24 months.

6.15.2 Impacts

Construction

Given the relatively minor environmental impacts associated with the Wilson Anabranch Offtake, the staggered timing for construction and the distance to each of the nearest YCMP project parts and other major projects, any potential cumulative impacts associated with construction are considered to be negligeable.

Furthermore, construction of each of the YCMP project parts would be coordinated by the NSW DCCEEW in order to minimise any potential cumulative impacts.

Operation

Operation of the project would be undertaken in accordance with the Yanco Creek System Operations Plan currently being developed for the broader YCMP in consultation with key stakeholders, including WaterNSW. Operations at Wilson Anabranch would be similar to current operations.

Operation of each of the YCMP project parts would be managed by WaterNSW in accordance with its water supply work approval and the delivery of water to its customers and the environment. Monitoring and evaluation undertaken of operations would enable ongoing improvement to the operation of the system through adaptive management and minimise any potential cumulative impacts associated with the operation of each of the project parts.

6.15.3 Safeguards

The safeguards proposed to avoid, minimise, or manage potential cumulative impacts associated with the project are included in section 8.3.

7 Matters of national environmental significance under the EPBC Act

As noted in section 4.3, the project is not located on Commonwealth land. In terms of potential impacts on MNES, this was considered as part of the assessments as detailed in section 6 of this REF and summarised in Table 7.1 below. Overall, the project is unlikely to have a significant impact on MNES.

Table 7.1 EPBC matters of national environmental significance factors for consideration

MNES	Applicable?	Assessment	Impact
Listed threatened species or ecological communities	Yes	Two threatened terrestrial fauna species listed under the EPBC Act are considered to have a high likelihood of using the habitats in the study area: the Superb Parrot (*Polytelis swainsonii*) (listed as vulnerable), and the Southern Bell Frog (*Litoria raniformis*) (listed as vulnerable). Assessments of significance for these species have been prepared in accordance with the EPBC Act and summarised in section 6.4.3. One threatened aquatic fauna species listed under the EPBC Act are identified as likely to be present in the study area: the Murray Cod (*Maccullochella peelii*) (listed as vulnerable). Assessments of significance for this species has been prepared in accordance with the EPBC Act and summarised in section 6.5.2. No threatened flora species listed under the EPBC Act are considered to have a high likelihood of occurrence within the study area. However, the Slender Darling Pea (*Swainsona murrayana)* was determined to have a moderate likelihood of occurrence. An assessment of significance for this species has been prepared in accordance with the EPBC Act and summarised in section 6.4.3.	The project is unlikely to have a significant impact.

MNES	Applicable?	Assessment	Impact
Listed migratory species	Yes	While no migratory species were recorded during the field survey, the Satin Flycatcher (*Myiagra cyanoleuca*), White-throated Needletail (*Hirundapus caudacutus*), and the Fork-tailed Swift (*Apus pacificus*) may occasionally occur within the study area. Assessments of significance for these species have been prepared in accordance with the EPBC Act and summarised in section 6.4.3.	The project is unlikely to have a significant impact as the project would not remove any important habitat for these species.
Wetlands of international importance (listed under the Ramsar Convention)	No	There are no Ramsar wetlands in proximity to the proposed activity.	N/A
World heritage areas	No	There are no world heritage areas in proximity to the proposed activity.	N/A
National heritage places	No	There are no national heritage places in proximity to the proposed activity.	N/A
Commonwealth marine areas	No	There are no Commonwealth marine areas in proximity to the proposed activity.	N/A
Great Barrier Reef Marine Park	No	The proposed activity is not in proximity to the Great Barrier Reef.	N/A
Nuclear actions	No	No nuclear action is proposed.	N/A
Water resources (relating to coal seam gas development and/or large coal mining development)	No	The proposed activity does not entail a coal seam gas development and/or a large coal mining development.	N/A

8 Environmental management

A number of safeguards have been proposed in this REF to avoid, minimise or manage potential environmental impacts of the project (refer to Table 8.1). Should the project proceed, these safeguards would be incorporated into the detailed design and applied during construction and operation of the project.

8.1 Construction environmental management

A CEMP would be prepared prior to construction to outline site specific environmental management measures and performance targets that would be adopted during the construction of the project. The CEMP would detail how the safeguards proposed in this REF would be implemented, including who would be responsible for their implementation and when.

The CEMP would be prepared prior to commencement of construction. The CEMP would be a working document, subject to ongoing change and updated as necessary.

The key objective of the CEMP would be to deliver and implement the environmental commitments made in the REF throughout the construction period, together with conditions imposed by any licences and approvals. The CEMP would include the following information:

- details of all positions and contact details of all key personnel
- audit and reporting program to ensure all actions/measures are implemented
- training requirements, including site induction requirements to ensure that all personnel understand the principles of environmental management
- emergency and incident response procedures
- list of approvals to be obtained before work commences
- consultation requirements (government and community) and complaint handling procedures
- actions for meeting environmental objectives based on the mitigation measures identified in this REF and any statutory or regulatory obligations
- details of person responsible for the implementation of each action.

8.2 Operational environmental management

As discussed in section 3.5.2, the proposed upgraded Wilson Anabranch Offtake would be operated by WaterNSW The principles for operation of the new Wilson Anabranch Offtake structure are outlined in the Yanco Creek System Operations Plan, and consistent with water sharing plans and environmental watering requirements. The plan is to form part of the requirements of the water supply work approval issued to WaterNSW for the Murrumbidgee regulated river water source.

Additionally, a number of safeguards have been proposed for the project in order to avoid, minimise or manage potential environmental impacts during operation of the project. These are identified in section 8.3.

8.3 Summary of safeguards

A summary of all measures proposed to avoid, minimise or manage potential environmental impacts of the project are detailed below in Table 8.1.

Table 8.1 Summary of safeguards

Theme	Safeguards	Responsibility	Timing
Erosion and sedimentation	Erosion protection to be considered and included in detailed design in accordance with SDLAM Acceleration Project General Technical Specification.	NSW DCCEEW	Detailed design
Acid sulfate soils	Requirement for an acid sulfate soils plan (ASSMP) would be confirmed after final detailed design and based on the findings of geotechnical investigations.	NSW DCCEEW	Detailed design
Offtake operating schedule	According to the current Operating Plan, Wilson Anabranch Offtake is fully opened from 1 April to 31 August every year (153 days). Irrespective of when construction of the project occurs, water will need to be delivered to Wilson Anabranch for the same number of days within the same calendar year. Timing for delivery of this water, based on construction timing of the project, will be determined following consultation with the NSW DCCEEW Environment and Heritage Division.	NSW DCCEEW	Detailed design
General	A construction environmental management plan (CEMP) prepared in accordance with the NSW DCCEEW Environmental Management Plan - minimum standards guideline, will be endorsed by the NSW DCCEEW prior to works commencing. WaterNSW to be notified at least two weeks prior to construction commencing.	Construction contractor	Prior to construction

Theme	Safeguards	Responsibility	Timing
Water quality	Water quality sampling would be obtained from Wilson Anabranch (upstream and downstream of construction activities) prior to construction. This will allow more accurate assessment and management of potential impacts during construction.	NSW DCCEEW	Prior to construction
Vegetation clearing	The limits of the assessed Clearing and Contractor Activity Zone will be clearly marked on-site. As far as practicable, vegetation clearance and disturbance will be minimised, including impacts to mature trees and hollow-bearing trees. Where possible, limit clearing to trimming rather than the removal of whole plants.	Construction contractor	Prior to construction
Cultural heritage	All personnel working on site are to be provided site specific cultural heritage induction to highlight the cultural sensitivities of work sites and are to be made aware of the procedures for the management of Aboriginal cultural heritage during construction, such as the discovery of Aboriginal artefacts or other cultural material. WaterNSW to be notified of any unexpected Aboriginal and/or other cultural heritage finds during construction.	Construction contractor	Prior to construction
Historical archaeology and research	If project footprints or access track alignments change, then the potential for historical archaeology will need to be reconsidered for the changed area and an assessment of impact may be required.	NSW DCCEEW	Prior to construction

Theme	Safeguards	Responsibility	Timing
Aboriginal Heritage Consultation and Impact Permit	NSW DCCEEW are to apply to Heritage NSW for an Aboriginal Heritage Impact Permit to destroy sites WAO AS 1 (b) (1) (A)) and WAO ISO 1 (b) (1) (A)), in accordance with the process described in section 6.8.4 of this Review of Environmental Factors. NSW DCCEEW to continue to inform the Aboriginal stakeholders about the management of Aboriginal cultural heritage through to the completion of the project. The consultation outlined as part of the Aboriginal Cultural Heritage Assessment is valid for six months and must be maintained by the proponent for it to remain continuous. If a gap of more than six months occurs, then the consultation will not be suitable to support an Aboriginal Heritage Impact Permit for the project if required.	NSW DCCEEW	Prior to construction
Traffic and access	Private landowners will be consulted about access arrangements.	NSW DCCEEW / Construction contractor	Prior to construction / construction
Environmental inductions	All workers to be provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the site and measures to be implemented to protect biodiversity.	Construction contractor	Prior to construction / construction
Protection of threatened species	If any threatened species (flora or fauna) are discovered during the works, stop work immediately and notify the NSW DCCEEW. Work will only recommence once the impact on the species has been assessed and appropriate control measures provided.	Construction contractor	Construction
Damage to vegetation	If any damage occurs to vegetation outside of the Clearing Area and Contractors Activity Zone, notify the NSW DCCEEW Project Manager and Environmental Representative so that appropriate remediation strategies can be developed.	Construction contractor	Construction

Theme	Safeguards	Responsibility	Timing
Protection of sensitive areas	Adjust methodology (e.g. avoid area, hand excavate, use hand tools for branch trimming, employ arborists to complete tree trimming of any hollow-bearing trees, implement exclusion fencing) to protect sensitive areas where possible such as hollow-bearing trees.	Construction contractor	Construction
Fish passage management	If possible, schedule construction activities within the watercourse during low or no flow periods when fish passage won't be impacted. Minimise the duration of fish passage restrictions.	Construction contractor	Construction
Erosion and sediment control	Implement site specific control measures to manage potential erosion or sedimentation impacts including but not be limited to: • Floating silt fences for instream works. • Undertaking work when flows are low/dry and minimise the duration of works within the watercourse as far as practicable. • Minimise clearance of vegetation and retain existing vegetation as much as possible. • Develop a methodology with consideration of contingencies for moderate to high flows during instream works should this occur while works are occurring. • Wherever possible, prefabricate instream structural elements prior to instream installation. • Install sediment controls around stockpiles to contain coarse soil and sediment, as applicable to prevent sedimentation of watercourses. • Placement of stockpiles away from the watercourse (at least 20 m of creek channels) and be covered when not in use to prevent sediment runoff. • Stabilise exposed soil where applicable with the appropriate structural materials and media for the construction activities (e.g. stabilisation matting, rock armour or vegetation).	Construction contractor	Construction

Theme	Safeguards	Responsibility	Timing
	• Regular, at least daily, visual water quality monitoring of waterways adjacent to the project area during construction, to assess the effectiveness of silt fences, so they can be fixed if necessary. If the visual assessment identifies potential water quality issues, further testing should be undertaken for comparison against the baseline. • Erosion and sediment controls established prior to commencement of vegetation clearing or earthworks. These controls to be documented in the CEMP.		
Aquatic habitat disturbance minimisation	• Disturbance to riparian vegetation and snags would be limited to the assessed clearing areas and avoided wherever possible. • Relocate large woody debris and snags (>3m long or 30 cm wide) from the construction footprint area to a suitable location upstream or downstream of the site in consultation with a qualified ecologist, the NSW DCCEEW and with WaterNSW so that the removal does not impact operations or cause future damage to the offtake. • Consult with NSW DPI – Fisheries prior to removal and relocation of in-stream snags.	NSW DCCEEW / Construction contractor	Construction

Theme	Safeguards	Responsibility	Timing
Spills or leaks	Site specific controls to be developed to manage the risk of accidental spills or leaks of fuels, oils and chemicals (such as hydraulic oils), or concrete, during construction. These controls would be documented in the CEMP and would include: • Emergency spill response procedure in accordance with the NSW DCCEEW incident management protocols. • Site specific controls to reduce the risk of the release of potentially harmful chemicals from spills or leaks entering waterways downstream. • Storage of hazardous materials such as oils, chemical and refuelling activities in bunded areas within contractor's temporary work areas. • Bunded receptacles for concrete waste including concrete slurries and washout water provided at the work sites to capture, contain, and appropriately dispose of any concrete waste at a suitably licenced waste facility. These will be located as far from waterways as feasible.	Construction contractor	Construction

Theme	Safeguards	Responsibility	Timing
Weeds and pathogen management	Develop and implement a weed and pathogen control plan that includes the following requirements and measures to mitigate spread: • Vehicle, personnel, material and equipment hygiene protocols (including measures required to prevent the spread or transmission of Chytrid Fungus) as per Hygiene protocols for the control of diseases in Australian frogs (Murray et al. 2011). • Weed, pest animal and pathogen management and monitoring and reporting requirements during the construction period. Weed and pathogen management and monitoring and reporting requirements should be documented. Measures must be auditable and linked to management outcomes such as: • Identify listed weeds (identified in NSW WeedWise) in the construction area and assess the risk of additional spread prior to relocating topsoil. Implement measures to manage this risk during clear and grade, and reinstatement. • To a reasonable extent practicable during the clear and grade phase, check that vehicles and plant equipment are free of soil (dust/clods) and vegetation prior to entry and exit from the construction area. • Evaluate disturbed areas post-construction and implement rehabilitation in accordance with the appropriate safeguards. • To avoid and minimise spread of pathogens, all vehicles and plant undertaking construction works directly in the watercourse must be cleaned and free of debris prior to entrance of each waterway and on exit if working between multiple waterways (excluding vehicles and plant equipment using the constructed access route).	Construction contractor	Construction

Theme	Safeguards	Responsibility	Timing
Vegetation clearing	During clearing and excavation, topsoil will be retained and stored for reuse during site rehabilitation. Stockpiles are to be identified and managed in accordance with the CEMP.	Construction contractor	Construction
Pest control	Food waste accumulated on site will be stored in inaccessible bins and disposed off-site regularly so that the waste doesn't attract predatory pests such as cats and foxes.	Construction contractor	Construction
Aquatic and terrestrial fauna management	Implement the following fauna management procedures during construction, to be documented in the CEMP: • Prepare a dewatering plan for temporary works associated with the construction of the new regulator to avoid potential impacts to aquatic fauna such as fish stranding. – As a requirement of the plan, in parts of the waterway that become isolated during construction by silt curtains, coffer dams, or the block bank, entrained native aquatic fauna will be captured and relocated to a nearby suitable habitat by qualified aquatic ecologists. – Isolated reaches will be re-cleared of native fish if the isolating structures are overtopped by a flood. – Large woody debris will be removed from the dry site as a final step following fauna salvage and dewatering. – Any groundwater that enters excavations within the work sites will be tested and, if suitable, pumped into nearby waterways or otherwise transferred into a treatment pond and treated before being discharged into nearby waterways. The CEMP will include water quality criteria for any water to be discharged into nearby waterways.	Construction contractor	Construction

Theme	Safeguards	Responsibility	Timing
	• Development and implementation of handling and salvage protocols for terrestrial and aquatic fauna during construction, including legislative permit and authorisation requirements of wildlife handlers. This will include procedures for pre-clearing and clearing surveys and procedures should fauna or nests/burrows be found during these surveys. The protocols will include details of requirements, including wildlife handler/ecologist/any permits. • All fencing must be fauna friendly to minimise risk of injury from collision and include provision of egress points, for example: – Temporary to exclude construction: High visibility string of bunting or plastic mesh (not transparent) attached to star pickets with plastic caps (or weighted posts that avoid ground penetration in culturally sensitive areas). – Temporary to exclude wildlife (e.g. from open trenches): Fencing stays located inside the exclusion area, or with high visibility mesh to guide wildlife away from obstructions. Shade cloth or other suitable deterrent attached to the lower 50 cm of the outside of the exclusion zone and weighted to the ground. – No barbed or razor wire will be used. • Trench management, including avoiding open trenches overnight where practicable. Where trenches cannot be closed, check trenches at the start and end of each day (i.e., dawn/dusk), and consider feasibility of measures (e.g., ramps) to aid animal escape. • Avoiding night works during periods of high insect/bird/bat activity (October to March) as far as reasonably practical, so as to minimise disturbance to fauna communication, foraging and other behaviours that depend on sound and darkness.		

Theme	Safeguards	Responsibility	Timing
Fauna vehicle protection	Construction vehicles movements will be defined in a site access plan which could include a limitation to access site during daytime only and a speed limit implemented to reduce the risk of vehicle strike to fauna.	Construction contractor	Construction
Reinstatement	• Disturbed areas will be revegetated with endemic riparian and floodplain species (replacing like for like) to be undertaken as soon as practical, progressively. • Rehabilitation at construction sites to include replacing topsoil. • Mature trees removed from the construction footprint will be cut into appropriate sections and relocated adjacent to waterways. Existing woody debris will also be relocated. Consultation with WaterNSW would be undertaken prior to reinstatement.	NSW DCCEEW / Construction contractor	Construction
Aboriginal heritage protection	No track widening is to occur where it intersects with WAO AS 1 (b) (1) (A)) as shown in Figure 1.2 of this REF.	Construction contractor	Construction
Unexpected finds – Aboriginal heritage	• A traditional owner is to be present during all ground clearing works. • If an Aboriginal object is identified, it is a legal requirement under Section 89A of the NPW Act to notify Heritage NSW as soon as possible. The process for further investigations include: – Confirming if the site (find) is of Aboriginal heritage origin. This verification is to be done by a Traditional Owner. – Stopping works in the vicinity of the identified Aboriginal heritage site and fending off this area. – Recording the Aboriginal heritage site (by a qualified archaeologist) and if possible, removal of the cultural material before work recommences. – An AHIMS site card will be completed for each new find located under the unexpected find process.	NSW DCCEEW / Construction contractor	Construction

Theme	Safeguards	Responsibility	Timing
	– An AHIP may be required prior to certain activities recommencing. • If human skeletal remains (or suspected human remains) are encountered, all work must cease immediately and NSW Police must be contacted, they will then notify the Coroner's Office. Following this, if the remains are believed to be of Aboriginal origin, then the Aboriginal stakeholders and NSW DCCEEW — Heritage must be notified. Procedures outlined in the unexpected finds protocol within the CEMP must be followed.		
Unexpected finds – non-Aboriginal heritage	An unexpected finds protocol is to be prepared and implemented during construction to manage any unexpected historical archaeological material uncovered. The protocol needs to follow a process that if unexpected items are discovered during construction, all work will cease in the area. The Contractor will inform the site supervisor and Project Manager, and a Historical Archaeologist will be engaged to assess the item's significance.	NSW DCCEEW / Construction contractor	Construction
Waste	All construction and operation waste would be classified in accordance with the Waste Classification Guidelines (EPA, 2014) and would be disposed of at licensed waste receiving facilities. Records are to be kept with regards to the total volume of waste disposed to: • landfill • recycled • disposed offsite • other	Construction contractor	Construction
Hazard	Emergency contacts and response procedures will form part of the CEMP and site inductions.	Construction contractor	Construction
Air quality	Dust suppression would be applied by means of water spray during any construction activities causing substantial dust.	Construction contractor	Construction

Theme	Safeguards	Responsibility	Timing
Hydrology	The proposed offtake regulator will be subject to review and flow reporting, to allow improvements in operation, as required by the Yanco Creek System Operations Plan	NSW DCCEEW – WaterGroup / WaterNSW	Operation
Erosion and sediment	Erosion and sediment controls, including semi-permanent controls along the creek bed and bank as required, will be maintained post construction until disturbed areas are stabilised. Undertake two post-construction visual assessments of the block bank and regulator over 2 years to identify and assess any erosion caused by the structure, so it can be addressed if required. Assessment would be undertaken by WaterNSW O&M works.	WaterNSW	Operation
Monitoring flow	Daily discharge will be monitored based on measured water levels and gate settings. Gate position will be set in accordance with the Operating Plan.	WaterNSW	Operation
Water quality	Site environmental management, inclusive of spill response measures, will be in accordance with broader WaterNSW O&M and environmental management procedures for operations.	WaterNSW	Operation
Fish passage during operation	Inspect the regulator annually to check that fish passage is not obstructed and remove obstructions (e.g. rocks, logs) if present.	WaterNSW	Operation
Fauna management during operation	All operation personnel would be informed of environmental responsibility with respect to the protection of aquatic and terrestrial fauna and their habitat. All vehicles driven by operation personnel would be required to remain on designated tracks and not drive through water.	WaterNSW	Operation
Hazard	Emergency contacts and response procedures will form part of the WaterNSW operation and maintenance procedures which will be incorporated into an O&M manual.	WaterNSW	Operation

9 Conclusion

9.1 Justification

The project is being delivered as one of the sub-projects of the YCMP, which forms part of the commitments within the SDLAM program being delivered by the NSW DCCEEW.

Potential environmental impacts of the project have been identified and assessed in section 6 and found to be insignificant. Required native vegetation removal would be limited and over time it is expected that vegetation would regenerate in areas cleared during construction. The project is unlikely to significantly impact threatened species, populations, ecological communities, or migratory species.

The objective of the FM Act is to promote ecologically sustainable development, including the conservation of biological diversity, promote ecological sustainable development and provide social and economic benefits for the wider community. The project would be consistent with the FM Act by regulating flow, control water supply and water delivery to wetlands.

Safeguards specific to the project and the project area have been developed to avoid, minimise, or manage these potential impacts and are outlined in section 8.3.

The minor potential environmental impacts of the project are outweighed by the broader, long-term benefits and the project is considered to be in the public interest.

9.2 Objectives of the EP&A Act

A review of the project's consistency with the objectives of the EP&A Act is presented below in Table 9.1. The project is found to be consistent with the EP&A Act.

Table 9.1 Consideration of the objectives of the EP&A Act

Objective	Project response
To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	The key objectives of the project relate to delivering improved environmental outcomes for the Yanco Creek system, as discussed in section 2.2. This is also expected to deliver positive outcomes for the local community, with negligible adverse socio-economic impacts, as described in section 6.13.

Objective	Project response
To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	This REF comprehensively assesses potential environmental impacts of the project, including potential socio-economic impacts, and has found them to be primarily positive. Potential adverse environmental impacts are minor and insignificant.
To promote the orderly and economic use and development of land.	The project is not expected to significantly affect land use in the region.
To promote the delivery and maintenance of affordable housing.	N/A
To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	The design of the project has sought to minimise impacts. A biodiversity assessment considering aquatic and terrestrial biodiversity has been completed (refer to sections 6.4 and 6.5) and found that the project is unlikely to have a significant impact on threatened species, populations, ecological communities, and migratory species.
To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	Potential impacts to Aboriginal heritage and non-Aboriginal heritage have been assessed in sections 6.8 and 6.9 and the project will have minor or negligible impacts.
To promote good design and amenity of the built environment.	Potential visual impacts of the project area are assessed in section 6.12 and were found to be negligible.
To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	N/A
To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	As described in section 7, the project would not require approval from the Commonwealth government. The project is unlikely to significantly impact on MNES including nationally listed threatened species, ecological communities and migratory species, or the environment of Commonwealth land.
To provide increased opportunity for community participation in environmental planning and assessment.	Completed and ongoing community and stakeholder consultation is described in section 5.

9.3 Ecological sustainable development

Ecologically sustainable development is development that improves the total quality of life, both now and in the future. Clause 193 of the EP&A Regulation identifies four principles of ecologically sustainable development that are presented below in Table 9.2. The table also identifies how the project aligns with each of the principles.

Table 9.2 Consideration of the EP&A Regulation principles of ecologically sustainable development

Principle of ESD	Project Response
The precautionary principle This principle states: 'if there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation'	The key objectives of the project relate to delivering improved environmental outcomes for the Yanco Creek system, as discussed in section 2.2. This REF assesses potential environmental impacts of the project, including potential socio-economic impacts, and has found them to be primarily positive. Potential adverse environmental impacts are minor or insignificant.
Intergenerational equity This principle states: 'the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.'	
Conservation of biological diversity and ecological integrity This principle states: 'the diversity of genes, species, populations and communities, as well as the ecosystems and habitats to which they belong, must be maintained and improved to ensure their survival.'	A biodiversity assessment considering aquatic and terrestrial biodiversity has been completed (refer to sections 6.4 and 6.5) and found that the project is unlikely to have a significant impact on threatened species, populations, ecological communities and migratory species, and residual biodiversity impacts are low.
Improved valuation, pricing and incentive mechanism This principle is defined as: 'Improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as: i. polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance, or abatement, ii. the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,	As discussed in section 2.3, a qualitative multi-criteria analysis was carried out to assess the relative advantages and disadvantages of each project option alongside the capital cost. The preferred option was selected due to the lowest environmental impact, high functionality and design life scores and a mid-range capital cost score, giving it the best overall desired outcome.

Principle of ESD	Project Response
iii. environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structures, including market mechanisms that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.'	

9.4 Conclusion

The project is subject to assessment under Division 5.1 of the EP&A Act. This REF has examined and taken into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the proposed activity.

This REF demonstrates that the site selection, options assessment and concept design development of the project aimed to minimise environmental impacts, and the project as described in this REF best meets the project objectives described in section 2.2. Whilst the project would have some minor environmental impacts as identified in section 6, safeguards outlined in section 8.3 would avoid, minimise or manage these potential impacts.

Furthermore, the project is expected to provide broader, long-term environmental benefits to the Yanco Creek system channel and floodplain ecology and, on balance, the project is considered justified.

In response to the purpose of this REF document described in section 1.3:

- The project is not considered likely to have a significant impact on the environment and therefore preparation of an EIS under division 5.2 of the EP&A Act is not required.
- The project is not considered likely to have a significant impact on threatened species as defined by the BC Act and FM Act (referred to in section 1.7 of the EP&A Act) and therefore an SIS or a BDAR is not required.
- The project is not considered likely to have a significant impact on MNES or Commonwealth land under the EPBC Act.

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11 Terms and abbreviations

Glossary of Terms

Term	Definition
Basin Plan	The Basin Plan as developed by the Murray-Darling Basin Authority under the *Water Act 2007*.
Block bank	A block bank is a bank or wall, usually of earthen material, that acts as a dam that blocks the flow of water resulting in an increase in the water level upstream of the bank.
Effluent	An effluent stream is one that leaves the main river and does not return.
Environmental water	Environmental water is water that is allocated and managed specifically to maintain and improve the health of rivers, wetlands and floodplains.
Held environmental water	Water available under a water access right, a water delivery right, or an irrigation right for the purposes of achieving environmental outcomes (including water that is specified in a water access right to be for environmental use).
Hydrometric station	A hydrometric flow monitoring station contains scientific equipment that measures the water height of a stream that can be used to calculate the flow in a stream. Automated water quality sampling is often incorporated in the station.
Regulated river	A river that is gazetted under the NSW Water Management Act 2000. Flow is largely controlled by major dams, water storages and weirs.
Sustainable diversion limit	Defined by the Murray-Darling Basin Plan. The maximum long-term annual average quantities of water that can be taken, on a sustainable basis, from the Murray-Darling Basin's water resources as a whole, and the water resources, or particular parts of the water resources, of each water resource plan area.
Sustainable diversion limit adjustment mechanism	A mechanism under the Murray-Darling Basin Plan that allows the sustainable diversion limit to be adjusted under certain circumstances.
The Code of Practice	The Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW.

Term	Definition
Water entitlement	The volume of water authorised to be taken and used by an irrigator or water authority; includes bulk entitlements, environmental entitlements, water rights, sales water and surface-water and groundwater licences.
Water resource plan	A document prepared by state authorities and accredited by the Commonwealth under the Basin Plan. The document describes how water will be managed and shared between users in an area.
Water sharing plan	A plan made under the NSW Water Management Act 2000 that sets out specific rules for sharing and trading water between the various water users and the environment in a specified water management area. It forms part of a WRP.

Abbreviations

Terms	
ACHAR	Aboriginal Cultural Heritage Assessment Report
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information System
AHIP	Aboriginal Heritage Impact Permit
BC Act	Biodiversity Conservation Act 2016
BDAR	Biodiversity Development Assessment Report
BFRMP	Bushfire Risk Management Plan 2009
CEMP	Construction Environmental Management Plan
CEWH	Commonwealth Environmental Water Holder
CEWO	Commonwealth Environmental Water Office
CNVG	Construction Noise and Vibration Guideline
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DPE	Department of Planning and Environment (NSW)

Terms	
DPI	Department of Primary Industries (NSW)
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation 2021
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EPI	Environmental Planning Instrument
EPL	Environment Protection Licence
FM Act	Fisheries Management Act 1994
GDE	Groundwater Dependent Ecosystem
ha	Hectares
KFH	Key Fish Habitat
km	Kilometres
LEP	Local Environmental Plan
LGA	Local Government Area
LWD	Large Woody Debris
m	Metres
MDBA	Murray Darling Basin Authority
MLTWP	The Murrumbidgee Long-Term Water Plan
MNES	Matters of National Environmental Significance
MW	Megawatt
NPW Act	National Parks and Wildlife Act 1974

Terms	
NSW	New South Wales
NT Act	Native Title Act 1993
PAD	Potential Archaeological Deposit
PCT	Plant Community Type
PMST	Protected Matters Search Tool
POEO Act	Protection of the Environment Operations Act 1997
PU	Planning Units
RAP	Registered Aboriginal Party
REF	Review of Environmental Factors
SDL	Sustainable Diversion Limit
SDLAM	Sustainable Diversion Limit Adjustment Mechanism
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
SSI	State Significant Infrastructure
SVTM	State Vegetation Type Map (NSW)
TEC	Threatened Ecological Community
TSS	Total Suspended Solids
WHL	World Heritage List
WINSW	Water Infrastructure New South Wales
WM Act	Water Management Act 2000
WQO	Water Quality Objectives
YCMP	Yanco Creek Modernisation Project

Appendix A Clause 171 Environmental Factors Checklist

The following factors listed in clause 171(2) of the EP&A Regulation, have also been considered to assess the likely impacts of the Proposed Activity on the environment. These are provided in the table below. These considerations are required to comply with sections 5.5 and 5.7 of the EP&A Act.

Environmental Factor	Impact
(a) the environmental impact on the community	The key objectives of the project are about delivering improved environmental outcomes for the Yanco Creek system, as discussed in section 2.2. This is also expected to deliver positive for the local community, with negligible adverse socio-economic impacts, as described in section 6.13.
(b) the transformation of the locality	The project is not expected to significantly affect land use in the region. The project is replacing existing infrastructure. Potential visual impacts of the project assessed in section 6.12 were found to be negligible.
(c) the environmental impact on the ecosystems of the locality	A biodiversity assessment considering aquatic and terrestrial biodiversity has been completed (refer to sections 6.4 and 6.5) and found that the project is unlikely to have a significant impact on threatened species, populations, ecological communities and migratory species, and residual biodiversity impacts are low.
(d) reduction of the aesthetic, recreational, scientific, or other environmental quality or value of the locality	This REF assesses potential environmental impacts of the project and has found them to be primarily positive. Potential adverse environmental impacts are minor or insignificant.

Environmental Factor	Impact
(e) the effects on any locality, place or building that has— (i) aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance, or (ii) other special value for present or future generations	Potential impacts of Aboriginal heritage and non-Aboriginal heritage have been assessed in sections 6.8 and 6.9. The project would impact on two Aboriginal items including WAO AS 1 (b) (1) (A)) and WAO ISO 1 (b) (1) (A)). An AHIP under the *National Parks and Wildlife Act 1974* is required to relocate the two items prior to any works taking place. The project is not expected to impact upon non-Aboriginal heritage.
(f) the impact on the habitat of protected animals, within the meaning of the *Biodiversity Conservation Act 2016*	A biodiversity assessment considering aquatic and terrestrial biodiversity has been completed (refer to sections 6.4 and 6.5) and found that the project is unlikely to have a significant impact on threatened species, populations, ecological communities and migratory species, and residual biodiversity impacts are low.
(g) the endangering of a species of animal, plant or other form of life, whether living on land, in water or in the air	
(h) long-term effects on the environment	This REF assesses potential environmental impacts of the project and has found them to be primarily positive. Potential adverse environmental impacts are minor or insignificant.
(i) degradation of the quality of the environment	
(j) risk to the safety of the environment	The project is not expected to alter flooding or bushfire risk in the locality.
(k) reduction in the range of beneficial uses of the environment	The key objectives of the project are about delivering improved environmental outcomes for the Yanco Creek system, as discussed in section 2.2. The project is not expected to significantly affect land use in the region. The project is replacing existing infrastructure.
(l) pollution of the environment	There is a low potential for minor impacts to water quality due to erosion and sedimentation during construction, as assessed in section 6.2. This risk is readily managed by standard construction practices and additional safeguards outline in Table 8.1

Environmental Factor	Impact
(m) environmental problems associated with the disposal of waste	Waste management during construction of the project is a minor risk and would be readily controlled by construction practices and safeguards outlined in Table 8.1.
(n) increased demands on natural or other resources that are, or are likely to become, in short supply	Concrete and steel quantities used for construction are widely available and would deliver long-term beneficial environmental outcomes by operation of the project. Re-use of materials are discussed in section 6.7.
(o) the cumulative environmental effect with other existing or likely future activities	As discussed in section 6.15, given the relatively low environmental impacts associated with the project, cumulative environmental impacts are not considered likely.
(p) the impact on coastal processes and coastal hazards, including those under projected climate change conditions	N/A
(q) applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1	This REF assesses the objectives of the Riverina Murray Regional Plan 2041 and has found the project to be consistent with the Plan's strategic outcomes.
(r) other relevant environmental factors.	This REF assesses potential environmental impacts of the project, including potential socio-economic impacts, and has found them to be primarily positive. The potential adverse environmental impacts are considered to be minor and insignificant.

Appendix B Biodiversity Impact Assessment

Appendix C Aquatic Ecology and Water Quality Assessment

Appendix D Aboriginal Heritage Assessment

Appendix E Non-Aboriginal Heritage Assessment