8 Traffic and transport

The Traffic and Transport Impact Assessment (Jacobs, 2015) examined the extent to which the Project is expected to address improvements to accessibility and connectivity, provide access to high productivity and oversized vehicles, and deliver road infrastructure that supports local, regional, state and national economies, as outlined in the Project Objectives.

It is expected the Project would provide benefits to road users including:

- Traffic volumes on the existing bridge would reduce by around 40% by 2044
- 42% of through traffic would be removed from the area of High Street near the historic port area by 2044
- Truck volumes are expected to decrease by a similar proportion in and around the town centres
- No adverse impacts have been identified for public transport, walking or cycling
- Additional off road shared path facilities along the entire alignment
- Provision of sealed shoulders for on road cyclists
- Improved river crossing access for heavy and oversize vehicles, currently restricted from using the existing bridge
- Provision of a higher mass limit compliant crossing.

The Project would result in a forecast increase in traffic volumes along Warren Street of around 54 per cent by 2044. The potential for this predicted increase in traffic volumes along Warren Street to create road safety issues was assessed. As the Project would result in upgrades to existing intersections, provide off-road shared path facilities, and be subject to a road safety audit at detailed design stage, it was considered that impacts to road safety during operation would be minor.

The majority of adverse traffic and transport impacts would be expected to occur during the construction stage of the Project. It is expected there would be short-term impacts on the existing road network. This would include an increase in truck movements, potential road safety issues and the potential for increased crashes in the construction zone.

With VicRoads standard environmental protection measures, as well as additional Project-specific environmental management measures such as communication and Traffic Management Plans, the Project is expected to only have minor impacts on traffic and transport in Echuca-Moama.

8.1 EES objectives

The objective of the Traffic and Transport Impact Assessment for the Project, as specified in the EES Scoping Requirements Draft Evaluation Objectives, is *"To improve accessibility and connectivity for the people of Echuca-Moama and the wider region by providing for existing and future traffic capacity and safety needs."*

This chapter is based on the Traffic and Transport Impact Assessment completed by Jacobs (2015), which is included in EES Technical Appendix B. This chapter is a summary of that assessment, and discusses the existing transport conditions for Echuca and Moama including capacity, safety and accessibility, as well as the potential impacts of the Project on traffic movement, volumes and access.

This chapter includes a discussion of the following key issues and requirements as they relate to traffic and transport, as specified in the EES Scoping Requirements for the Project.

Key issues

- *Exacerbation of congestion on the existing bridge and approach roads through the central business districts of Echuca and Moama, and the potential impact on emergency service response, in absence of an alternate crossing point.*
- *The capacity limit of existing bridge restricts freight movements requiring load separation prior to crossing the bridge.*
- *The current width of the existing bridge necessitates the closing of the opposing lane for the movement of over-dimensional vehicles and thus, such movements are restricted to off-peak periods.*

Priorities for characterising the existing environment

- *Characterise current traffic conditions including restrictions within the existing road network in the Project area.*
- *Provide modelling projections of road network traffic flows in absence of the Project.*

Design and mitigation measures

- *Potential design and use solutions to optimise linkages with the existing road network and enhance capacity and safety of a new crossing (including access for pedestrians and bicycles).*

Assessment of likely effects

- *Assess the effects of the Project on the transport network (including in terms of road traffic volumes, freight vehicle types that may be accommodated and travel time outcomes).*

Approach to manage performance

- *Briefly describe the principles or approach to management of traffic conditions during the Project's construction, including as part of the Environmental Management Framework (EMF).*

The Traffic and Transport Impact Assessment focussed on the preferred alignment. The term 'the Project' is used in this chapter to refer to the preferred alignment only.

8.2 Study area

The study area for the Traffic and Transport Impact Assessment is a rectangular area of approximately 5km by 7km that extends just beyond the Echuca-Moama township boundaries and encompasses all major roads into Echuca and Moama (see Figure 8-1).

8.3 Methodology

The existing conditions of the study area were characterised using information from the following sources:

- Visiting Echuca and Moama, reviewing the transport network and discussing local issues with council representatives
- Examining current and historical traffic volumes provided by VicRoads, New South Wales Roads and Maritime Services and councils
- Reviewing the road crash history in Echuca and Moama and determining particular crash hot spots
- Reviewing council strategic documents, policies and guidelines related to transport and land use
- Examining 2011 Census data (population, dwellings and place of work)
- Examining Victoria in Future (2014 and 2008) population and dwelling size projections and NSW population projections (2014 and 2008).

A traffic model developed for the 2008-2010 Echuca-Moama bridge study (SKM, 2009), which included updates made in 2012 for the Echuca-Moama Bridge Mid-West 2 Options assessment (SKM, 2012) was used to assess traffic demands for the Project. Details of the methodologies used to create of the model can be found in the respective model validation/modelling reports (SKM, 2009 and 2012). The model was further updated for this EES by incorporating the latest 2011 Census data and planning information from VicRoads, Roads and Maritime Services, Campaspe and Murray Shire Councils. This included consideration of the latest Victoria in Future (VIF, 2014) population growth projections and those from NSW. Land use zones, aerial photographs and strategic development plans were also examined for Echuca and Moama.

To validate the EES traffic model to 2014 conditions, recent traffic counts were sourced from Murray Shire Council and VicRoads. The model is calibrated to a normal winter weekday; however there are significant variations in holiday and seasonal peak traffic volumes.

To establish predicted traffic volumes, two road network scenarios were modelled – the 'No Project' scenario (the existing road network with no new bridge) and the preferred alignment (with the new bridge connecting to a new roundabout in Warren Street and the opening of Francis Street in Moama).

To estimate future network performance, the ratio of traffic volume to road capacity was used as a basic measure of congestion. Volume-capacity ratios less than 0.8 typically indicate a road operating well within its nominated capacity. Values between 0.8 and 1.0 indicate a road approaching capacity, often with stop-start traffic. Values above 1.0 indicate that traffic demand exceeds the capacity of the road, leading to extended queues forming during peak periods. Using this approach, forecast volume-capacity ratios for 2014, 2029 and 2044 peak hours were calculated.

The performance of several key intersections in Echuca and Moama were assessed using the SIDRA intersection analysis software package. The analysis was carried out using forecast 2044 traffic volumes, with typical peak hour volumes calculated as 8.4 per cent of daily volumes.

Impact pathways were identified, consequence criteria were developed and initial and residual risks were assessed following implementation of VicRoads' standard environmental protection measures and Project-specific environmental management measures. This informed an assessment of the impacts of the Project against the 'No Project' scenario.

8.4 Legislation and policy

The relevant legislation and policies for traffic and transport are outlined in Table 8-1.

Table 8-1 Relevant traffic and transport legislation and policy

Legislation/policy	Description
Commonwealth	
National Land Freight Strategy Discussion Paper (2011)	The overarching purpose of the National Land Freight Strategy is to drive the development of efficient, sustainable freight logistics that balance the needs of a growing Australian community and economy, with the quality of life aspirations of the Australian people. The objectives under consideration aim to: ➢ Improve the efficiency of freight movements across infrastructure networks ➢ Minimise externalities associated with such freight movements ➢ Influence policy making in areas relevant to freight. The Project would assist in providing a more suitable freight link between Victoria and NSW (to assist the agricultural industry), which would also be beneficial to the state and regional economies.
State	
Planning and Environment Act 1987 (Vic.)	The Planning and Environment Act establishes a framework for planning the use, development and protection of land in Victoria in the present and long-term interest of all Victorians. The Planning and Environment Act sets out the legislative basis to ensure that standard planning provisions are prepared and approved throughout Victoria. The Planning and Environment Act sets out procedures for preparing and amending the Victoria Planning Provisions (VPP) and planning schemes, obtaining permits under planning schemes, settling disputes, enforcing compliance with planning schemes, and other administrative procedures. The Planning and Environment Act provides for a single instrument of planning control in a particular area, the planning scheme, which sets out the way land may be used or developed. The planning scheme is a legal document, prepared and approved under the Planning and Environment Act. The relevant planning scheme for the study area is the Campaspe Planning Scheme.
Transport Integration Act 2010 (Vic.)	The Transport Integration Act is the guiding legislative framework for VicRoads and the entire transport portfolio. As well as ensuring integration and sustainability are core principles of Victorian transport agencies, the Transport Integration Act aims to align corporate planning with the Department of Economic Development, Jobs, Transport and Resources' strategic priorities. The Transport Integration Act: ➢ Introduces a core focus on an integrated and sustainable transport system ➢ Sets out objectives for the transport system including economic prosperity and environmental sustainability ➢ Recognises the importance of coordinated transport and planning ➢ Recognises the importance of the Victorian Transport Plan as the State's plan for transport ➢ Recognises the role and responsibilities of all transport agencies including VicRoads, Linking Melbourne Authority, V/Line and VicTrack.
Road Management Act 2004 (Vic.)	The Road Management Act came into operation on 1 July 2004. The Road Management Act was developed to provide a more efficient and safer Victorian road network, and is the result of extensive stakeholder and community consultation. The Road Management Act is based on the following key principles: ➢ Clear allocation of road asset ownership and management ➢ Established processes and accountabilities for policy decisions and performance standards ➢ Provision of operational powers to achieve targets and performance standards; and clarification of civil liability laws for the management of roads.
Plan Melbourne (2014)	Plan Melbourne provides direction for the future growth of Melbourne and improved connections between regional cities. Rebalancing growth between Melbourne and regional Victoria is a key initiative in Plan Melbourne that will deliver productivity and employment benefits for the whole state. Unlocking the growth potential of regional cities will create a state of cities with good transport connections between regional areas and Melbourne, renewal of regional city centres and improved services. The growth of regional centres will create greater employment opportunities, improved health and education services, and more choices for Victorians about where they live and work. Plan Melbourne, in conjunction with the Regional Growth Plans seeks to identify land use and infrastructure initiatives to increase regional growth and support regional transport corridors. Major transport links, including links through Echuca, connect industries to national and international markets.

Legislation/policy	Description
Loddon Mallee North Regional Growth Plan (2014)	Regional Growth Plans will shape and guide the future of Victoria's regions to 2041. These plans identify strategic land uses and seek to improve integration with transport and infrastructure planning. The Loddon Mallee North Regional Growth Plan identifies key population growth areas and demographic change. Economic change and needs are also identified in the Plan. The Plan recognises Echuca is experiencing relatively significant population growth, along with its twin NSW city, Moama. The Echuca-Moama river crossing is critical for serving populations on both sides of the river, particularly as services such as the new Echuca Hospital and the education precinct have been designed to meet the needs of the combined population of Echuca, Moama and the surrounding hinterland.
Victoria's Road Safety Strategy 2013-2022 and Victoria's Road Safety Action Plan 2013-2016	Victoria's Road Safety Strategy outlines a plan for reducing death and injuries on Victoria's roads, particularly those incidents related to speed, drink driving and drug driving. It also outlines an approach for improving safety for vulnerable road users such as pedestrians, cyclists and motorcyclists. The Strategy is accompanied by a first Action Plan (2013-2016), which sets out steps for reducing death and serious injury on Victoria's roads by more than 30 per cent, reducing the road toll from 282 (2012) to below 200, and reducing cases of serious injury from 5,500 to below 3,850.
Victoria, the Freight State (2013)	Victoria – The Freight State (the Plan) outlines the long term strategy to improve freight efficiency, grow productivity and better connect Victorian businesses with their markets, whether local, national or international. The Plan is supported by a series of key directions, strategies and actions intended to provide greater certainty to the private sector and to help inform business planning and investment decisions. The Plan supports the Project in that it would assist efficiencies with key cross-border supply chains.
Local	
Campaspe Planning Scheme	A planning scheme sets out objectives, policies and provisions relating to the use, development, protection and conservation of land in the area to which it applies. The applicable planning scheme within the Victorian proportion of the study area is the Campaspe Planning Scheme. A set of standard provisions called the VPP forms a template for all planning schemes. Included in the VPP is the State Planning Policy Framework (SPPF), which covers strategic issues of State importance. Of relevance to the Project, Clause 18 of the SPPF states that "*Planning should ensure an integrated and sustainable transport system that provides access to social and economic opportunities, facilitates economic prosperity, contributes to environmental sustainability, coordinates reliable movements of people and goods, and is safe*."
Campaspe Walking and Cycling Strategy (2007)	The Campaspe Walking and Cycling Strategy aims to increase participation in walking and cycling by both residents and visitors. It aims to encourage walking and cycling to work, recreational facilities, schools and shops and as a tourism activity. To support this aim, the Shire will promote existing paths and develop new safe and well-designed paths. The Project would provide ongoing access to existing walking and cycling paths as well as create new paths and connections.

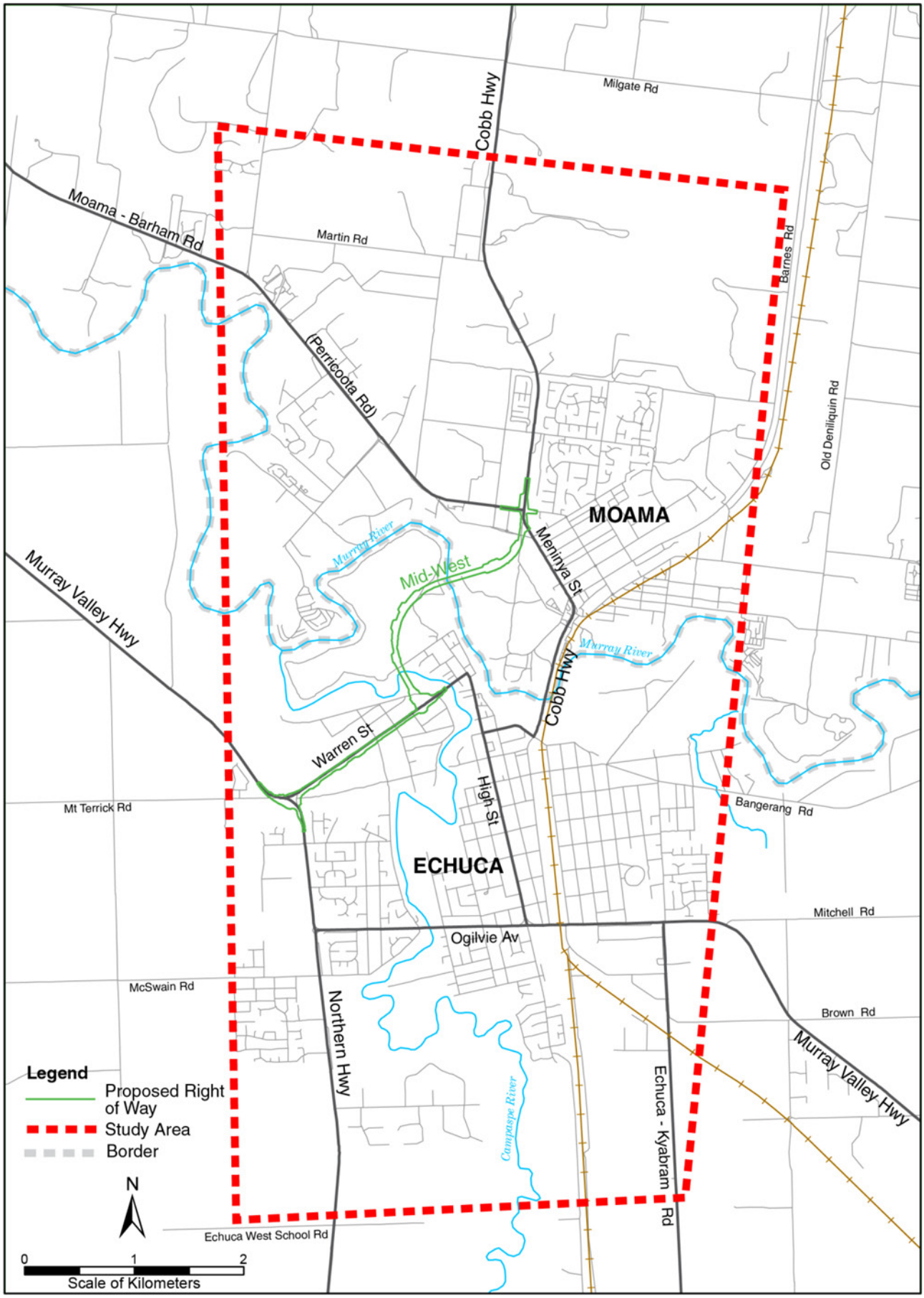


Figure 8-1 Study area

8.5 Existing conditions

8.5.1 Road network

Major highways in the study area include the Northern Highway which connects Echuca to the south, the Murray Valley Highway which runs from east to west along the Murray River, and the Cobb Highway which connects Moama to the north.

The main roads in the study area and their descriptions are shown in Table 8-2.

Local roads in the vicinity of the proposed Right-of-Way are described in Chapter 6 in Table 6–2.

Table 8-2 Main roads in the study area and their description

Road	Responsible authority	No. of lanes	Speed limit
Warren Street (Cohuna-Echuca Road)	VicRoads	▪ 1 traffic lane in each direction ▪ No sealed shoulders or pathway	80km/h west of Campaspe River
Heygarth Street (Northern Highway)	VicRoads	▪ 1 traffic lane in each direction ▪ On street parking (angle) ▪ Pedestrian path	50km/h
High Street, north of Heygarth Street (Cohuna-Echuca Road)	VicRoads	▪ 2 traffic lanes in each direction ▪ On-road cycle lane ▪ On street parking (angle) ▪ Pedestrian path	50km/h
High Street, south of Heygarth Street	VicRoads	▪ 2 traffic lanes in each direction ▪ On-road cycle lane ▪ On street parking (parallel) ▪ Pedestrian path	50km/h 60km/h 80km/h
Cobb Highway – bridge (NSW) and Annesley Street/Northern Highway south of the Murray River (Victoria)	VicRoads and Roads and Maritime Services	▪ Murray Shire: • 1 traffic lane in each direction • Pedestrian path ▪ Shire of Campaspe: • 1 traffic lane northbound, 2 southbound (south of the existing bridge) • Pedestrian path	50km/h
Cobb Highway/Meninya Street	Roads and Maritime Services	▪ One 1 traffic lane in each direction ▪ On street parking (parallel) ▪ Off-road cycle path ▪ Pedestrian path	50km/h
Murray Valley Highway (south of Warren Street)	VicRoads	▪ 1 traffic lane in each direction ▪ No sealed shoulders or pathway ▪ No parking ▪ No pedestrian path	80km/h
Murray Valley Highway (Ogilvie Avenue)	VicRoads	▪ 2 traffic lanes in each direction ▪ On-road cycle lane ▪ On street parking (parallel) ▪ Pedestrian path	60km/h 70km/h
Sturt Street	Campaspe Shire Council	▪ 2 traffic lanes in each direction ▪ Sealed shoulders	60km/h
Perricoota Road	Roads and Maritime Services	▪ 1 traffic lane in each direction ▪ No sealed shoulders or pathway ▪ No parking ▪ No pedestrian path	50km/h 80km/h

8.5.2 Road restrictions

Currently, the existing bridge can carry 42.5 tonne six axle semi-trailers and 62.5 tonne nine axle B-doubles. The B-Doubles network in Victoria includes alternative crossings of the Murray River at Barham (86km to the east) and Tocumwal (120km to the east), both of which provide a more direct connection to Sydney. The larger freight transports (road trains) from NSW are often forced to separate part of their load before they are permitted to cross the bridge and enter Victoria, and over-dimensional loads that need to cross the bridge are restricted to off-peak times.

While Roads and Maritime Services allows general access heavy vehicles to have unrestricted road access (over width/higher mass limit loads must be pre-approved), VicRoads only allows pre-approved permitted heavy vehicles to use its roads. Approval conditions for heavy vehicle road travel in Victoria are listed in Table 8-3.

Table 8-3 Heavy vehicle permit requirements

Permit	Pre-approved roads	Restricted roads
Performance Based Standards (PBS) level 1 (or general access vehicles)	• Arterial roads • State highways • Small number of local roads (Anstruther Street)	• Local roads
PBS level 2A B-Doubles	• State highways	• Arterial roads • Local roads
Road trains	• None	• All

8.5.3 Traffic volumes

Road volumes

Traffic counts conducted from June to September 2008 at 28 locations around the study area captured both external trips to Echuca and Moama as well as trips between the two town centres. Traffic counts were collected again in August 2014 by VicRoads and the local councils, with SCATS (Sydney Coordinated Adaptive Traffic System) counts (automated counts collected from traffic signals) also conducted around this time.

All counts confirm that the heaviest traffic volumes occur on the main arterial routes through the town centres of Echuca and Moama, with Ogilvie Avenue, High Street, Heygarth Street and Meninya Street providing inter-town passage.

The main connectors to regions outside Echuca-Moama include the Northern Highway, Murray Valley Highway, Cobb Highway and Perricoota Road (see Technical Appendix B – Traffic and Transport Impact Assessment for a traffic count map).

For locations surveyed in both 2008 and 2014, there have been increases in the proportions of heavy vehicles.

Holiday periods and weekends had higher traffic volumes due to the seasonal tourist market.

Bridge volumes

The 2008 survey collated the traffic volumes across the existing bridge (both normal and heavy vehicles), and conducted an origin and destination survey. For the purposes of this EES, the 2014 traffic patterns were assumed to be similar to those surveyed in 2008. This is reasonable as the road network and land use activities of the study area have not changed significantly in the intervening years.

Key findings of the survey in relation to traffic on the existing bridge were:

- Average two-way traffic volume for the bridge was 18,300 vehicles per day
- 8% of the traffic volume were trucks
- 78% of southbound vehicles start in Moama and end in Echuca
- 7% of southbound vehicles start from elsewhere in NSW, pass through Moama and end in Echuca
- 73% of northbound vehicles start in Echuca and end in Moama
- 8% of northbound vehicles start in Echuca and pass through Moama to end elsewhere in NSW
- 1% of northbound vehicles come from elsewhere in Victoria, pass through Echuca-Moama and continue into NSW
- For bridge traffic in both directions, around three quarters of all traffic movements have origins and destinations within Echuca and Moama, with only around 3-4% starting and finishing outside of/or wanting to bypass Echuca-Moama completely.

Seasonal variation of traffic volumes across the bridge was tested using further traffic counts from 2010 and 2013 (2013 data sourced from Roads and Maritime Services). This data is displayed in Figure 8-2.

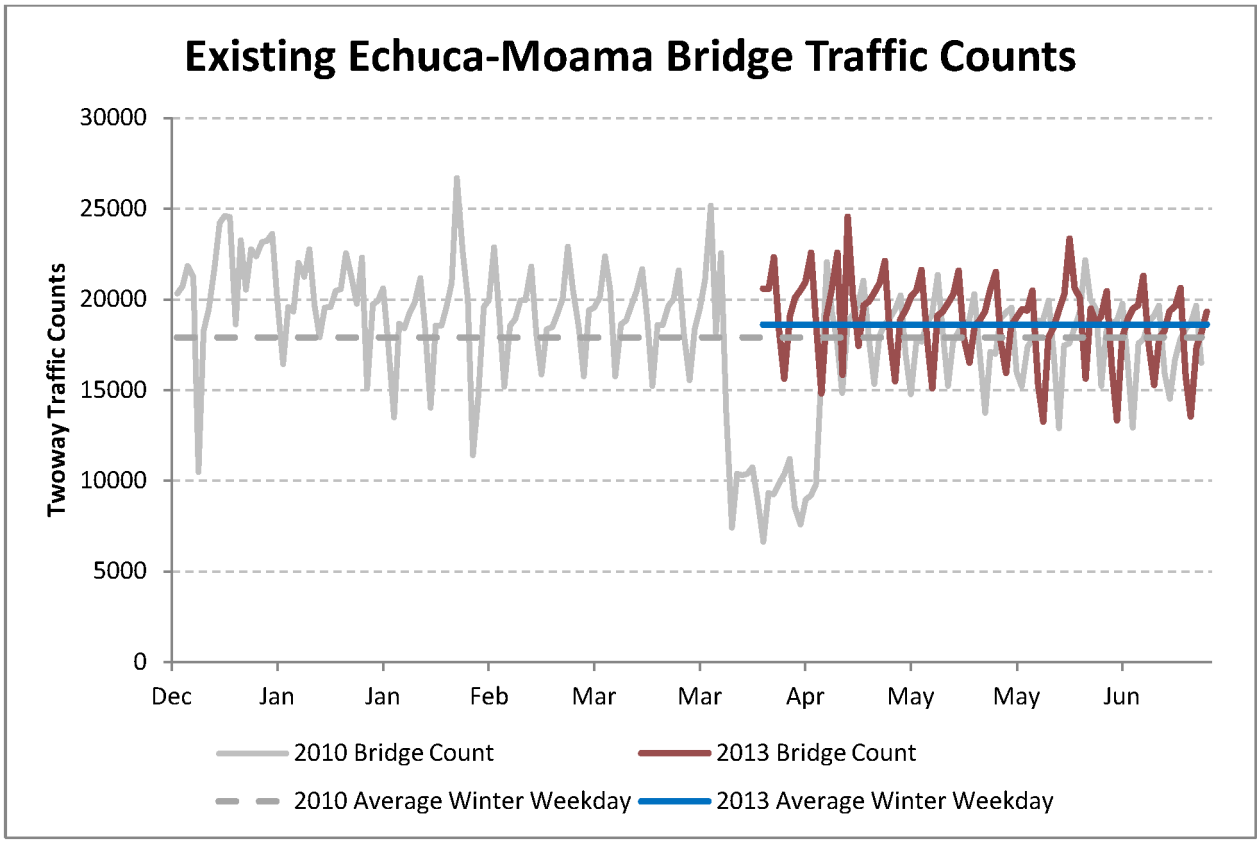


Figure 8-2 Plot of two-way daily bridge volumes (2010 and 2013)

Note: during April 2010 the southbound traffic counter failed, so results from that period should be ignored. Also due to counter failure, only four months' worth of data was available for 2013 with a relatively high error rate.

Figure 8-2 indicates that the magnitude of the bridge traffic volume was similar for the same period in 2010 and 2013, with an average of 18,000 vehicles per day (for a winter weekday). During peak periods the bridge volumes can exceed 25,000 vehicles per day. Holiday periods have significantly different travel patterns, with major annual events such as the Southern 80 Ski Race (February), the Queen' Birthday Steam Rally (June) and the Deniliquin Ute Muster and Elmore & District field days (October) increasing the traffic volumes for between one to three days.

8.5.3.1 Heavy vehicles

Heavy vehicle numbers on arterial roads increase significantly during the grain and tomato harvest season (mid-November to mid-February for grain and February to early April for tomatoes).

The Omega Warehousing and Distribution heavy vehicle depot in Moama currently serves as a termination point for multi trailer road trains, so they can be split into single trailer trucks to continue travelling into Victoria. This depot services around 85 road trains during a normal month, which translates into approximately 360 truck bridge crossings (both ways) per month. This increases during the harvest months, as many more trucks travel from Echuca and use the weighbridge at the depot.

8.5.4 Crash analysis

An analysis of crash data for the last 10 years (July 2003 to June 2013) from Echuca and Moama was studied for this EES. The key findings are presented below.

Echuca – 257 injury crashes:

- 40% serious injury crashes
- One fatality
- About two thirds of all injury crashes were collisions between vehicles
- About one third were collisions with fixed objects or pedestrians
- Since 2005/2006 crashes decreased from 46 to 14 crashes per annum by 2012/2013
- More crashes occurred in warmer months (September to January) with the increase in tourist traffic
- Most crashes happened at or near intersections; specifically near traffic signals and roundabouts on the Northern Highway and Murray Valley Highway.

Moama – 124 crashes:

- Half non-casualty, half injury crashes
- Two fatalities

- Over two thirds of crashes were collisions between vehicles, the remainder were single vehicle crashes
- Relatively constant number of 13 crashes per annum
- No clear relationship between season and crash rate
- Most crashes occurred around Cobb Highway and Meninya Street
- Three crashes occurred on the existing bridge, one of which was an injury crash.

Weather patterns do not appear to have affected the crash rates in either town, with the majority of crashes occurring when the weather was clear and the roads were dry. Crashes also commonly occurred in the afternoon.

8.5.5 Public transport

Within the study area there is one train route and seven coach routes that serve Echuca and Moama, with 10 regional bus services also operating within the study area (refer Table 8-4).

Passenger train services from Melbourne terminate at Echuca with connecting bus services. Interstate bus services currently utilise the existing bridge. There are also several local school bus routes in Echuca-Moama. Although these routes use Warren Street and the existing bridge, there are no designated stops within the towns except at the individual schools.

Current school bus routes are currently under review by Public Transport Victoria (PTV), however any new routes would follow the main roads as they approach the town centre, with possible diversions onto other roads through the town centre.

Table 8-4 Public transport services

Operator	Route	Service Frequency		
		Monday-Friday	Saturday	Sunday
Train service				
V/Line	Melbourne – Echuca (via Bendigo or Heathcote)	1 service daily each way	2 services each way	2 services each way
Coach services				
V/Line	Melbourne - Echuca/Moama via Bendigo or Heathcote	3 services per day from Melbourne 2 services per day from Bendigo	2 services per day from Melbourne 1 service per day from Bendigo	1 service per day from Melbourne 1 service per day from Bendigo
	Echuca/Moama - Melbourne via Bendigo or Heathcote	1 service per day to Melbourne 2 services per day to Bendigo	1 service per day to Melbourne 1 service per day to Bendigo	1 service per day to Bendigo
	Deniliquin - Melbourne via Moama, Echuca & Heathcote	1 service each way per day	-	-
	Echuca/Moama - Melbourne via Shepparton	3 services each way per day	-	-
	Kerang - Echuca via Cohuna	Operates on the first Tuesday and the third Friday of the month only	-	-
NSW TrainLink	733/734 Wagga Wagga – Lockhart – Echuca	1 service each way (Mon, Wed, Fri)	-	1 service each way
	741/742 Echuca – Howlong – Albury	1 service each way (Tues, Thurs)	-	1 service each way

Operator	Route	Service Frequency		
		Monday-Friday	Saturday	Sunday
Regional bus services				
Echuca Moama Transit	Route 1: Echuca – Echuca South	13 services operating (3 operate on school days only) from 09:00 – 18:00	3 services operating from 10:00 – 14:00	-
	Route 2: Echuca – Echuca East	13 services operating (3 operate on school days only) from 07:45 – 17:30	3 services operating from 09:30 – 13:30	-
	Route 3: Echuca – Moama	17 services operating (7 on school days only) from 07:50 – 16:35	-	-
	Route 4: Echuca – Cunningham Downs Retirement Village	9 services operating from 09:00 – 17:00	2 services operating from 09:00 – 11:00	-
	Route 5: Echuca - 24 Lane	3 services operating from 09:30 – 13:35	-	
Newton's Bus Service	Route 938: North Route Echuca Post Office – Westwood Park	7 services operating from 07:55 – 15:25	2 services operating from 09:30 – 11:40	-
	Route 938: South Route Westwood Park – Echuca Post Office	9 services operating from 10:05 – 16:55	2 services operating from 09:30 – 13:00	-
	Route 938: East Route	6 services operating from 08:00 – 16:18	2 services operating from 09:55 – 12:03	-
	Route 938: West Route	2 services operating from 08:40 – 15:50	-	-
	Route 938: Moama Route	13 services operating from 07:45 – 16:30	2 services operating from 10:20 – 12:35	-

8.5.6 Walking and cycling

There are a number of existing cycling and walking tracks in Echuca-Moama. In Echuca these include on-road cycle lanes in High Street, Ogilvie Avenue, Pakenham Street and Sutton Street, and off-road cycle paths along Warren Street, Murray Valley Highway, Butcher Street, Cobb Highway and along the Campaspe River. Moama has a designated walking/cycling shared use path along Perricoota Road, Boundary Road, Hunt Street and Blair Street.

Campaspe Shire Council also has a Walking and Cycling Strategy (Campaspe Shire Council, 2007) which aims to increase participation in walking and cycling to work, recreational facilities, schools, shops, and as a tourism activity. The policy also focuses on promoting existing paths and developing new paths.

Echuca-Moama has four highly promoted, self-guided recreational cycling and walking routes, including:

- Banyule State Forest Ride (Banyule/River Village Forest)
- Historic Adventure (Scenic Drive/Wharparilla Flora Reserve)
- Moama Meander (Moama Bus Riverside)
- Campaspe River Ride (Campaspe Esplanade).

8.5.7 Journey to work

The 2011 census showed that 71 per cent or 4,290 of Echuca's employed residents work within Echuca. Almost 29 per cent of Echuca's workers live outside of Echuca, with 9 per cent travelling from Moama.

Approximately 28 per cent of Moama's workers live within Moama. The rest of Moama's workers travel from Echuca (47 per cent), from other areas of NSW (14 per cent) or from other areas of Victoria (11 per cent).

The 2011 census also revealed that 4,460 (74 per cent) workers in Echuca travelled to work by car as the driver or passenger and a further 5 per cent either walked or cycled. The rest worked from home or did not go to work (17 per cent), took other modes of transport (2 per cent) or did not state their mode of travel (2 per cent).

Similarly, in Moama, 106 (5 per cent) workers cycled or walked to work and 1,691 (72 per cent) travel to work by car. The rest worked from home or did not go to work (19 per cent), took other modes of transport (2 per cent) or did not state mode (2 per cent).

8.6 Impact assessment

8.6.1 Key issues

The Traffic and Transport Impact Assessment considered the impacts that could occur if the ultimate duplication of the Project was completed.

The Traffic and Transport Impact Assessment identified the following key issues:

- Existing bridge capacity and volume
- Truck movements
- Road safety
- Public transport
- Pedestrians and cyclists
- Construction.

These issues are all discussed in this section. Changes in access as a result of the Project are also discussed.

8.6.2 Benefits and opportunities

The traffic modelling conducted for the Project shows that the preferred alignment would contribute to the reduction of traffic volumes through the Echuca town centre. This is likely to contribute to improved access and amenity for local traffic and pedestrians, as well as potentially improving road safety in and around the town centre.

8.6.3 Existing bridge capacity and volume

'No Project' scenario

The main impacts of the Project on traffic flow can be seen by assessing how the existing bridge road capacity and volume changes over time.

The existing bridge currently services around 18,800 two-way vehicle trips per day. This is modelled to increase to 22,900 for 2029 and then to 25,000 for 2044.

Volume-capacity ratios are often used to estimate traffic network performance, as a measure of congestion. A volume to capacity ratio of less than 0.8 indicates that the road is working within capacity, between 0.8 and 1.0 the road is experiencing stop/start conditions, and a ratio of greater than 1.0 indicates that capacity is being exceeded and long queues are developing.

The volume-capacity ratios in this instance indicate that the existing bridge is approaching capacity (0.88 at 2014) on an average winter weekday, and by 2029 the existing bridge would be over its traffic capacity (1.07, rising to 1.17 by 2044).

Preferred alignment

With the Project built, the daily two-way trips on the existing bridge would drop to approximately 13,700 in 2029 and 15,000 in 2044. This is a reduction of approximately 40 per cent on the number of vehicles in 2044 for the 'No Project' scenario (refer Table 8-5 and Figure 8-3).

This results in a reduced volume-capacity ratio for the **existing bridge** (0.64 in 2029 and 0.70 in 2044) such that it would be operating well within its capacity.

The volume-capacity ratio for the **new bridge** also remains at a level that would allow free flowing traffic, well within its capacity.

The traffic model predicts that the new bridge would mainly be used by traffic accessing the western areas of Echuca and Moama and the Northern Highway and Murray Valley Highway to the west of Echuca. Most traffic travelling between Moama town centre and Echuca town centre would continue to use the existing bridge.

Upgrading the intersection at the Murray Valley Highway and Warren Street would also improve the performance of this intersection significantly.

Table 8-5 Forecast bi-directional traffic volumes on key links (total vehicles)

Year	2014	2029		2044	
Scenario / Road Segment	'No Project' scenario (base)	'No Project' scenario (base)	With the Project	'No Project' scenario (base)	With the Project
Existing bridge	18,817	22,899	13,693 (-40%)	25,019	15,036
New bridge	0	0	9,814	0	11,447
Francis Street	0	0	2,003	0	2,095
Murray Valley Highway, north of Warren Street	3,613	4,828	4,660 (-3%)	5,433	5,298 (-2%)
Murray Valley Highway, south of Warren Street	7,326	9,911	13,988 (41%)	11,428	16,368 (43%)
Warren Street, east of Murray Valley Highway	6,440	8,465	12,788 (51%)	9,569	14,783 (54%)
Warren Street, crossing Campaspe River	6,508	8,514	6,687 (-21%)	9,607	7,486 (-22%)
Heygarth Street, west of Annesley Street	10,988	13,259	4,009 (-70%)	13,646	3,670 (-73%)
Sturt Street, east of Annesley Street	5,949	6,687	6,818 (2%)	7,333	7,792 (6%)
High Street, north of Heygarth Street	10,748	12,557	7,324 (-42%)	13,705	7,903 (-42%)
High Street, south of Heygarth Street	9,506	11,164	7,034 (-37%)	11,369	7,125 (-37%)
Pakenham Street, east of Annesley Street	1,700	1,075	1,822 (70%)	2,787	2,498 (-10%)
Murray Valley Highway, south of McSwains Road	9,195	14,181	14,185 (0%)	16,813	16,817 (0%)
Ogilvie Street, crossing Campaspe River	18,697	24,415	20,191 (-17%)	27,898	23,012 (-18%)
Ogilvie Street, crossing the railway	14,427	18,634	17,819 (-4%)	20,017	19,703 (-2%)
Ogilvie Street, east of Cornelia Creek Road	5,675	7,402	7,402 (0%)	8,587	8,587 (0%)

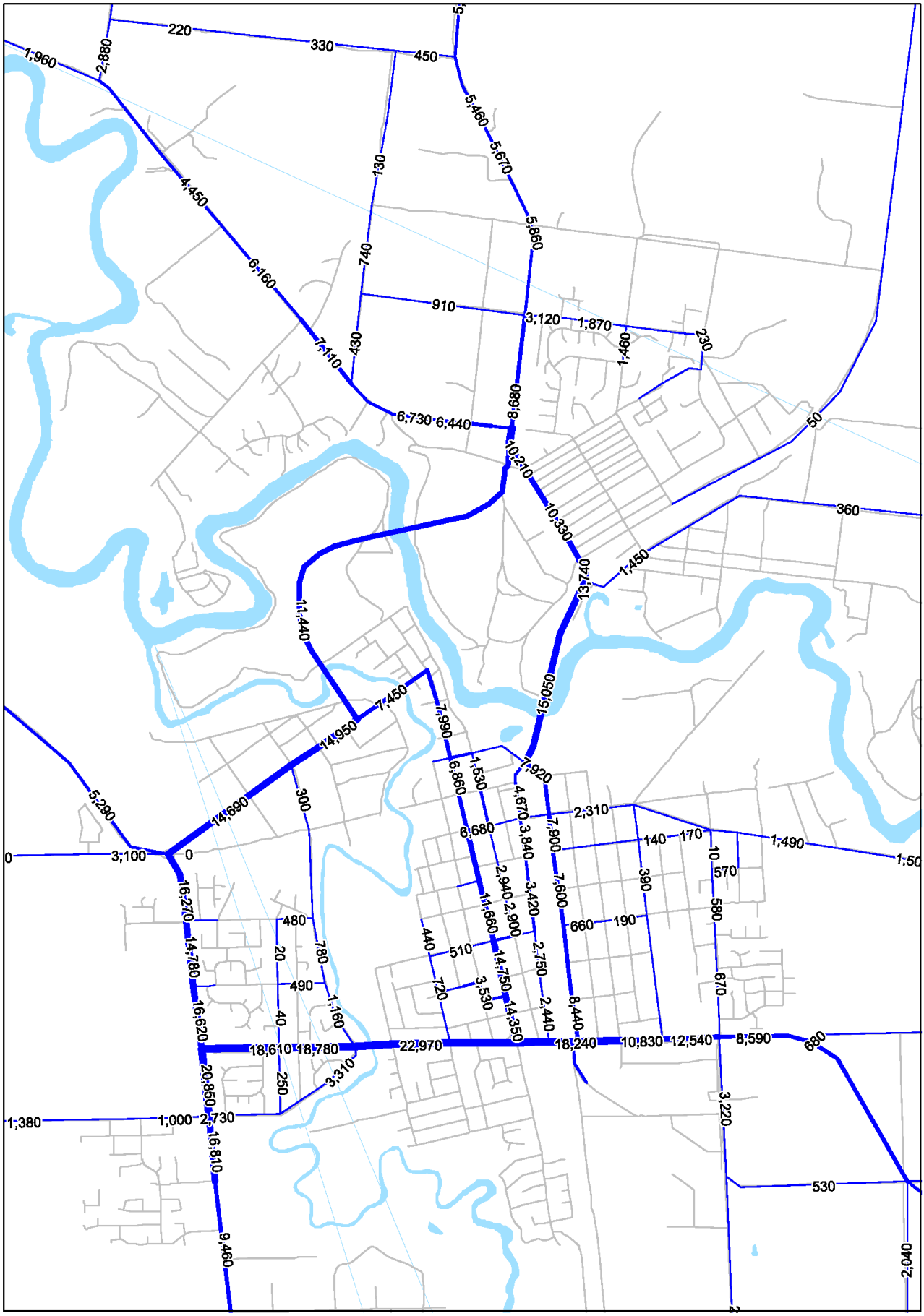


Figure 8-3 Map of modelled daily traffic volumes in 2044

8.6.4 Truck movements

The traffic model assigned truck movements and traffic generation between commercial, industrial and retail functions. It also used the findings of the origin and destination surveys undertaken in 2008. The model predicts that around 21 per cent of the truck trips would seek to access the south and east of Echuca and therefore are likely to use the proposed bridge.

There would be a continued reliance on the existing bridge structure for movement of freight accessing the existing industrial areas in Moama to the east of the town centre and in Echuca to the south east of the town centre.

Seasonal movement of agricultural produce from southern NSW, accessing processing plants in the industrial precinct of Echuca would continue to use the existing bridge.

Freight movements that bypass the two towns, such as access between southern NSW and Victorian markets and ports would be likely to use the proposed bridge.

Moama's industrial area generates, on average, approximately 160 truck movements per day. This is forecast to grow to around 200 movements per day by 2029 (refer Figure 8-5).

It is likely the Project would attract around 27 per cent of trucks headed to the west or south of Echuca, as well as provide the only route for over dimensional or High Mass Limit vehicles.

Overall, the traffic model predicts that the Project would draw approximately 44 per cent of the bi-directional heavy vehicle traffic in 2029.

8.6.5 Road safety

Traffic volumes through the town centre (e.g. Heygarth and High Streets) are forecast to decrease when the Project is operational. A total of 42 per cent of through traffic would be removed from the area of High Street near the Historic Port area by 2044. This would reduce road safety risks in areas with high levels of pedestrian activity.

Meanwhile, traffic volumes along the preferred alignment (in Warren Street) are forecast to increase by around 57 per cent. However, intersections along Warren Street would be upgraded to improve safety for turning vehicles, pedestrians and cyclists, and off-road shared path facilities would be provided for bicycles and pedestrians.

In addition, a road safety audit would be completed on the detailed design of the Project, and items identified in the audit would be addressed prior to sign-off on the detailed design. As such, impacts on road safety during operation are expected to be minor and the residual risk is considered to be low.

8.6.6 Changes in access

As discussed in more detail in Chapter 6, the only permanent changes to local access roads in Victoria once the Project is operational would be:

- The truncation of Campaspe Esplanade to the north-west side of Warren Street (near the Warren Street roundabout)
- A slight realignment of Scenic Drive.

Bicycle and pedestrian access along Campaspe Esplanade would be maintained under the proposed Campaspe River bridge. West of the new road alignment, Campaspe Esplanade would be accessible from Redman Street and Homan Street.

Scenic Drive would still be able to be accessed.

A new 400m right-turn lane would be provided along Warren Street to the north-east of Homan Street for funeral traffic travelling from Echuca and turning right into Homan Street to access the Echuca Cemetery. The extended right turn lane would improve safety by separating turning and through traffic on Warren Street.

Access for properties fronting the north-west side of Warren Street would be provided by two-way service roads that would connect to Homan and Redman streets. Residents north-east of Redman Street would no longer have direct vehicular access onto Warren Street. The appropriate standard of the service road would be determined in consultation with Campaspe Shire Council and local residents.

8.6.7 Public transport

Existing cross-town bus and regional coach services would continue to use the existing bridge, as it would still be the most direct route between Echuca-Moama and to other hubs such as the Echuca railway station.

Due to the Project's improvements to Warren Street, specifically the improvements to the intersection with the Murray Valley Highway, safety and access for bus and coach services using Warren Street would also be improved.

Bus services would benefit from the general reduction in traffic volumes due to the Project, especially along the existing bridge, High Street and Heygarth Street.

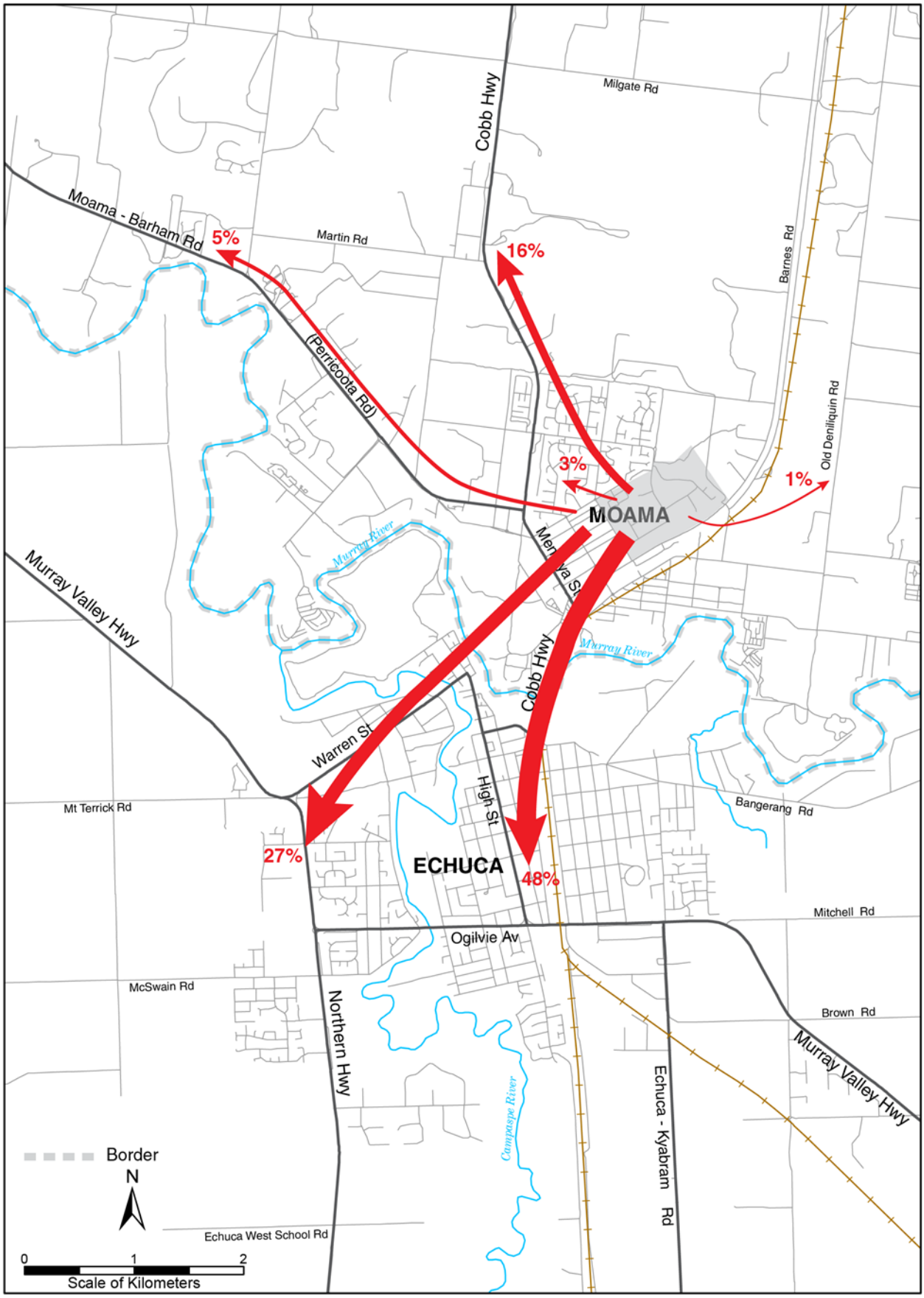


Figure 8-4 Destinations of truck trips from Moama industrial area (based on traffic model forecasts in 2029)

8.6.8 Pedestrians and cyclists

The Project is not expected to have any significant impacts on the existing walking and cycling routes within or between Echuca-Moama.

The Project would include the construction of a new separate pedestrian/cyclist shared path along Warren Street and pedestrian/cyclist access along the new link connection and across the two bridges, providing a second pedestrian crossing of the Murray and Campaspe rivers.

There would be a minor deviation of the existing shared pathways in Victoria Park, across the sand hill to the north of the tennis courts and near the boat ramp at Scenic Drive. However, impacts would mostly be avoided as the connectivity of the shared pathways would be maintained by new connections under the proposed bridge.

The existing bridge would maintain its direct bike and pedestrian path between the towns, with the Project also providing a new off-road path for bike and pedestrian travel along the Project as well as connecting the new path to existing networks in Echuca and Moama.

8.6.9 Construction impacts

The following construction activities for the Project would generate traffic:

- Set out and preparation of the construction corridor
- Relocation or protection of utilities and other services, where required
- Completion of drainage works
- Undertaking surface preparation, compaction and associated earthworks
- Construction of pavement, including verges, batters, kerb and channel, where required
- Construction of bridge and culvert structures
- Application of flexible asphalt pavement and/or spray seal treatment
- Application of line markings, re-vegetation and installation of other road furniture.

Construction vehicles would not typically use local roads and would likely access the site via the Murray Valley Highway in Victoria and the Cobb Highway in NSW. Purpose-built access tracks along the alignment would also be used.

The volume of construction traffic would depend on the program and staging of construction sections, where an increased rate of construction would result in higher traffic volumes on the network each day but for a shorter overall period.

An accurate estimate of construction traffic generation cannot be made until a program and staging of construction has been developed. However, the construction of similar projects has shown that, typically, the greatest traffic volumes are generated during the earthworks, bridging and pavement construction phases, and generally lower traffic volumes at other times.

VicRoads expects that these phases could generate in the order of 100 to 150 truck trips per day across the workday. Less than 100 light vehicle trips per day would be expected to be generated by the worksite contractor(s) accessing the site, typically expected to occur during early morning and late-afternoon periods.

At its peak, the construction of the Project would typically be expected to generate in the order of 250 vehicle trip ends per day, including 150 heavy vehicles.

It is not anticipated that night work would be required on the Project, although this would be considered where it may reduce the overall impact to the public and local community.

It is conservatively assumed that 30 per cent of light vehicle construction traffic would occur during the peak hours, associated with worksite employees arriving and departing the site. Similarly, it is conservatively assumed that 15 per cent of heavy vehicle traffic would occur in the peak hours, associated with an even distribution of truck movements across the workday. It is therefore estimated that construction activities may generate up to 52 vehicle trip ends in peak hours, including 22 heavy vehicles.

In accordance with VicRoads policy, construction vehicles and machinery would be restricted to the highways and arterial roads wherever possible.

In some instances, local road connectivity may change during construction, with alternative access arrangements to be provided. Access to all properties would be maintained during construction.

Construction traffic routes would be designated and managed as part of a Traffic Management Plan. Construction routes would be designed to avoid, where possible, disruption or severing of local access routes. In addition, a communication strategy would be implemented to inform stakeholders of the Project traffic impacts, and construction during major events periods and locations would be avoided. With the implementation of these management measures, it is expected that the road safety risk as a result of Project construction would be negligible.

8.7 Risk assessment

An environmental risk assessment was undertaken for the Project to identify key environmental issues associated with the construction and operation of the Project. The methodology for this risk assessment is described in Chapter 5 and details of the assessment are provided in EES Technical Appendix B – Traffic and Transport Impact Assessment. Table 8-6 is a summary for traffic and transport of:

- The identified impact pathways
- A description of the consequence
- The initial risk rating, prior to the implementation of Project-specific environmental management measures.

Table 8-6 Traffic and transport risks

Risk No.	Impact pathway	Description of consequence	Initial risk rating
TT1	Construction of the Project would disrupt or sever local access routes	Increased travel time and disruption to traffic movements	Medium
TT2	Reduced road safety during operation	Potential for increased interaction with wildlife, new intersections, altered property access, pedestrian and bicycle interactions on bridge route	Medium
TT3	Reduced road safety during construction	Increased risk of crashes at localised construction zones	Low

8.8 Environmental management measures

VicRoads has a set of standard environmental protection measures which are typically incorporated into the contracts of road and bridge construction works. These measures have been used as the starting point for the assessment of construction-related risks and are listed in Chapter 20 and described in detail in EES Technical Appendix O – Section 177 Environmental Management. In some instances, additional Project-specific environmental management measures have been recommended by specialists to reduce risks relating to construction and operation.

Project-specific environmental management measures specific to each identified impact pathway for traffic and transport are outlined in Table 8-7. This table also shows the residual risk rating after the implementation of VicRoads' standard environmental protection measures and Project-specific environmental management measures.

Table 8-7 Transport Project-specific environmental management measures and residual risks

Risk No.	Project-specific environmental management measures	Residual risk rating
TT1	Risk would be managed by implementing VicRoads standard environmental protection measures as outlined in Chapter 20 and EES Technical Appendix O – Section 177 Environmental Management. No Project-specific environmental management measures were identified.	Medium
TT2	Items identified in Road Safety Audit are addressed prior to signoff of detailed design.	Low
TT3	Construction traffic routes to be designated and managed as part of the Traffic Management Plan in accordance with the relevant standards. Communication strategy to be implemented to inform stakeholders of Project traffic. Avoid construction during major event periods and locations.	Negligible

8.9 Conclusion

The existing Echuca-Moama Bridge currently services around 18,800 two-way vehicle trips per day. Under the 'No Project' scenario this is modelled to increase to 22,900 and then to 25,000 for 2029 and 2044 respectively. The existing bridge is expected to exceed its capacity by 2029.

The Project is expected to provide the following benefits to Echuca-Moama:

- Traffic volumes on the existing bridge would reduce by around 40% by 2044. This would result in a reduced volume-capacity ratio for the existing bridge such that it would be operating well within its capacity.
- The volume-capacity ratio for the new bridge would also remain at a level that would allow free flowing traffic, well within its capacity.
- The traffic model predicts that the new bridge would mainly be used by traffic accessing the western areas of Echuca and Moama and the Northern Highway and Murray Valley Highway west of Echuca. Most traffic travelling between Moama town centre and Echuca town centre would continue to use the existing bridge.
- 42% of through traffic would be removed from the area of High Street near the Historic Port area by 2044.
- Truck volumes would be expected to decrease by similar proportions in and around the town centres.
- River crossing access for heavy and oversize vehicles that would otherwise be restricted from using the existing bridge would improve.

No adverse impacts have been identified for existing public transport, walking or cycling connections, and a new pedestrian/cyclist shared path would be constructed along Warren Street.

The predicted reduction in traffic volumes would reduce road safety risks in areas with high levels of pedestrian activity. Whilst traffic volumes along the preferred alignment (i.e. Warren Street) are forecast to increase (by around 54 per cent by 2044), the Project would result in upgrades to existing intersections and would provide off-road shared path facilities. In addition, a road safety audit would be completed on the detailed design of the Project, and items identified in the audit would be addressed prior to sign-off on the detailed design. As such, impacts to road safety during operation are expected to be low.

Access to major events and local roads may be affected by construction of the Project. These impacts could be managed via a Traffic Management Plan and Communication Strategy and hence the potential impact is considered minor.

In addition, there are potential safety risks due to construction, including as a result of increased truck trips, the interaction of construction and normal traffic and the potential for additional crashes. However, these risks are considered to be negligible following the implementation of management measures

With VicRoads standard environmental protection measures, as well as additional Project-specific environmental management measures such as communication plans and designated construction traffic routes, the Project is expected to only have minor impacts on traffic and transport and significant operational benefits in Echuca-Moama.

9 Biodiversity and habitat

The Biodiversity and Habitat Impact Assessment (Brett Lane & Associates, 2015) examined the existing terrestrial ecology of the study area and the potential impacts that the Project could have on terrestrial flora and fauna.

The Biodiversity and Habitat Impact Assessment is based on a number of assessments undertaken prior to the EES process, as well as the assessments completed as part of the EES process.

A large proportion of the study area supports native vegetation. This includes a contiguous area of woodland vegetation between the Campaspe and Murray rivers.

There would be 13.655ha of remnant native vegetation removed for construction of the Project. The removal of native vegetation would be offset, as required under the Biodiversity Assessment Guidelines. It is expected that locating suitable offsets would be achievable given the extent of similar native vegetation in the region.

There are no nationally significant flora species or communities affected by the Project. The flora species likely to be affected are listed under the Department of Environment, Land, Water and Planning (DELWP) Advisory List and the impact is expected to be minor.

There were seven *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth.) (EPBC Act) listed fauna species considered likely to occur in the study area, and one of these was identified in site assessments. There were 16 *Flora and Fauna Guarantee Act 1988* (Vic.) (FFG Act) listed fauna species considered likely to occur, with three identified in site assessments.

The species identified in the site assessments included:

- Rainbow Bee-eater (EPBC listed)
- Masked Owl (FFG listed)
- Squirrel Glider (FFG listed)
- Yellow-bellied Sheathtail Bat (FFG listed).

Of these four listed fauna species recorded in the study area, all are dependent on hollow bearing trees except for the Rainbow Bee-eater.

The key impacts arising from the Project are to threatened fauna species through removal of habitat, and particularly hollow bearing trees.

Of the large old trees (LOTs) recorded in the Victorian component of the study area, 221 are proposed to be removed, however a large number of LOTs would still remain within the study area. As the extent of hollow bearing trees removed would be a comparatively small proportion of the treed habitat on the Murray and Campaspe River floodplains near Echuca-Moama, the overall impact on habitat is expected to be minor.

The assessment found that all impacts on local flora and fauna could be managed and were expected to be minor. A key management measure would be to limit the removal of hollow bearing trees, where possible. Where this was not possible, species salvage and translocation management measures would be used to reduce the potential impact on species dependent on hollow bearing trees.

The South-eastern Long-eared Bat (EPBC listed) was initially considered to be present within the study area, based on the analysis of calls recorded during targeted bat surveys and initial findings that there was suitable habitat present. However, a subsequent peer review of these findings found that the habitat was not suitable and the recorded calls could not be attributed to the South-eastern Long-eared Bat. As such, this species is considered not likely to occur within the study area and the Project would not impact upon this species. VicRoads is preparing Preliminary Documentation as required under the EPBC Act based on these revised findings that the South-eastern Long-eared Bat is not present within the study area.

The Biodiversity and Habitat Impact Assessment also considered the potential impact on wildlife corridors. The landscape of the study area and surrounds has changed significantly following European settlement and the introduction of various agricultural practices.

The Project would not contribute significantly at a regional scale to the fragmentation of existing wildlife corridors as this habitat is already fragmented due to historical and existing land uses. However, the Project would lead to fragmentation at a local scale specifically affecting Victoria Park. It is likely that many of the remaining fauna species in the existing habitat have already adapted to a degree of habitat fragmentation.

With the implementation of VicRoads standard environmental protection measures, and the additional measure of creating a management plan to mitigate the potential impacts on Victoria Park and its habitat, the impact to wildlife corridors is expected to be minor.

9.1 EES objectives

The EES objective relevant to the Biodiversity and Habitat Impact Assessment is "*To avoid or minimise adverse effects on native vegetation and listed flora and fauna species and ecological communities, and address opportunities for offsetting potential losses consistent with relevant policy.*"

This chapter is based on the Biodiversity and Habitat Impact Assessment completed by Brett Lane & Associates (2015) which is included as EES Technical Appendix C. It includes a discussion of the following key issues and requirements as they relate to biodiversity and habitat, as specified in the EES Scoping Requirements for the Project.

Key issues

- *Loss of, or degradation to, native vegetation and associated significant habitat for listed flora species such as Blue Burr-daisy, Pale Flax-lily and Weeping Myall.*
- *Loss of, or degradation to, habitat for listed species of fauna, in particular the South-eastern Long-eared Bat (Corben's Long-eared Bat), Masked Owl, Squirrel Glider and Yellow-bellied Sheathtail Bat.*

Priorities for characterising the existing environment

- *Characterise the distribution and quality of biodiversity values that could be affected by the project, including native vegetation, terrestrial… habitat and patterns of wildlife movement.*
- *Identify the existence or likely existence of any listed species or communities and any declared weeds or pathogens.*
- *Identify any potentially threatening processes that could result from the Project under the FFG Act.*
- *This characterisation is to be informed by relevant databases, literature and appropriate targeted and/or seasonal surveys and modelling where appropriate. In the absence of positive identification of the presence of listed species and communities, but where suitable habitat is identified, a precautionary approach to the further investigation and assessment of its occurrence should be applied.*

Design and mitigation measures

- *Identify and describe the potential and proposed design and mitigation measures, which could avoid or minimise significant effects on native vegetation, and/or any listed flora, fauna and ecological communities and potentially threatening processes.*

Assessment of likely effects

- *Identify and assess likely direct and indirect effects on native vegetation, ecological communities and the habitat of any listed species of flora and fauna along the alignments.*

Approach to manage performance

- *Identify proposed measures to further mitigate and manage residual effects of the Project, including addressing the offset requirements of Victoria's native vegetation permitted clearing regulations and relevant provisions of planning schemes.*
- *Identify in the EES any further methods proposed to manage risks of effects on other biodiversity values and native vegetation, including as part of the Environmental Management Framework (EMF) and resulting residual effects.*

The key issues and requirements that relate to aquatic flora and fauna are addressed separately in Chapter 10.

The Biodiversity and Habitat Impact Assessment focussed on the preferred alignment. The term 'the Project' is used in this chapter to refer to the preferred alignment only.

9.2 Requirements for Preliminary Documentation – Controlled Action for South-eastern Long-eared Bat

Under the EPBC Act a Referral to the Commonwealth Government is required for proposed actions that have the potential to significantly impact on matters of national environmental significance (MNES). The Australian Government then determines if the proposed action, in this case the Project, is a 'controlled action' or not. A controlled action requires further assessment and approval under the Act.

On 23 April 2013 an EPBC Act referral for the Project was made in relation to the potential impact on the South-eastern Long-eared Bat, Macquarie Perch, Murray Cod and Murray Hardyhead based on previous flora and fauna investigations undertaken between 2009 and 2013 (the fish species are discussed separately in Chapter 10). On 11 July 2013, the Commonwealth Minister for Environment determined the Project had the potential to significantly impact EPBC listed species, and was considered likely to have a significant impact as it would involve the destruction and modification of habitat for the South-eastern Long-eared Bat.

As such, the Project was declared to be a controlled action under the EPBC Act. The Minister further determined the Project would be assessed via Preliminary Documentation. The Preliminary Documentation will consider the whole project located in both Victoria and NSW.

9.3 Study area

The Biodiversity and Habitat Impact Assessment considered a project investigation area, study area and construction area. Each of these areas encompasses the following:

- The 'project investigation area' was a 'search region' encompassing an area 10km in radius from the approximate centre point of the study area, which was used to search for existing flora and fauna information
- The 'study area' was defined as the area where detailed field survey and impact assessment was undertaken, and includes the Right-of-Way defined for the preferred alignment
- The 'construction area' is defined as a sub-section of the study area where direct impacts would occur, and is located within the Right-of-Way.

There was also an additional investigation area where detailed surveys were undertaken to provide context for the impact assessment as many fauna species readily move over a wider area than the Right-of-Way.

Refer to Figure 9-1 for the location of the study area and additional investigation area.

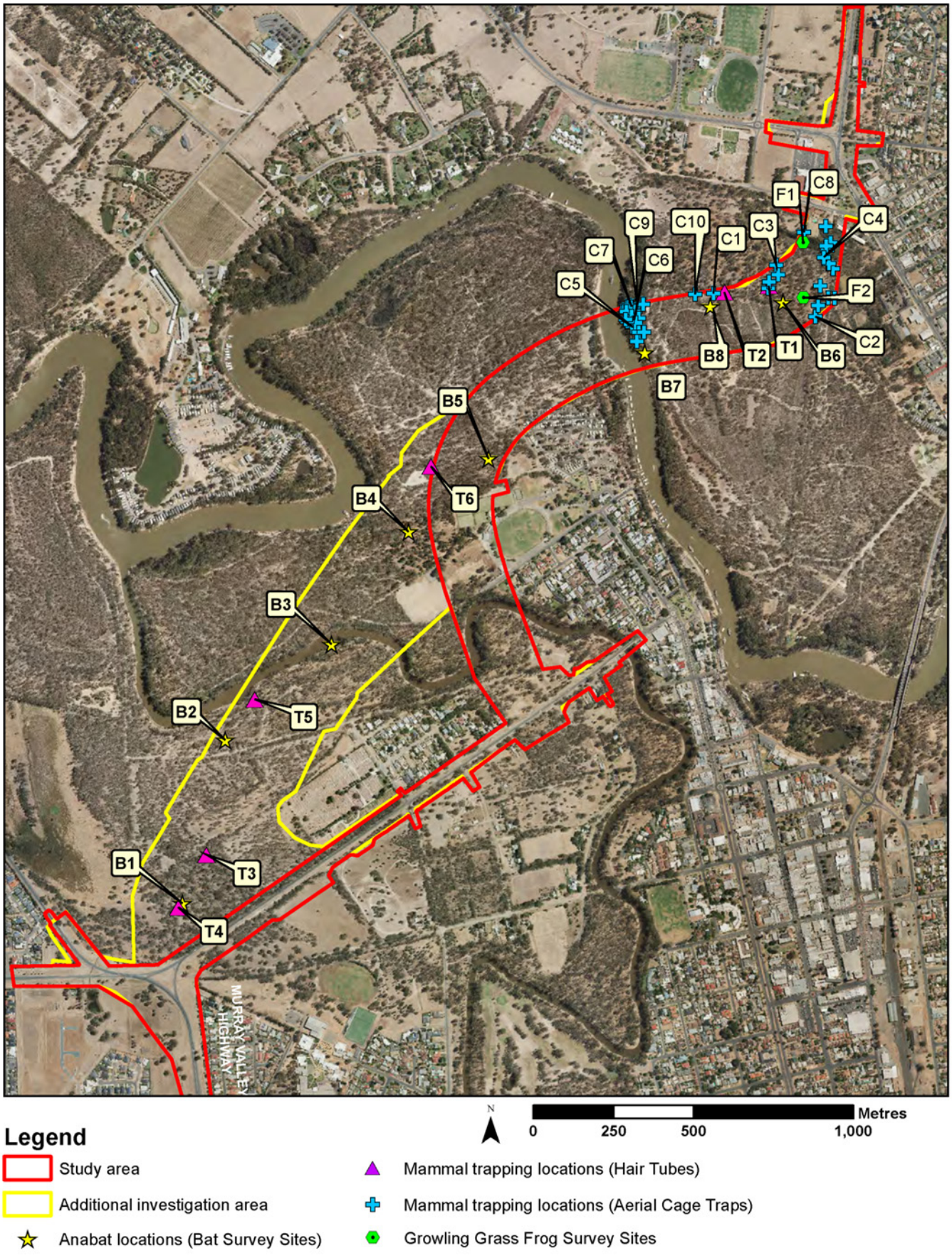


Figure 9-1 Study area (with additional investigation area and targeted fauna survey locations)

9.4 Methodology

The Biodiversity and Habitat Impact Assessment for the Project is based on a number of assessments undertaken prior to the EES process, as well as the assessments completed as part of the EES process. A detailed description of the survey methods used and the species that were surveyed for is included in EES Technical Appendix C – Biodiversity and Habitat Impact Assessment.

The Biodiversity and Habitat Impact Assessment included the following tasks:

- Review of relevant existing reports
- Review of the following databases to obtain a list of species previously recorded within 10km of the study area:
  - Flora Information System
  - Victorian Biodiversity Atlas
  - Atlas of Victorian Wildlife
  - New Atlas of Australian Birds
  - Relevant Ecological Vegetation Classes (EVC) benchmarks (DSE, 2011a)
  - Biodiversity Interactive Maps (DSE, 2011b)
  - FFG Act Threatened List (DEPI, 2014)
  - Protected Matters Search Tool (DSEWPaC, 2014).
- Field assessments including:
  - An initial flora and fauna field assessment (2008)
  - Additional botanical field assessment to assess additional areas within an updated construction area (2010)
  - A detailed flora and fauna assessment within the additional investigation area (2011)
  - Targeted surveys for species of conservation significance likely to occur within the study area and additional investigation area (based on the desktop assessment findings) (2009, 2011, 2012 and 2015).

Further details of the field assessment including the species targeted and the timing of these surveys is provided in Table 9-1.

A native vegetation assessment was also undertaken using the habitat hectare assessment method from the Biodiversity Assessment Guidelines (DEPI, 2013c).

A risk and impact assessment was undertaken to evaluate the potential impacts of the Project on biodiversity and habitat against the 'No Project' scenario. Impact pathways were identified based on the existing ecological values present and the activities outlined in the project description. For the risk assessment, consequence criteria were developed specifically for the project. Initial and residual risks were identified based on the impact pathways and considering the implementation of VicRoads' standard environmental protection measures (for initial risks) and Project-specific environmental management measures (for residual risks).

In order to determine the significance of biodiversity and habitat impacts, it was necessary to consider a wider area than simply the preferred alignment of the Mid-West Option. Including a wider area provided context for the impact assessment given that many fauna species readily move over larger areas than just the study area.

Table 9-1 Fieldwork summary

Activity/species	Date completed	Season
Initial flora and fauna assessment. This included: - Direct search and observation for fauna - Spotlighting along the length of Warren Street (mainly for Squirrel Glider) - Call playback (Barking and Masked owls, Growling Grass Frog).	13-15 October 2008	Spring
Botanical field assessment	21 and 22 July 2010	Winter
Detailed flora and fauna assessment. This included: - Spotlighting (mainly for Squirrel Glider) - Mammal trapping - Call playback (Bush Stone-Curlew, Growling Grass Frog).	26-30 September 2011	Spring
Targeted fauna surveys		
Hair tube trapping for Squirrel Glider	8-22 November 2011	Spring
Call playbacks and spotlighting for Bush Stone-Curlew and Squirrel Glider	6-8 January 2009	Summer
Call playback and spotlighting for Bush Stone-Curlew and Barking Owl	8-17 November 2011	Spring
First bat survey (Anabat) (7 nights each for 8 sites) (MNES species)	8-22 November 2011	Spring
Second bat survey (Anabat) (10 nights each for the same 8 sites) (MNES species)	24 February to 14 March 2012	Summer-Autumn
Brief call playback for Growling Grass Frog	January 2009	Summer
Detailed call playback survey for Growling Grass Frog and tadpole surveying	17 and 18 October 2012	Spring
Spotlight search for Squirrel Glider	8-17 November 2011	Spring
Arboreal cage trapping for Squirrel Glider	15-18 October 2012	Spring
Hollow bearing tree survey (Squirrel Glider habitat)	17 October 2012	Spring
Arboreal cage trapping for Squirrel Glider undertaken by the Australian Research Centre for Urban Ecology (van der Ree et al., 2015)	16-17 March 2015	Autumn
Targeted flora surveys		
Targeted species include: - Chariot Wheels - River Swamp Wallaby-grass - Silky Swainson-pea - Slender Darling-pea - Small scurf-pea - Western Water-starwort.	6-8 January 2009	Summer
Targeted species include: - Hairy tails - River Swamp Wallaby-grass - Slender Darling-pea - Small scurf-pea - Western Water-starwort.	21-23 November 2011	Spring

9.5 Legislation and policy

The relevant legislation and policies for biodiversity and habitat are outlined in Table 9-2.

Table 9-2 Relevant biodiversity and habitat legislation and policies

Legislation/ policy	Description
Commonwealth	
Environment Protection and Biodiversity Conservation Act 1999 (Cwlth.)	The Environment Protection and Biodiversity Conservation Act (EPBC Act) protects a number of threatened or migratory species and ecological communities that are considered to be matters of national environmental significance. Any significant impact on such matters requires the approval of the Australian Minister for the Environment. If there is a possibility of a significant impact on MNES, a Referral under the EPBC Act should be considered. The Minister will decide after 20 business days whether the project will be a 'controlled action' under the EPBC Act, in which case it cannot be undertaken without the approval of the Minister. This approval depends on a further assessment and approval process.
State	
Planning and Environment Act 1987 (Vic.)	The Planning and Environment Act establishes a framework for planning the use, development and protection of land in Victoria in the present and long-term interest of all Victorians. The Planning and Environment Act sets out the legislative basis to ensure that standard planning provisions are prepared and approved throughout Victoria. The Act sets out procedures for preparing and amending the Victoria Planning Provisions (VPP) and planning schemes, obtaining permits under planning schemes, settling disputes, enforcing compliance with planning schemes, and other administrative procedures. The Act provides for a single instrument of planning control in a particular area, the planning scheme, which sets out the way land may be used or developed. The planning scheme is a legal document, prepared and approved under the Planning and Environment Act. The relevant planning scheme for the study area is the Campaspe Planning Scheme. Destruction, lopping or removal of native vegetation on land which, together with all contiguous land in-one-ownership, has an area of 0.4 hectares (ha) or more requires a planning permit under Clause 52.17 of all Victorian planning schemes. This includes the removal of dead trees with a diameter at breast height (DBH), or 1.3m, of 40cm or more and any individual scattered native plants. On 20 December 2013 a planning scheme amendment was gazetted to implement a number of reforms to Victoria's native vegetation permitted clearing regulations, particularly Clauses 12.01 (Biodiversity), 52.16 (Native vegetation precinct plan) and 52.17 (Native vegetation). As part of these reforms the previously incorporated document *Victoria's Native Vegetation – a Framework for Action* was replaced by a new incorporated document, *Permitted clearing of native vegetation – Biodiversity assessment guidelines* (the Guidelines) (DEPI, 2013c). Before issuing a planning permit, Responsible Authorities are obligated to refer to Clause 12.01 (Biodiversity) in the relevant planning scheme. This refers in turn to the following online tool and document: - The Native Vegetation Information Management (NVIM) system (DELWP, 2014) - Permitted clearing of native vegetation – Biodiversity assessment guidelines (DEPI, 2013c).
Permitted clearing of native vegetation – Biodiversity assessment guidelines 2013	As set out in the Guidelines the objective for permitted clearing of native vegetation in Victoria is 'No net loss in the contribution made by native vegetation to Victoria's biodiversity'. The key strategies for ensuring this outcome when considering an application to remove native vegetation are: - Avoiding the removal of native vegetation that makes a significant contribution to Victoria's biodiversity - Minimising impacts on Victoria's biodiversity from the removal of native vegetation, and - Where native vegetation is permitted to be removed, ensuring it is offset by native vegetation that makes an equivalent contribution to Victoria's biodiversity. Note: if native vegetation does not meet the definition of either a remnant patch or scattered trees, the Guidelines are not required to be applied. A planning permit under Clause 52.17 of the Campaspe Planning Scheme is required for the removal of native vegetation. A Planning Scheme Amendment is being undertaken to exempt the Project from the requirement to obtain such a permit.
Flora and Fauna Guarantee Act 1988 (Vic.)	The Flora and Fauna Guarantee Act (FFG Act) lists threatened and protected species and ecological communities (DEPI, 2013a; DEPI, 2014). Any removal of threatened flora species or communities (or protected flora) listed under the FFG Act from public land requires a Protected Flora Licence or Permit under the Act, obtained from DELWP. The FFG Act does not apply to private land.
Wildlife Act 1975 (Vic.)	The Wildlife Act establishes the framework for the protection of the Victoria's native wildlife. The inspection, removal or relocation of fauna species for the Project would require a permit under the Wildlife Act.

Legislation/ policy	Description
Catchment and Land Protection Act 1994 (Vic.)	The purpose of the Catchment and Land Protection Act is to: • Set up a framework for the integrated management and protection of catchments • Encourage community participation in the management of land and water resources • Set up a system of controls on noxious weeds and pest animals. Noxious weeds (declared under the Catchment and Land Protection Act) are present in the study area. Therefore, the construction and maintenance of the Project would need to comply with the provisions of the Act, which protect against the spread of these weeds.
Local	
Campaspe Planning Scheme	A planning scheme sets out objectives, policies and provisions relating to the use, development, protection and conservation of land in the area to which it applies. A planning scheme is established under the Planning and Environment Act and regulates the use and development of land through planning provisions. The applicable planning scheme within the Victorian proportion of the study area is the Campaspe Planning Scheme. Included in the VPP is the State Planning Policy Framework (SPPF), which covers strategic issues of State importance. Clauses of the SPPF that are relevant to catchment values and strategies within these clauses of relevance include: • Clause 12.01-1 Protection of biodiversity - The objective of this Clause is "*To assist the protection and conservation of Victoria's biodiversity, including important habitat for Victoria's flora and fauna and other strategically valuable biodiversity sites*." • Clause 12.01-2 Native vegetation management - The objective of this Clause is "*To ensure that permitted clearing of native vegetation results in no net loss in the contribution made by native vegetation to Victoria's biodiversity*." The objectives, policies and implementation strategies of the Municipal Strategic Statement are set out in Clause 21.04 of the Campaspe Planning Scheme. The key elements of Clause 21.04 of relevance to this Project are: Clause 21.04-2 Environment - The relevant objectives of this Clause are: • *To protect, manage and restore native vegetation, including grasslands and wetland vegetation.* • *To protect and enhance indigenous roadside vegetation.* The proposed Right-of-Way is affected by Environmental Significance Overlay Schedule 1 (ESO1) – Murray River Corridor (Clause 42.01 of the planning scheme). Relevant objectives of the ESO1 are: • *To protect the environs of the Murray River recognising its importance for nature conservation, flooding, economic development, recreation and tourism* • *To protect and enhance the biodiversity, ecological, and cultural values of waterways* • *To prevent the loss of riparian flora and fauna, biodiversity, habitat and wetland environments* • *To assess the use or development of land adjoining the Murray River corridor according to the capacity of the proposal to protect the environmental and landscape qualities of the river environs in accordance with sustainable development principles* • *To specifically address land degradation processes including erosion, native vegetation decline, pollution of ground or surface water, groundwater accession, salinisation and soil acidity, and adverse effects on the quality of land and water habitats.* A planning permit is required under this overlay to remove, destroy or lop any vegetation, including dead vegetation. A planning permit is also required to remove, destroy or lop native vegetation, including dead native vegetation, under Clause 52.17 Native Vegetation. However as part of the Project, a planning scheme amendment is proposed which would facilitate the removal of native and non-native vegetation associated with the Project by incorporating a document into the Campaspe Planning Scheme which would exempt the Project from requiring a planning permit.

9.6 Existing conditions

A large proportion of the study area (and additional investigation area) supports native vegetation. This includes a large contiguous area of woodland vegetation between the Campaspe and Murray rivers.

The native vegetation within the study area is contiguous with River Red Gum and Black Box woodland to the north. It also provides habitat linkages to other areas of woodland vegetation along the Murray River. The River Red Gum and Black Box vegetation dominates the area, with several LOTs.

The Campaspe and Murray rivers are predominantly lined with River Red Gums. Native shrubs and grasses are common near the rivers, although the understory layer is degraded, containing a high level of introduced flora and ground cover weed species.

At the eastern end of Warren Street, and between the former Echuca Secondary College and the Murray River, there are large areas of Black Box woodland. These areas support various native shrub and herb species and have a low instance of introduced flora.

The Victorian component of the Project is located across the Campaspe River boundary of the Victorian Riverina and Murray Fans bioregions. The Murray Fans bioregion is to the north between the Campaspe and Murray rivers, with the Victorian Riverina bioregion lying to the south.

9.6.1 Flora

The Biodiversity and Habitat Impact Assessment for the Project identified a number of listed flora species, EVCs and scattered trees within the study area. Figure 9-2 to Figure 9-5 show the locations of the EVCs and listed species.

During the field assessments 115 plant species were recorded with 66 (58 per cent) being indigenous and 47 (40 per cent) non-indigenous species.

Desktop searches also identified the presence, or the potential presence, of suitable habitat for 38 rare or threatened flora species in the search area (10km radius from study area).

Threatened ecological communities

No threatened ecological communities listed on the EPBC Act or the FFG Act were identified in the Victorian component of the study area and are therefore considered unlikely to occur.

Flora species of national significance

Nine nationally significant flora species (listed under the EPBC Act) have previously been documented or predicted to occur within 10km of the study area.

As suitable habitat for four of these species exists in the areas of high quality Black Box woodland, a targeted survey was undertaken to confirm their presence.

None of the EPBC listed species were recorded during the surveys, and are therefore considered unlikely to occur in the study area. As such, EPBC flora species are not considered further in this assessment.

Flora species of State significance

Thirteen species listed under the FFG Act and 35 species on the DELWP Advisory List have previously been documented or been predicted to occur within 10km of the study area. Of these species, only two DELWP Advisory Listed species were recorded during the field surveys. A full list of species can be found in Technical Appendix C – Biodiversity and Habitat Impact Assessment.

Blue Burr-daisy (rare on the DELWP Advisory List) was recorded in one area within habitat zone 19 (see Figure 9-3 to Figure 9-5).

Pale Flax-lily (vulnerable on the DELWP Advisory List) was recorded throughout the Victorian component of the study area as scattered individuals in several locations. Pale Flax-lily locations are therefore not presented in the figures.

There is suitable habitat in the study area for the FFG Act listed Weeping Myall however it was not identified in field surveys and is therefore considered unlikely to occur. The Weeping Myall is not considered further in this assessment.

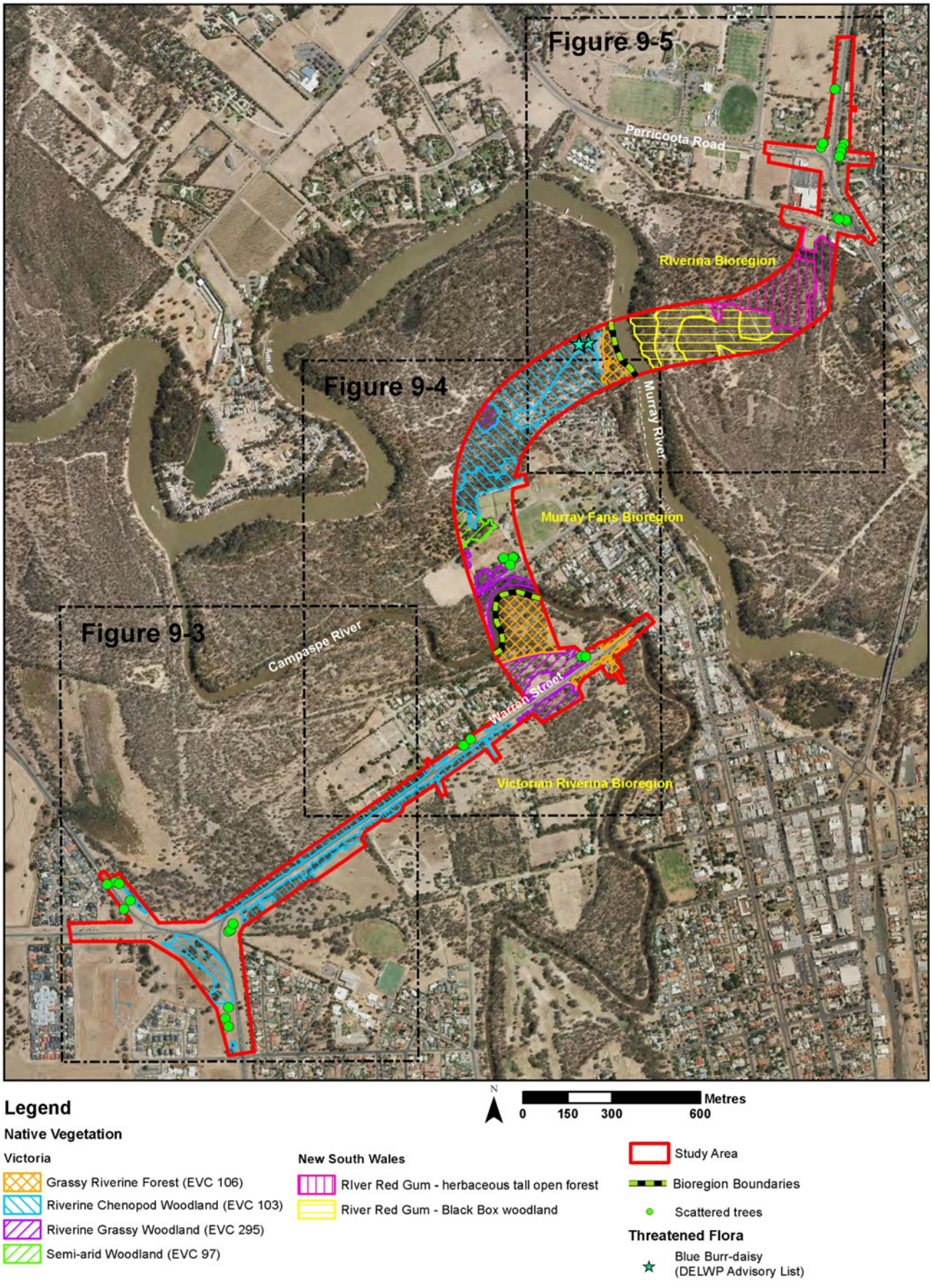


Figure 9-2 Existing native vegetation within the proposed Right-of-Way

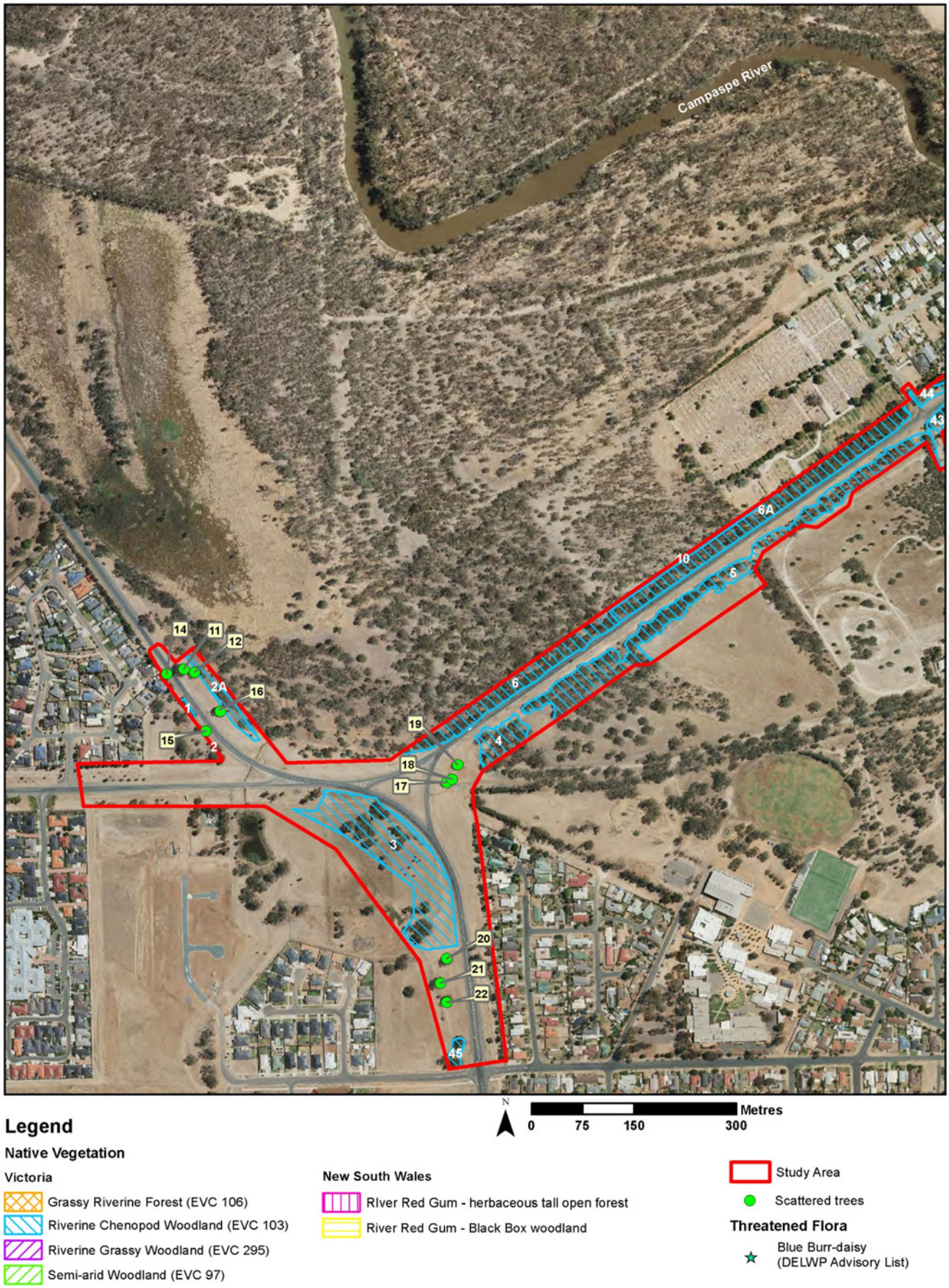


Figure 9-3 Detailed native vegetation map (south-west end of the Project)

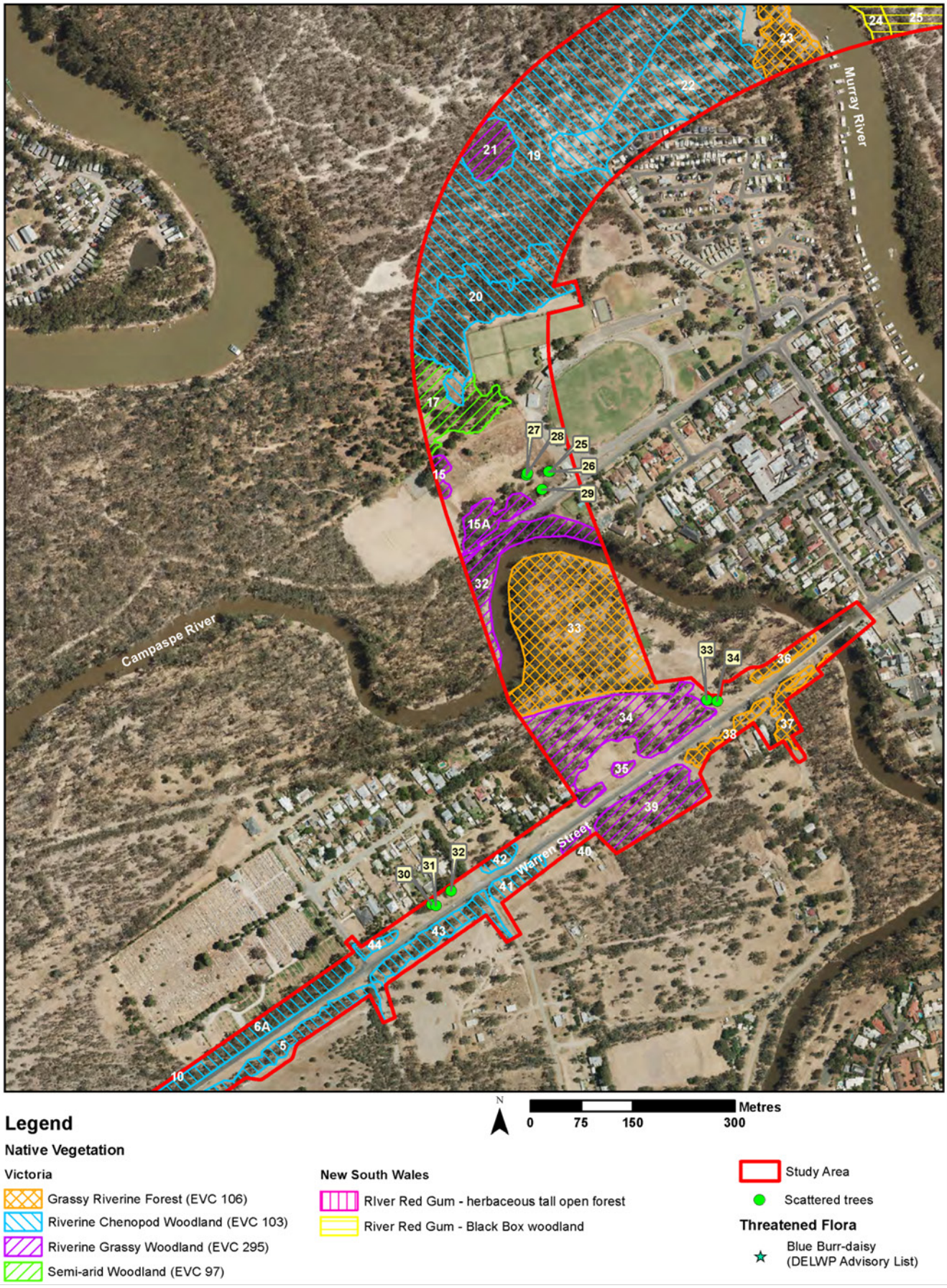


Figure 9-4 Detailed native vegetation map (centre of the Project)

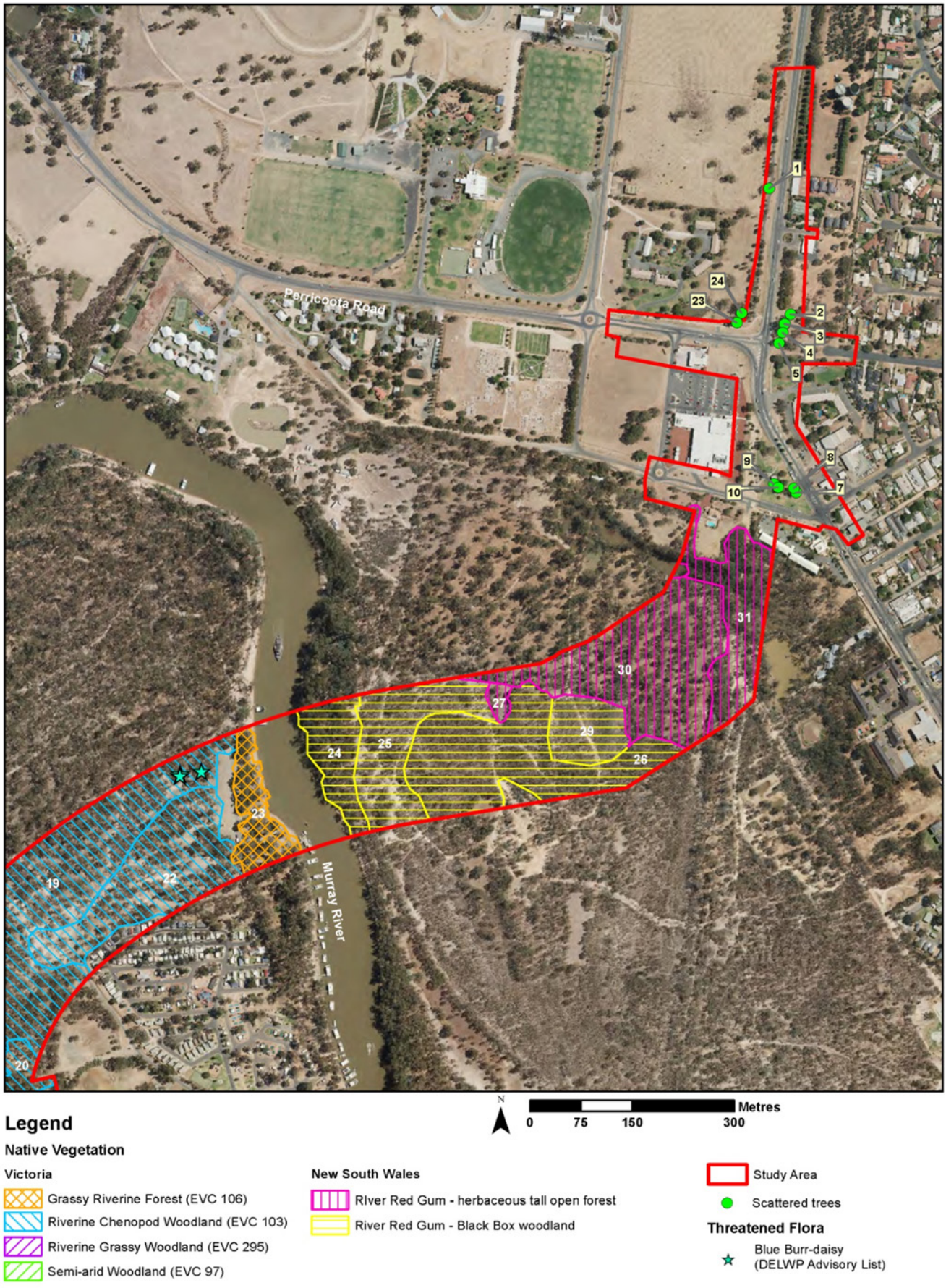


Figure 9-5 Detailed native vegetation map (north-east end of the Project)

Ecological Vegetation Classes

Mapping of pre-European EVCs (DSE, 2011b) indicated the presence of four EVCs. All four of these EVCs were recorded as being present within the study area within 31 remnant patches.

A description of the EVCs within the study area is presented in Table 9-3.

Table 9-3 EVCs in the study area

EVC	Description	Bioregion status
EVC 97 Semi-arid Woodland	Non-eucalypt woodland or open forest to 12m tall, of low rainfall areas. Occurs in a range of somewhat elevated positions not subject to flooding or inundation. The surface soils are typically light textured loamy sands or sandy loams (DSE, 2011a). This EVC was distinguished in the study area by the presence of Murray Pines as the dominant canopy species.	Vulnerable conservation status within the Murray Fans bioregion.
EVC 103 Riverine Chenopod Woodland	Eucalypt woodland to 15m tall with a diverse shrubby and grassy understorey occurring on most elevated riverine terraces. Confined to heavy clay soils on higher level terraces within, or on the margins of, riverine floodplains (or former floodplains), naturally subject to only extremely infrequent incidental shallow flooding from major events if flooded at all (DSE, 2011a). This EVC was distinguished in the study area by the presence of Black Box as the dominant canopy species.	Vulnerable conservation status in the Victorian Riverina bioregion Endangered conservation status in the Murray Fans bioregion.
EVC 106 Grassy Riverine Forest	Occurs on the floodplain of major rivers in a slightly elevated position where floods are infrequent, on deposited silts and sands, forming fertile alluvial soils. River Red Gum forest to 25m tall with a ground layer dominated by graminoids. Occasional tall shrubs are present (DSE, 2011a). This EVC was distinguished in the study area by the presence of tall dense River Red Gum as the dominant canopy species.	Depleted conservation status in both the Victorian Riverina and Murray Fans bioregions.
EVC 295 Riverine Grassy Woodland	Occurs on the floodplain of major rivers, in a slightly elevated position where floods are infrequent, on deposited silts and sands, forming fertile alluvial soils. River Red Gum woodland to 20m tall with a ground layer dominated by graminoids and sometimes shrubby or with chenopod shrubs (DSE, 2011a). This EVC was distinguished in the study area by the presence of sparse River Red Gum as the dominant canopy species.	Assigned a vulnerable conservation status in both the Victorian Riverina and Murray Fans bioregions.

Scattered trees

A total of 21 scattered trees were found in the Victorian component of the construction area. These can be seen in Figure 9-2 to Figure 9-5. A large proportion of these scattered trees are hollow bearing trees.

Weeds

Noxious weed species listed under the Catchment and Land Protection Act that were recorded in the study area include:

- African Box-thorn
- Horehound
- Patterson's Curse
- Prickly Pear
- Bridal Creeper.

9.6.2 Fauna

The Biodiversity and Habitat Impact Assessment identified fauna species that are of national, State and regional significance, and areas of fauna habitat in the study area.

Review of existing information indicated that 210 fauna species may occur within 10km of the study area (including both the Victorian and NSW components of the Project).

During field assessments 139 fauna species were recorded in the study area. This included 105 birds (seven introduced), 22 mammals (four introduced), four reptiles and six frogs. Fish species are discussed in Chapter 10.

The fauna habitat areas have been rated on a scale from low to high quality depending on the value of the habitat to its inhabitant fauna.

Fauna habitat

There are five major habitat types that occur in the study area. These types are:

- River Red Gum woodland
- Black Box woodland
- Mixed Murray Pine-River Red Gum
- Wetlands
- Disturbed roadside vegetation.

The condition of these areas and a description is outlined in Table 9-4.

The high quality forest and woodlands, and moderate quality wetlands of the study area provide habitat for, and were found to attract, a diverse range of fauna. The fauna species found in the study area, particularly birds, were not usually restricted to certain habitats and were almost equally distributed amongst the different habitat types. However, waterbirds were generally confined to the riverbanks and wetland areas.

Table 9-4 Habitat descriptions

Fauna habitat	Corresponding EVC	Quality	Description
River Red Gum woodland	EVC 106 Grassy Riverine Forest & EVC 295 Riverine Grassy Woodland	High	In Victoria, the River Red Gum woodland occurs on either side of the Campaspe River and on the shore of the Murray River. These areas contain several large trees and a contiguous canopy, although the understory is highly disturbed with introduced grasses.
Black Box woodland	EVC 103 Riverine Chenopod Woodland	High	The Black Box woodlands in Victoria consist of many LOTs. The areas dominated by these woodlands include to the north of Warren Street, to the north and south of the sand hill, and between the Murray River and the Murray Pine woodland described below. While the Warren Street area has only a sparse understory (though mostly native), it has some of the highest quality habitat.
Mixed Murray Pine-River Red Gum woodland	EVC 97 Semi-arid Woodland	High	The mixed Murray Pine-River Red Gum woodland that exists to the west of the tennis courts occurs on a raised area of sandy soil. This area supports an indigenous canopy of Murray Pines, but also has a dense carpet of introduced weed (Bridal Creeper) which has taken over the ground layer.
Wetlands	NA	High	Aquatic habitat for the area includes the Campaspe and Murray rivers, which due to the continuity they provide are considered high quality habitat corridors (mostly for fish).
	NA	Moderate	The wetland habitat surrounding Campaspe River has moderate fringing vegetation cover which could provide habitat for frog species. The dam investigated near the intersection of Warren Street and the Murray Valley Highway was found to have habitat for five species of frog and several aquatic birds.
Disturbed roadside vegetation	NA	Low	Roadside habitat consists mainly of modified vegetation and is highly disturbed. They are unlikely to provide habitat for any threatened species, though scattered trees may provide some habitat for locally common fauna species.

Fauna species of national significance

The review of existing information indicated that within the search region, 54 listed fauna species (including nationally, State or regionally listed species) may occur within the Victorian section of the study area. This includes 41 birds, eight mammals, three reptiles, one frog and one invertebrate. A full list is given in EES Technical Appendix C – Biodiversity and Habitat Impact Assessment.

Based on a likelihood of occurrence assessment for threatened fauna, suitable habitat was deemed to occur in the study area for 25 listed fauna species. During field surveys (of both the study area and the additional investigation area), 10 of these listed fauna species were recorded (see Figure 9-6).

Species considered not likely to occur due to a lack of suitable habitat or an absence of recent records, and species only listed in NSW and not in Victoria, are not discussed further (with the exception of the South-eastern Long-eared Bat and Growling Grass Frog).

Eight species considered likely to occur in the study area are listed under the EPBC Act. This includes seven birds and one mammal which are listed below:

- Eastern Great Egret (Migratory)
- Rainbow Bee-eater (Migratory)
- Superb Parrot (Vulnerable)
- Swift Parrot (Endangered)
- White-bellied Sea-Eagle (Migratory)

- Fork-tailed Swift (Migratory)
- White-throated Needletail (Migratory)
- Koala (Vulnerable in NSW only)

The only EPBC listed fauna species recorded during the field assessments undertaken for the project was the Rainbow Bee-eater. The Rainbow Bee-eater is a summer visitor to the study area. It was not recorded during the initial 2011 survey, probably as it had not yet arrived in the area, but was later recorded during the November 2011 and October 2012 surveys. It has also previously been reported on both sides of the river in the study area (BL&A 2013). The Rainbow Bee-eater is widespread in Australia, and though listed as a migratory species under the EPBC Act, it is not a threatened species. The removal of native vegetation within the study area is unlikely to have a significant impact on this species.

The Eastern Great Egret has been recorded eight times in the larger search region. However, the study area contains minimal suitable habitat and is likely only used by Eastern Great Egrets for foraging rather than breeding. The Superb and Swift parrots are expected to occasionally pass through the study area due to the suitability of core habitat for foraging, however records are limited. Such occurrence would only be for short periods and no impacts are expected on their populations from changes to habitats in the study area arising from the Project.

The White-bellied Sea-Eagle nests in River Red Gums and has once been recorded within 10km of the study area in 1999. However, no nests were found during the field assessment, and they are unlikely to be regular residents of the study area. This species is unlikely to be significantly impacted by the Project.

The South-eastern Long-eared Bat roosts in tree hollows, crevices and under loose bark within a variety of inland woodland vegetation types scattered throughout the region. Capture rates vary across NSW and Victoria and records of the species are very limited in Victoria. The two closest records to the study area are near Terrick Terrick National Park, approximately 50km west of Echuca.

The South-eastern Long-eared Bat was formally described in 2009 and requires capture to be able to distinguish it from the closely related Gould's Long-eared Bat (*Nyctophilus gouldi*) and Lesser Long-eared Bat (*Nyctophilus geoffroyi*). Although the Draft South-eastern Long-eared Bat Recovery Plan (Schulz and Lumsden 2012) asserted the Bat was considered to be potentially absent from River Red Gum forests along the Murray River, there is much about the ecology of the species which remains unknown.

Analysis of bat calls from the study area conducted by Dr. Greg Richards (Greg Richards and Associates) identified the presence of the South-eastern Long-eared Bat. However, it was found the recorded calls could not reliably attribute the call to the South-eastern Long-eared Bat due to its call similarity to the Gould's Long-eared Bat and Lesser Long-eared Bat.

The subsequent peer review of bat surveys was conducted by Gration in 2015. Consultation with subject matter experts resulted in a consensus that suitable habitat for the South-eastern Long-eared Bat was not present within proximity of the study area. As such, this species was considered not likely to occur within the study area (Gration, 2015).

Fork-tailed Swift and White-throated Needletail are both migratory species. They are highly nomadic when in Australia and move in flocks ahead of weather fronts, often over heavily forested areas. These species have the potential to occur in the study area occasionally due to the presence of suitable habitat, however these species are unlikely to be significantly impacted by the Project.

The koala has not been detected in or adjacent the study area during any of the flora and fauna field investigations for this Project since 2008. This indicates that there is no evidence of either a current or historical population of the Koala in the vicinity of the study area. It is therefore unlikely that a viable population of the species exists in the study area and locality, and it is therefore not considered further in this assessment.

Two targeted surveys for the Growling Grass Frog were undertaken, both in the NSW component of the study area. The results for both surveys were negative for the presence of the Growling Grass Frog and the species is considered unlikely to occur. Therefore the Growling Grass Frog is not considered further in this assessment.

Fauna species of State significance

Fourteen species identified as likely to occur in the area are listed under the FFG Act and 20 are listed on the DELWP Advisory List. These species are discussed in Table 9-5.

Three FFG Act listed species were recorded during the surveys. The recorded species were the Masked Owl, Squirrel Glider and Yellow-bellied Sheathtail Bat.

State significant fish species are discussed in Chapter 10.

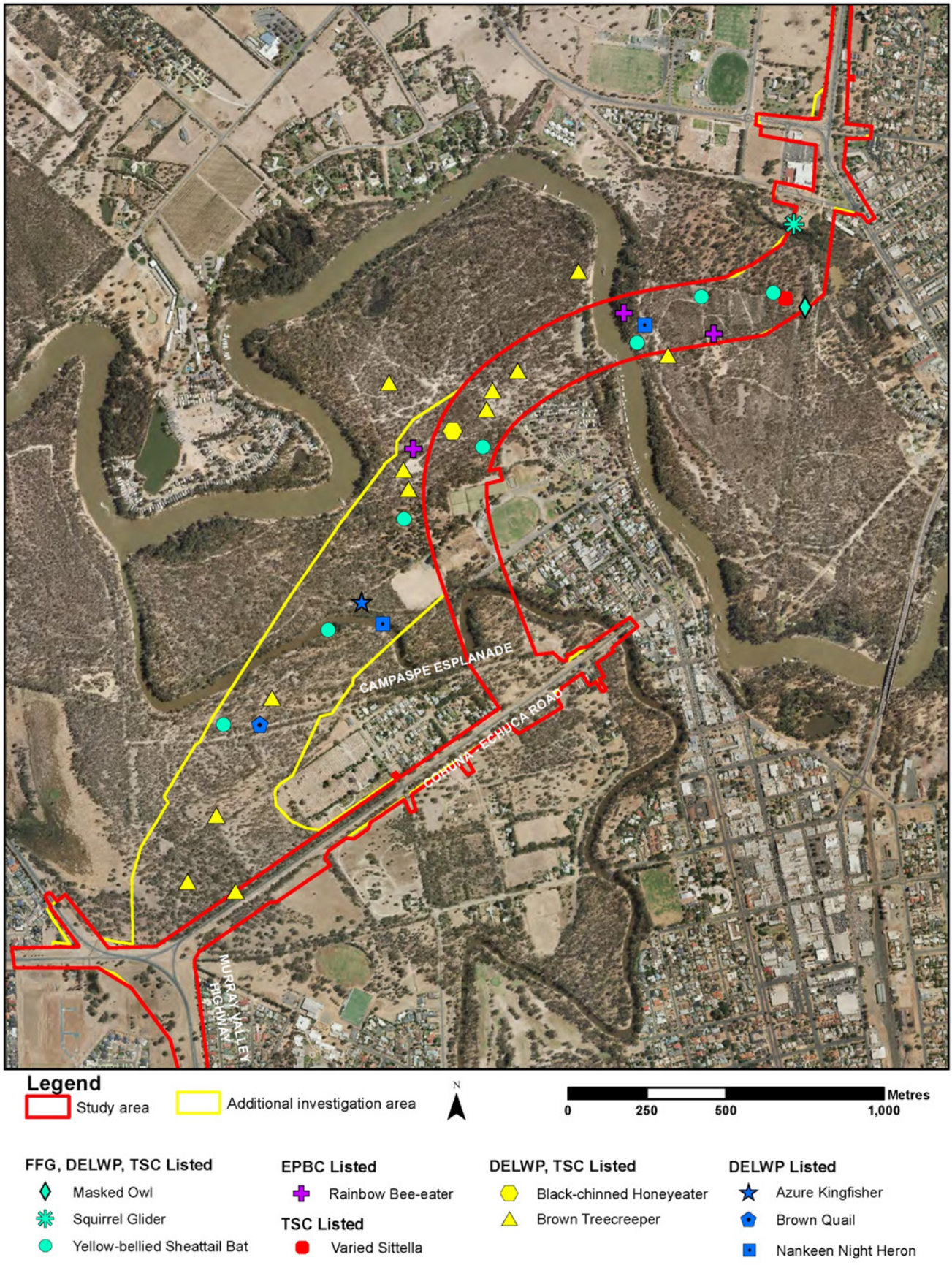


Figure 9-6 Threatened fauna species recorded in the study area and additional investigation area

Table 9-5 Threatened fauna species likely to occur in the study area (excludes species only listed in NSW)

Species	EPBC	FFG	DELWP	Habitat	Likelihood of occurrence
Birds					
Azure Kingfisher	-	-	NT	Mostly well vegetated freshwater wetland margins or along tidal rivers and creeks, especially with still or slowly flowing waters (Higgins, 1999).	One bird observed on the Murray River. Recorded in the study area.
Black-chinned Honeyeater	-	-	NT	Open box-ironbark forests and woodlands. Usually found in Red or Mugga Ironbarks, Grey Box, Yellow Gum and Yellow Box. Especially mature tall trees along gullies, low-lying flats and lower slopes. Characteristic box-ironbark species, widespread but moderately common. The species is gregarious, usually seen in groups of 3–10 birds (Higgins et al., 2001; Tzaros, 2005).	Few birds observed within the Black Box woodland. Recorded in the study area.
Brown Quail	-	-	NT	Prefers tall ground vegetation, such as grass, ferns and shrubs over damp or swampy ground. Also occurs in grasslands, cereal crops, stubble, leafy crops, heath, bracken and stands of vegetation fringing freshwater wetlands. In Victoria it is widespread and could be locally common in suitable habitats (Marchant and Higgins, 1993).	Two pairs were observed in Black Box forest in Victorian section. Recorded in the study area.
Brown Treecreeper	-	-	NT	Woodlands dominated by eucalyptus, especially Stringybarks or other rough-barked eucalypts usually with open grassy understorey, some dead trees and fallen timber (Higgins et al., 2001).	A thriving population occurred on both sides of Murray River. Recorded in the study area.
Diamond Firetail	-	L	VU	Commonly found in open forests and woodlands often with sparse grassy understorey. The species also occurs along watercourses and in farmland areas. Widespread but scattered. Populations have declined in Victoria since the 1950s (Higgins et al., 2006).	This species may occasionally utilise the habitats in the study area, although records are limited. The species is considered unlikely to occur regularly or in significant numbers.
Eastern Great Egret	M	L	VU	Variety of wetlands including estuaries and intertidal mudflats; various permanent and ephemeral freshwater, brackish and saline wetlands; shallows of deep permanent lakes (Marchant and Higgins, 1990).	The study area contains minimal suitable habitat, and is likely only used by Eastern Great Egrets for foraging rather than breeding.
Grey-crowned Babbler	-	L	EN	Inhabits dry woodlands and forests with a shrub layer and a groundcover of leaf litter and fallen timber. In Victoria it is found in woodlands and forests with box-ironbark eucalypt associations and River Red Gums, including narrow remnants along roadsides and streams. Formerly widespread over much of Victoria, but the population has declined and its range has contracted markedly, mostly from the south and west since the 1970s (Higgins and Peter, 2002; Tzaros, 2005).	Potential to occur in woodland habitat within both sides of the study area. During the field survey no evidence was found for the occurrence of this species. Information obtained from the Murray Shire indicates that this species is occasionally observed on the NSW side of the study area. Such occurrences appear to be dispersing individuals, as there is an absence of nests which would suggest a permanent presence. It is therefore unlikely that a breeding population of Grey-crowned Babblers occurs in the study area.

Species	EPBC	FFG	DELWP	Habitat	Likelihood of occurrence
Hooded Robin	-	L	NT	Mostly occurs in lightly timbered woodlands dominated by acacias or eucalypts, often with pockets of saplings or taller shrubs, an open shrubby understorey, sparse grasses and patches of bare ground and leaf-litter with scattered fallen timber. This species typically occurs north of the Great Dividing Range in shrubland or woodland dominated by acacias (Higgins and Peter, 2002; Tzaros, 2005).	This species may occasionally utilise the habitats in the study area but records are limited. Therefore it is unlikely they occur regularly or in significant numbers.
Intermediate Egret	-	L	CE	Mainly occurs in inland freshwater wetlands, occasionally visit coastal wetlands and forages amongst aquatic vegetation in shallow water and requires trees for roosting and nesting. Often occurs in wetlands that contain vegetation, including *Typha.* They are generally scarce in Victoria only few breeding records from Gunbower Island and Murray River, few pairs nested near Barmah during deep spring floods (Marchant and Higgins, 1990).	Very limited habitat for waterbirds occurs along the rivers and the billabongs of the study area, and such habitat would be temporally used for foraging but unlikely to support breeding.
Masked Owl	-	L	EN	Mostly occurs in open woodlands and forests that provide dense and tall tree cover, and adjoining open habitats such as cleared farmlands (Higgins, 1999).	Recorded in the NSW section of the study area. Suitable habitat present.
Nankeen Night Heron	-	-	NT	Inhabits littoral and estuarine habitats and terrestrial wetlands. Mainly nocturnal foraging over soft or firm substrates in still or slow-moving shallow water, on exposed shores, banks and flats of wetlands, or swampy vegetation. Often occurs where sheltered by tall emergent or ground vegetation and near trees used for roosting (Marchant and Higgins, 1990).	Recorded in the study area. Suitable habitat present along the rivers and at wetlands in the study area.
Rainbow Bee-eater	M	-	-	Usually in open or lightly timbered areas, often near water. Occurs in partly cleared land such as farmland and in sand dunes, both coastal and inland (Higgins, 1999).	Recorded in the study area. The Rainbow Bee-eater is a summer visitor to the study area. The Rainbow Bee-eater is widespread in Australia, and though listed as a migratory species under the EPBC Act, it is not a threatened species.
Royal Spoonbill	-	-	VU	This species occurs in terrestrial wetlands, sheltered marine habitats and wet grasslands. Foraging is limited to shallow waters, often among aquatic or emergent vegetation or submerged logs that shelter prey and favour coastal habitats (Marchant and Higgins, 1990).	Very limited habitat for waterbirds occurs along the rivers and the billabongs of the study area, and such habitat would be temporally used for foraging but unlikely to support breeding.
Speckled Warbler	-	L	VU	Inhabits dry eucalypt forests and woodlands, especially those with box-ironbark eucalypt associations. It is also found in River Red Gum woodlands. The species is uncommon and populations have declined since the 1980s (Higgins and Peter, 2002; Tzaros, 2005).	This species may occasionally utilise the habitats in the study area, although records are limited. Considered unlikely to occur regularly or in significant numbers.
Superb Parrot	VU	L	EN	It occurs in riparian River Red Gum forests and adjacent areas of box eucalypt vegetation from the Murrumbidgee and Murray rivers northwards to the Namoi Valley (Higgins, 1999).	It is possible this species may occasionally occur in the study area due to the presence of suitable foraging habitat. However the lack of recent and regular records, there is potential for the species to occur.
Swift Parrot	EN	L	EN	This species prefers a narrow range of eucalypts in Victoria, including White Box, Red Ironbark and Yellow Gum as well as River Red Gum when this species supports abundant 'lerp'. It breeds in Tasmania and migrates to the mainland of Australia for the autumn, winter and early spring months (Higgins, 1999; Kennedy and Tzaros, 2005).	The study area contains suitable foraging habitat when River Red Gum is flowering. Although there is a lack of recent and regular records. There is potential to for the species to occur.

Species	EPBC	FFG	DELWP	Habitat	Likelihood of occurrence
Turquoise Parrot	-	L	NT	Occurs in eucalypt woodlands and open forests, with ground cover of grasses and sometimes low understorey of shrubs. It usually occurs in native grassy forests and woodlands composed of mixed assemblages of native pine and a variety of eucalypts. It can also occur in savannah woodlands and riparian woodlands. In Victoria is has been recorded in East Gippsland, the north and north-east districts (Higgins, 1999).	Suitable habitat present. Although this species may occur in the study area, it is unlikely to occur regularly as evidenced by the lack of recent records.
White-bellied Sea-Eagle	M	L	VU	Occurs in maritime habitats, terrestrial large wetlands and coastal lands of tropical and temperate Australia and offshore islands. Its range extends far inland only over large rivers and wetlands (Marchant and Higgins, 1993).	Suitable habitat present along Murray River, and the species may occasionally fly over. Although there is a lack of recent and regular records, there is potential for the species to occur.
Fork-tailed Swift	M	-	-	This species is aerial and occurs over inland plains, sometimes above foothills or in coastal areas, over cliffs and urban areas (Higgins 1999).	This species may occasionally fly over the study area. There is potential for the species to occur.
White-throated Needletail	M	-	-	This is an aerial species. It occurs over all habitats, but probably more over wooded areas, including open forest and rainforest. It is often found over heathland and less often above treeless areas such as grassland and swamps or farmland (Higgins 1999).	This species may fly over the study area during summer months. There is potential for the species to occur.
Mammals					
Squirrel Glider	-	L	EN	Dry forest and woodland and nearby riverine corridors (Menkhorst, 1995).	Recorded in the study area in NSW. Suitable habitat present. Targeted surveying identified residents adjacent to the preferred alignment in both Victoria and NSW (van der Ree et al., 2015).
Yellow-bellied Sheathtail Bat	-	L		Wide range of habitats, from wet and dry sclerophyll forests to open woodlands, acacia shrubland and Mallee. Migratory species found only between January and April (Churchill, 2008).	Recorded in the study area. Suitable habitat present. While Yellow-bellied Sheathtail Bat may infrequently occur in the region, although it is unlikely to be a permanent resident.
Reptiles					
Murray River Tortoise	-	-	DD	Rivers, creeks and lagoons associated with the Murray/Darling drainage system (Wilson and Swan, 2003).	Suitable habitat along the Murray River and wetland habitats. Considered likely to occur.

L: Listed, NT: Near Threatened, EN: Endangered, VU: Vulnerable, CE: Critically Endangered, DD: Data Deficient, M: Listed Migratory species

9.7 Impact assessment

The following section outlines the potential impacts the ultimate duplication of the Project may have on the biodiversity and habitat values of the study area and wider region.

The potential impacts of the Project would arise from the removal of remnant native vegetation and significant habitat including hollow bearing trees, impacts on nationally and State significant species, and the impact on wildlife corridors that facilitate significant fauna movements.

Other indirect impacts, such as shading, the spread of weeds or pathogens, noise, light and vibration and accidental fire may also result during both construction and operation of the Project.

9.7.1 Impacts to native vegetation and fauna habitat

The construction of the Project would result in the removal of native vegetation and fauna habitat, including removal of remnant native vegetation patches and scattered trees (refer to Figure 9-7). This impact relates to risks FF1, FF3, FF5 and FF7 in Table 9-7.

Approximately 13.655ha of remnant native vegetation would be removed in Victoria to facilitate the Project. The estimated amount of each EVC to be removed is presented in Table 9-6.

An important consideration when removing vegetation is the presence of hollow bearing trees, which are a vital habitat feature for many types of fauna.

In Victoria, hollow bearing trees are accounted for by mapping LOTs within patches of native vegetation as it is considered that many LOTs are likely to contain hollows. The 221 hollow bearing trees proposed to be removed would be a comparatively small proportion of the treed habitat on the Murray and Campaspe river floodplains near Echuca-Moama. Therefore the overall impact to hollowing bearing tree habitat is expected to be minor.

Scattered trees, which are trees that are identified as not belonging to remnant patches, were also counted in the study area. There were 21 recorded scattered trees in the Victorian section of the Project, and it was noted that a large proportion of these trees were also hollow bearing. The Project would result in the removal of seven of these scattered trees. This is considered to be a minor impact on scattered LOTs in the study area.

One of the reasons the preferred alignment was selected was due to its avoidance of native vegetation relative to alternative alignment options (refer Chapter 4). Any further refinement of the design would adopt the approach of avoiding, minimising and if necessary, offsetting removal of native vegetation.

Further refinements to the Project during the detailed design phase would also help to reduce the likelihood of removing LOTs.

9.7.2 Impacts on significant flora

Two flora species listed in Victoria on the DELWP Advisory List were recorded during the field assessment. This included the Blue Burr-daisy and the Pale Flax-lily. Neither species is listed as threatened under the FFG Act.

Two Blue Burr-daisy plants and an unknown number of Pale Flax-lily plants are proposed to be removed from within the project footprint. A salvage and translocation plan for significant flora species would be implemented for the Project.

With the implementation of this Project-specific environmental protection measure, the impact on DELWP Advisory List flora species is expected to be insignificant.

9.7.3 Impacts on significant fauna

Species of national significance

The Rainbow Bee-eater was the only EPBC Act listed species observed in the study area during the surveys. It is listed as a migratory species but not as a threatened species under the EPBC Act. This species is common and widespread throughout Australia. The potential removal of a small proportion of its habitat would not have a significant impact on the species.

The South-eastern Long-eared Bat was initially considered to be present within the study area based on the analysis of calls recorded during targeted bat surveys and initial findings that there was suitable habitat. However, a subsequent peer review of these findings found that the habitat was not suitable and the recorded calls could not be attributed to the South-eastern Long-eared Bat. Therefore the Project would not impact upon this species. VicRoads is preparing Preliminary Documentation as required under the EPBC Act (refer section 9.2) based on these revised findings that the South-eastern Long-eared Bat is not present within the study area.

The White-bellied Sea-Eagle and Eastern Great Egret are both migratory species, and are only expected to pass through the study area and potentially use it as a foraging area. These species are not likely to use the area for roosting or breeding. As such, the impacts are expected to be minor and not significant.

Superb and Swift parrots are predicted to utilise the study area occasionally whilst moving between other habitats. The Superb Parrot may also use the area rarely for roosting although it is not a known breeding site and there have been no recent records of the Superb Parrot in the region. As the Superb and Swift parrots presence is likely to be infrequent and short term, the Project's impacts are expected to be minor and not significant.

The Fork-tailed Swift and White-throated Needletail are both migratory species and highly nomadic when in Australia. They move in flocks ahead of weather

fronts, often over heavily forested areas. Due to the presence of suitable habitat, these species have the potential to occur in the study area. These species are unlikely to be significantly impacted by the Project.

Species of State significance

The potential impact to FFG Act listed species identified in the site assessments, and which are not also EPBC listed, are discussed below.

Masked Owl

A single individual was recorded in the NSW component of the study area and it is considered to also occur in the Victorian component as appropriate habitat is present. The species occurs in open woodlands and forests that provide dense tree cover, although they also utilise adjacent open habitats. The Masked Owl is dependent on hollow bearing trees for roosting and breeding.

There are few records of this species in the Echuca-Moama region. The species has a wide home range of 400 to 1,100ha and it is possible the individual recorded in NSW was a visitor to the study area. The potential breeding and foraging habitat proposed to be removed as part of the Project represents a small proportion of the likely home range of this species.

The species has been recorded in forest habitats within urban areas (DEC, 2006) indicating a degree of adaptability to human settlement, including roads and vehicles.

VicRoads standard environmental protection measures for the removal of hollow bearing trees as well as species salvage and translocation management measures would be implemented to reduce the potential impact to this species.

Given the species can move between habitats and utilise a variety of habitats; the impact is expected to be minor.

Squirrel Glider

Squirrel Gliders have been recorded in both the Victorian and NSW components of the study area (van der Ree et al., 2015).

This nocturnal species occurs in woodlands and linear stands of remnants of hollow bearing trees that provide a source of food by flowering in the winter (eucalypts or wattles) and also have a good sap flow. Suitable habitat in the area occurs mostly along the riverbanks where there are hollow trees and a sub-canopy of wattles. The eucalypt species that dominate the area (River Red Gum and Black Box) do not flower reliably in winter and therefore only the wattles provide a reliable winter carbohydrate source on which the species depends.

The Project would remove an estimated 221 potentially hollow bearing trees from the study area, potentially impacting on breeding habitat for the Squirrel Glider. The extent of hollow bearing trees removed would be confined to a comparatively small proportion of the treed habitat on the Murray and Campaspe river floodplains near Echuca-Moama, and a large number would still remain. As such, the overall availability of hollow bearing trees for the Squirrel Glider in the study area is unlikely to be significantly affected. Avoiding the removal of hollow bearing trees where possible as well as species salvage and translocation management measures would reduce the potential for impact to these species.

Wattles would only be removed where the bridge crosses the river and large riverbank populations of wattles would remain in the area to provide a winter food source. The Project therefore is unlikely to result in a significant reduction in the availability of a winter carbohydrate source for the Squirrel Glider and the species is likely to persist in the area after the Project is completed.

The potential impact to habitat connectivity for the Squirrel Glider as a result of the Project has also been considered. Connectivity within the existing habitat is already impaired by the township and existing roads. A further barrier, in the form of an elevated road, is unlikely to have a significant impact, particularly if Project-specific environmental management measures are taken into account, including installation of artificial land/launch poles and aerial rope bridges to facilitate squirrel gliders crossing of the road.

The impact on the Squirrel Glider is expected to be minor given the availability of suitable habitat, a winter food source in the region, the adoption of VicRoads standard environmental protection measures and the Project-specific management measures to address habitat connectivity loss.

A preliminary crossing strategy has been developed in consultation with Roads and Maritime Services New South Wales (Brett Lane & Associates, 2015b). The location of crossing zones in Victoria would be determined in accordance with the Project-wide strategy, improving connectivity across the Murray River and Squirrel Glider habitat.

Yellow-bellied Sheathtail Bat

This species was recorded in the study area, although it is considered unlikely to be a permanent resident. This is due to the species' highly dispersive nature. It is also unlikely the species uses the study area for breeding as few captured specimens in southern Australia have been in breeding condition. If permanently present in the region, the Yellow-bellied Sheathtail Bat would utilise hollow bearing trees.

VicRoads standard environmental protection measures for the removal of hollow bearing trees and Project-specific species salvage and translocation management measures would be implemented to reduce the potential for impact to these species.

The impact is expected to be minor given the availability of suitable habitat in the region, infrequent occurrence of the species, and the adoption of VicRoads standard environmental protection measures.

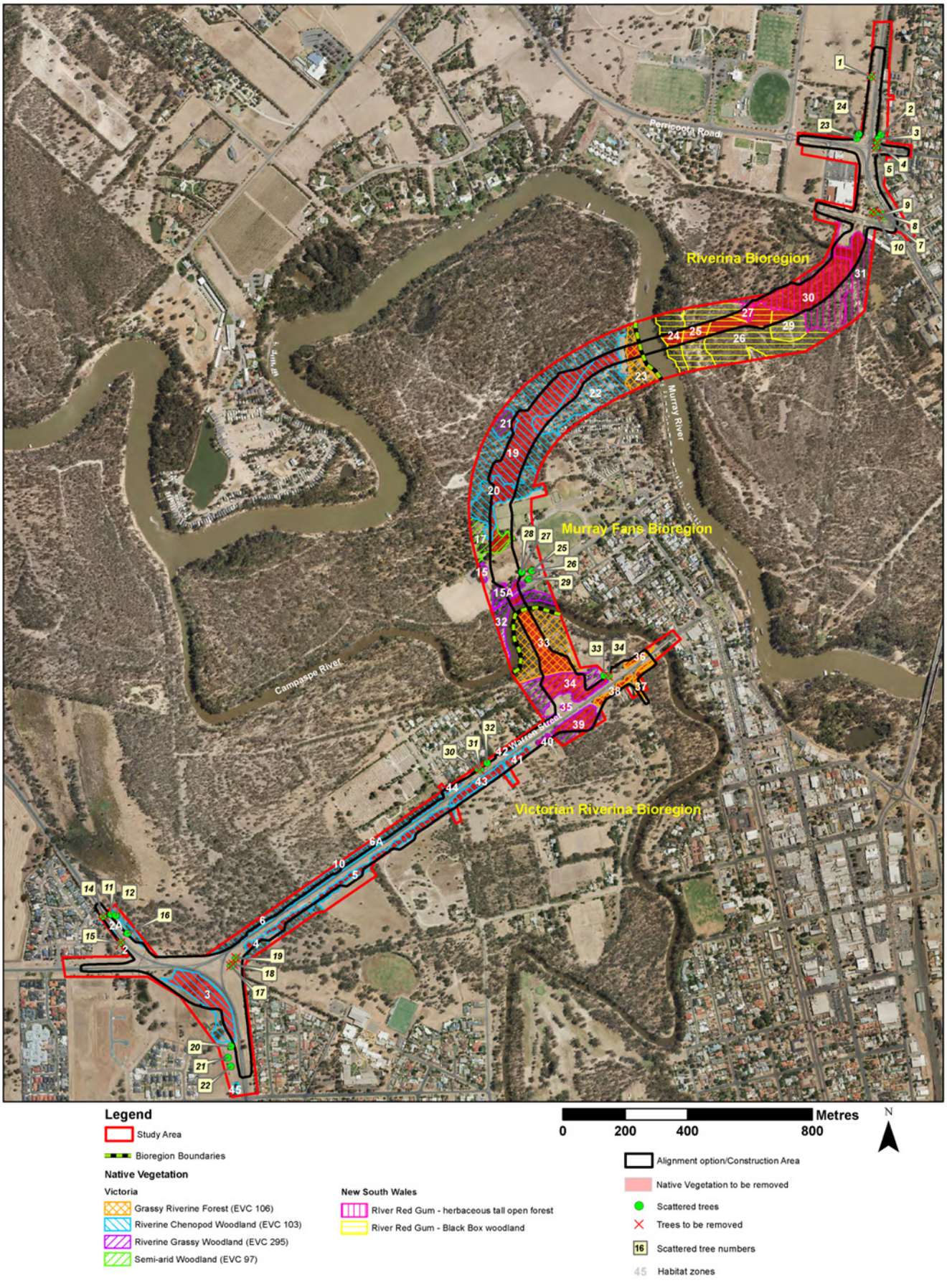


Figure 9-7 Native vegetation proposed to be removed from the study area

9.7.4 Wildlife corridors

The impact of the Project on wildlife corridors within the region has been considered.

The predominant habitat areas within the region surrounding the study area include: Barmah National Park, Gunbower State Forest-Perricoota State Forest block; and Murray River vegetation corridor (including Victoria Park Reserve, Banyule Park State Forest and Moama State Forest).

Agricultural land use and urban development has changed the landscape surrounding these habitat areas extensively. This has impacted on the links along the Murray River vegetation corridor between the Barmah National Park and the Gunbower State forest areas, an important wildlife corridor.

Victoria Park Reserve, Banyule Park State Forest and Moama State Forest also form a wide block of habitat along the Murray River vegetation corridor. However, these areas are fragmented, separated by cleared/developed land.

The floodplain of the Murray and Campaspe rivers near Echuca supports extensive areas of River Red Gum grassy woodland. Past removal of vegetation for agricultural and urban development has fragmented treed habitat along the rivers into patches separated by the rivers themselves or by the occasional road crossing.

The Project would not contribute significantly at a regional scale to fragmentation as habitat is already fragmented by land use and removal of vegetation. However, the Project would lead to fragmentation at a local scale.

Many of the remaining fauna species in the existing habitat are likely to already be adapted to a degree of habitat fragmentation due to past changes. For many species, the river does not represent a significant barrier to movement. For less mobile species the current state of the riparian corridor is effectively fragmented, with either cleared land or the river itself representing a barrier to movement.

The study area is located in a section of the corridor along the Murray River, which is already very narrow. While the Project would further reduce the extent of vegetation in this part of the vegetation corridor, it is unlikely to reduce gene flow along the corridor below current levels.

With the implementation of VicRoads standard environmental protection measures, and the additional Project-specific management measure of creating a management plan to mitigate the risks to Victoria Park and its habitat, the impact on wildlife corridors is expected to be minor.

9.7.5 Indirect impacts

Shading

Shading may cause loss (or change) of flora and vegetation beneath and adjacent to the preferred alignment due to lack of direct sunlight. In these areas under the bridges, works would be undertaken to stabilise the banks to protect water quality. This could include planting of shade tolerant species if required.

The areas affected are small and the effects are localised. With VicRoads standard environmental protection measures and the implementation of a management plan for Victoria Park, the impacts are expected to be insignificant.

Weeds and pathogens

Weeds and pathogens can be transported to and around the study area due to plant and machinery present on the Project site during construction. The weeds listed in section 9.6.1, and other unknown weeds and pathogens, have the potential to spread due to the Project. VicRoads standard environmental protection measures, which include a weed management plan, are expected to reduce the spread of any weeds or pathogens. The impact on the terrestrial ecosystem is expected to be minor.

9.7.6 Fire

During construction of the Project, there is potential for plant and machinery to cause a fire. This would likely impact the native vegetation, not just within the study area, but also within a larger area. This could cause a large loss of habitat for many species and potentially their death or injury, including to the listed flora and fauna described in this chapter. With the implementation of VicRoads standard environmental protection measures and Project-specific management measures such as stopping work on total fire ban days, the residual risk is expected to be negligible.

9.7.7 Light, noise and vibration

There is a possibility that additional light, noise and vibration during construction and operation (e.g. pile driving noise, new street lights etc.) could impact on native fauna species causing stress and potentially the displacement of fauna species from local habitat areas. However, it is expected that any impacts from light, noise or vibration would be minor due to the limited areas affected, the temporary nature of the disturbance and VicRoads standard environmental protection measures. Installation of minimal lighting, adequate for public safety, is to be used in operation of the road.

9.7.8 Road kill

The Project could result in an increase in fauna species killed by vehicles. Given much of the preferred alignment is elevated within Victoria Park, the risk of impact to ground dwelling species is reduced.

It is expected that with the additional Project-specific management measure of erecting signage to alert drivers to the risk of wildlife on the road and fencing where appropriate, the impacts to fauna from road kill would be minor.

9.8 Native vegetation offset

The incorporated document: *Permitted clearing of native vegetation – Biodiversity assessment guidelines* 'the Guidelines' (DEPI, 2013c) is the guiding document for vegetation removal for all planning schemes.

The Guideline's objective for permitted clearing of native vegetation in Victoria is 'No net loss in the contribution made by native vegetation to Victoria's biodiversity'.

The impacts on biodiversity from native vegetation removal are managed using a risk-based approach presented in the sections below. There are several different pathways that can be used to assess impacts and offsets. The risk-based assessment process determines the pathway used to calculate the Project-specific impacts to vegetation, and the amount, location and quality of offsets required.

Depending on what risk pathway is required for the Project, different amounts of information are required to assess the removed vegetation.

9.8.1 Risk-based assessment pathways

The first step in determining the type of assessment required for any site in Victoria is to determine the risk to biodiversity associated with the proposed native vegetation removal and therefore the risk-based assessment pathway. l. There are three risk-based pathways for assessing an application to remove native vegetation, below.

- Low risk
- Moderate risk
- High risk.

Two factors – extent risk and location risk – are used to determine the risk associated with the removal of native vegetation.

Extent risk is determined by the extent of native vegetation that is proposed to be removed. The 'extent' is broken down into the sizes of the remnant patches and the amount of scattered trees that are proposed to be removed.

Location risk is determined by assessing the likelihood that removing native vegetation in a location will have an impact on the persistence of a rare or threatened species.

Table 9-6 presents the amount of each EVC proposed to be removed for the Project and the corresponding habitat hectares (site condition score).

Table 9-6 Summary of vegetation losses for Victoria

EVC	Description and Bioregion Status	Amount removed (ha)	Habitat Hectares removed (HabHa)
EVC 97	Semi-arid Woodland Vulnerable	0.349	0.209
EVC 103	Riverine Chenopod Woodland Vulnerable	7.343	1.755
EVC 103	Riverine Chenopod Woodland Endangered	1.603	2.895
EVC 106	Grassy Riverine Forest Depleted	2.074	0.738
EVC 295	Riverine Grassy Woodland Vulnerable	2.289	1.105
	Total for Victoria	**13.655**[1]	**6.7**

1. Total is based on calculations by DELWP and may be different to the total of the amounts shown for each EVC due to rounding.

The area assessed for the Project would result in the removal of a total extent of 14.147ha (6.798HabHa) of native vegetation. The total extent of native vegetation removed comprises 13.655ha of remnant patch native vegetation (within Victoria) and 0.071ha for each of the seven scattered trees.

Based on Guideline criteria, the Project is located in a 'Location Risk A' area, which combined with the amount of vegetation and scattered trees proposed to be removed, means the Project would be assessed under the 'moderate' risk assessment pathway.

As the Project is required to be assessed via a 'moderate' risk assessment pathway, the following information would need to be determined:

- The strategic biodiversity score
- The habitat importance score(s)
- The habitat hectares assessment report, including the condition score, for the vegetation.

9.8.2 Strategic biodiversity score

The strategic biodiversity score generated by NVIM acts as a measure of the site's importance for Victoria's biodiversity relative to other locations across the landscape. It is calculated based on a weighted average of scores across an area of native vegetation proposed for removal on a site.

The strategic biodiversity score of each area of native vegetation loss has been provided by DELWP. Refer to EES Technical Appendix C – Biodiversity and Habitat Impact Assessment.

9.8.3 Habitat importance

Habitat importance mapping produced by DELWP is based on one or a combination of habitat importance models, habitat distribution models or site record data. It identifies the following:

- Habitat importance for dispersed species – based on habitat distribution models and assigned a habitat importance score ranging from 0 to 1
- Highly localised habitats – considered to be equally important for a particular species and assigned a habitat importance score of 1.

Habitat importance mapping is used to determine the type of offset required under the 'moderate' and 'high risk' assessment pathways.

It was determined by DELWP that the Project would not result in the removal of important habitat for Victorian rare and threatened species.

9.8.4 Biodiversity equivalence

Biodiversity equivalence scores are used to quantify losses in the contribution to Victoria's biodiversity of removing native vegetation and gains in this contribution from a native vegetation offset.

There are two types of biodiversity equivalence scores depending on whether or not the site makes a contribution to the habitat of a Victorian rare or threatened species. 'General' scores apply if native vegetation contributes to Victoria's overall biodiversity; 'Specific' scores apply if the native vegetation contributes to the habitat of a rare or threatened species.

While the Project would be assessed under the 'moderate' risk pathway, losses in only 'general' Biodiversity Equivalence Units (BEUs) apply. This general BEU is calculated by multiplying the habitat hectares of the area (Table 9-6) with the strategic biodiversity score.

The Project would result in the loss of:

- 3.025 general BEUs.

9.8.5 Offset requirements

A native vegetation offset is required for the approved removal of native vegetation. As a 'general' BEU was applied to the Project, DELWP determined the offsets required to compensate for the proposed removal of native vegetation from the study area. This amount was calculated by multiplying the general BEU score by 1.5:

- 4.537 BEUs.

Under the Guidelines all offsets must be secured prior to the removal of native vegetation.

General offsets must be located within the North Central Catchment Management Authority area and/or Shire of Campaspe. They must have a minimum strategic biodiversity score of 0.354.

It is expected that locating suitable offsets would be achievable given the extent of similar native vegetation in the region. Suitable offsets to meet these requirements are available in the VicRoads offset bank and other sources.

9.9 Risk assessment

An environmental risk assessment was undertaken for the preferred alignment to identify key environmental issues associated with the construction and operation of the Project. The methodology for this risk assessment is described in Chapter 5 and details of the assessment are provided EES Technical Appendix C – Biodiversity and Habitat Impact Assessment.

Table 9-7 is a summary of the following for biodiversity and habitat:

- The identified impact pathways
- A description of the impact consequences
- Initial risk rating.

Residual risk ratings considering the application of mitigation measures are presented in Table 9-8.

Risk FF6 as identified in the Biodiversity and Habitat Impact Assessment report in EES Technical Appendix C is not included here as it relates specifically to NSW threatened species classifications. This risk is separately addressed in the Review of Environmental Factors prepared by Roads and Maritime Services for the NSW component of the Project.

Table 9-7 Biodiversity and habitat risks

Risk No.	Impact pathway	Description of consequence	Initial risk rating
FF1	Construction encounters confirmed habitat for EPBC listed fauna species (Rainbow Bee-eater)	Removal of fauna habitat	Low
FF2	Construction encounters confirmed habitat for EPBC listed fauna species (Rainbow Bee-eater)	Possible injury or death to listed fauna species during construction	Low
FF3	Construction encounters confirmed habitat for FFG listed fauna species (Masked Owl, Squirrel Glider and Yellow-bellied Sheath-tailed Bat) or impact outside of nominated construction footprint	Removal of fauna habitat	Medium
FF4	Construction encounters confirmed habitat for FFG listed fauna species (Masked Owl, Squirrel Glider and Yellow-bellied Sheath-tailed Bat) or impact outside of nominated construction footprint	Possible injury or death to listed fauna species during construction	Medium
FF5	Construction encounters Scattered LOTs	Removal of scattered trees along the preferred alignment	High
FF7	Construction encounters habitat for DELWP Advisory listed flora and fauna species	Removal of flora and fauna habitat	Medium
FF8	Construction results in weeds and/or pathogens being spread	Invasion of native vegetation and/or fauna habitat and increased spread of weeds	Low
FF9	Loss of habitat due to machinery sparking fire during construction	Impact to native vegetation within a wider area and possible loss of habitat	Low
FF10	Light, noise, vibration disturbance to native fauna during construction and operation	Potential for stress on native fauna	Low
FF11	Construction removes remnant native vegetation and habitat	Fragmentation of habitat either side of the Project alignment effectively reducing area of connected habitat resulting in reduction in resilience of retained vegetation/habitat/populations to ongoing impacts due to reduction in area/size	High
FF12	Shading	Loss/adverse change of flora and vegetation from adjacent to bridge (particularly to the south) due to a lack of sufficient sunlight	Low
FF13	Operational collision with wildlife, particularly at dawn, dusk and night	Possible injury or death to listed fauna species	Medium
FF14	Construction encounters habitat for DELWP Advisory listed flora and fauna species	Possible injury or death to listed fauna species during construction	

9.10 Environmental management measures

VicRoads has a standard set of environmental protection measures which are typically incorporated into the contracts of road and bridge construction works. These measures have been used as the starting point for the assessment of construction-related risks. They are listed in Chapter 20 and described in detail in EES Technical Appendix O – Section 177 Environmental Management. In some instances, additional Project-specific environmental management measures have been recommended by specialists to reduce risks relating to construction and operation.

Project-specific management measures relevant to each identified impact pathway for biodiversity and habitat are outlined in Table 9-8. This table also shows the residual risk rating after the implementation of VicRoads standard environmental protection measures and Project-specific management measures.

Table 9-8 Biodiversity and habitat Project-specific environmental management measures and residual risks

Risk No.	Project-specific environmental management measures	Residual risk rating
FF1	Refine the alignment through detailed design and/or construction planning to minimise removal of known fauna habitat.	Medium
FF2	Risk would be managed by implementing VicRoads standard environmental protection measures as outlined in Chapter 20 and described in detail in EES Technical Appendix O – Section 177 Environmental Management. No Project-specific environmental management measures were identified.	Low
FF3	As per risk FF1.	Medium
FF4	Include a requirement in the EMP to undertake salvage and translocation of tree dwelling fauna species.	Low
FF5	As per risk FF1, to minimise removal of scattered trees.	Medium
FF7	As per risk FF1. Include a requirement in the EMP to undertake salvage and translocation of Dianella and other similar flora species.	Low
FF8	Risk would be managed by implementing VicRoads standard environmental protection measures as outlined in Chapter 20 and described in detail in EES Technical Appendix O – Section 177 Environmental Management. No Project-specific environmental management measures were identified.	Low
FF9	Construction not to occur on total fire ban days and diesel vehicles to be used. Keep vehicles to well-designed haul roads and limit vehicle speeds.	Negligible
FF10	As per risk FF4. Erect signage to alert drivers of risks of traffic to wildlife and fencing, where appropriate, to exclude animals.	Low
FF11	Engage a suitably qualified and skilled ecologist to prepare a management plan, or update any existing management plan, for the Victoria Park Reserve, ensuring that any predicted future threats arising from edge effects, reduced area, etc. are managed. The management plan should be prepared in consultation with, and made freely available to, the relevant managing authority. In order to minimise Squirrel Glider road mortality and facilitate ease of movement across the preferred alignment, it is recommended that an appropriate number of crossing zones. Crossings should be approximately 100m long and incorporate the following features: • Suitable Squirrel Glider vegetation to be retained as close to the road as practical • Artificial land/launch poles to be strategically placed to facilitate glider road crossing • Aerial rope bridges to be constructed over the road to facilitate glider road crossing. Crossing zones should be designed in consultation with the Centre for Urban Ecology and Campaspe Shire Council (the relevant managing authority). A preliminary crossing strategy has been developed in consultation with Roads and Maritime Services New South Wales (Brett Lane & Associates, 2015b). The location of crossing zones in Victoria should be determined in accordance with the Project-wide strategy.	Medium

Risk No.	Project-specific environmental management measures	Residual risk rating
FF12	Engage a suitably qualified and skilled ecologist to prepare a management plan, or update any existing management plan, for the Victoria Park Reserve. The management plan should be prepared in consultation with, and made freely available to, the relevant managing authority.	Negligible
FF13	Erect signage to alert drivers of risks of traffic to wildlife and fencing, where appropriate, to exclude animals.	Low
FF14	As per risk FF4.	Low

9.11 Conclusion

The key potential impacts of the Project on biodiversity and habitat would arise from:

- The removal of remnant native vegetation and hollow bearing trees
- The impact to significant fauna species
- The impact to wildlife corridors that facilitate fauna movements.

There are other potential impacts of the Project on biodiversity and habitat, although these are all readily managed through VicRoads standard environmental protection measures.

Native vegetation and hollow bearing trees

Native vegetation as remnant patches and scattered trees is proposed to be removed for construction of the Project. The Project would remove 13.655ha of remnant native vegetation.

The removal of native vegetation would be offset, as required under the Biodiversity Assessment Guidelines. It is expected that locating suitable offsets would be achievable given the extent of similar native vegetation in the region.

When removing native vegetation, an important habitat feature for fauna that should be considered is the presence of hollow bearing trees.

It is considered that many LOTs in the study area are likely to contain hollows. 221 LOTs recorded within remnant patches in the Victorian component of the study area are proposed to be removed. In addition, there were 21 recorded scattered trees (i.e. trees not belonging to remnant patches) in the Victorian component of the study area, and it was noted that a large proportion of these trees were also hollow bearing. The Project would result in the removal of seven of these scattered trees. This is considered to be a minor impact on scattered LOTs in the study area.

The extent of hollow bearing trees proposed to be removed for the Project would be a comparatively small proportion of the treed habitat on the Murray and Campaspe river floodplains near Echuca-Moama.

VicRoads standard environmental protection measures for the removal of hollow bearing trees and Project-specific species salvage and translocation management measures would be implemented to reduce the potential for impact to species that are dependent on hollow bearing trees.

Significant species

There are no nationally significant flora species or communities affected by the Project. Two Blue Burr-daisy plants and an unknown number of Pale Flax-lily plants are proposed to be removed from within the proposed Right-of-Way. These flora species are listed on the DELWP Advisory List and the impact to these species is expected to be insignificant.

There are eight EPBC Act listed fauna species considered likely to occur in the study area, and one of these was identified in site assessments: the Rainbow Bee-eater. There are 14 FFG Act fauna listed species considered likely to occur, and three were recorded during the surveys. The recorded species include the Masked Owl, Squirrel Glider and Yellow-bellied Sheathtail Bat.

The Rainbow Bee-eater was the only EPBC Act listed species observed in the study area during the surveys. It is listed as a migratory species but not as a threatened species under the EPBC Act. The Rainbow Bee-eater is common and widespread throughout Australia, and therefore the potential removal of a small proportion of its habitat is expected to have an insignificant impact following the implementation of management measures.

The South-eastern Long-eared Bat was initially considered to be present within the study area by Dr. Greg Richards (Greg Richards and Associates), based on the analysis of calls recorded during targeted bat surveys and initial findings that there was suitable habitat. However, a subsequent peer review of these findings found that the habitat was not suitable and the recorded calls could not be attributed to the South-eastern Long-eared Bat. As such, this species is not likely to occur within the study area (Gration, 2015). The Project would therefore not impact upon this species.

The Squirrel Glider was recorded in both the Victorian and NSW components of the study area, whilst the Masked Owl was only recorded in the NSW component. Both species are reliant on hollow bearing trees and can move between available habitats. The Yellow-bellied Sheathtail Bat was recorded in the Victorian component of the study area. However it is considered unlikely to be a permanent resident. With the implementation of VicRoads standard environmental protection measures and Project-specific management measures in place, the impact to FFG Act listed species is expected to be minor.

Wildlife corridors

The landscape of the study area and surrounds has been dramatically changed over many years by agriculture and settlements. This has impacted on the environment and links along the Murray River vegetation corridor between the Barmah and the Gunbower forest areas, which is now an important wildlife corridor.

The Project would not contribute significantly at a regional scale to fragmentation of this wildlife corridor as habitat is already fragmented by historical land uses. However, the Project would lead to fragmentation at a local scale affecting Victoria Park Reserve. Despite this, many of the remaining fauna species in the existing habitat are likely already adapted to a degree of habitat fragmentation due to past changes.

With the implementation of VicRoads standard environmental protection measures, and the additional measure of creating a management plan to mitigate the impact on Victoria Park and its habitat, the overall impact to wildlife corridors is expected to be minor.

Overall

The key impacts arising from the Project are to threatened fauna species through removal of habitat, and particularly hollow bearing trees. There is minimal impact to threatened flora species and the extent of native vegetation removed is expected to be readily offset.

Overall the impacts to fauna are considered to be confined to an area within and immediately adjacent to the study area, which represents a comparatively small proportion of the available habitat for native fauna on the floodplains of the Murray and Campaspe rivers in and near Echuca. Therefore, significant consequences to fauna populations of more than a local scale are not anticipated. Additionally, these effects can be mitigated through the adoption of VicRoads standard environmental protection measures and additional Project-specific management measures.

10 Aquatic flora and fauna

The Aquatic Flora and Fauna Impact Assessment (GHD, 2015a) examined the existing aquatic ecology of the study area and the potential impacts that the Project could have on aquatic flora and fauna.

The EES focuses on the assessment of potential impacts of the Project within Victoria. However, as the Murray River falls under NSW jurisdiction, both the Victorian and NSW areas of the Project were assessed for any impacts to aquatic ecology.

No National or State threatened species were sighted during the field surveys of the study area, although desktop assessments listed 16 threatened flora and fauna species that could occur in the study area. These were identified from the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* (Cwlth.), *Flora and Fauna Guarantee (FFG) Act 1988* (Vic.), and the DELWP Advisory List. Using a 'likelihood of occurrence' assessment, those 16 species were limited to eight species judged as 'likely' or 'possible' to occur in the study area. The four likely species included:

- Murray Cod (EPBC vulnerable, FFG listed, on DELWP advisory list)
- Silver Perch (EPBC critically endangered, FFG listed, on DELWP advisory list)
- Golden Perch (on DELWP advisory list)
- Murray Spiny Crayfish (FFG listed, on DELWP advisory list).

The four possible species included:

- Trout Cod (EPBC endangered, FFG listed, on DELWP advisory list)
- Freshwater (Eel-tailed) Catfish (FFG listed, on DELWP advisory list)
- Flat-headed Galaxias (on DELWP advisory list)
- Murray River Turtle (on DELWP advisory list).

The assessment found that construction of the Project had associated risks that could cause insignificant to minor adverse impacts on aquatic flora and fauna, including:

- Potential to encounter EPBC and Victorian threatened species and their habitat
- Contamination of water that could enter downstream wetlands
- Increased erosion
- Increased noise and vibration
- Destruction of riparian vegetation
- Infestation of aquatic weeds and introduction of pathogens
- Impeding the passage of aquatic fauna
- Impacts on floodplain habitat and ecological function.

Many of these minor impacts of the Project are considered unlikely to occur and therefore have a low residual risk rating. It is considered that they would be adequately managed using VicRoads and Roads and Maritime Services standard environmental protection measures.

During operation of the Project, there is a risk that if a chemical spill occurred during a heavy local rainfall event, this could potentially cause a major adverse impact to downstream water quality. This risk is not unique to the Project and also applies to the existing river crossing.

With the implementation of VicRoads and Roads and Maritime Services standard environmental protection measures, it is considered that the likelihood of a major consequence resulting from this risk is rare, and as such the residual risk rating is medium.

10.1 EES objectives

The EES objectives relevant to the Aquatic Flora and Fauna Impact Assessment are the biodiversity and catchment values objectives:

- *"To avoid or minimise adverse effects on native vegetation and listed flora and fauna species and ecological communities, and address opportunities for offsetting potential losses consistent with relevant policy."*
- *"To maintain floodplain functions…of proximate sections of the lower Campaspe and Murray Rivers."*

This chapter is based on the Aquatic Flora and Fauna Impact Assessment report completed by GHD (2015a) which is included as EES Technical Appendix D. It is a summary of that assessment and includes a discussion of the following key issues and requirements as they relate to aquatic flora and fauna, as specified in the EES Scoping Requirements Draft Evaluation Objectives for the Project.

Key issues

- Biodiversity and habitat
  - *Loss of, or degradation to, native vegetation and associated significant habitat for listed flora species.*
  - *Loss of, or degradation to, habitat for listed species of fauna.*
  - *Degradation to local and downstream aquatic habitat from increase in sedimentation.*

- Catchment values
  - *Potential for the project to have significant effects on the functions, values…of…proximate sections of the lower Campaspe and Murray Rivers.*

Priorities for characterising the existing environment

- Biodiversity and habitat
  - *Characterise the distribution and quality of biodiversity values that could be affected by the project, including native vegetation, aquatic habitat and patterns of wildlife movement.*
  - *Identify the existence or likely existence of any listed species or communities and any declared weeds or pathogens.*
  - *Identify any potentially threatening processes that could result from the project under the FFG Act.*
  - *This characterisation is to be informed by relevant databases, literature and appropriate targeted and/or seasonal surveys and modelling where appropriate. In the absence of positive identification of the presence of listed species and communities, but where suitable habitat is identified, a precautionary approach to the further investigation and assessment of its occurrence should be applied.*
- Catchment values
  - *Identify and characterise relevant surface water and floodplain environments…*

Design and mitigation measures

- Biodiversity and habitat
  - *Identify and describe the potential and proposed design and mitigation measures, which could avoid or minimise significant effects on native vegetation, and/or any listed flora, fauna and ecological communities and potentially threatening processes.*
- Catchment values
  - *Identify proposed measures to mitigate any potential effects, including any relevant features or preventative techniques to be employed during construction.*

Assessment of likely effects

- Biodiversity and habitat
  - *Identify and assess likely direct and indirect effects on native vegetation, ecological communities and the habitat of any listed species of flora and fauna along the alignments.*
- Catchment values
  - *Identify potential effects on the functions, values…of surface water and geomorphic stability of proximate sections of the lower Campaspe and Murray rivers.*

Approach to manage performance

- Biodiversity and habitat
  - *Identify proposed measures to further mitigate and manage residual effects of the project, including addressing the offset requirements of Victoria's native vegetation permitted clearing regulations and relevant provisions of planning schemes.*
  - *Identify in the EES any further methods proposed to manage risks of effects on other biodiversity values and native vegetation, including as part of the EMF (see section 4.10) and resulting residual effects.*
- Catchment values
  - *Identify any additional measures to manage and monitor effects on catchment values and identify likely residual effects.*

The key issues and requirements that relate to terrestrial biodiversity and habitat are addressed separately in Chapter 9.

The Aquatic Flora and Fauna Impact Assessment focussed on the preferred alignment. The term 'the Project' is used in this chapter to refer to the preferred alignment only.

10.2 Study area

The study area for the Aquatic Flora and Fauna Impact Assessment included the proposed Right-of-Way, as well as the intersecting waterways (Murray River and Campaspe River) and floodplain wetlands (e.g. unnamed wetlands in NSW).

The study area extended beyond the proposed Right-of-Way due to the potential for aquatic ecosystem impacts to extend downstream, such as water quality degradation from increased sedimentation. For this reason, the study area extended downstream of the Murray-Campaspe confluence to Torrumbarry weir (approx. 83km along the river) and approximately 5km upstream from the proposed Right-of-Way on both the Campaspe and Murray rivers. Torrumbarry weir provides the first significant hydrological barrier on the Murray River downstream of Echuca-Moama, and is therefore considered to be a meaningful downstream boundary to the study area.

A buffer of 5km out from the river edges was also allowed for in the study area. This larger extent provides confidence that all relevant species have been included in the assessment (refer to Figure 10-1).

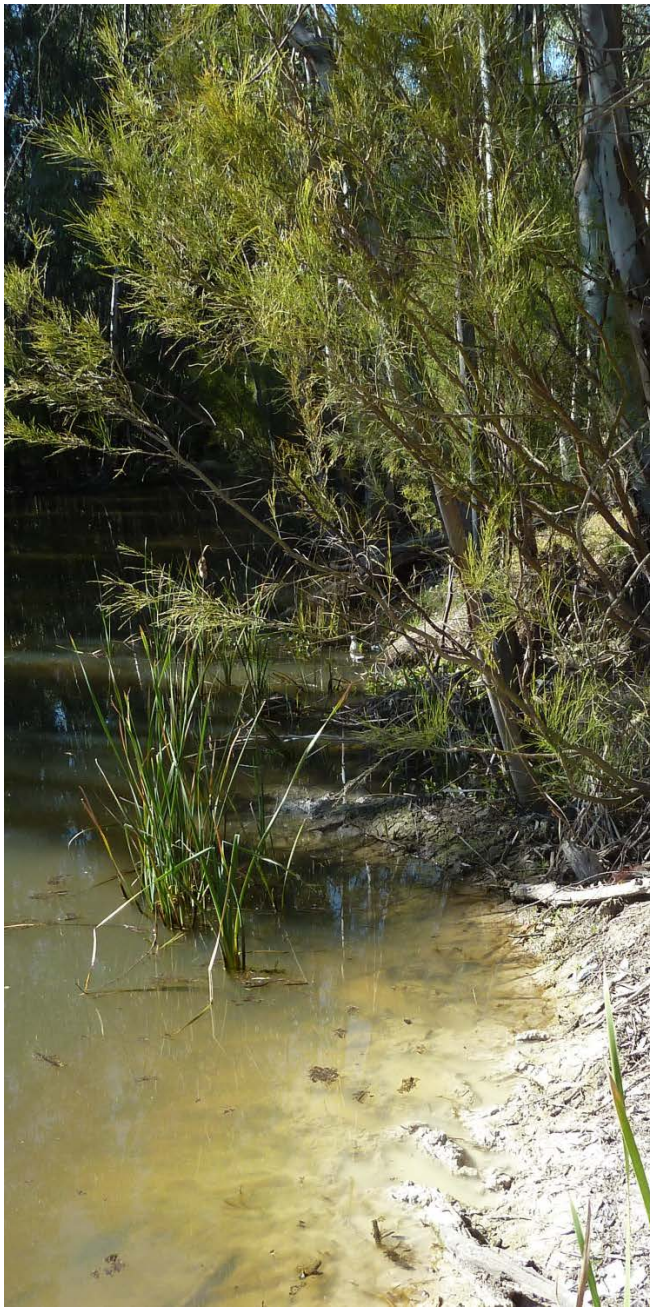
The study area lies within the Central Murray River, which is defined by the Murray-Darling Basin Authority as extending from Yarrawonga down to the confluence with the Darling River at Wentworth (Murray-Darling Basin Authority, 2015). The Lower Murray River continues from Wentworth further downstream to the Coorong and Lower Lakes near the Murray mouth. Potential impacts beyond the study area are considered to occur at a regional scale, affecting the Central and Lower Murray River areas.

This EES assesses the Victorian component of the Project. However, the Scoping Requirements relating to defining relevant floodplain environments and potential effects on the Murray River necessitate consideration of NSW environments. Consideration of the Murray River is required particularly because it is connected to the Campaspe River and the adjoining wetland systems in both Victoria and NSW. These systems are all integrated and aquatic flora and fauna move freely throughout these water bodies. Therefore, both the Victorian and relevant NSW areas of the Project (including the Murray River and adjacent wetlands to the south of Boundary Road in Moama) are discussed in this chapter.

10.3 Methodology

The Aquatic Flora and Fauna Impact Assessment for the Project included the following tasks:

- Review of relevant State and local legislation, policies and guidelines
- Review of existing literature and reports
- Review of the following databases to obtain a list of species recorded in the study area including areas upstream of the river crossings, and a 5km buffer from the study area to adequately capture any mobile fauna:
    - The Commonwealth Department of the Environment's Protected Matters Database
    - Victorian Biodiversity Atlas
    - Victorian Rare or Threatened Species Advisory lists (invertebrates and vertebrates)
- Two habitat field assessments (April 2012 and August 2014) of the river reaches within 150m of the preferred alignment. These documented the general landscape characteristics (land use and water levels), river specific parameters (channel width, bank stability, riparian condition etc.) and any other relevant observations:
    - The April 2012 field survey assessed the proposed Murray River crossing point and a point approximately 500m downstream of the proposed crossing point on the Campaspe River
    - The August 2014 field survey revisited the Murray River crossing point of 2012 and the proposed Campaspe River crossing point
- Two fish field surveys (April 2012 and August 2014). A detailed description of the survey methods used and the species surveyed is included in EES Technical Appendix D. A map showing the location of the surveys is provided in Figure 10-2
- The April 2012 survey included two sites in the Murray River and two sites in the Campaspe River. The August 2014 survey occurred at the unnamed Boundary Road wetland in NSW
- Identification of impact pathways, development of consequence criteria and assessment of initial and residual risks following implementation of VicRoads' standard environmental protection measures
- Assessment of the impacts of the Project against the 'No Project' scenario.



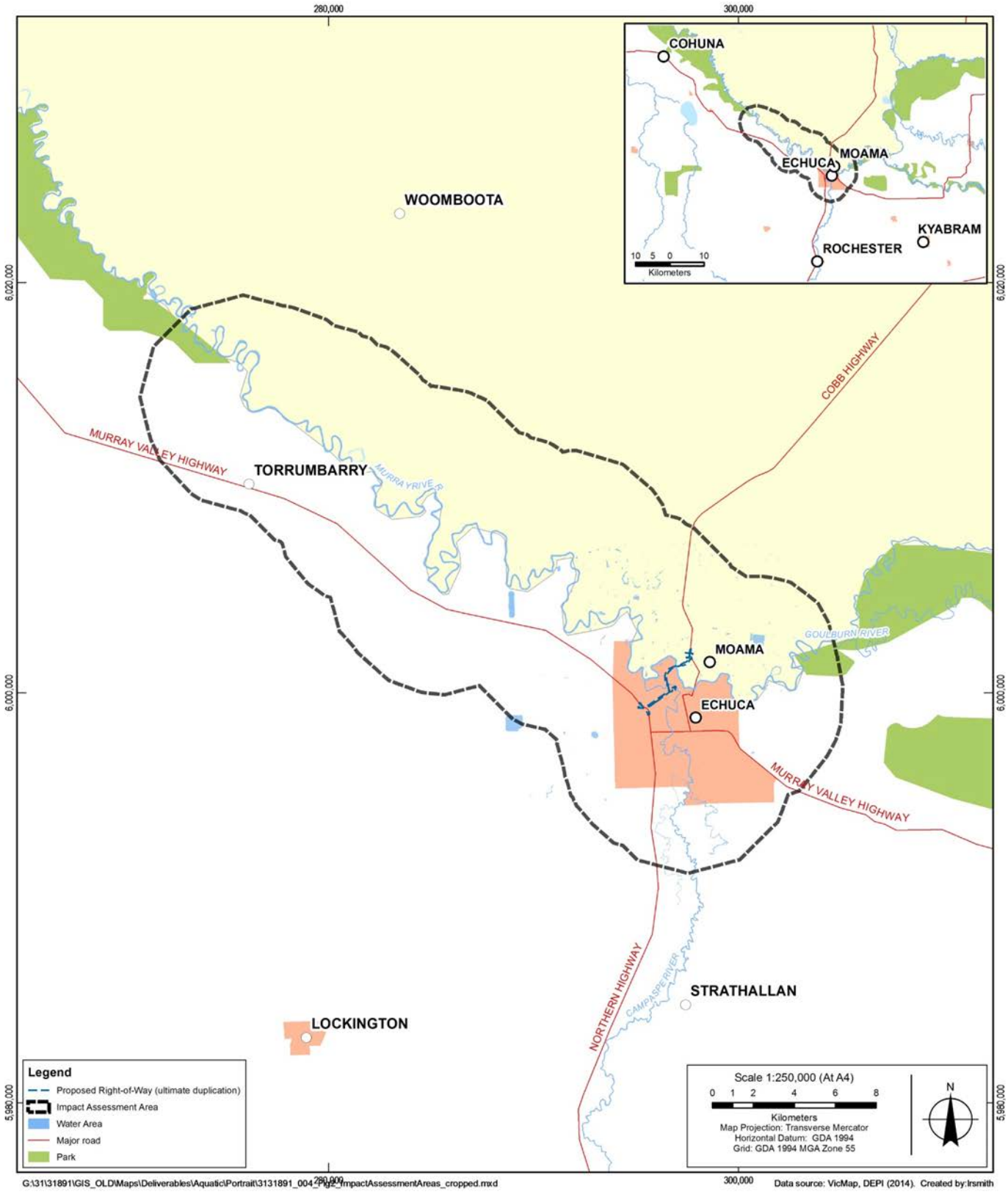


Figure 10-1 Study area

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Data source: VicRoads Imagery, and VicMap, DEPI (2014). Created by:lrsmith

Figure 10-2 Survey locations

10.4 Legislation and policy

The relevant legislation and policies for aquatic flora and fauna are outlined in Table 10-1.

Table 10-1 Relevant aquatic flora and fauna legislation and policies

Legislation / policy	Description
Commonwealth	
Environment Protection Biodiversity Conservation Act 1999 (Cwlth.)	The Environment Protection and Biodiversity Conservation Act (EPBC Act) aims to promote the conservation of biodiversity by providing protection for threatened species, threatened ecological communities, migratory and marine species and other protected matters. The Matters of National Environmental Significance (MNES) listed under the EPBC Act relevant to this assessment are: ➢ Wetlands of International Significance (Ramsar Sites) ➢ Threatened Species and Ecological Communities ➢ Migratory Species. EPBC Act species likely to occur in the study area are listed below: ➢ Silver Perch (Critically Endangered) ➢ Trout Cod (Endangered) ➢ Murray Cod (Vulnerable). No Wetlands of international importance (Ramsar sites) are located within the study area. Five Ramsar sites are located downstream of the study area. These are: ➢ Gunbower Forest ➢ NSW Central Murray state forests ➢ Banrock Station Wetland complex ➢ Riverland ➢ Coorong and Lakes Alexandrina and Albert. There are no aquatic EPBC listed Migratory Species. The Project was referred to the Commonwealth Department of the Environment for a decision on whether or not the Project was a 'controlled action' due to its impact on MNES. The referral decision listed the Project as a controlled action due to its potential impact on threatened terrestrial fauna species. Only this matter is being assessed under the EPBC Act.
State	
Planning and Environment Act 1987 (Vic.)	The Planning and Environment Act establishes a framework for planning the use, development and protection of land in Victoria in the present and long-term interest of all Victorians. The Planning and Environment Act sets out the legislative basis to ensure that standard planning provisions are prepared and approved throughout Victoria. The Planning and Environment Act sets out procedures for preparing and amending the Victoria Planning Provisions (VPP) and planning schemes, obtaining permits under planning schemes, settling disputes, enforcing compliance with planning schemes, and other administrative procedures. The Planning and Environment Act provides for a single instrument of planning control in a particular area, the planning scheme, which sets out the way land may be used or developed. The planning scheme is a legal document, prepared and approved under the Planning and Environment Act. The relevant planning scheme for the study area is the Campaspe Planning Scheme.
Flora and Fauna Guarantee Act 1988 (Vic.)	The Flora and Fauna Guarantee Act (FFG Act) provides for the protection of species, the management of threats, the promotion of community conservation initiatives and a regulatory structure for flora and fauna conservation in Victoria. The FFG Act covers both vertebrates and invertebrates in terrestrial and aquatic habitats. It lists flora or fauna species that are in a demonstrable state of decline which is likely to result in extinction or significantly prone to future threats which are likely to result in extinction. There is no differentiation between the conservation status of FFG Act listed species. The Project potentially triggers a number of key threatening process listed under the FFG Act including: ➢ Alteration of the natural flow regimes of rivers and streams ➢ Input of toxic substances into Victorian rivers and streams ➢ Degradation of native riparian vegetation along Victorian rivers and streams ➢ Increase in sediment input into Victorian rivers and streams due to human activities ➢ Removal of wood debris from Victorian streams.

Legislation / policy	Description
Environment Protection Act 1970 (Vic.) and State Environmental Protection Policy (Waters of Victoria) 2003	The Environment Protection Act allowed for the creation of the State Environment Protection Policy (Waters of Victoria) 2003 (SEPP WoV) (Victorian Government, 2003), which applies to all surface waters of Victoria. SEPP WoV aims to provide a coordinated approach to the protection and, where necessary, rehabilitation of the health of Victoria's water environments. The SEPP WoV identifies 'beneficial uses' of waterways and establishes environmental quality objectives at levels that will ensure the protection of these uses. SEPPs are legally enforceable statutory instruments. When undertaking works on, or adjacent to, surface water systems, management measures need to be implemented to minimise environmental risks to aquatic ecosystems and to protect other beneficial uses. Impacts on water quality must not exceed water quality objectives specified to protect beneficial uses, unless extensive modification or natural variation precludes this attainment. In such situations, the background level becomes the objective. The following clauses are applicable to the Project: ➨ Clause 43 – Surface water management and works ➨ Clause 53 – Aquatic and riparian vegetation protection and rehabilitation ➨ Clause 56 - Construction activities ➨ Clause 57 – Roads.
Catchment and Land Protection Act 1994 (Vic.)	The Catchment and Land Protection Act aims to establish a framework for the integrated and coordinated management of catchments that will: ➨ Maintain and enhance long-term land productivity while also conserving the environment ➨ Ensure the quality of the State's land and water resources and their associated plant and animal life are maintained and enhanced. The Catchment and Land Protection Act establishes catchment management authorities (CMAs) and provides for the development of regional catchment strategies that must assess the nature, causes, extent and severity of land degradation of in these regions and identify areas for priority attention. The Project is located in the North Central CMA (NCCMA) region and therefore falls under the NCCMA Regional Catchment Management Strategy 2013. The strategy lists objectives that are aimed at improving the condition of waterways within the region. In relation to the lower Campaspe River the objective is to: ➨ Improve the condition of the lower Campaspe River from 'moderate' to 'good' (based on Index of Stream Condition) by 2050. The Project should take the strategy into account. Specifically, it should avoid activities that would result in further deterioration of river health and could decrease the likelihood of achieving the NCCMA Regional Catchment Management Strategy objectives.
Water Act 1989 (Vic.)	The Water Act is intended to ensure that water resources are conserved and properly managed for sustainable use for the benefit of present and future Victorians. It is also intended to provide formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses as well as provide for the protection of catchment conditions. Part 10 of the Water Act outlines the waterway management responsibilities and requirements for regional drainage and floodplain management, as relevant to the authorities responsible for waterway management districts. Any works undertaken in and around waterways and their floodplains would need to be undertaken in accordance with the Water Act. The NCCMA, as caretakers for river health under the Water Act is responsible for issuing licences for works on waterways and therefore VicRoads would require a licence (Works on Waterways) from NCCMA prior to undertaking any Project works.
Fisheries Act 1995 (Vic.)	A key objective of the Fisheries Act is to protect and conserve fisheries resources, habitats and ecosystems including the maintenance of aquatic ecological processes and genetic diversity. One of the provisions of the Fisheries Act is that fish passageway must not be blocked. FFG-listed fish are also protected under the Fisheries Act and may not be taken without authorisation under both Acts. Recreational angling is a popular activity downstream of the preferred alignment, and in accordance with the Fisheries Act, bridge development should not impede this activity or the ecologically sustainable management and development of these fisheries in the future.
Wildlife Act 1975 (Vic.)	The Wildlife Act forms the procedural, administrative and operational basis for the protection and conservation of native wildlife within Victoria. The Wildlife Act is often the default reference for other associated legislation, and is the basis for the majority of wildlife permit/licensing requirements within Victoria. In accordance with the Wildlife Act, a permit is required to take (including salvage and translocation during the construction activities) or destroy wildlife.

Legislation / policy	Description
Local	
Campaspe Planning Scheme	A planning scheme sets out objectives, policies and provisions relating to the use, development, protection and conservation of land in the area to which it applies. The applicable planning scheme within the Victorian proportion of the study area is the Campaspe Planning Scheme. A set of standard provisions called the VPP forms a template for all planning schemes. Included in the VPP is the State Planning Policy Framework (SPPF), which covers strategic issues of State importance. Also included in planning schemes is the Local Planning Policy Framework (LPPF) which sets a local and regional strategic policy context for a municipality and consists of the Municipal Strategic Statement (MSS) and specific local planning policies. Clauses of the SPPF and LPPF that are relevant to aquatic flora and fauna include: ➢ Clause 11.11-4 Environmental assets ➢ Clause 12.01-1 Protection of biodiversity ➢ Clause 13.02-1 Floodplain management ➢ Clause 14.02-1 Catchment planning and management ➢ Clause 14.02-2 Water quality ➢ Clause 21.04-2 Environment. The Campaspe Planning Scheme also includes a number of zones and overlays of relevance to the Project, as follows: ➢ Clause 36.03 Public Conservation and Resources Zone ➢ Clause 42.01 Environmental Significance Overlay – Schedule 1 (Murray River Corridor) ➢ Clause 44.03 Floodway Overlay. See EES Technical Appendix D for further information on objectives and strategies of relevant clauses.

10.5 Existing conditions

10.5.1 Campaspe River

Aquatic habitat

Along the reach of the Campaspe River where the proposed crossing would take place, the river is meandering, with steep V-shaped banks and a bed of fine grained sediment. The proposed crossing occurs at a bend on the river that is 30-50m wide at that point.

Erosion of the riverbanks, on both side of the river, has exposed riparian tree roots and there is overhanging vegetation, mainly comprising eucalyptus trees. There is also a moderate amount of large woody habitat observed in-stream on both banks of the river, with approximately one submerged log every 10-20m.

There is generally good canopy vegetation connectivity, both along the banks of the river (longitudinally) and out from the riverbanks (laterally), although the ground cover vegetation is mostly exotic grasses, or non-existent.

Shading at peak time (midday) only covers around 10 per cent of the surface area of the river channel. The floodplain back from both riverbanks is well forested, and contains flood runners, back swamps and good lateral and longitudinal canopy cover. The understory, however, is less established and there are large patches of bare earth.

River health

Recent comprehensive river health assessments show that the Campaspe River around the area of the proposed crossing, has an overall rating of moderate ecosystem health (Davies et al., 2013; DEPI, 2013b). This is in part due to the lower reaches of the Campaspe River being modified from their 'natural' condition.

Campaspe River aquatic life has also been classified as being in moderate condition, using the Index of Stream Condition Aquatic Life sub-index, which is based on the number and type of aquatic macroinvertebrates found within the river (DEPI, 2013b).

10.5.2 Murray River

Aquatic habitat

The Murray River habitat investigated included a 600m stretch of river centred on the boat ramp, located on the Victorian side of the river, which is approximately where the bridge, proposed as part of the preferred alignment, would be built.

In this reach of the Murray River, the river is unconfined and meandering, with a bed of fine-grained sediments. At the proposed crossing, the river is approximately 70-80m wide with sloped banks on both sides. Sand deposition occurs on the Victorian side of the river, linked to erosion control measures described below.

Local erosion was observed, with both banks exposed throughout the riparian zone. Erosion control has been attempted in the form of rock beaching on the Victorian side of the river.

At the proposed crossing, there is no overhanging vegetation, or any large woody habitat on the banks.

Generally good longitudinal and lateral canopy vegetation connectivity is present on both sides of the proposed Murray River crossing. There is generally poor ground cover, which, when present on the Victorian side, mostly consists of exotic grasses. The Murray River has minimal shading.

Fauna habitat in this reach of the Murray River comprises low levels of in-stream wood or tree roots which provide shelter, breeding and ambush sites for many fish species. This lack of habitat, combined with the area being widely used for recreational activities such as fishing, power boating and paddle-steamers, is likely to result in this area being less preferred by many fish species.

River health

The presence of macro invertebrates (e.g. shrimp, mosquitos etc.) and fish can be used to rate the condition of the Murray River (based on the indicators of aquatic biota used by the NSW Department of Environment, Climate Change and Water). In this reach of the Murray River, the condition of macro invertebrate assemblages and fish assemblages are very poor and poor respectively (DECCW, 2010).

10.5.3 Victorian floodplain wetlands

The preferred alignment traverses the Campaspe River floodplain and some of the Murray River floodplain (refer to Figure 10-3).

Warren Street currently has three existing culverts that occasionally contain water following a rainfall event, and therefore potentially act as aquatic habitats or as a fish pass. Field investigations of these areas indicated a poor habitat quality, comprising mainly of grasses, rushes and sedges.

The floodplains are occasionally inundated by the Murray and Campaspe rivers and may also have ephemeral aquatic habitat. Previous surveys targeting the EPBC protected species Growling Grass Frog (*litoria raniformis*) identified a Campaspe River floodplain billabong located outside the preferred alignment. Although this billabong has not been surveyed for aquatic fauna, it is possible it could provide temporary aquatic habitat after a large flood or local rainfall event.

As the significance of floodplain habitat for threatened aquatic species relies on inundation and connectivity with the main river channels, the presence or absence of significant species or ecological values is dependent on flood events.

Threatened aquatic species are unlikely to be present in the floodplain except following major flooding events that connect the floodplain to the main river channel. The floodplain where the Project is located would most likely be inundated following local rainfall events, which would not connect the floodplain to the main river channel. As such, it is considered unlikely that the floodplain would provide significant habitat for aquatic flora and fauna species.

10.5.4 NSW floodplain wetlands

The preferred alignment crosses the Murray River floodplain in NSW, and is close to wetland areas to the south of Boundary Road, Moama.

Approximately 500m from the Murray River and located on private property, these wetlands are likely to have only sporadic connectivity with the Murray River. During the August 2014 field investigation, a maximum of 100 x 20 metres square of wetted area was observed. Depths range from approximately 15cm to 3m. The wetlands act as stormwater retention basins for this area of Moama, with urban litter observed throughout. Periodic de-silting activities by the Murray Shire are likely to degrade the aquatic habitat in the basins. De-silting also results in grading of the nearby banks to an almost vertical slope. The least disturbed area to the east of the basins contains habitat potentially suitable for aquatic fauna. This was substantiated by the presence of aquatic plants as well as some woody debris.

The Murray River floodplain's ephemeral aquatic habitat was surveyed as part of the Biodiversity and Habitat Impact Assessment (EES Technical Appendix C). Flooded Red Gum woodland was found 500m from the Murray River. Approximately 50 x 60 metres square in area, with a depth of around 15cm, the woodland was not surveyed for aquatic fauna, although it is possible that it could provide temporary habitat for fish species after large flooding events. The location of the woodland means it would only be connected to the Murray River and its fish populations infrequently.

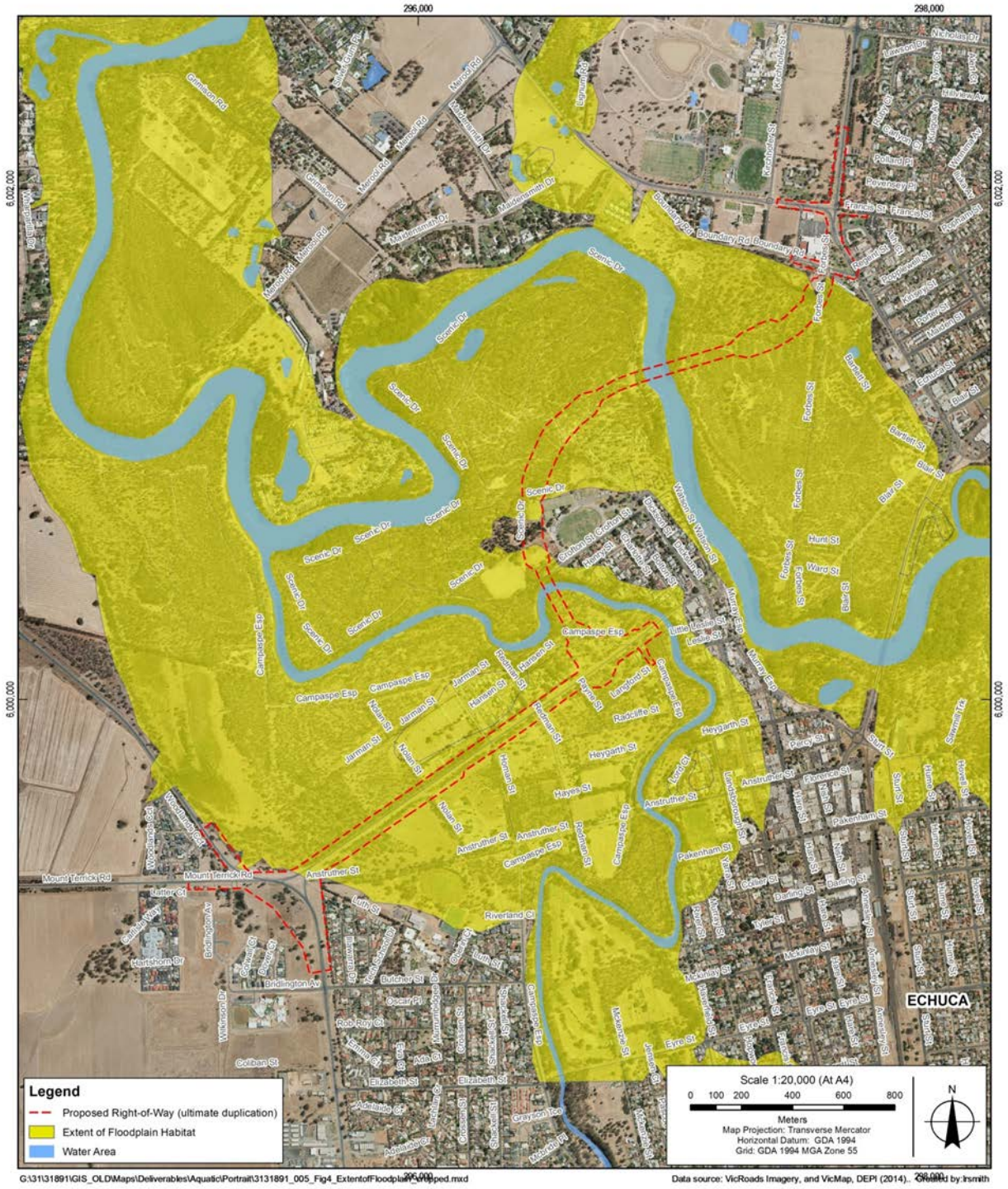

Figure 10-3 Location of Victorian and NSW floodplains

10.5.5 Aquatic weeds and pathogens

Aquatic weeds

Two aquatic weeds are known to occur in or near the study area: Willow trees (*Salix* spp.) and Arrowhead (*Sagittaria platyphylla* and *Sagittaria montevidensis*). Willow trees and Arrowhead are listed as Weeds of National Significance (WONS) and are also listed as noxious weeds in Victoria.

There are another 10 aquatic weeds with the potential to occur in the study area. A full list can be found in EES Technical Appendix D. No listed aquatic weeds were identified during any of the site surveys.

Pathogens

Epizootic Haematopoietic Necrosis Virus (EHNV) has the potential to occur within the study area, however at present it is thought to be absent (Department of Primary Industries NSW, 2015). Although EHNV is primarily known to affect non-native species, specifically Redfin Perch and Rainbow Trout, it also has the potential to affect native fish species.

10.5.6 Significant flora and fauna

Due to the nearby confluence of the Murray and Campaspe rivers, if a species was listed as being found in one waterway, it was assumed to exist in the other as well. Table 10-2 shows the 16 Victorian threatened fauna species that were identified in the desktop assessment as potentially occurring within the study area.

Table 10-2 Threatened fauna species in the study area identified from desktop assessments

Species	EPBC	VIC FFG	VIC DELWP	Details
Murray Hardyhead (*Craterocephalus fluviatilis*)	En	L	Cr En	Habitat known to occur
Murray Cod (*Maccullochella peelii peelii*)	V	L	V	Habitat may occur
Macquarie Perch (*Macquaria australasica*)	En	L	En	Habitat may occur
Silver Perch (*Bidyanus bidyanus*)	Cr En	L	V	Species and habitat known to occur
Trout Cod (*Maccullochella macquariensis*)	En	L	Cr En	Habitat known to occur
River Swamp Wallaby Grass (*Ampibromus fluitans*)	V			Habitat may occur
Western Water-Starwort (*Callitriche cyclocarpa*)	V	L	V	Habitat likely occur
Ridged Water Milfoil (*Myriophyllum porcatum*)	V	L	V	Habitat likely occur
Flat-headed Galaxias (*Galaxias rostratus*)			V	Species known from Goulburn, Loddon and Campaspe catchments
Freshwater (Eel-tailed) Catfish (*Tandanus tandanus*)		L	En	Previously recorded
Golden Perch (*Macquaria ambigua*)			N Th	Previously recorded
Striped Gudgeon (*Gobiomorphus australis*)			N Th	Previously recorded
River Snail (*Notopala sublineata*)		L	Cr En	Previously recorded
Murray Spiny Crayfish (*Euastacus armatus*)		L	N Th	Previously recorded
Southern Pygmy Perch (*Nannoperca australis*)			V	No records near Echuca-Moama
Murray River Turtle (*Emydura macquarii*)			V	Previously recorded

En: Endangered, V: Vulnerable, Cr En: Critically Endangered, N Th: Near Threatened, L: Listed

Likelihood of occurrence

For the species listed in Table 10-2 above, a 'likelihood of occurrence assessment' was undertaken to determine which of the 16 species were most likely to occur in the study area. This process assesses whether or not the identified species have ever been recorded in the study area, and if they have, how likely they are to be present during the Project. If considered likely to be present, then any consequences from the potential impacts would be relevant to those species.

Out of the 16 species, only eight fauna species were considered as being either likely or possible to occur in the study area:

- Likely:
  - Murray Cod
  - Silver Perch
  - Golden Perch
  - Murray Spiny Crayfish.
- Possible:
  - Trout Cod
  - Freshwater (Eel-tailed) Catfish
  - Flat-headed Galaxias
  - Murray River Turtle.

No listed aquatic flora species were considered as likely or possible to occur in the study area. The full likelihood assessment is presented in EES Technical Appendix D.

10.6 Impact assessment

10.6.1 Key issues

The Aquatic Flora and Fauna Impact Assessment in EES Technical Appendix D is divided into ten key areas relevant to Victoria, including:

- Encountering threatened fauna species
- Encountering threatened fauna species habitat
- Impacts to downstream wetlands
- Impacts of sedimentation
- Decrease in downstream water quality
- Increase in noise and vibration
- Degradation of riparian vegetation
- Infestation of aquatic weeds or introduction of pathogens
- Impedance to passage of aquatic fauna
- Impacts on floodplain habitat and ecological function.

These areas address the following relevant threatening processes listed under the FFG Act that could result from the Project:

- Alteration to the natural flow regimes of rivers and streams (refer sections 10.6.2, 10.6.10 and 10.6.11)
- Input of toxic substances into Victorian rivers and streams (refer section 10.6.6)
- Degradation of native riparian vegetation along Victorian rivers and streams (refer section 10.6.8)
- Increase in sediment input into Victorian rivers and streams due to human activities (refer section 10.6.5)
- Removal of woody debris from Victorian streams (refer sections 10.6.3 and 10.6.8).

The Aquatic Flora and Fauna Assessment considered the impacts that could occur in each of the ten areas if the ultimate duplication of the Project was completed.

10.6.2 Threatened fauna species

Identified threatened species considered as likely or possible to occur within the study area (refer section 10.5.6) include Murray Cod, Silver Perch, Golden Perch, Murray Spiny Crayfish, Trout Cod, Freshwater (Eel-tailed) Catfish, Flat-headed Galaxias and Murray River Turtle.

Direct impacts to these species would only be likely to occur if construction activities required access to the waterways. This could occur if coffer dams needed to be constructed within the wetted area of the Murray River.

The Murray River bridge piers would be constructed above the average summer flow level, within the riverbank, but out of the wetted area. Coffer dams would be installed at pier locations in the riverbanks in dry conditions if possible, to protect the construction works in the event of high river flow, and to minimise impacts on the environment.

Coffer dams have the potential to directly impact threatened species by stranding, injuring or killing individuals. Although coffer dam installation would ideally occur outside the river channel, a rise in water level outside the river channel may occur during construction. This could possibly allow aquatic species to move into the area of the coffer dam, and then be caught within the coffer dam walls.

However, as the construction of bridge piers and other works is currently planned to occur outside the average summer flow level of the Murray River, this should prevent the Project from directly affecting threatened aquatic fauna.

If works are required within the waterway, standard VicRoads and Roads and Maritime Services environmental protection measures would be implemented, including Construction Environmental Management Plans (CEMPs) with salvage and translocation measures (specifically to remove fish from any coffer dams). These measures would allow

any impacted fauna to be safely captured and moved from the construction area.

Overall the impact of the Project on threatened species within study area is considered minor. Following the implementation of management measures, impacts are considered unlikely to occur and have therefore been rated as having a low residual risk.

10.6.3 Threatened fauna species habitat

Aquatic habitat that may be impacted by the construction of the Project predominantly includes large woody debris that is submerged in the Campaspe and the Murray rivers. This habitat is commonly used by a number of threatened species that have been identified as likely to occur in the study area.

As there are no plans for construction of any kind within the river channels, any habitat that is within the rivers should be unaffected by the construction of the Project. If coffer dams are deemed necessary during the course of construction at the proposed Murray River crossing, and aquatic habitat was found to be present, standard VicRoads and Roads and Maritime Services environmental protection measures would be implemented to allow for relocation of important aquatic habitat to other sections of the river.

The impacts of the Project's construction and operation activities on the Murray River's aquatic habitat are considered minor. As the proposed Campaspe River bridge would fully span the river channel, and would have no in-channel structures, any construction and operational impacts on the Campaspe River's aquatic habitat are also considered to be minor. As such, whilst these impacts could possibly occur, they have a low residual risk rating.

There is no habitat for threatened species in the floodplain in the location of the Project. Threatened species would not be present in the floodplain during normal flow conditions. Section 10.6.10 addresses the impact of the Project on aquatic fauna passage across the floodplain during a flood event.

10.6.4 Impacts to downstream wetlands

There are several Ramsar wetlands associated with the Murray Valley that exist downstream of the Project, as listed in Table 10-1.

As is typical of Murray River wetlands, they are dependent on numerous factors for inundation and are disconnected from the river for a significant portion of the year. Some wetland complexes have become dependent on flow manipulation, levees and other management intervention to allow flows into the wetlands.

Activities from the Project that may impact on the water quality in the Murray River may also potentially impact on these downstream wetlands. This includes impacts such as sedimentation, spills, run-off including litter or contaminants from heavy rainfall during construction, and erosion from areas of exposed soil.

However, for these wetlands to be impacted so far downstream from the bridge crossing, the spill would need to coincide with a time of elevated water levels in the river, elevated enough for the river to overflow into the channels leading to the wetlands. Additionally, at these times of high flow, the impact would also need to be of a size that is not dissipated or diluted by the amount of water in the river or the distance downstream to the wetlands.

Overall, given the intermittent connection between these wetlands and the river and the combination of factors required for an impact to occur, impacts are considered unlikely to occur. With the implementation of standard VicRoads and Roads and Maritime Services environmental protection measures, only minor impacts are expected at downstream wetlands and the residual risk rating is low.

10.6.5 Sedimentation

The physical process of flooding and sedimentation in lowland river floodplains is essential to replenishing topsoil and nutrients and distributing plant seeds (Boulton and Brock, 2014).

However, increased sedimentation in waterways can impact on aquatic ecosystems by blocking sunlight, smothering habitat and clogging fish gills. An increase of sediment in the Murray and Campaspe rivers may be caused by any earthworks or vegetation removal required by the Project.

Sedimentation impacts can be mitigated by preventing construction site run-off, monitoring erosion on site so that control measures can be put in place, and, monitoring water quality to determine adverse impacts on aquatic habitat. These measures are included in the standard VicRoads and Roads and Maritime Services environmental protection measures.

As these river systems already carry a high sediment load, sedimentation impacts on aquatic flora and fauna are expected to be minor and are unlikely to occur. The residual risk rating is low.

10.6.6 Downstream water quality

Construction

During construction, the key potential contributors to adverse impacts on downstream water quality are spills from plant equipment onsite, run-off during rainfall events that could carry onsite contaminants, as well as increased sedimentation, downstream, dust and litter.

Standard VicRoads and Roads and Maritime Services environmental protection measures including the development of CEMPs, stockpile management, and appropriate bunding to prevent sediment run-off would be installed at Project construction sites. With the full suite of measures in place, impacts on water quality during construction could possibly still occur, but they would be considered minor. The residual risk rating is low.

Operation

The major risk to aquatic habitat during the Project's operational phase is the possibility of a truck carrying hazardous material being involved in a traffic accident. In normal circumstances, any spill would be collected and directed to one of the spill basins near the road which are designed to handle all run-off from the bridge. However, if an accident were to occur during a heavy rainfall event, this could lead to the spill basins being overwhelmed with stormwater run-off and release of the contaminant into the waterway(s). Although the level of impact would be dependent on the type of hazardous material spilled, any material could cause ecological and water quality impacts downstream of the source of the spill.

There are two Wetlands of International Importance (Gunbower Forest and NSW Central Murray state forest Ramsar Sites) located approximately 60km downstream of the Project. Impacts on water quality may have major consequences on these high value ecosystems.

To mitigate the risk and impacts of such an event, the capacity of the spill basins would need to be designed to accommodate a major rainfall event, despite the unpredictability and rarity of such an event. The design would be finalised during the detailed design of the Project. It is proposed that a road safety audit be completed during the detailed design phase of the Project, and that standard VicRoads and Roads and Maritime Services environmental protection measures are implemented.

With the implementation of VicRoads and Roads and Maritime Services standard environmental protection measures, it is considered that the likelihood of a major consequence resulting from this risk is rare, and as such the residual risk rating is medium. It should be noted that if this risk were to occur at the existing river crossing, the impact of a spill as described here would be just as great, if not worse.

10.6.7 Noise and vibration

Fish use sound to communicate, hunt and know when to avoid predators. The two kinds of noise produced by humans that can impact fish are high intensity (acute) noise and low intensity (chronic) noise. While acute noise may kill or damage fish hearing, chronic noise tends to pervade the environment and can lead to behavioural changes over the long term.

Vibrations, including sound waves, travel faster and more effectively through liquids than through air, and even more effectively through solids. The vibration generated through construction activities in waterways and in the ground near waterways is expected to cause noise impacts on aquatic ecosystems.

During construction, vibration (noise) generated would be produced by pile driving, as well as plant movement and other activities and this is discussed further in EES Technical Appendix D. However, it is considered likely that fish would simply leave or avoid passing through the area while acute noise was taking place – as long as their movement was not restricted (McCauley et al., 2000). Based on information extrapolated from marine studies, it is assumed that a short-term behavioural impact would occur on aquatic fauna, and these impacts would fade once the noise ceased.

No night works are proposed for the Project, which would provide a reprieve from any noise impacts.

It is considered unlikely that the chronic noise associated with plant movement would impact on the fauna in the study area. Murray River fauna already experience noise disturbance linked to commercial and recreational activities, and the proposed Campaspe River crossing site would not have works within the channel.

VicRoads and Roads and Maritime Services Standard environmental protection measures are generally aimed at protecting human beings from noise but they would also minimise impacts on aquatic fauna.

Whilst noise impacts associated with the Project could possibly occur, they are considered short-term and localised, with fauna being allowed to escape or avoid the area. Therefore the impact is rated as minor, with a low residual risk rating.

10.6.8 Riparian vegetation

Riparian vegetation provides the triple function of providing riverbank stability, shading the aquatic ecosystem and contributing both in-stream woody habitat (fallen trees) and plant litter.

Impacts that may result from the Project include removal or destruction of riparian vegetation, which could lead to riverbank instability and increased erosion (discussed in 10.6.5).

While native vegetation is proposed to be removed as a result of the Project, this vegetation would be removed outside the channel banks. In addition, any riparian vegetation requiring removal would be cut off at ground level. This would leave the root mats of the vegetation intact, thereby helping to maintain bank soil stability.

Whilst they would almost certainly occur, decreases to river shading, plant litter or woody debris that would result from the Project are considered to be insignificant, and thereby the impacts on aquatic fauna are also considered insignificant. The residual risk rating is low.

10.6.9 Aquatic weeds and pathogens

The presence of noxious weeds in aquatic environments can cause a number of negative impacts, which are not confined to the immediate weed-infested area. Weeds can displace native species, have impacts on water quality and can degrade the aquatic habitat.

Aquatic pathogens can be defined as bacteria, viruses or other microorganisms that can cause illness or death to aquatic fauna.

Weed invasion and pathogen spread could occur as a result of the Project, either due to the transportation of weeds and pathogens into the area, or by transmitting them to different locations within the construction area. Plant machinery, personnel, vehicles, boats and barges used during construction could contribute to increased weed infestation, as well as to the spread of pathogens.

A weed management program and monitoring controls would be implemented to manage noxious aquatic weeds and to minimise the risk of weed infestation. These management measures would also minimise the spread of pathogens. With these management measures in place, the impact on the aquatic ecosystem is expected to be minor, however impacts are unlikely to occur and therefore the residual risk rating is low.

10.6.10 Passage of aquatic fauna

Construction

Unimpeded aquatic travel is important for fauna to access habitat, food, shelter, avoid predators, and also to allow for seasonal breeding (Fairfull and Witheridge, 2003). As outlined in section 10.6.2, only construction activities within the 'wetted' Murray River channel (coffer dam construction) would impact fish passage. Given the width of the Murray River, this is unlikely to occur, and if it did, it would only be for a short period of time. The proposed bridge at Campaspe River would not include any in-stream works.

Project construction impacts to fish passage on the Murray and Campaspe rivers are considered to be minor and are unlikely to occur. The residual risk rating is low.

Operation

River channels

Operation of the Project would see an increased amount of shading over both Murray and Campaspe rivers, and increased noise due to vehicle movements. As some fish prefer not enter an intensely shaded section of river during daylight hours (Fairfull and Witheridge, 2003), shading impacts could result in behavioural restrictions to fish passage (Thorncraft and Harris, 2000).

However, as the proposed bridges have been designed to be high enough to provide for reflected and scattered light during the day, it is not expected that shading would impact on fish passage. It is also not expected that the level of noise and vibration under the bridge would be sufficient to deter fish passage.

The overall operational impact of the Project on fish passage is considered to be minor and impacts are unlikely to occur. The residual risk rating is low.

Floodplain

During a flood event, aquatic fauna move out of the river channels and onto the floodplain. Floods can allow aquatic fauna access to intermittently connected populations or to colonise other suitable aquatic habitats that are hydrologically connected during flood (Boulton and Brock, 2014). Construction of a barrier across the floodplain could impact the movement of aquatic fauna across the floodplain. The Project design includes bridging to allow for floodwaters and wildlife passage underneath the roadway. Existing culverts under roadways across the floodplain would also be upgraded to improve hydrological connectivity across the floodplain.

The elevated roadways constructed on battered slopes may interrupt existing flowpaths for floodwater across the floodplain. However, these interruptions are expected to be isolated, and are not expected to cause impacts at the scale of the study area. Therefore, the impact of the Project on the movement of threatened aquatic fauna species onto and across the floodplain is considered minor. Impacts are unlikely to occur, and the residual risk rating is low.

10.6.11 Impacts on floodplain habitat and ecological function

The physical process of flooding and sedimentation in lowland river floodplains is essential to replenishing topsoil and nutrients, distributing propagules of plants and animals and temporarily inundating the floodplain vegetation (Boulton and Brock, 2014). The natural flow regimes of rivers are particularly important for maintaining native riparian vegetation. Any significant change to flow regimes may therefore have ecological implications.

The following paragraphs relate to floodplain habitat for non-threatened aquatic fauna species. Habitat for threatened aquatic fauna species is discussed above in section 10.6.3.

Construction

The construction of bridge piers in the Murray River channel and the Campaspe floodplain has the potential to directly impact upon floodplain habitat at the pier locations. However, given the extent of the floodplain and as it is already modified, it is unlikely that construction of the bridge piers would lead to a significant loss of aquatic species habitat or alteration to ecological function. Therefore, the impact of construction of the Project on floodplain habitat for aquatic species and ecological function is considered minor. Impacts are unlikely to occur, and the residual risk rating is low.

Operation

Impacts during operation of the bridge would likely be similar to those that may occur during the construction phase. There would be a direct loss of floodplain habitat at pier locations along the proposed Right-of-Way. However, given the extent of the floodplain, any overbank flows would likely still allow for all ecological functions to take place. Therefore the impact of the Project on floodplain habitat for aquatic species and on ecological function during operation is considered minor. Impacts are unlikely to occur, and the residual risk rating is low.

10.7 Risk assessment

An environmental risk assessment was undertaken for the preferred alignment to identify key environmental issues associated with the construction and operation of the Project. The methodology for this risk assessment is described in Chapter 5 and details of the assessment are provided in EES Technical Appendix D.

Table 10-3 is a summary for aquatic flora and fauna of:

- The identified impact pathways
- A description of the consequence
- The initial risk ratings, prior to the implementation of Project-specific environmental management measures.

Risks AQ1, AQ7 and AQ8 as identified in the Aquatic Flora and Fauna Impact Assessment report in EES Technical Appendix D are not included here as they relate specifically to NSW threatened species classifications. These risks are separately addressed in the draft Review of Environmental Factors prepared by Roads and Maritime Services for the NSW component of the Project.

Table 10-3 Aquatic flora and fauna initial risks

Risk No.	Impact pathway	Description of consequence	Initial risk rating
AQ2	Construction encounters unexpected listed aquatic flora or fauna species	Injury or death to listed aquatic flora or fauna species during construction	Low
AQ3	Construction encounters habitat for EPBC listed species	Removal or degradation of aquatic fauna habitat during construction	Low
AQ4	Construction encounters EPBC listed species	Injury or death to listed aquatic fauna species during construction	Low
AQ5	Construction encounters habitat for Victorian FFG listed species	Removal or degradation of aquatic fauna habitat during construction	Low
AQ6	Construction encounters Victorian FFG listed species	Injury or death to listed aquatic fauna species during construction	Low
AQ9	Construction encounters habitat for DELWP Advisory listed species	Removal or degradation of aquatic fauna habitat during construction	Low
AQ10	Construction encounters DELWP Advisory listed species	Injury or death to listed aquatic fauna species during construction	Low
AQ11	Construction works impact on downstream aquatic habitat water quality	Degraded river health, reduced aquatic habitat	Low
AQ12	Construction works result in sediment smothering aquatic habitat	Degraded aquatic habitat quality, reduced river health condition and suitability for aquatic fauna	Low
AQ13	Construction noise (e.g. pile driving) degrades aquatic habitat quality	Aquatic fauna behaviours affected, leave study area or are deterred from moving through the study area by extreme construction noise	Low
AQ14	Operational impacts on water quality from spills and run-off	Water quality impacts results in degraded aquatic habitat quality or death or injury to aquatic flora and fauna	Medium
AQ15	Construction and operation results in listed aquatic weeds and/or pathogens being spread in aquatic habitats	Invasion of aquatic habitat and increased spread of weeds, affecting aquatic habitat quality	Low
AQ16	Impedance to passage of aquatic fauna	Construction works and bridge design provide a barrier or deterrent to aquatic fauna movement	Low
AQ17	Loss of riparian vegetation	Impacts aquatic fauna and flora dependant on riparian vegetation inputs for food/nutrient source or habitat quality (shading, structure)	Low
AQ18	Construction has an adverse effect on Wetlands of International Importance (Ramsar)	Degradation of aquatic ecosystem of the Murray River through impacts on water quality, habitat quality, flora or fauna	Low
AQ19	Construction and operation impacts aquatic ecological function of floodplain	Loss of lateral and longitudinal connectivity of river with floodplain, loss of aquatic habitat on floodplain, interruption to nutrient cycling and flood event aquatic species movement	Low

10.8 Environmental management measures

VicRoads and NSW Roads and Maritime Services have a standard set of environmental protection measures, which are typically incorporated into the contracts for road and bridge construction works. These measures have been used as the starting point for the assessment of construction-related risks and are listed in Chapter 20 and described in detail in EES Technical Appendix O.

In some instances, additional Project-specific environmental management measures have been recommended by specialists to reduce risks relating to construction and operation. However, all identified risks in relation to aquatic flora and fauna can be managed to an acceptable level by implementing the VicRoads and Roads and Maritime Services standard environmental protection measures (refer Table 10-4).

Table 10-4 Aquatic flora and fauna Project-specific management measures and residual risks

Risk No.	Project-specific environmental management measures	Residual risk rating
AQ2	All identified risks would be managed by implementing VicRoads and Roads and Maritime Services standard environmental protection measures as outlined in Chapter 20 and EES Technical Appendix O. No Project-specific environmental management measures were identified.	Low
AQ3		Low
AQ4		Low
AQ5		Low
AQ6		Low
AQ9		Low
AQ10		Low
AQ11		Low
AQ12		Low
AQ13		Low
AQ14		Medium
AQ15		Low
AQ16		Low
AQ17		Low
AQ18		Low
AQ19		Low

The Aquatic Flora and Fauna Impact Assessment considered the implementation of:

- VicRoads and Roads and Maritime Services standard environmental protection measures
- Project commitments outlined in Chapter 6, including:
  - Flood relief structures including bridging and/or culverts would be provided over low lying flood prone land, providing adequate clearance for movement of flood waters and aquatic fauna
  - The piers of the Campaspe and Murray River bridges would be constructed outside of the river channel (summer flow/low water mark extent). At the Campaspe River, bridge piers would be located clear of the riverbanks to the north and south of the river
  - At the Murray River, coffer dams would be installed at pier locations in the riverbanks in dry conditions if possible. The dams would protect pier construction works from inundation in the event of high river flow, and minimise impacts on the river environment
  - The Project would be constructed and operated in accordance with the VicRoads Integrated Water Management Guidelines (VicRoads, 2013)
  - Use of flood relief structures and other best-practice environmental management techniques to prevent sediment laden run-off from leaving construction sites
  - Erosion and sedimentation controls would progressively be installed for all activities.
  - Utilisation of non-potable (non-drinking water quality) water for construction activities wherever practicable
  - Kerb and channel would be constructed along the full length of the ultimate duplication to direct road run-off to spill basins prior to discharging the water to the floodplain
  - The Project design includes provision for spill basins to be constructed adjacent to the preferred alignment to capture run-off from the new roadway during construction and operation. The spill basins have been incorporated into the design consistent with discussions with the EPA and allow for the capture and/or treatment of run-off from the road surface and enable removal or release into the floodplain as required. The depth of the spill basins would be determined during detailed design.

10.9 Conclusion

Fish surveys were undertaken at both the Murray and Campaspe rivers (2012) and associated areas of the floodplains (2014), with no National or State significant aquatic species identified.

The overall health of the Campaspe River is rated as moderate, while the health of the Murray River is rated as very poor for macro invertebrates and poor for fish assemblages.

No significant aquatic flora and fauna were identified within the Victorian and NSW floodplains, although it should be noted that the floodplains were not observed during an inundation event, which is the only likely time when aquatic flora and fauna would be expected to temporarily colonise the area.

As most of the Project's potential impacts are short-term, construction of the Project is not expected to have any significant impact on the aquatic ecology of the study area. All potential impacts to aquatic flora and fauna during construction were identified as having appropriate mitigation measures. In most cases, these mitigation measures were taken from VicRoads and Roads and Maritime Services standard environmental protection measures. As such, construction impacts constituted a low risk.

The operational impacts of the Project were also generally considered to be a low risk, with the exception of a potential water quality impact associated with a chemical spill on the bridge during a major rainfall event. In a worst case scenario, the spill basins designed to accommodate bridge run-off could overflow and allow a contaminant to enter the Campaspe River or Murray River. Due to the major impact this risk could have on water quality far downstream from the source, the risk level remains at medium.

Overall, the assessment found that while there were several low risks with minor impacts to aquatic flora and fauna, only one risk could potentially have a major impact – the risk of a chemical spill occurring on the bridge during a high intensity rainfall event, resulting in decreased water quality. This risk already exists for the current bridge crossing. Due to the rare likelihood of this event occurring, the residual risk rating is medium. It is considered that this risk can be adequately managed with the implementation of VicRoads and Roads and Maritime Services standard environmental protection measures.

11 Aboriginal cultural heritage

The Aboriginal Cultural Heritage Impact Assessment completed by Heritage Insight (2015b) examined the potential for the Project to encounter and impact on places of Aboriginal cultural heritage value within Victoria. This assessment is separate to the Cultural Heritage Management Plan (CHMP), which is also being prepared for the Project in consultation with the Yorta Yorta Nation Aboriginal Corporation (YYNAC).

A desktop assessment indicated the Echuca region has been occupied by people for at least 30,000 years. There are 87 registered Aboriginal cultural heritage places located within the geographic region, including six scarred trees identified within and one just outside of the proposed Right-of-Way. Assessment of these trees using the Australian International Council on Monuments and Sites' (ICOMOS) Burra Charter Criteria determined they are of considerable aesthetic, historical, scientific and social value both to the contemporary Yorta Yorta people, other Aboriginal communities and the wider Australian community.

Construction works for the initial alignment would have the potential to directly impact on one dead scarred tree and three live scarred trees within the proposed Right-of-Way, as well as one live tree located just outside of the proposed Right-of-Way. The dead tree would be relocated prior to construction however it is still considered that the Project could result in a moderate impact on this tree. The four live scarred trees would be retained in their current locations, with the Project design minimising any disruption to the water supply of these trees. It is therefore considered that the impact of the Project on these four live scarred trees would be minor.

Similarly, a live scarred tree is located adjacent to the proposed Murray River bridge structure. Although this tree would be retained as part of the Project, it would require lopping prior to construction of the ultimate duplication. Provided this was undertaken by a qualified arborist, it is expected the impact of the Project on this tree would also be minor.

A second dead scarred tree on the southern side of Warren Street would be retained as part of the initial alignment. The base of this tree is largely rotted out and VicRoads would monitor its condition and discuss options for treatment with the YYNAC if it was identified that the tree was at risk of collapse. To avoid further impacts, the tree would be relocated prior to construction of the ultimate duplication. Provided this was undertaken by a qualified arborist, it is expected the impact of the Project on this tree would be minor.

Sub-surface investigations identified two deposits of stone artefacts just north of the Campaspe River, within the proposed Right-of-Way and near to where the proposed bridge piers would be constructed. One of these deposits, consisting of three stone artefacts, would most likely be disturbed during construction, but this is not considered to be significant given it is within highly disturbed soil. In order to minimise the potential for any impacts to the other buried deposit of stone artefacts, bridge piers would be installed south of Scenic Drive as well as at the bridge abutment at the northern end of the bridge.

The sand hill near the former Echuca Secondary College site, the banks of the Murray and Campaspe rivers and permanent spill or temporary sedimentation basin excavation areas have all been identified as sensitive areas that may contain sub-surface Aboriginal cultural heritage places, including Aboriginal ancestral remains. Construction works at these locations would be undertaken in accordance with an approved CHMP. Additional approval of protocols for the protection of ancestral remains and other unidentified Aboriginal cultural heritage places would also be sought from the YYNAC.

No excavation other than minimal topsoil removal would occur at the sand hill location and a rigid road pavement would be used to minimise the potential for compression of the underlying sand deposits. Consultation would be undertaken with the YYNAC to determine the most appropriate arrangement for a new emergency access on or near the high point of the sand hill, and its use would be restricted to emergency services. Pavement material would be placed on top of the existing ground to enable access for emergency vehicles whilst minimising disturbance to the natural surface.

It is acknowledged that impact to previously unidentified Aboriginal cultural heritage places encountered during construction could have a moderate impact; however the proposed management measures would ensure that the likelihood of impact would be rare.

Similarly, it is acknowledged that impact to unregistered Aboriginal ancestral remains encountered during construction could be a significant impact; however the proposed management measures preventing ground disturbance would ensure that this is unlikely.

If unregistered Aboriginal ancestral remains or previously unidentified Aboriginal cultural heritage places are encountered during construction, the contingency arrangements in the approved CHMP will provide best practice outcomes in collaboration with the YYNAC.

11.1 EES objectives

The objective of the Aboriginal Cultural Heritage Impact Assessment for the Project, as specified in the EES Scoping Requirements Draft Evaluation Objectives, is "*To avoid or minimise adverse effects on Aboriginal… cultural heritage values.*"

This chapter is based on the findings of the Aboriginal Cultural Heritage Impact Assessment completed by Heritage Insight (2015b) which is included in EES Technical Appendix E.

This chapter includes a discussion of the following key issues and requirements as they relate to Aboriginal cultural heritage, as specified in the EES Scoping Requirements for the Project.

Key issues

- *The potential for adverse effects on Aboriginal cultural heritage.*

Priorities for characterising the existing environment

- *Identify and characterise Aboriginal cultural heritage sites and areas of sensitivity within the Project area, in accordance with the requirements for the Cultural Heritage Management Plan (CHMP) under the Aboriginal Heritage Act 2006 (Vic.).*

Design and mitigation measures

- *Identify and describe potential and proposed design and mitigation measures to address effects on any Aboriginal…cultural heritage.*

Assessment of likely effects

- *Identify and assess the likely effects on Aboriginal…cultural heritage resulting from the Project.*

Approach to manage performance

- *Identify in the EES any further methods proposed to manage risks of effects on cultural heritage values, including as part of the Environment Management Framework (EMF) (see section 4.10) and resulting residual effects.*
- *Respond to any relevant requirements under the Aboriginal Heritage Act, such as preparation of a draft CHMP.*

As the purpose of this EES is to consider the potential effects of the construction and operation of the Project within Victoria, this chapter does not consider Aboriginal cultural heritage values in NSW.

The Aboriginal Cultural Heritage Impact Assessment focussed on the preferred alignment. The term 'the Project' is used in this chapter to refer to the preferred alignment only.

11.2 Study area

The study area for this impact assessment is broader than the proposed Right-of-Way.

The study area extends north and east of the proposed Right-of-Way to include the passive recreation area of Victoria Park, and also extends to include an area to the south of Warren Street and west of the Murray Valley Highway. The study area is shown in Figure 11-1.

CHMP activity area

VicRoads is required to prepare a CHMP for the section of the Project that is in Victoria, pursuant to Victoria's Aboriginal Heritage Act. A mandatory CHMP is required as the construction of the Project is considered a high impact activity, which would occur in areas of cultural heritage sensitivity that have not been subject to significant ground disturbance, as defined in the *Aboriginal Heritage Regulations 2007*. Areas of cultural heritage sensitivity include land within 200m of the Murray and Campaspe rivers and land within 50m of any registered Aboriginal places. The CHMP is separate to the Aboriginal Cultural Heritage Impact Assessment that is summarised in this chapter. The CHMP is being developed in consultation with the YYNAC. The YYNAC will formally consider the CHMP for approval as required under the *Aboriginal Heritage Act 2006 (Vic.).*

Under the Aboriginal Heritage Regulations, an 'activity area' means the area or areas to be used or developed for an activity. The activity area for the Project is the proposed Right-of-Way for the preferred alignment.

The Aboriginal Heritage Regulations require an Aboriginal cultural heritage desktop assessment to identify and determine a geographic region within which the activity area is located. Identification of a geographic region is based on the area considered relevant to the Aboriginal cultural heritage that may be present in the activity area.

The geographic region of the proposed Right-of-Way can be described as the area to the north of Ogilvie Avenue and east of Wharparilla Drive in Echuca.

11.3 Methodology

The Aboriginal Cultural Heritage Impact Assessment included the following activities:

- Undertaking a desktop assessment, including:
  - Review of relevant State and local legislation, policies and guidelines
  - Searching the Victorian Aboriginal Heritage Register (VAHR) administrated by the Office of Aboriginal Affairs Victoria (OAAV)
  - A review of previous archaeological studies, including archaeological surveys undertaken from 2000 to 2011 as part of previous investigations into a second Murray River crossing at Echuca-Moama

- A brief review of written and oral local history about Aboriginal people in the Echuca area
- Identification of the study area's geographic region and environmental conditions
- Studying the land-use history for the proposed Right-of-Way and undertaking a review of previous archaeological work in the geographic region, particularly for evidence of the extent and nature of past land disturbance.

- Information from the desktop assessment was used to produce an archaeological site prediction model to assist in determining:
  - The type of archaeological sites that potentially occur in the proposed Right-of-Way, and the possible contents of these sites
  - The possible past use of the landscape by Aboriginal people
  - The likely extent of ground disturbance to archaeological sites.

  The information provided by the site prediction model was used to design a fieldwork strategy for archaeological surveys undertaken in 2014-2015. Areas which had not been previously surveyed and yet had a high probability of containing archaeological sites were targeted. To test the effectiveness of the site prediction model, areas or landforms considered as having a low probability of containing Aboriginal archaeological sites were also assessed.
- Meetings were held with the YYNAC, as the Registered Aboriginal Party for the activity area, to:
  - Introduce the Project and review the Aboriginal cultural heritage studies undertaken as part of investigations into a second Murray River crossing at Echuca-Moama
  - Discuss the results of the 2014 and 2015 archaeological field surveys
  - Discuss management measures to minimise impacts to Aboriginal cultural heritage as a result of the Project.

  Consultation with the YYNAC is ongoing.
- Assessment of the impacts of the Project against the 'No Project' scenario.

A risk and impact assessment was undertaken to evaluate the potential impacts of the Project on heritage against the 'No Project' scenario. Impact pathways were identified based on the existing ecological values present and the activities outlined in the project description. For the risk assessment, consequence criteria were developed specifically for the project. Initial and residual risks were identified based on the impact pathways and considering the implementation of VicRoads' standard environmental protection measures (for initial risks) and Project-specific environmental management measures (for residual risks).

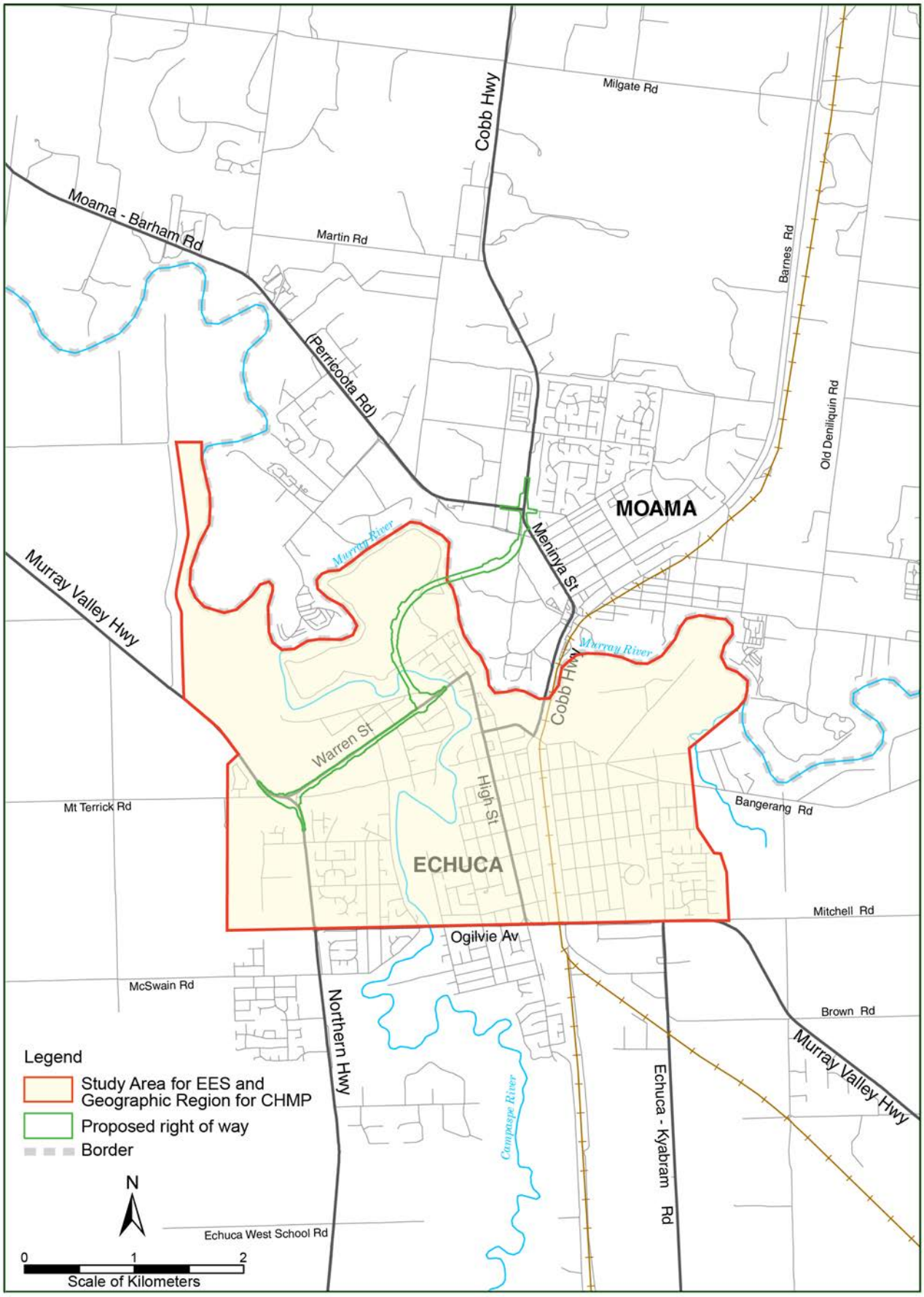

Figure 11-1 Aboriginal cultural heritage study area and geographic region for CHMP

11.4 Legislation and policy

Legislation and policies relevant to Aboriginal cultural heritage for the Project are discussed in Table 11-1.

Table 11-1 Legislation and policies relevant to Aboriginal cultural heritage

Legislation / policy	Description
International	
Australian International Council of Monuments and Sites' Charter for the Conservation of Places of Cultural Significance (known as the Burra Charter)	In 1977 the Australian International Council of Monuments and Sites (ICOMOS) reviewed the Venice Charter adopted in 1964 in relation to Australian practice. In 1979 the Charter for the Conservation of Places of Cultural Significance was adopted at a meeting in the historic mining town of Burra, South Australia. It is now commonly known as the 'Burra Charter'. The Burra Charter and its accompanying guidelines define the basic principles, processes and practices on which statutory assessments of heritage significance in Australia are based. In most cases the wording of the various sets of criteria differs slightly. However, all are based on the same principles and incorporate general criteria such as the following: - Association with special events, developments or phases - Rarity due to association with a distinctive way of life, custom, process, land use, function or design no longer practiced - Importance for demonstrating principal characteristics of a particular type or class of human activities) - Aesthetic value to the local community - Value for demonstrating a particular technical or creative process - Strong or special association with a particular community or ethnic group for social, cultural or spiritual reasons. Generally these criteria can be grouped into three main categories: social (I), scientific (II) and historical (III), depending on the nature of a given place or item.
State	
Planning and Environment Act 1987 (Vic.)	The Planning and Environment Act establishes a framework for planning the use, development and protection of land in Victoria in the present and long-term interest of all Victorians. An objective of planning under the Act is to conserve and enhance those buildings, areas or other places which are of scientific, aesthetic, architectural or historical interest, or otherwise of special cultural value. The Planning and Environment Act sets out the legislative basis to ensure that standard planning provisions are prepared and approved throughout Victoria. The Act sets out procedures for preparing and amending the Victoria Planning Provisions and planning schemes, obtaining permits under planning schemes, settling disputes, enforcing compliance with planning schemes, and other administrative procedures. The Act provides for a single instrument of planning control in a particular area, the planning scheme, which sets out the way land may be used or developed. The planning scheme is a legal document, prepared and approved under the Planning and Environment Act. The relevant planning scheme for the study area is the Campaspe Planning Scheme.
Aboriginal Heritage Act 2006 (Vic.) *Aboriginal Heritage Regulations 2007*	The Aboriginal Heritage Act forms the framework within which Aboriginal heritage assessment is undertaken in Victoria. It provides for: - The ownership and custody of Aboriginal cultural heritage - The protection of Aboriginal cultural heritage - The preparation of mandatory and voluntary CHMPs for Aboriginal cultural heritage - The making of Cultural Heritage Agreements - Provision of Cultural Heritage Audits, Stop Orders and Protection Declarations - Resolution of disputes regarding Aboriginal cultural heritage - Administration of the Act, including the appointment of an Aboriginal Heritage Council and Registered Aboriginal Parties - Enforcement provisions. Under sections 27-28 of the Aboriginal Heritage Act, harming Aboriginal cultural heritage or doing an act likely to harm Aboriginal cultural heritage is unlawful. Penalties may apply for a breach of sections 27 or 28. In addition, the Act provides for the issue of Stop Orders (Part 6, Division 2) and Interim or Ongoing Declarations of Preservation (Part 7 Divisions 1-2) where the Act has been breached.

Legislation / policy	Description
	Harm to Aboriginal cultural heritage is permitted when either a Permit to Harm Aboriginal Cultural Heritage is issued or an approved CHMP is completed, which allows for harm to Aboriginal Cultural Heritage. In some circumstances the preparation of a mandatory CHMP is required. These circumstances are set out in Part 2 of the Aboriginal Heritage Regulations. The preparation of a mandatory CHMP is required where an activity is carried out within an area of cultural heritage sensitivity defined in Part 2, Division 3 of the Aboriginal Heritage Regulations and where that activity is a high impact activity defined in Part 2, Division 5 of the Regulations. The CHMP must comply with standards set out in Part 3 and Schedule 2 of the Regulations. Once completed, the CHMP must be submitted for evaluation. Where a Registered Aboriginal Party is appointed, the CHMP will be evaluated by that organisation. Where no Registered Aboriginal Party is appointed, the CHMP will be evaluated by the delegate of the Secretary, Department of Premier and Cabinet. YYNAC is the Registered Aboriginal Party for the Project activity area and will evaluate the CHMP for the Project.
Local	
Campaspe Planning Scheme	A planning scheme sets out objectives, policies and provisions relating to the use, development, protection and conservation of land in the area to which it applies. The applicable planning scheme within the Victorian proportion of the study area is the Campaspe Planning Scheme. A set of standard provisions called the Victoria Planning Provisions (VPP) forms a template for all planning schemes. Included in the VPP is the State Planning Policy Framework (SPPF), which covers strategic issues of State importance. Clause 15.03-2 (Aboriginal cultural heritage) of the SPPF is relevant to the Project. The objective of this Clause is "To ensure the protection and conservation of places of Aboriginal cultural heritage significance." Strategies to achieve this objective include: - Identify, assess and document places of Aboriginal cultural heritage significance, in consultation with relevant Registered Aboriginal Parties, as a basis for their inclusion in the planning scheme - Provide for the protection and conservation of pre- and post-contact Aboriginal cultural heritage places - Ensure that permit approvals align with recommendations of a CHMP approved under the Aboriginal Heritage Act.

11.5 Existing conditions

11.5.1 Environmental conditions of the geographic region

The geographic region has environmental conditions that are representative of the broader Murray River floodplain. A prominent sand hill is located north of Warren Street and extends across the area between Nolan Street, Homan Street and approximately 50m north of Jarman Street, encompassing the Echuca Cemetery. A second sand hill extends from near the Campaspe River, across the former Echuca Secondary College site, to Reflection Bend on the Murray River. This sand hill is likely to be associated with a prior stream or an ancestral course of the Murray or Campaspe rivers, and could have been formed by windblown sands from a dry stream or river bed. This sand hill is discussed further in this chapter and in section 11.5.3.

11.5.2 Ethnographic and land use history

The temperate climatic conditions of Echuca would have placed no restrictions on Aboriginal occupation of the area. The Murray and Campaspe rivers, and the surrounding wetlands formerly located near the Murray River, were sources of fresh water that supported diverse vegetation types and fauna species. The availability of these resources is likely to have influenced Aboriginal settlement in the area.

The traditional Aboriginal owners of the geographic region are the Wollithiga clan of the Yorta Yorta people. Ethnographic accounts of the Traditional Owners indicate that subsistence activities were variable, drawing on riverine and terrestrial resources (Curr, 1883). The Yorta Yorta peoples' lifestyle and culture was based on hunting, fishing and collecting food mainly from the network of rivers, lagoons, creeks and wetlands in the area (YYNAC, 2010).

The arrival of Europeans had a devastating impact on the Yorta Yorta people. It is estimated that within the first generation of the arrival of Europeans, the Yorta Yorta population of approximately 6,000 people was reduced by 85 per cent (YYNAC, 2010).The land use history of the geographic region indicates that various European activities would have impacted on Aboriginal cultural heritage places including:

- Initial clearance of native vegetation
- Cattle grazing
- Sand mining
- Grading of the floodplain
- Construction of the township of Echuca.

In 1858, the Board for the Protection of Aborigines was established and Aboriginal people were relocated to missions and stations. Aboriginal people living in Echuca were relocated to Coranderrk, near Healesville, and later many returned to traditional country near Barman when the Maloga mission was established. In 1883, 1,800 acres adjacent to the Maloga site was gazetted by the NSW Government for the purpose of accommodating the Murray River tribes and this site was named Cummeragunja in 1889.

In 1939, Yorta Yorta and Wemba Wemba residents of Cummeragunja walked off the mission in protest against the living conditions, the leasing of most of the reserved land to a European, and the oppressive laws of the reserve system. Some of the people who left Cummeragunja purchased houses in Warren Street and some of these houses have remained in their families since that time.

Between 1860 and 1994 the YYNAC made around 18 separate attempts to claim land and compensation. The only land that has been returned is 1,200 acres of the former Cummeragunja Reserve.

11.5.3 Desktop assessment and archaeological field studies

A review of previous archaeological work in the geographic region indicated it has been occupied by people for at least 30,000 years, and this occupation has been consistently related to the proximity of fresh water sources.

It has been shown that in close proximity to major watercourses Aboriginal cultural heritage places are more numerous and the types more varied, whereas on the floodplain, places are less numerous and scarred trees tend to be the only type represented (Young and Rhodes, 2009).

Previously recorded places

Desktop assessments and archaeological field surveys were undertaken in the years 2000, 2007, 2008, 2009 and 2011 as part of investigations into a second Murray River crossing at Echuca-Moama (refer to Chapter 2 for a description of these investigations).

During the 2007 archaeological survey, a small natural levee on the north bank of the Campaspe River was also noted. This would have been a suitable location for campsites during times of high floodwater.

Searches of the VAHR undertaken in 2011, 2013 and 2014 indicated there are 87 registered Aboriginal cultural heritage places located within the geographic region. These comprise 70 scarred trees, eight shell middens, six artefact scatters or low-density artefact deposits, two oven mounds/earth features and one Aboriginal historic place.

During past surveys for all of the options for the second Murray River crossing at Echuca-Moama, there have been 59 Aboriginal cultural heritage places recorded. These comprise 54 scarred trees and five shell middens, which account for 65 per cent of all the Aboriginal cultural heritage places recorded in the geographic region.

The large number of Aboriginal cultural heritage places located within the various study corridors that have been surveyed between Warren Street, the Murray and Campaspe rivers is biased by the intensive survey coverage of the area between 2000 and 2013. While this has resulted in the discovery of a large number of places, particularly scarred trees, there has been relatively little survey coverage over the balance of the geographic region for this study.

A total of six previously recorded Aboriginal cultural heritage places were identified within the proposed Right-of-Way. These are all scarred trees and are listed in Table 11-2.

Table 11-2 Registered Aboriginal scarred trees within the proposed Right-of-Way

VAHR Number	Field Name	Type
7825-0371	Murray Scarred Tree 3	Scarred Tree
7825-0372	Murray Scarred Tree 4	Scarred Tree
7825-0386	Murray Scarred Tree 10	Scarred Tree
7825-0396	Murray Scarred Tree 21	Scarred Tree
7825-0398	Murray Scarred Tree 22	Scarred Tree
7825-0399	Murray Scarred Tree 23	Scarred Tree

The six scarred trees were assessed for their cultural significance using the Australia ICOMOS Burra Charter criteria. The assessment determined that these scarred trees are generally of high aesthetic, historical, scientific and social value both to the contemporary Yorta Yorta people, other Aboriginal communities and to the wider Australian community. However, Murray Scarred Tree 10 (VAHR 7825-0386) was assessed as being of moderate scientific value, as the scar is situated on a stump which is largely rotted out at the base.

The sand hill extending between the former Echuca Secondary College site and Reflection Bend on the Murray River is an area of approximately 25 hectares considered to be of high Aboriginal cultural heritage sensitivity. Although these surveys found no surface evidence of Aboriginal cultural heritage places within the sand hill area, it was assessed as having a very high potential to contain buried Aboriginal cultural heritage places and ancestral remains (human burials).

New places

Three new scarred trees were recorded during a 2014 archaeological field survey of land on the southern side of Warren Street. These were registered with the OAAV (refer to Table 11-3).

Mid-West Corridor 2 – Scarred Tree 10 (VAHR 7825-0380) and Mid-West Corridor 2 – Scarred Tree 12 (VAHR 7825-0481) are more than 50m from the southern edge of the existing road reserve in Warren Street and are outside of the proposed Right-of-Way. Mid-West Corridor 2 – Scarred Tree 11 (VAHR 7825-0482) is approximately 46m south of the southern edge of the existing road reserve, just outside of the proposed Right-of-Way.

Table 11-3 Aboriginal scarred trees recorded during the 2014 field survey

VAHR Number	Field Name	Type
7825-0480	Mid-West Corridor 2 – Scarred Tree 10	Scarred Tree
7825-0481	Mid-West Corridor 2 – Scarred Tree 12	Scarred Tree
7825-0482	Mid-West Corridor 2 – Scarred Tree 11	Scarred Tree

No other Aboriginal cultural heritage places were recorded during the 2014 field surveys. Although ground visibility was poor, there is a low likelihood of other Aboriginal cultural heritage places being found in the area that was surveyed, as:

- There is considerable ground disturbance from agricultural activities
- The area was regularly inundated during flood events prior to the construction of levees and other flood mitigation measures.

In early 2015, it was found that the sand hill bordering the former Echuca Secondary College site and the Echuca Lawn Tennis Club extends further than was previously identified. The sand hill extends through the former Echuca Secondary College site toward the Campaspe River.

VicRoads and the cultural heritage consultant held a meeting with YYNAC on 11 March 2015 to discuss the results of the initial assessment and the scope of further investigation of the sand hill. VicRoads also discussed design measures and construction techniques that would enable them to avoid impacts. Additional sub-surface testing was carried out from the 25-27 March 2015. Parts of the sand hill where the former Echuca Secondary College buildings were located have been excavated to depth of greater than 1m. The sand hill appears to be less disturbed outside of the former building envelopes.

The results of this fieldwork are being analysed and the full extent of the sand hill will be mapped to enable further classification of this area by OAAV. This information will be included in the CHMP.

Details of design measures to manage potential impacts on this newly identified Aboriginal cultural heritage place will also be included in the CHMP.

However, proposed management measures are also included in this EES (refer section 11.8).

Additional sub-surface testing was carried out in February 2015 and at the end of March 2015 near the locations of the proposed bridge piers on the north and south banks of the Campaspe River, in order to assess whether the installation of the piers would impact on Aboriginal cultural heritage. Aboriginal heritage artefacts were located in two locations within the proposed Right-of-Way on the north bank of the Campaspe River, in a small section of remnant sand deposit near the former Echuca Secondary College site. One sub-surface deposit of stone artefacts (VAHR 7825-0485) was found just north of Scenic Drive near where it meets Crofton Street. The other deposit consisting of three stone artefacts was found in highly disturbed soil further to the south of Scenic Drive (VAHR 7825-0486).

Consultation with YYNAC has identified that areas north and south of Warren Street, where families of Yorta Yorta and Wemba Wemba people settled after walking off Cummeragunja, are places of intangible heritage value. These places are close to, but not within, the proposed Right-of-Way. VicRoads is engaged in ongoing discussions with YYNAC about possible ways to acknowledge the importance of the area to Yorta Yorta and Wemba Wemba people, particularly for those families still living in Echuca.

11.5.4 Predictive modelling

The results of the desktop assessment of the geographic region indicated the site prediction model developed by Rhodes (Terra Culture, 2000a) for the Murray River floodplain is highly applicable to the study area. The model predicts that:

- There would be a higher density of cultural heritage places close to the banks of the Murray and Campaspe rivers. This distribution may be partly a reflection of post-contact land clearance during the 19th century, which meant that cultural heritage places were more likely to survive on land closer to the rivers
- There would be a greater range of cultural heritage places types and complex occupation areas near riverbanks including scarred trees, shell middens, mounds and human burials. Land clearance may have disturbed these places
- Scarred trees are likely to occur on all landforms within and around the preferred alignment
- Ancestral human remains are most likely to be located within the sand hill, but could potentially be located on the lowland plain, particularly near riverbanks
- Aboriginal occupation areas are most likely to date from the mid-Holocene (5,000 years ago)
- It is unlikely there would be landforms associated with older watercourses underlying the floodplain, even though the channel of the river has migrated over millennia and the study area is near the junction of the Campaspe and Murray rivers.

11.6 Impact assessment

To adequately assess the potential impact of the Project on Aboriginal cultural heritage, the following values were considered:

- Impact on registered Aboriginal cultural heritage places
- Impact on potential Aboriginal cultural heritage places.

11.6.1 Impacts on registered Aboriginal cultural heritage places

Construction of the initial alignment

Impacts on scarred trees

As described in section 11.5.3, there are six registered scarred trees located within the proposed Right-of-Way.

Construction of the initial alignment has the potential to directly impact one scarred tree (Murray Scarred Tree 10 VAHR 7825-0386). The tree is dead, with a cultural scar visible within the stump. The tree would be relocated prior to construction. Whilst it would be rare that this relocation would cause the destruction of the tree, it is still considered that the Project could result in a moderate impact.

Two live scarred trees (Murray Scarred Tree 3 VAHR 7825-0371 and Murray Scarred Tree 21 VAHR 7825-0396) would be retained in the road reserve adjacent to the proposed bridge structure, and one live scarred tree would be retained within the roundabout at the intersection of the Murray Valley Highway and Warren Street (Murray Scarred Tree 22 VAHR 7825-0398). The Project design would minimise the potential impact of the roundabout works and earth embankments on existing drainage paths, so that the water supply to these trees would not be affected. It is therefore considered unlikely the Project would affect these three scarred trees, and the impact of the Project would be minor.

Construction of the initial alignment would not directly impact on a dead scarred tree (Murray Scarred Tree 23 VAHR 7825-0399) located on the southern side of Warren Street. This tree would be retained in its current location in the short-term, prior to construction of the ultimate duplication, when it would be relocated (see below). Once the initial alignment was constructed, it is anticipated this tree would be more visible and more accessible. For this reason, a barrier would be erected around the tree and the condition of the tree would be monitored. It is noted the base of the tree is largely rotted out and it is possible this rot may cause the tree to fall over in the near future. VicRoads would discuss treatment options with the YYNAC if monitoring identified the tree was at risk of collapse.

In addition, construction of the initial alignment has the potential to directly impact Mid-West Corridor 2 – Scarred Tree 11 (VAHR 7825-0482), which is located just outside of the proposed Right-of-Way but immediately to the south of the proposed roundabout on Warren Street south-west of Campaspe Esplanade. This live tree would be retained and the Project would be designed to minimise any potential impacts on this tree. It is therefore considered unlikely the Project would affect this scarred tree, and the impact of the Project would be minor.

Impacts on registered sub-surface artefacts

As described in section 11.5.3, there are two registered deposits of stone artefacts (VAHR 7825-0485 and VAHR 7825-0486) within the proposed Right-of-Way, north of the Campaspe River. The deposit of three stone artefacts (VAHR 7825-0486) would most likely be disturbed during construction, but this is not considered to be significant given the highly disturbed context of the site.

In order to minimise the potential for any impacts to registered Aboriginal cultural heritage place VAHR 7825-0485, bridge piers would be installed south of Scenic Drive as well as at the bridge abutment at the northern end of the bridge. The CHMP will require monitoring to be undertaken during construction in this area and will detail the procedure to be followed should other artefacts be found.

Construction of the ultimate duplication

Construction of the ultimate duplication would have the potential to directly impact on Murray Scarred Tree 23 VAHR 7825-0399. Although the tree is one of the better examples of a scarred tree, the cultural scar is located on the tree stump which is largely rotted out at the base. If relocation of the tree prior to construction was successful, it is considered the impact of the Project on the tree would be minor.

One live scarred tree (Murray Scarred Tree 4 VAHR 7825-0372) would be located adjacent to the Murray River bridge structure. The Project design would minimise the potential impact to existing drainage paths so that the water supply to the tree would not be affected. This tree would require lopping. Provided this was undertaken by a qualified arborist, it is expected the impact of the Project on this tree would be minor.

11.6.2 Impacts on potential Aboriginal cultural heritage places

As with many other projects, there is the potential to encounter previously unregistered ancestral remains or unidentified Aboriginal cultural heritage places during construction, which could result in damage to or destruction of these places.

Impacts on the sand hill

The sand hill near the former Echuca Secondary College site is an area of high Aboriginal cultural heritage sensitivity and high archaeological potential. It has the potential to contain buried ancestral remains and/or sub-surface Aboriginal cultural heritage.

No excavation, other than the clearing of surface vegetation and minimal removal of topsoil, is required for the Project to cross the sand hill. Vegetation would be cut to ground level and roots would not be removed.

The construction of the road is unlikely to impact on the sand hill as a rigid pavement would be adopted for the road crossing at this location. The design of the rigid pavement would ensure the load of the road structure would be evenly distributed on the sand hill, thereby minimising the potential for compression of the underlying sand deposits. The CHMP will also outline requirements for monitoring and other controls during construction at this location.

It is likely that emergency access to the road would be provided on or near the high point of the sand hill. The access would be gated or restricted but would allow for access by the emergency services as necessary. Consultation would be undertaken with the YYNAC to determine the most appropriate arrangement for the emergency access.

Management measures for minimising impacts to the sand hill will be included in the CHMP, including the placement of pavement material on top of the existing ground to enable access for emergency vehicles while minimising disturbance to the natural surface.

It is acknowledged that if previously unidentified Aboriginal cultural heritage places were encountered at the sand hill during construction this could have a moderate impact; however the proposed management measures would ensure that the potential for impacts would be a rare occurrence. If unregistered Aboriginal ancestral remains were encountered this could be a significant impact; however the proposed management measures preventing ground disturbance would ensure that this is unlikely.

If unregistered Aboriginal ancestral remains or previously unidentified Aboriginal cultural heritage places are encountered during construction, the contingency arrangements in the approved CHMP will provide best practice outcomes in collaboration with the YYNAC.

Impacts on other previously unidentified cultural heritage places

The construction of the Murray and Campaspe river bridges would require excavation for geotechnical testing and the installation of driven piles on the banks of both rivers, as described in section 11.5.3. These riverbanks are sensitive landforms which could contain previously unidentified sub-surface Aboriginal cultural heritage, such as shell middens and ancestral remains (in addition to the two stone artefact sites that have already been identified).

The CHMP will outline requirements for monitoring and other controls during construction at the proposed locations for the bridge piers at the banks of the Murray and Campaspe rivers.

On the south side of Warren Street, the spill basins would be excavated on sections of the alluvial plain that have previously been ploughed and have been regularly inundated in the past by floods. The likelihood of Aboriginal cultural heritage places being present within this section of the floodplain is unlikely. However, if they are present, any places to depths of up to 1m could potentially be impacted by these excavation works.

Depending on their location, the excavation of other permanent and temporary spill/sedimentation basins (for capturing runoff and silt from construction works) have the potential to impact on Aboriginal cultural heritage.

Construction works would be undertaken in accordance with an approved CHMP and additional approval of protocols for the protection of ancestral remains and other unidentified Aboriginal cultural heritage places would be sought from the YYNAC. With these management measures in place, it is considered the Project is unlikely to impact on previously unregistered ancestral remains, and that the likelihood of impacting a previously unidentified Aboriginal cultural heritage place is rare.

However, it is acknowledged that in the unlikely event that unidentified Aboriginal cultural heritage places were encountered during construction, there could be a moderate impact, while the impact on unregistered ancestral remains could be significant.

11.7 Risk assessment

An environmental risk assessment was undertaken for the preferred alignment to identify key environmental issues associated with the construction and operation of the Project. The methodology for this risk assessment is described in Chapter 5 and details of the assessment are provided EES Technical Appendix E.

Table 11-4 is a summary for Aboriginal cultural heritage of:

- The identified impact pathways
- A description of the consequence
- The initial risk rating, prior to the implementation of Project-specific environmental management measures.

Table 11-4 Aboriginal cultural heritage risks

Risk No.	Impact pathway	Description of consequence	Initial risk rating
CH1	Project impacts on registered Aboriginal scarred tree VAHR 7825-0386.	Destruction of tree	High
CH2	Project impacts on registered Aboriginal scarred trees VAHR 7825-0371, VAHR 7825-0482, VAHR 7825-0396 or VAHR 7825-0398.	Destruction of trees	Low
CH3	Project impacts on registered Aboriginal scarred tree VAHR 7825-0372. Tree impacted by lopping of tree branches at ultimate duplication.	Destruction of tree	Low
CH4	Project impacts on registered Aboriginal scarred tree VAHR 7825-0399 at ultimate duplication.	Destruction of tree	High
CH5	Construction encounters previously unregistered ancestral remains.	Destruction of Aboriginal ancestral remains	High
CH6	Construction encounters previously unidentified Aboriginal cultural heritage place.	Destruction of Aboriginal cultural heritage place	High
CH7	Construction encounters Aboriginal cultural heritage place in a sensitive location, such as the sand hill or banks of the Murray or Campaspe rivers.	Destruction of Aboriginal cultural heritage place in a sensitive location	High
CH8	Fill for the road construction is obtained from a source where excavation impacts on Aboriginal cultural heritage places.	Destruction of Aboriginal cultural heritage place	Low

11.8 Environmental management measures

VicRoads has a set of standard environmental protection measures which are typically incorporated into the contracts of road works and bridge works. These measures have been used as the starting point for the assessment of construction-related risks and are listed in Chapter 20 and described in detail in EES Technical Appendix O – Section 177 Environmental Management. In some instances, additional Project-specific environmental management measures have been recommended by specialists to reduce risks relating to construction and operation.

Project-specific environmental management measures specific to each identified impact pathway for Aboriginal cultural heritage are outlined in Table 11-5. This table also shows the residual risk rating after the implementation of VicRoads' standard environmental protection measures and Project-specific environmental management measures.

Table 11-5 Aboriginal cultural heritage Project-specific environmental management measures and residual risks

Risk No.	Project-specific environmental management measures	Residual risk rating
CH1	Scarred tree to be removed and re-instated at a location to be agreed with the YYNAC and any other relevant management authorities. The tree removal must be monitored and assisted by representatives from the YYNAC, in consultation with a qualified arborist.	Low
CH2	Scarred trees VAHR 7825-0371, VAHR 7825-0482, VAHR 7825-0396, VAHR 7825-0398 must be retained in their current locations. The way in which the trees are conserved must ensure the long-term health of the trees.	Low
CH3	Lopping of the tree branches must be carried out by a qualified arborist with the assistance of representatives from the YYNAC. The lopping of branches must be carried out in such a way as to not endanger the long-term health of the tree.	Low
CH4	This tree would not be impacted by the initial alignment and may safely be retained in the road reserve in the short term. A barrier or fence must be erected around the tree. The condition of the tree is to be monitored regularly (at least once per year) to assess the likelihood of the tree collapsing. If it appears likely that the tree may collapse, VicRoads must contact the YYNAC to discuss treatment of the tree. If the tree is moved prior to construction of the ultimate duplication, the removal of the tree must be carried out by a qualified arborist in consultation with, and the assistance of, representatives from the YYNAC. After the tree is removed, it must be transported to a location agreed to by YYNAC to undergo conservation treatment. The conservation work and the re-erection of the tree must be carried out or supervised by a qualified arborist in association with YYNAC representatives.	Medium
CH5	Additional negotiation with, and approval by, the YYNAC to be carried out regarding the protocol for the protection of ancestral remains. All work must cease in the area where the remains are found and statutory procedures for reporting the discovery that are contained in the contingency recommendations for the CHMP must be followed. Monitoring of excavation works for temporary sedimentation basins and permanent spill basins would be required by the CHMP.	High
CH6	All work must cease in the area where the place is found and statutory procedures for reporting the discovery that are contained in the contingency recommendations for the CHMP must be followed. Additional negotiation and approval from YYNAC regarding protocol for protection of the Aboriginal cultural heritage place.	Low
CH7	All work must cease in the area where the place is found and statutory procedures for reporting the discovery that are contained in the contingency recommendations for the CHMP must be followed. Additional negotiation and approval from YYNAC regarding protocol for protection of the Aboriginal cultural heritage place.	Low
CH8	Fill for the road works must be sourced from a licenced existing quarry. Any other fill sources are subject to the provisions in the CHMP.	Low

11.9 Conclusion

The desktop assessment, contained in the Aboriginal Cultural Impact Assessment, identified six scarred trees within the proposed Right-of-Way that would be impacted by the Project.

Assessment of these trees using the Australia ICOMOS Burra Charter criteria determined they are of considerable aesthetic, historical, scientific and social value to the contemporary Yorta Yorta people, other Aboriginal communities and to the wider Australian community.

Construction of the initial alignment has the potential to directly impact one dead scarred tree (Murray Scarred Tree 10 VAHR 7825-0386) and three live scarred trees within the proposed Right-of-Way (Murray Scarred Tree 3 VAHR 7825-0371, Murray Scarred Tree 21 VAHR 7825-0396 and Murray Scarred Tree 22 VAHR 7825-0398), as well as one live tree located just outside of the proposed Right-of-Way (Mid-West Corridor 2 – Scarred Tree 11 VAHR 7825-0482). The dead tree would be relocated prior to construction but it is still considered that the Project could result in a moderate impact on this tree. The four live scarred trees would be retained in their current locations, and the Project design would minimise the potential impact of construction works on existing drainage paths so that the water supply to these trees would not be affected. It is considered the impact of the Project on these four live scarred trees would be minor.

Similarly, a live scarred tree located adjacent the Murray River bridge structure (Murray Scarred Tree 4 VAHR 7825-0372) would be retained. However, it would require lopping prior to construction of the ultimate duplication. Provided this was undertaken by a qualified arborist, it is expected the impact of the Project on this tree would be minor.

A dead scarred tree on the southern side of Warren Street (Murray Scarred Tree 23 VAHR 7825-0399) would be retained for the initial alignment. A barrier would be erected around the tree to protect it from increased vehicle and pedestrian access. The base of this tree is largely rotted out and it is possible this rot may cause the tree to fall over in the near future. VicRoads would monitor the condition of the tree and discuss options for its treatment with the YYNAC if it was identified that the tree was at risk of collapse. To avoid further impacts, the tree would be relocated prior to construction of the ultimate duplication. Provided this was undertaken by a qualified arborist, it is expected the impact of the Project on this tree would be minor.

Sub-surface investigations identified two deposits of stone artefacts just north of the Campaspe River, within the proposed Right-of-Way and near to where the proposed bridge piers would be constructed. One of these is a deposit of three stone artefacts (VAHR 7825-0486) that would most likely be disturbed during construction, but this is not considered to be significant given it is within highly disturbed soil.

The other is a sub-surface deposit of stone artefacts (VAHR 7825-0485), located just north of Scenic Drive near where it meets Crofton Street. In order to minimise the potential for any impacts to this registered Aboriginal cultural heritage place, bridge piers would be installed south of Scenic Drive as well as at the bridge abutment at the northern end of the bridge.

The sand hill near the former Echuca Secondary College site, the banks of the Murray and Campaspe rivers and spill/sedimentation basin excavation areas all have the potential to contain buried Aboriginal cultural heritage places and/or human remains.

A rigid road pavement would be adopted for the road crossing at the sand hill, which would minimise the potential for compression of the underlying sand deposits.

Pavement material would be placed on top of the existing ground to enable access for emergency vehicles on or near the high point of the sand hill, whilst minimising disturbance to the natural surface. Consultation would be undertaken with the YYNAC to determine the most appropriate arrangement for the emergency access and its use would be restricted to emergency services.

Construction works at the sand hill, on the banks of the Murray and Campaspe rivers and excavation for the spill/sedimentation basins would be undertaken in accordance with an approved CHMP. Additional approval of protocols for the protection of ancestral remains and other unidentified Aboriginal cultural heritage places would also be sought from the YYNAC.

It is acknowledged that in the unlikely event that unidentified Aboriginal cultural heritage places were encountered during construction, there could be a moderate impact on them, while the impact to unregistered ancestral remains could be significant. However, with management measures preventing ground disturbance in place, including contingency arrangements in the CHMP, it is considered the Project would be unlikely to impact on previously unregistered ancestral remains, and the likelihood of impacting on a previously unidentified Aboriginal cultural heritage place would be rare.

12 Historic heritage

The Historic Heritage Impact Assessment (Heritage Insight, 2015a) examined the extent to which the Project is expected to impact registered heritage sites in or adjacent to the proposed Right-of-Way.

The impact assessment found there are no registered heritage sites, heritage places or historic archaeological sites within the proposed Right-of-Way. However, there are a number of registered or potential heritage places within or adjacent to the study area.

Key heritage places within or adjacent to the study area include:

- Echuca Wharf
- Echuca – Historic Area
- Echuca Cemetery and its cast iron gates
- Old Echuca Township Precinct
- A stand of Murray Pines near Reflection Bend on the Murray River
- Echuca North Residential Precinct
- A number of private dwellings including St Leonards Homestead
- Campaspe River Former Weir.

Echuca Wharf, Echuca – Historic Area, Old Echuca Township Precinct, Echuca North Residential Precinct and Campaspe River Former Weir are all outside the proposed Right-of-Way and would not be impacted by the Project.

Echuca Cemetery is a highly significant place within the study area but is also outside the proposed Right-of-Way to the north of Warren Street. It is not formally listed on the Campaspe Heritage Overlay, although its cast iron gates are. The Echuca Cemetery would not be directly or indirectly impacted by the Project.

The preferred alignment crosses the site of the former Echuca Secondary College. A stand of remaining palm trees at the former entrance to the college is within the proposed Right-of-Way, however there is no evidence to suggest that these palm trees are of heritage significance. VicRoads has committed to relocating these palm trees. All other structures on the site have been demolished.

Recently Campaspe Shire Council proposed an amendment to the Campaspe Planning Scheme (Planning Scheme Amendment C101), which would apply the Heritage Overlay to a number of identified heritage precincts and individual places across the municipality.

As part of this amendment, it is proposed to extend two Heritage Overlays: HO79 covering the stand of Murray Pines; and HO41 covering the St Leonards Homestead. These changes would result in an overlap between the Heritage Overlays and the proposed Right-of-Way. The proposed amendment was exhibited between 29 January and 2 April 2015. VicRoads made a submission in relation to Amendment C101 which recommended that any overlap be avoided. Amendment C101 was considered by a Planning Panel in July 2015. The Planning Panel's report had not been released at the time of writing this EES.

At the time of publication none of the sites identified within or adjacent to the study area in Victoria are within the proposed Right-of-Way, and construction activities would be managed to avoid any impacts to identified historic heritage sites. Standard environmental protection measures of VicRoads and Roads and Maritime Services would also be used.

There is a low to moderate likelihood that previously unrecorded historic heritage places or sites exist within the study area. Contingency measures would be included in the Environmental Management Plan to manage the unexpected discovery of previously unregistered and assessed historical cultural heritage sites and features.

12.1 EES objectives

The objective of the Historic Heritage Impact Assessment for the Project, as specified in the EES Scoping Requirements Draft Evaluation Objectives, is "*To avoid or minimise adverse effects on historic cultural heritage values".*

This chapter provides a summary of the Historic Heritage Impact Assessment completed by Heritage Insight (2015a), which is included in EES Technical Appendix F. It describes the historic heritage values within the study area, the potential impacts of the Project on these values, and the management measures proposed to minimise these impacts.

The chapter includes a discussion of the following key issues and requirements as they relate to historic heritage, as specified in the EES Scoping Requirements for the Project.

Key issues

- *The potential for the loss of significant historical heritage values.*

Priorities for characterising the existing environment

- *Identify and document known and previously unidentified historic heritage values within the Project area, including any areas of significant archaeological interest, in accordance with the Guidelines for Conducting Archaeological Surveys (Heritage Victoria, 2008), as updated in 2013.*

Design and mitigation measures

- *Identify and describe potential and proposed design and mitigation measures to address effects on any…historic cultural heritage.*

Assessment of likely effects

- *Identify and assess the likely effects on…historic cultural heritage resulting from the Project.*
- *Archaeological investigations are to evaluate the significance, location and extent of historic archaeological sites that may be affected by the Project, in accordance with the Guidelines for Investigating Historical Archaeological Artefacts and Sites (Heritage Victoria, 2012).*

Approach to manage performance

- *Identify in the EES any further methods proposed to manage risks of effects on cultural heritage values, including as part of the EMF…and resulting residual effects.*

The Historic Heritage Impact Assessment focussed on the preferred alignment. The term 'the Project' is used in this chapter to refer to the preferred alignment only.

12.2 Study area

The study area for the Historic Heritage Impact Assessment is broader than the proposed Right-of-Way and includes the township areas of Echuca in Victoria and Moama in NSW in the vicinity of the preferred alignment. It also extends along the Murray River upstream and downstream of the proposed crossing point, where a desktop search was undertaken for shipwrecks on the bed of the river. Within the study area, only areas of heritage importance that have the potential to be impacted by the preferred alignment were assessed. The study area is shown in Figure 12-1.

As the purpose of this EES is to consider the potential effects of the construction and operation of the Project within Victoria, this chapter does not address historic heritage values in NSW. However, as far as VicRoads is aware, there are no historic heritage issues in NSW which would materially impact the Project in Victoria. NSW historic heritage is discussed in the Historic Heritage Impact Assessment in EES Technical Appendix F.

12.3 Methodology

The following activities were undertaken, both prior to and as part of the EES process, to inform the Historic Heritage Impact Assessment:

- A literature review of published and unpublished historical sources, including a detailed review of the planning investigation
- A search of the following Commonwealth, State and local databases to identify any registered heritage sites within the study area:
  - Victorian Heritage Register
  - Victorian Heritage Inventory
  - Register of the National Trust
  - National Heritage List
  - Campaspe Planning Scheme Heritage Overlay.
- An archaeological survey completed by Terra Culture Pty Ltd (2000b) that included:
  - A survey assessing a similar route to the preferred alignment
  - An assessment of the previous Central Option.
- Additional archaeological field surveys, comprising:
  - A 2008 survey investigating a route similar to the current Mid-West Option
  - A 2011 survey investigating four earlier alignment options (Mid-West options 2A-2D)
  - A 2014 survey investigating the preferred alignment.
- Consultation in 2008 and 2014 with the Echuca Historical Society and the Echuca Cemetery Trust to discuss known heritage issues
- Consultation with the Shire of Campaspe in 2014 to discuss the proposed Amendment C101 to the Campaspe Planning Scheme
- Identification of impact pathways, development of consequence criteria and assessment of initial and residual risks following implementation of VicRoads' standard environmental protection measures
- Assessment of the impacts of the Project against the 'No Project' scenario.

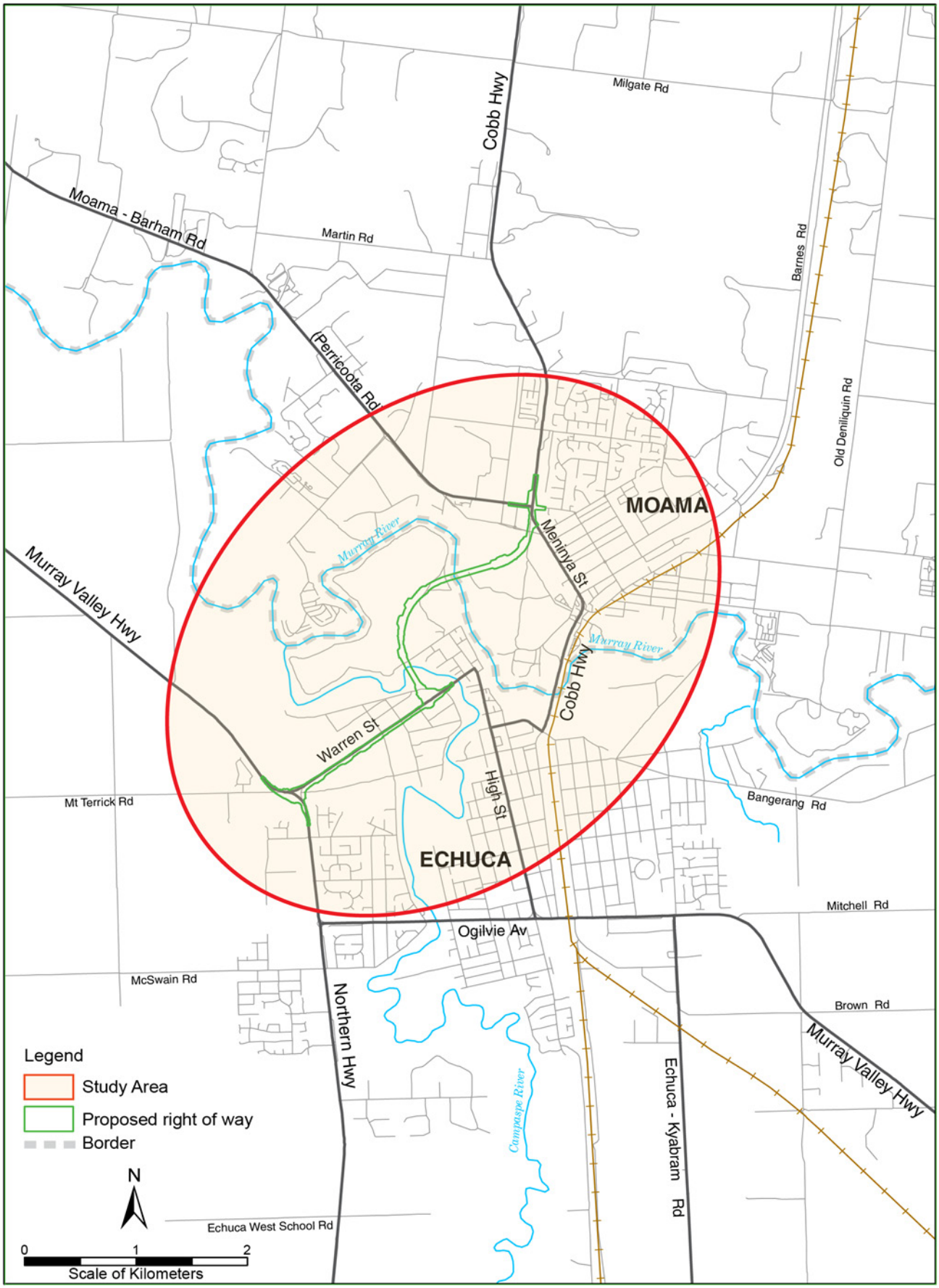

Figure 12-1 Study area

12.4 Legislation and policy

The relevant legislation and policies for historic heritage are outlined in Table 12-1.

Table 12-1 Relevant legislation and policies for historic heritage

Legislation/policy	Description
Commonwealth	
Environment Protection and Biodiversity Conservation) Act 1999 (Cwlth.)	The Environment Protection and Biodiversity Conservation Act provides that certain matters – in particular actions that are likely to have a significant impact on a Matter of National Environmental Significance (MNES) – are subject to a rigorous assessment and approval process. There are two categories of MNES that relate to heritage places: ➢ World Heritage Properties (places of outstanding cultural or natural heritage significance at a world scale which are included on the World Heritage List) ➢ National Heritage Places (places of outstanding cultural heritage significance to Australia that are included on the National Heritage List). In addition, the Act requires the Australian Government to protect places on the Commonwealth Heritage List (for significant heritage places owned or controlled by Australian Government organisations).
National Trust	The National Trust is a community-based, non-government organization, and as such it has no statutory power. A National Trust classification means that a place has been recognised for its cultural heritage significance. If a classified place becomes threatened, the National Trust will take action to preserve it through advocacy and campaigns. The National Trust also liaises with the government bodies, such as Heritage Victoria, to obtain legal protection for a place and encourages appropriate and sensitive planning in recognised historic precincts.
State	
Heritage Act 1995 (Vic.)	The purpose of the Heritage Act is to "provide for the protection and conservation of places and objects of cultural heritage significance and the registration of such places and objects" (s.1). There are two levels of protection for cultural heritage places: ➢ Victorian Heritage Register: The Victorian Heritage Register registers Victoria's most significant heritage places and objects. These can be searched on the Victorian Heritage Database ➢ Heritage Inventory: The Heritage Inventory lists all recorded historical archaeological sites in Victoria. It includes information about sites and artefacts, including a description and assessment of significance. Under the Heritage Act, it is an offence to damage or disturb unregistered archaeological places or objects (s.127) of registered places or objects without consent (s. 129) and the discovery of archaeological places or objects must be reported (s.132). An archaeological object is any archaeological deposit or artefacts which are 50 or more years old (s.3). An archaeological site (or place) under the Act is any area in which archaeological objects are situated (s.3). Previously unrecorded archaeological sites are also protected under the Heritage Act.
Planning and Environment Act 1987 (Vic.)	The Planning and Environment Act outlines specific objectives for planning in Victoria, including objectives relating to the protection of natural and man-made resources, the maintenance of ecological processes and genetic diversity, and the conservation and enhancement of those buildings, areas or other places which are of scientific, aesthetic, architectural or historical interest, or otherwise of special cultural value. The Planning and Environment Act provides for the creation of planning schemes (refer below), and for the Minister for Planning to prepare a set of standard provisions for all planning schemes called the Victoria Planning Provisions (VPP).
Local	
Campaspe Planning Scheme	A planning scheme sets out objectives, policies and provisions relating to the use, development, protection and conservation of land in the area to which it applies. The applicable planning scheme within the Victorian proportion of the study area is the Campaspe Planning Scheme. A set of standard provisions called the VPP forms a template for all planning schemes. Included in the VPP is the State Planning Policy Framework (SPPF), which covers strategic issues of State importance. The objective of Clause 15.03-1 Heritage conservation of the SPPF is "To ensure the conservation of places of heritage significance." The Campaspe Planning Scheme also contains local policies relating to the protection and conservation of heritage places, namely: ➢ Clause 22.02 Heritage Policy ➢ Clause 22.03 Port of Echuca Heritage Policy. In addition, the Campaspe Planning Scheme includes a number of Heritage Overlays (HOs). Places of natural or cultural heritage significance to a locality can be protected by a HO. HOs include places of local significance as well as places included in the Victorian Heritage Register.

12.5 Existing conditions

There are no previously registered heritage sites, heritage places or historic archaeological sites within the proposed Right-of-Way in Victoria.

However, there are a number of registered or potential heritage places within or adjacent to the study area. A description of each site is outlined in Table 12-2 and the locations illustrated in Figure 12-3.

12.5.1 Brief history of the study area

The early settlement of Echuca and Moama stems largely from the rivalry between John Maiden and Henry Hopwood. In 1842, John Maiden was the superintendent of Perricoota Station on the NSW side of the Murray River, and, taking advantage of the traffic to meat and wool markets in Melbourne, he constructed a punt across the Murray River in the present-day town of Moama (Coulson, 1995).

Henry Hopwood arrived on the Murray River in 1849. Between 1854 and 1857 Hopwood established a punt, inn, two stores, two smiths, a doctor and a bakery to cater for travellers and residents at the junction of the Murray and Campaspe rivers. He subsequently constructed a pontoon and the still extant Bridge Hotel, on the corner of Hopwood Place in Echuca (Coulson, 1995).

The area north of the Victoria Park oval and tennis courts has been used for a range of activities, including cattle grazing, sand mining, a shooting range, timber cutting for firewood, a hockey field and a reserve for social gatherings (Echuca Historical Society, pers. comm. with D Rhodes, 14 August 2008).

Anecdotal historical information indicates that the Victoria Park area was repeatedly logged until recently, and that timber milling also occurred within it. There was extensive logging and removal of timber on this land after floods in 1956 and there was possibly some cropping on the site after this time (Echuca Historical Society, pers. comm. with D Rhodes, 14 August 2008).

12.5.2 Archaeological surveys

There have been previous archaeological surveys for historic heritage sites within or in close proximity to the study area. These surveys included corridors assessed in 2000, 2008 and 2011 by Terra Culture.

Archaeological survey 2000 (Terra Culture)

The survey undertaken in 2000 assessed the Central Option (refer to Chapter 2 for a description and map of this area). Sites recorded within Victoria as part of this survey comprised three small scatters of historic artefacts and structural remains. Artefacts found included early 20th century domestic materials, such as bottle glass and ceramics, and remnants of structural materials such as broken hand-made bricks.

It was suggested these artefacts may have been derived from logging camps or Depression era camps on the floodplain. These sites were all highly disturbed. The sites are registered on the Victorian Heritage Inventory and are considered to be of local significance.

Archaeological survey 2008 (Heritage Insight)

The 2008 field survey assessed the Mid-West corridor (refer to Chapter 2 for a description and map of this area).

There were no historic archaeological sites identified during the 2008 field survey.

The ground surface between Warren Street and the Campaspe River has been extensively disturbed by various types of land use, but particularly by logging and/or firewood cutting. There were no structural features or artefact scatters found in this area.

The St Leonards property on the north side of the Campaspe River is partially within the proposed Right-Of-Way and was inspected during this survey. The homestead is listed in the Shire of Campaspe Heritage Overlay (HO41), but the small section of the grounds that is within the proposed Right-Of-Way is not currently affected by the Heritage Overlay. The original homestead, which is presumably incorporated in the present building, was constructed c. 1857.

The area within the former Echuca Secondary College site was not surveyed in 2008 as access to the school was restricted at this time. Although the college has operated since c. 1903, there were no buildings from that date remaining on the site at the time of the 2008 field survey. The school has since been entirely demolished.

Palm trees, which may have been associated with the original school, are still present on the site and are within the proposed Right-of-Way. Whilst these palm trees have been identified by Heritage Victoria as being of potential local heritage significance, the Historic Heritage Impact Assessment found no evidence to confirm this.

On the west bank of the Murray River there is an existing car park and boat ramp. There are numerous vehicle tracks in this area and the ground surface has been extensively disturbed by vehicles and past timber cutting. This section of the proposed Right-Of-Way crosses Hopwood's 'Junction Paddock'.

Archaeological survey 2011 (Terra Culture)

During 2011, the Mid-West 2 corridor options (2A to 2D – refer to Chapter 2 for a description and map) were surveyed for archaeological sites. Two sites were identified during this survey. One site was comprised of 16 timber piles exposed in the north bank of the Campaspe River along approximately 17m of the riverbank.

The structure is the remains of a timber weir constructed in 1886 to harness water from the Campaspe River for irrigation (Priestley, 1965). The weir was destroyed the following year in a severe flood and was not rebuilt (Priestley, 1965). It is unknown whether there are other structural elements of the weir surviving below the water level but it is likely.

The second site comprised a small surface scatter of dark olive bottle glass and ceramics within the road reserve west of the Echuca Cemetery. The site is likely the remains of a small dump or campsite, which is a common occurrence on the floodplain of the Murray River.

Both sites were assessed as being of low scientific and local heritage significance.

Archaeological survey 2014 (Heritage Insight)

The survey undertaken in 2014 assessed the preferred alignment.

There were no historic archaeological sites, places or structures identified during the 2014 field survey.

It was noted that the proposed Right-Of-Way is very close to the boundary of a brick dwelling on the Heritage Overlay (HO68), comprising a property identified as 279-281 Campaspe Esplanade, Echuca.

During the survey, a visual inspection of the St Leonards Homestead was also carried out by Heritage Insight from outside the property boundary on Warren Street. Substantial modifications to the property had occurred since the 2008 survey: the small brick outbuilding, likely constructed at the same time as the original house in 1857, had been completely demolished; and excavation had been undertaken at the western end of the garden. This excavation, combined with the demolition of the brick outbuilding, is likely to have removed any archaeological features if they had been present.

12.5.3 Planning Scheme Amendment

Campaspe Shire Council has proposed an amendment to the Campaspe Planning Scheme (Planning Scheme Amendment C101) which would apply the Heritage Overlay to a number of identified heritage precincts and individual places across the municipality, including those that were identified in the Campaspe Shire Heritage Gaps Study (2005). The exhibition of Amendment C101 commenced on 29 January 2015 and closed on 2 April 2015.

As part of this amendment, it is proposed to extend two Heritage Overlays: HO79 covering the Murray Pines, and HO41 covering St Leonards Homestead. These changes would result in both HO79 and HO41 extending into the proposed Right-of-Way (refer to Figure 12-4). However, VicRoads has made a submission objecting to Amendment C101. Amendment C101 was considered by a Planning Panel in July 2015. The Planning Panel's report had not been released at the time of writing this EES.

Table 12-2 Identified historic heritage places within or adjacent to the study area

Site name	Description	Registration type	Site reference	Significance
Echuca Wharf	The development of Echuca Wharf and its connection to the railway facilitated the movement of goods through Echuca from points throughout the entire Murray Darling catchment area. This resulted in the Port of Echuca becoming the pre-eminent port for Murray River trade and Victoria's second largest port up until the 1880s. The wharf and railway at Echuca were crucial in the process of Melbourne wresting the status of Australia's economic capital from Sydney.	National Heritage List	Place ID 105777	National
Echuca – Historic Area	The significance of the area relates to: • The buildings which reflect the development of the town as an important commercial centre • The buildings which tell a story of surplus wealth and civic endeavour • The Murray River. The extent of the area is not defined in the National Trust registration.	National Trust	File B2186	National
Echuca Cemetery	The cemetery, particularly the western end of the reserve, contains the burial places of many historic figures associated with the development of Echuca. It incorporates an Aboriginal cemetery and also includes graves of Chinese and Italian market gardeners who moved to Echuca during the 19th and 20th centuries.	National Trust	File B5326	Listed as a file only – not formally registered
Old Echuca Township Precinct	The Old Echuca Township Precinct provides evidence of the earliest settlement of Echuca. Surviving structures from this period of early settlement illustrate the built character and specific activities that were associated with the Port of Echuca.	Campaspe Planning Scheme HO	HO1	Local
Dwelling, 33 Crofton Street Echuca (St Leonards Homestead)	The main St Leonards Homestead building is a substantial two storey brick structure, which has been extensively modified (refer to Figure 12-2). The original homestead, which is presumably incorporated in the present building, was constructed c. 1857.	Campaspe Planning Scheme HO	HO41	Local
Cast Iron Gates, Echuca Cemetery	Echuca Cemetery cast iron gates. The cemetery abuts the northern edge of the proposed Right-of-Way on Warren Street.	Campaspe Planning Scheme HO	HO43	Local
279-281 Campaspe Esplanade, Echuca	Historic brick dwelling.	Campaspe Planning Scheme HO	HO68	Local
Stand of Murray Pine, north of Echuca High School, Victoria Park, Echuca	An extensive sand hill extends between the former Echuca Secondary College site and Reflection Bend on the Murray River. The only remnant stand of Murray Pines in the local area is located on the sand hill.	Campaspe Planning Scheme HO	HO79	Local
Echuca North Residential Precinct	The Echuca North Residential Precinct was developed in conjunction with the river trade and the Port of Echuca. The largely single storey character of this gracious 19th and early 20th century precinct – with its generous setbacks, open garden settings and low front fences – has maintained a sense of 19th century spatial qualities.	Campaspe Planning Scheme HO	HO87	Local

Site name	Description	Registration type	Site reference	Significance
Artefact scatters	Artefact scatters were identified by Terra Culture during an archaeological survey in 2000. These comprised fragments of early 20th century materials, including broken hand-made bricks. It was suggested that these artefacts may have been derived from logging camps or Depression-era camps on the floodplain.	Victorian Heritage Inventory – registration under consideration	H7825-0013 H7825-0014	Local
Campaspe River Former Weir	The site is the remains of a timber weir erected across the Campaspe River in 1886 to store water for irrigation. The weir was destroyed in a flood during 1887 and was not rebuilt. It comprises of a group of 16 timber red gum piles on the north bank and bed of the Campaspe River.	Victorian Heritage Inventory	H7825-0032	Local
Jarman Street artefact scatter	A surface scatter of dark olive bottle glass and ceramics. The site is located entirely within an unused road reserve west of Echuca Cemetery, and is interpreted as the remains of a small 19th century dump.	Victorian Heritage Inventory	H7825-0033	Local
Former Echuca Secondary College site	The former Echuca Secondary College was originally established c. 1912. All buildings at the site have now been demolished, with only the entrance gates and associated vegetation, including three palm trees, remaining. These palm trees have been identified by Heritage Victoria as being of potential local heritage significance; however the Historic Heritage Impact Assessment found no evidence to confirm this.	Not currently recognised as a heritage place	-	Palm trees at entrance identified as being of potential local significance

Figure 12-2 St Leonards Homestead

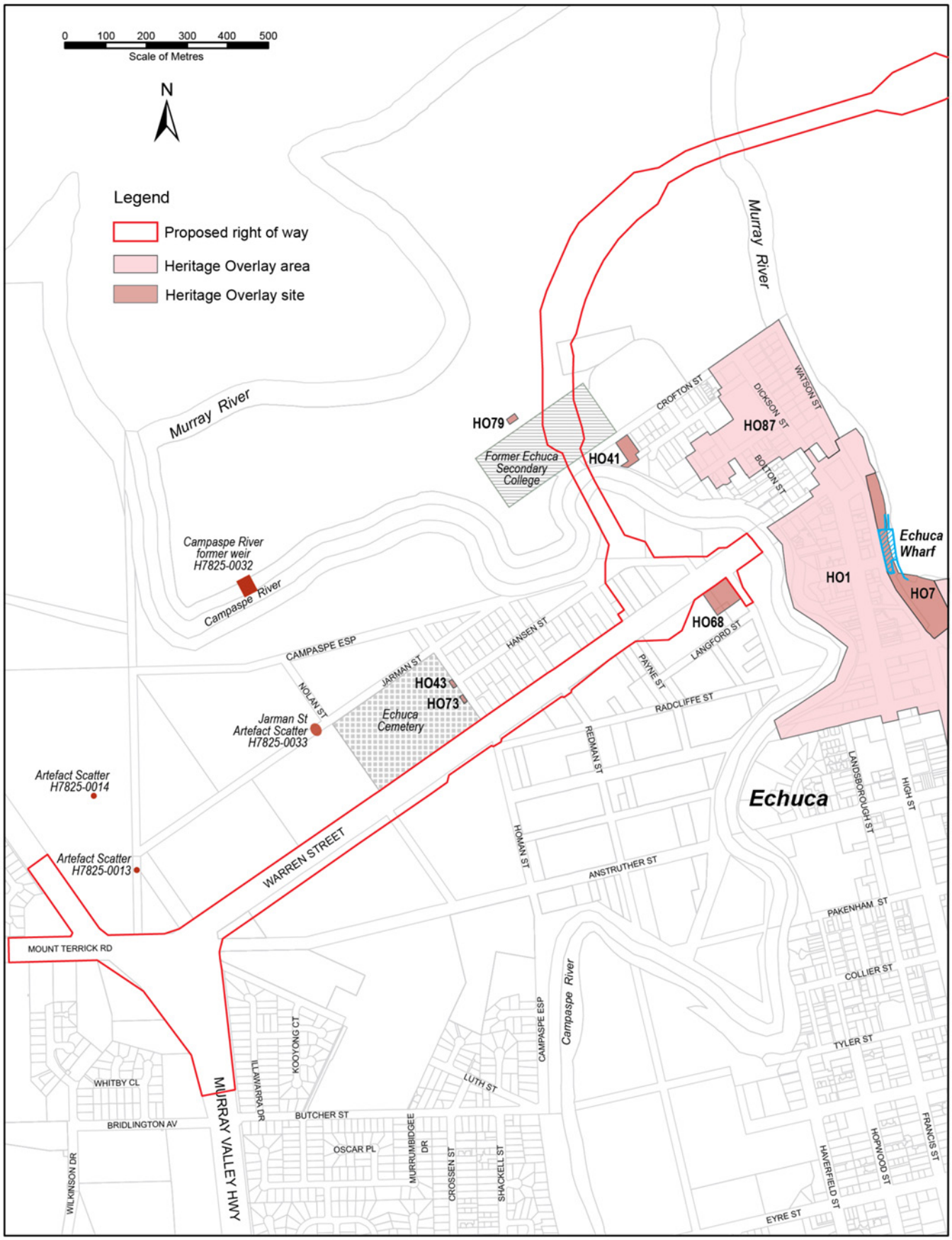

Figure 12-3 Location of identified historic heritage places within or adjacent to the study area

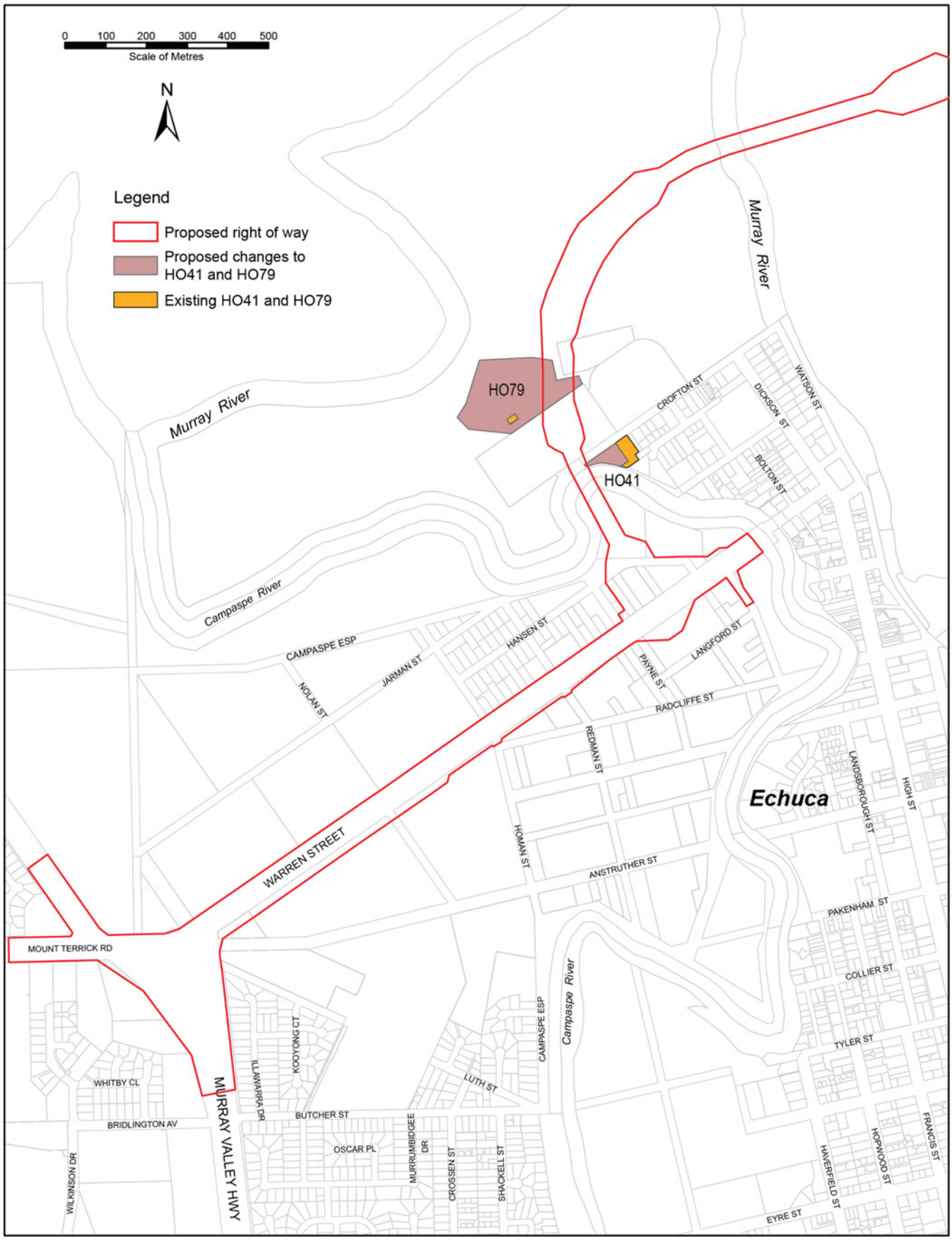

Figure 12-4 Proposed changes to HO41 and HO79 as part of Campaspe Planning Scheme Amendment C101

12.6 Impact assessment

To assess the potential impact of the Project on historic heritage, impacts on the following values were considered, based on the ultimate duplication:

- Registered historic places
- Potential historic places.

Both direct impacts to historic places (i.e. the Project directly encounters the historic place within the proposed Right-of-Way) and indirect impacts (i.e. the Project may result in changes in the context and setting of the historic place) were considered.

Impacts on registered historic places

The preferred alignment would not impact on any registered historic heritage sites, heritage places or archaeological sites in either Echuca or Moama during construction or operation.

There are no registered historic heritage sites, heritage places or archaeological sites within the proposed Right-of-Way (except for those described below that are subject to Amendment C101).

Construction activities would be managed to avoid any impacts to identified historic heritage sites.

Impacts on potential historic places

Proposed Planning Scheme Amendment C101

As described in section 12.5, proposed Amendment C101 to the Campaspe Planning Scheme would increase the extent of two existing heritage overlays: HO41 (Dwelling, 33 Crofton Street Echuca – St Leonards Homestead) and HO79 (Murray Pine Tree Stand, north of the former Echuca Secondary College site). These changes would result in both HO79 and HO41 extending into the proposed Right-of-Way. VicRoads has made a submission objecting to Amendment C101. Amendment C101 was considered by a Planning Panel in July 2015. The Planning Panel's report had not been released at the time of writing this EES.

The potential impacts of the Project, if these overlays are extended, are discussed below.

HO41 – St Leonards Homestead

If Amendment C101 is approved, the preferred alignment would impact on the far western edge of HO41. However, the preferred alignment would not impact on the main dwelling or on any buildings or vegetation within HO41.

A visual inspection from the property boundary in 2014 by Heritage Insight confirmed that the portion of the property that is proposed to be included in HO41 has been extensively modified. A small brick outbuilding, likely constructed at the same time as the original house in 1857, has been demolished. The structure of the original stables building, also likely constructed during 1857, has been completely altered. A driveway to the former stables building has been truncated across the western end of the garden and most of the extant plantings present in 2008 have been removed. Heritage Insight considers these works are likely to have removed any archaeological features if they had been present.

As the property has been extensively modified and the Project does not directly impact any structures or vegetation, the impact of the Project on HO41 (St Leonards Homestead) is considered to be minor.

HO79 – Stand of Murray Pines

Planning Scheme Amendment C101 proposes to extend HO79 to include all Murray Pines remaining on the sand hill adjacent to the former Echuca Secondary College site.

The stand of Murray Pines was shown on a plan of Echuca produced by surveyor, Phillip Chauncy in 1854 (Ward, 1992). The historical significance of the stand of Murray Pines has not been assessed as part of this EES. However, Ward (1992) notes that as it was identified in an early survey as a prominent landscape feature, it is considered to be of local historic heritage significance.

The Project would impact on 13 of 77 Murray Pines within an area of the sand hill surveyed by Brett Lane & Associates (2015) that are likely to date from the time before European settlement (BL&A, pers. comm. by email to VicRoads, 28 January 2015). These 13 Murray Pines would be situated within HO79 if Planning Scheme Amendment C101 is approved.

The impact of the Project on the heritage value of the stand of trees is considered to be minor.

Figure 12-5 Stand of Murray Pines

Palm trees at former Echuca Secondary College site

The three palm trees located at the entrance of the former Echuca Secondary College site have been assessed by Heritage Victoria as being of potential heritage significance. However, these trees are not currently recognised as a registered heritage place, and there is no evidence to suggest that they are of heritage significance.

Three of these palm trees are within the proposed Right-of-Way and two would be impacted by the Project. Given that their heritage status is currently indeterminate, it is considered that there would be no heritage impact associated with removing these trees, and as such this has not been assessed as a heritage risk.

VicRoads has committed to relocating the palm trees (refer to Chapter 6) and would liaise with the Campaspe Shire Council to determine if there is an appropriate location for the trees within the Shire.

Figure 12-6 Palm trees at former Echuca Secondary College site

Potential for indirect impacts on historic places

HO68 - 279-281 Campaspe Esplanade, Echuca

The proposed Right-of-Way passes close to, but outside the northern boundary of, an historic brick dwelling on Campaspe Esplanade which is listed as HO68.

The Heritage Overlay protects the building and grounds up to the title boundary. The proposed Right-Of-Way is outside the northern boundary of this property. Given that the proposed Right-Of-Way is outside the area protected by the Heritage Overlay, there will be no impacts on the property or dwelling.

It is not considered that there would be any indirect impacts on the heritage values of the dwelling as a result of the Project.

Echuca Cemetery

The Echuca Cemetery is of very high historical and social value. It is not listed on the Campaspe Heritage Overlay, although the gates to the cemetery are listed (HO43 and HO73).

The Echuca Cemetery and gates are located north of Warren Street and is outside the proposed Right-Of-Way. Therefore the Echuca Cemetery would not be directly impacted by the Project.

It is not considered that there would be any indirect impacts on the heritage values of the Echuca Cemetery as a result of the Project. This was confirmed through discussions with the Echuca Cemetery Trust.

Previously undiscovered heritage places

There is the potential to encounter previously unregistered and unassessed cultural heritage sites during construction, which could result in damage to these sites.

Given the results of previous archaeological surveys in the area, it is considered unlikely that a previously unregistered site would be encountered.

An Environmental Management Plan would be prepared which would include contingency measures (listed in Table 12-4) to manage unexpected discovery of previously unregistered and unassessed historic heritage sites and features.

With these management measures in place, it is considered that any impacts to heritage values would be minor.

12.7 Risk assessment

An environmental risk assessment was undertaken for the preferred alignment to identify key environmental issues associated with the construction and operation of the Project. The methodology for this risk assessment is described in Chapter 5 and details of the assessment are provided in EES Technical Appendix F. Table 12-3 is a summary of the following for historic heritage:

- The identified impact pathways
- A description of the consequence
- The initial risk rating, prior to the implementation of Project-specific environmental management measures.

Table 12-3 Historic heritage risks

Risk no.	Impact pathway	Description of consequence	Initial risk rating
HH1	Construction encounters previously unregistered and unassessed historical heritage site	Damage/destruction to a previously unregistered or unassessed historic archaeological site	Medium
HH2	Construction encounters Murray Pine tree stand (HO79) north of the former Echuca Secondary College site	Damage/destruction of a landscape feature that is within a Campaspe Planning Scheme Heritage Overlay	High
HH3	Alignment encounters heritage listed area of the Old Echuca township and Victoria Park (HO1)	Damage/destruction of a heritage place that is within a Campaspe Planning Scheme Heritage Overlay	Negligible
HH4	Alignment encounters St Leonards Homestead (HO41)	Damage/destruction of a heritage place that is within a Campaspe Planning Scheme Heritage Overlay	Negligible
HH5	Alignment encounters Dwelling, 279-281 Campaspe Esplanade (HO68)	Damage/destruction of a heritage place that is within a Campaspe Planning Scheme Heritage Overlay	Negligible

12.8 Environmental management measures

VicRoads has a standard set of environmental protection measures which are typically incorporated into its construction contracts for road works and bridge works. These measures have been used as the starting point for the assessment of construction-related risks and are listed in Chapter 20 and described in detail in EES Technical Appendix O – Section 177 Environmental Management. In some instances, additional Project-specific environmental management measures have been recommended by specialists to reduce risks relating to construction and operation.

Project-specific environmental management measures specific to each identified impact pathway for historic heritage are outlined in Table 12-4. This table also shows the residual risk rating after the implementation of VicRoads' standard environmental protection measures and Project-specific environmental management measures.

Table 12-4 Historic heritage management measures

Risk No.	Environmental management measures	Residual risk rating
HH1	Avoidance or alternatively reporting and approval would be obtained from relevant authorities (Heritage Victoria) prior to damaging, disturbing or otherwise impacting cultural heritage sites. Conduct salvage works on the site in accordance with Heritage Victoria conditions.	Low
HH2	Planning approval to impact on area of Heritage Overlay crossed by the preferred alignment to be obtained from the relevant authority prior to works commencing. Works to be conducted in accordance with conditions in any required planning approval. This applies only if Planning Scheme Amendment C101 is approved.	Medium
HH3	Planning approval to impact on area of Heritage Overlay crossed by the preferred alignment to be obtained from the relevant authority prior to works commencing. Works to be conducted in accordance with conditions in any required planning approval. Adopt sympathetic materials/colours for the bridge and/or complementary landscaping.	Negligible
HH4	As per HH2 above. Obtain a Consent to Disturb approval for impacts on any archaeological features from Heritage Victoria pursuant to the Heritage Act. Ensure design of the Project does not impact on the property and heritage features within the boundary of HO41.	Negligible
HH5	Works to be conducted in accordance with conditions in planning approval.	Negligible

12.9 Conclusion

The Historic Heritage Impact Assessment found there are no registered heritage sites, heritage places or historic archaeological sites within the proposed Right-of-Way for the Project.

However, there a number of registered or potential heritage places within or adjacent to the study area.

Of these, Echuca Cemetery is a highly significant place but is outside the proposed Right-of-Way and would not be impacted by the Project. The Echuca Cemetery itself is not formally listed on the Campaspe Heritage Overlay, although its cast iron gates are listed (refer to HO43).

A group of remaining palm trees at the entrance to the former Echuca Secondary College is within the proposed Right-of-Way and has been assessed as being of potential heritage significance by Heritage Victoria. However, these trees are not currently recognised as a registered heritage place, and there is no evidence to suggest that they are of heritage significance. Two of these palm trees would be impacted by the Project, but the Historic Heritage Impact Assessment concluded there would be no heritage impact associated with removing these trees. VicRoads has committed to relocating the palm trees.

A proposed amendment to the Campaspe Planning Scheme (Planning Scheme Amendment C101) proposes to extend two Heritage Overlays: HO79 covering the stand of Murray Pines near Reflection Bend on the Murray River; and HO41 covering the St Leonards Homestead in Crofton Street. These changes would result in both sites being within the proposed Right-of-Way and being impacted by the Project. The exhibition of Amendment C101 commenced on 29 January 2015 and closed on 2 April 2015. VicRoads has made a submission objecting to Amendment C101. Amendment C101 was considered by a Planning Panel in July 2015. The Planning Panel's report had not been released at the time of writing this EES.

At the time of publication of this EES none of the sites identified as being within or adjacent to the study area are within the proposed Right-of-Way in Victoria, and construction activities would be designed to avoid any impacts to identified historic heritage sites. VicRoads standard environmental protection measures would be sufficient to avoid any damage to registered historic sites.

Contingency measures would be included in the Project's Environmental Management Plan to manage the unexpected discovery of previously unregistered historical heritage sites and features, although such discoveries are considered unlikely.