16. Water quality

This chapter provides a summary of the water quality impact assessment of the proposal. It describes the existing environment, assesses the impacts of construction and operation, and provides recommended mitigation measures. The full assessment report is provided as Technical Report 7.

16.1 Assessment approach

16.1.1 Methodology

A qualitative water quality assessment was undertaken, involving:

- reviewing design information
- reviewing existing conditions using GIS mapping to identify locations of sensitive receiving environments, such as channels, watercourses, wetlands, national parks, conservation areas, and nature reserves
- identifying water quality objectives for the catchments in which the proposal site is located from the *NSW Water Quality and River Flow Objectives* website
- reviewing the existing and the proposed corridor hydrological conditions (described in chapter 15) to identify risks to water quality that are related to hydrology
- assessing the potential impacts of the proposal on water quality
- identifying measures that could be used to mitigate the impact of construction and operation.

16.1.2 Legislative and policy context to the assessment

The main NSW legislation relevant to water quality are the POEO Act, the *Water Management Act* 2000 and the *Water Act 1912*.

Section 120 of the POEO Act prohibits the pollution of waters by any person. Under section 122, the holding of an environment protection licence is a defence against accidental pollution of watercourses. The Act permits (but does not require) an EPL to be obtained for a non-scheduled activity for the purpose of regulating water pollution resulting from that activity. As noted in section 3.4.3, ARTC holds an EPL to carry out railway systems activities on certain parts of the NSW rail network. With respect to water quality, the licence requires ARTC to comply with section 120 of the POEO Act.

The *Water Management Act 2000* and *Water Act 1912* control the extraction of water, the use of water, the construction of works such as dames and weirs, and the carrying out of activities in or near water sources in NSW. The provisions of the *Water Management Act 2000* are being progressively implemented to replace the *Water Act 1912*.

The area in which the proposal site is located is subject to the water sharing plan for the *Lachlan Unregulated and Alluvial Water Sources*. This is a statutory instrument made under section 50 of the *Water Management Act 2000*, which includes rules for protecting the environment, water extractions, managing licence holders' water accounts, and water trading in the plan area.

As the proposal is State significant infrastructure, an activity approval is not required to undertake works in or near waterfront land (described in section 3.4). However, the design and construction of the proposal would take into account the Office of Water's *Guidelines for Controlled Activities on Waterfront Land*.

The *NSW Aquifer Interference Policy* (NSW Office of Water, 2012) explains the water licensing and impact assessment processes for aquifer interference activities under the *Water Management Act 2000* and other relevant legislation. Further information is provided in section 3.4.

The *National Water Quality Management Strategy* is a nationally agreed set of policies, processes, and 21 guidelines documents developed jointly by the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) and the Australian and New Zealand Environment and Conservation Council (ANZECC). The strategy establishes objectives to achieve sustainable use of the nation's water resources by protecting and enhancing their quality. The strategy contains healthy river guidelines for the protection of lowland river aquatic ecosystems.

The *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (known as the ANZECC 2000 guidelines) (ANZECC/ARMCANZ, 2000a) forms part of the strategy. This document sets water quality guidelines (numerical concentration limits or descriptive statements) for a range of ecosystem types, water uses (environmental values), and water quality indicators for Australian waters.

In 2006, water quality and river flow objectives were developed for 31 river catchments in NSW based on the ANZECC 2000 guidelines. The objectives (the *NSW Water Quality and River Flow Objectives*) are the agreed environmental values and long-term goals for NSW's surface water receptors. Guidance to using the ANZECC 2000 guidelines and the NSW water quality objectives is provided by *Using the ANZECC Guidelines and Water Quality Objectives in NSW* (DEC, 2006d).

16.2 Existing environment

16.2.1 Catchments and water quality

The majority of the proposal site is located within the Macquarie-Bogan River basin. A small portion of the proposal site, between the southern end and about seven kilometres north-west of Parkes, is located within the Lachlan River basin.

A total of 15 ephemeral watercourses with a stream order of three or above cross the proposal site. Flow occurs in these watercourses during and after rainfall events, and the watercourses dry out between rainfall events.

Further information on the existing hydrological environment is provided in section 15.2.

16.2.2 Existing water quality

There is no existing water quality data for the watercourses crossing the proposal site. No data has been collected as part of this assessment due to the ephemeral nature of the watercourses.

The *National Water Quality Assessment 2011* (SKM, 2011) classified the water quality of the Lachlan and Macquarie-Bogan river catchments as being relatively poor (refer to Table 16.1), exceeding the ANZECC 2000 guidelines for a number of criteria. This was based on data from 15 sites in the Lachlan River catchment and 17 sites in the Macquarie-Bogan River catchment. The *2015 NSW State of the Environment report* (EPA, 2015b) indicates that, for monitored watercourses in the central western region, there was a reduction in electrical conductivity values between 2011–12 and 2014–15, and a reduction in *Escherichia coli* bacterium (E. coli) counts between 2012–13 and 2014–15.

Table 16.1 Existing water quality data

Parameter	Lachlan River catchment	Macquarie-Bogan river catchment
Turbidity	Fair - 31% of samples exceeded guideline values	Good - 76% of samples complied with ANZECC 2000 guideline values
Salinity	Fair - 50% of samples exceeded guideline values	Poor - Range 92-1,140 µS/cm
pH	Good - 85% of samples within catchment within guideline values	Fair

Parameter	Lachlan River catchment	Macquarie-Bogan river catchment
Total nitrogen	Very poor - 96% of samples did not meet guideline values Median values at sites ranged from 456-860 µg/L	Very poor - Median values at sites ranged from 370-1,1200 µg/L
Total phosphorus	Poor - 72% of samples did not meet guideline values Median values at sites ranged from 12-83 µg/L	Very poor - Median values at sites ranged from 21-154 µg/L

16.2.3 Water quality objectives and criteria

The *NSW Water Quality and River Flow Objectives* provides water quality objectives for the Macquarie-Bogan and Lachlan river catchments, for the protection of:

- aquatic ecosystems
- visual amenity
- primary contact recreation
- secondary contact recreation
- livestock water supply
- irrigation water supply
- homestead water supply.

The water quality objective for aquatic ecosystems is to 'maintain or improve the ecological condition of waterbodies and their riparian zones over the long term'. The indicators and criteria (trigger values) for this objective are listed in Table 16.2. These are based on the ANZECC 2000 guideline default trigger values for the protection of aquatic ecosystems in slightly disturbed river ecosystems in south-eastern Australia.

Table 16.2 Trigger values for water quality parameters

Indicator	Criteria (lowland rivers)
Total phosphorus	50 µg/L
Total nitrogen	500 µg/L
Chlorophyll-a	5 g/L
Turbidity	6–50 NTU
Salinity (electrical conductivity)	125–2,200 µS/cm
Dissolved oxygen (per cent saturation)	85–110 %
pH	6.5–8.5
Oils and petroleum hydrocarbons	Insufficient data to give trigger value although the EPL is likely to require no visible oils or sheen in discharge water

A detailed list of the indicators and criteria for the other water quality objectives for the Lachlan and Macquarie-Bogan catchments is provided in Technical Report 7. The drinking water objectives were not considered due to the predominantly rural land use in the study area and the potential for water to be extracted for multiple uses. Drinking water objectives apply to all current and future licensed offtake points for town water supply, and to specific sections of rivers that contribute to drinking water storages or immediately upstream of town water supply offtake points. The objectives also apply to sub-catchments or groundwater used for town water supplies. No drinking water supply points were identified within the proposal site.

The Macquarie-Bogan River and Lachlan River catchments contain the following environmental values (DPI (Water), 2017):

- the Ramsar listed Macquarie Marshes, which is an important ecological site located about 200 kilometres downstream of Narromine in the Macquarie-Bogan River catchment
- nine wetlands, which are featured in the Directory of Important Wetlands In Australia, including Lake Cowal, Lake Brewster, Booligal wetlands and Great Cumbung Swamp (Lachlan River catchment). None of these wetlands are located within 100 kilometres of the proposal site.

16.3 Impact assessment

16.3.1 Risk assessment

Sensitive receiving environments

A sensitive receiving environment is one that has a high conservation value, or supports human uses of water that are particularly sensitive to degraded water quality (DECC, 2008). With regard to the potential impacts of the proposal, sensitive receiving environments are considered to include:

- nationally important wetlands
- National parks, nature reserves and state conservations areas
- threatened ecological communities associated with aquatic ecosystems
- known and potential habitats for threatened fish
- key fish habitats
- recreational swimming areas
- areas that contribute to drinking water catchments.

The watercourses in the proposal site are ephemeral and do not contain any significant sensitive environments. However, as described in chapter 10, a number of rivers and creeks that cross the proposal site, including Burril Creek, Ten Mile Creek, and Bradys Cowal, are key fish habitats, and a number of threatened species have been identified. Additionally, the watercourses in the proposal site are within the catchments of the Lachlan, Macquarie and Bogan rivers. These catchments are sensitive receiving environments that contain the environmental values described in section 16.2.3.

The design control measures considered in this section, and the mitigation measures provided in section 16.4, have been developed to protect the identified sensitive receiving environments and their associated environmental values, where relevant to the proposal.

Potential impacts

The environmental risk assessment for the proposal (summarised in Appendix B) included an assessment of the potential risks to water quality associated with the construction and operation of the proposal. The assessed level for the majority of potential water quality risks was medium to high. Risks with an assessed level of medium or above include:

- reduced water quality (including increased total suspended solids and turbidity) as a result of erosion and sedimentation near watercourses
- contamination due to spills and leaks
- impacts on groundwater quality and quantity during drawdown/extraction
- modification to existing drainage infrastructure resulting in water quality impacts
- impact to surface water quality and receiving environments due to increased runoff from impervious areas.

How potential impacts would be avoided and minimised

As the watercourses crossing the proposal site are ephemeral the main potential for impacts would occur during and following rainfall events. Potential impacts on water quality would be minimised by managing water quality in accordance with the requirements of the POEO Act and the environment protection licence for the proposal.

Potential impacts that are unable to be avoided would be minimised by designing, constructing, and operating the proposal so that potential impacts on hydrology are minimised, which in turn mitigates the potential for water quality to be impacted by increases in sediment loads in runoff.

This would include the following:

- designing flow discharge points (structures) to include erosion controls, such as rock protection, to slow flow velocities and minimise the risk of erosion as surface water enter and exits the structure
- designing culverts to have a minimal impact on existing surface flow paths across the proposal route
- locating structures in positions that are natural low points along the proposal site to avoid creating new water storage areas and facilitate fish passage
- incorporating protection measures, such as sedimentation basins, water quality ponds, and spill basins as required
- designing batters and retaining structures using appropriate slope gradients to minimise erosion, or using terracing
- design of ballast drainage to discharge to suitable outlets and control points
- selection of fill material for embankments to minimise the risk of erosion.

The design of the proposal has taken into account the requirements of relevant water sharing plans by:

- including culverts that would minimise the need for excavation and potential shallow aquifer interaction
- restricting the potential amount of water extraction for construction purposes (described in section 15.3.2).

Implementing the water quality mitigation measures provided in section 16.4.3 would also minimise the potential for water quality impacts. These measures would minimise the potential impacts on relevant water sharing plans (listed in 16.1.2).

Implementation of the design control measures identified above and the water quality measures provided in section 16.4.3 would enable the proposal to be designed, constructed, and operated to avoid or minimise water pollution, and protect human health and the environment.

16.3.2 Construction impacts

Potential water quality impacts

Construction presents a risk to downstream water quality if management measures are not implemented, monitored, and maintained throughout the construction period. If inadequately managed, construction activities can impact water quality if they disturb soil or watercourses, result in the uncontrolled discharges of substances to watercourses, or generate contamination.

Potential sources of water quality impacts include:

- increased sediment loads from exposed soil transported off-site to downstream watercourses during rainfall events
- increased sediment loads from discharge of sediment laden water from dewatering of excavations
- increased levels of nutrients, metals and other pollutants, transported in sediments to downstream watercourses or via discharge of water to watercourses
- chemicals, oils, grease and petroleum hydrocarbon spills from construction machinery directly polluting downstream watercourses
- litter from construction activities polluting downstream watercourses
- contamination of watercourses due to runoff from contaminated land.

The downstream effects of water quality impacts include:

- smothering aquatic life and/or inhibiting photosynthesis conditions for aquatic and riparian flora
- impacts to breeding and spawning conditions of aquatic fauna
- changes to water temperature due to reduced light penetration
- impacts to the ecosystems of downstream sensitive watercourses, wetlands and floodplains
- increased turbidity levels above the design levels of water treatment infrastructure
- reduced visibility in recreation areas.

The potential for soil and contamination impacts during construction are considered in chapter 14. Waste management impacts and mitigation measures are considered in chapter 24. The main potential sources of water quality impacts for the proposal are considered in the following sections.

Changes to surface water flows

Changes to surface water flows can impact water quality – an increase in flow rate and volume can lead to increased erosion and turbidity. The potential impacts of changes to surface water flows are considered in chapter 15.

Works in watercourses

The proposal involves works in watercourses to upgrade culverts and undertake track works. These works would disturb bed and bank substrates, and potentially lead to localised erosion and sediment transport downstream. As described in section 15.3.1, the proposal includes a number of design features, particularly in relation to culvert upgrades, to minimise the potential for impacts to watercourses and therefore water quality. This includes the use of pre-fabricated concrete culverts to minimise the extent of disturbance to watercourses.

Earthworks, stockpiling, and general runoff from construction sites

Excavations and the construction of embankments can impact water quality in downstream watercourses as a result of erosion. Runoff from stockpiles has the potential to impact downstream water quality during rainfall if the stockpiles are not managed appropriately. Sediments from the stockpiles could wash into watercourses, increasing levels of turbidity. This in turn could have the following impacts on human health and the environment:

- reduce the aesthetic quality of receiving watercourses
- harm fish and other aquatic life by reducing food supplies, affecting gill function and degrading spawning beds
- reduce light penetration and visibility
- increase surface water temperature.

Stockpiling cleared vegetation creates a risk of tannins leaching into watercourses, resulting in an increased organic load. Discharge of water high in tannins can increase the biological oxygen demand of the receiving environment, which may in turn result in a decrease in available dissolved oxygen. Once discharged to the environment, tannins may also reduce visibility, light penetration, and change the pH of receiving waters. These impacts may affect aquatic ecosystems in receiving environments.

Sediment loads in watercourses can increase in the vicinity of hard surfaces (such as roads) and compacted areas (such as construction laydown sites) due to increased surface runoff.

The mitigation measures provided in sections 13.4 and 16.4 would be implemented to minimise the potential for water quality impacts as a result of earthworks, stockpiling, and general runoff from construction sites. In general, with implementation of the mitigation measures provided, water quality impacts due to construction runoff would be negligible when compared to runoff from surrounding agricultural properties following a regional rainfall event.

Pollutant laden runoff or discharge to surface water

Identify and estimate the quality and quantity of all pollutants

In addition to the above, the proposal has the potential to introduce the following pollutants to surrounding watercourses:

- nitrogen and phosphorous – due to use of pesticides and herbicides for weed control
- chemicals, oils, grease, and petroleum hydrocarbons – due to any leaks and spills during construction or the discharge of water from vehicle wash down areas.

By implementing management measures provided in the CEMP, pollutant runoff due to leaks and spills and weed control would be minimal, and would be unlikely to cause long-term harm to human health or the environment.

The exact volume of discharge water and discharge points would be identified prior to construction. Discharge points would take into consideration the hydrological attributes of the receiving watercourse, including whether there is sufficient flow volume and velocity to incorporate the discharge volume.

Maintaining or achieving the water quality objectives

The water quality objectives and their relevance to the proposal are defined in Technical Report 7 (Table 2-2) for both the Lachlan and Macquarie-Bogan river systems, and are summarised in Table 16.2 for those pollutants that the proposal may introduce into the water cycle.

As described in section 16.2 the existing water quality is poor and generally does not meet the water quality objectives provided in Table 16.2. The poor quality is likely to reflect existing soil conditions and agricultural land use practices in the area surrounding the proposal site.

The majority of watercourses in the study area are ephemeral, and agricultural land uses dominate the study area. Therefore, it is considered unlikely that construction and operation of the proposal would have a significant influence on water quality in surrounding watercourses. Any water quality impacts would be short-term only.

However, the proposal would be constructed and operated in accordance with the relevant EPLs. This would mean that any discharge water would meet the water quality objectives provided in Table 16.2 and would be of better quality then that in the surrounding watercourses.

Construction and operation would also be undertaken in accordance with the management measures provided in section 16.4, which would minimise the potential for the proposal to reduce the quality of water in the surrounding watercourses.

Additionally, the proposal (particularly the proposed replacement of culverts and raising of track formation to greater than the level of the one per cent AEP catchment flood event) would mean that flow in watercourses is generally maintained and, with suitable erosion and scour protection measures, potential erosion downstream from culverts would be generally reduced. This would have a beneficial impact on water quality in the study area, with the quality of water more likely to meet the relevant objectives. Implementation of the design control measures identified in section 16.3.1 would not prevent or hinder the development or implementation of any future strategies that may assist in meeting overall water quality objectives for the catchments over the long term.

Groundwater quality

As existing groundwater is predominately perched and recharged by rainfall infiltration (described in section 15.2.3), the volumes of dewatering are likely to be minimal, resulting in minimal long term impacts. Potential risks to groundwater quality from changes to surface water include:

- contamination by hydrocarbons from accidental fuel and chemical spills
- contaminants contained in turbid runoff from unpaved surfaces.

Surface water from site runoff may infiltrate and impact groundwater sources. As the infiltration process is generally effective in filtering polluting particles and sediment, the risk of contamination of groundwater from any pollutants bound in particulate form in surface water, such as heavy metals, is generally low.

Soluble pollutants, such as pH altering solutes, salts and nitrates, as well as soluble hydrocarbons, can infiltrate soils and contaminate the groundwater system. Under certain pH conditions, metals may also become soluble and could infiltrate groundwater.

The mitigation measures provided in section 16.4 would be implemented to minimise the potential for groundwater quality impacts.

16.3.3 Operation impacts

Potential water quality impacts during operation could occur as a result of changes to hydrology or contamination of runoff. The release of toxicants and litter into watercourses during operation (including during maintenance activities) has the potential to impact on surface water quality and consequently on aquatic ecosystems. This also has the potential to impact on other water quality objectives by reducing visual and recreational amenity. During operation, the main risk to surface water from the release of pollutants is from spills or the release of litter and toxicants such as heavy metals, petroleum hydrocarbons and PAHs from vehicles, surface run-off from tracks, and maintenance of rail vehicles. The potential for contamination impacts as a result of accidental spills during operation is considered in section 14.3.3.

The watercourses crossed by the proposal are all moderately disturbed as a result of existing land use practices, and any contribution of contaminants due to surface runoff from the proposal is anticipated to be minimal.

During operation, surface water runoff would be controlled through a drainage system that connects to cross drainage infrastructure at existing drainage lines and watercourses. The drainage system would include scour protection at culvert outlets to minimise the potential for scouring and erosion. Where appropriate, culvert outlets would be lined to minimise scouring.

As described in section 15.3.4, without mitigation, the increase in water flowing through culverts has the potential to result in erosion in some locations. Further modelling would be undertaken during detailed design to confirm the locations and required erosion protection.

16.4 Mitigation and management

16.4.1 Approach to mitigation and management

The main risks to water quality are associated with erosion and sedimentation, and works within ephemeral watercourses. The soil and water management sub-plan prepared as part of the CEMP would include management measures that are commonly implemented during construction of linear infrastructure projects to manage issues associated with erosion and sedimentation that have the potential to impact on water quality. The soil and water management plan would be prepared and implemented in accordance with *Soils and Construction - Managing Urban Stormwater Volume 1* (Landcom 2004) and Volume 2C (DECC 2008). In accordance with these publications management measures would be designed to cope with a ten per cent AEP rainfall event.

Where discharge to surface watercourses is required, a monitoring program would be developed and implemented to assess water quality prior to discharge. Due to the ephemeral nature of the majority of the watercourses discharge to, and monitoring of, surface water would consider the hydrological attributes of the receiving watercourse.

During operation, water quality would be managed to comply with the operational environmental protection licence for the proposal.

16.4.2 Consideration of the interactions between mitigation measures

Mitigation measures to control impacts on water quality may overlap with mitigation measures proposed for the control of soil and contamination, hydrology and flooding, health and safety, waste management impacts.

All mitigation measures for the proposal would be consolidated and described in the CEMP. The plan would identify measures that are common between different aspects. Common impacts and common mitigation measures would be consolidated to ensure consistency and implementation.

16.4.3 Summary of mitigation measures

In addition to the measures provided to manage the potential for soil and contamination impacts (in section 14.4), the following measures would be implemented.

Table 16.3 Water quality mitigation measures

Stage	Impact/issue	Mitigation measures
Detailed design/ pre-construction	Water quality	The design features listed in section 16.3.1 would continue to be refined and implemented to minimise the potential impacts of the proposal on water quality.
	Surface water monitoring framework	A surface water monitoring framework would be developed and implemented, to monitor water quality at discharge points and selected locations in watercourses where works are being undertaken. The framework would include the relevant water quality objectives, parameters, and criteria from Technical Report 7, and specific monitoring locations which have been identified based on the hydrological attributes of the receiving watercourse, in consultation with DPI (Water) and the EPA.

Stage	Impact/issue	Mitigation measures
Construction	Soil erosion and sedimentation	A soil and water management sub-plan would be prepared as part of the CEMP. It would include a detailed list of measures that would be implemented during construction to minimise the potential for soil, water quality and contamination impacts, including: ▸ allocation of general site practices and responsibilities ▸ material management practices ▸ stockpiling and topsoil management ▸ surface water and erosion control practices.
	Surface water monitoring	Water quality would be monitored during construction in accordance with the surface water monitoring framework.
	Discharge to surface water	Discharge to surface water would be undertaken in accordance with the construction EPL, and would consider the hydrological attributes of the receiving watercourse.
Operation	Water quality	The proposal would be managed in accordance with the water quality management requirements specified in the environmental protection licence for ARTC and ARTC's Environmental Management System.

17. Aboriginal heritage

This chapter provides a summary of the Aboriginal cultural heritage assessment and archaeological assessmentof the proposal undertaken by Umwelt. It describes the existing Aboriginal heritage environment, assesses the potential impacts of the proposal, and provides recommended mitigation measures. The full report is Technical Report 8.

17.1 Assessment approach

17.1.1 Methodology

The assessment involved:

- A desktop review of archaeological literature and data to determine if Aboriginal sites have been previously identified within the study area, including a search/review of:
  - Aboriginal Heritage Information Management System (AHIMS) in September 2015 and July 2016 for a 500 metre buffer around the proposal site
  - EPBC Act Protected Matters Search Tool to identify any federally listed Aboriginal heritage sites or places near the proposal site
  - the Parkes and Narromine local environmental plans
  - previous archaeological investigations.
- consultation with registered Aboriginal parties (described below)
- a field survey to identify any visible surface evidence of cultural heritage sites and landforms (described below)
- developing a predictive model to assist in determining archaeological potential
- assessing the potential impacts of the proposal, and preparing the Aboriginal Cultural Heritage Assessment in accordance with the guidelines and requirements described in section 17.1.2.

The Aboriginal heritage assessment considered the potential impacts of the proposal on Aboriginal heritage in the proposal site (described in chapter 2) and, to provide flexibility for the design of culvert and level crossing upgrades, it also considered the following additional assessment areas outside the proposal site:

- an approximate 60 metre buffer around culverts
- an approximate 120 metre buffer around the locations of level crossings.

As described in chapter 2, the need for works in these areas would be determined during detailed design, and may be subject to further archaeological investigation and assessment in accordance with the recommendations of the Aboriginal Cultural Heritage Assessment. These areas do not currently form the proposal site for the purposes of the EIS.

Aboriginal consultation

Aboriginal consultation has been undertaken in accordance with the requirements of *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECC, 2010). This included:

- Notification of the proposal, assessment, and registration of interest, involving:
  - placing advertisements in relevant newspapers (including local newspapers and the Koori Mail) in December 2015

- sending letters to agencies on 9 December 2015 requesting the identification of Aboriginal parties with cultural interest/knowledge in the study area
- sending letters to Aboriginal parties identified by agencies on 8 January 2016 providing notification of the assessment and an opportunity to register their interest for consultation - nine Aboriginal parties registered an interest and are the Aboriginal stakeholders for the proposal.

- Presentation of information about the proposal:
  - a draft copy of the assessment methodology (with a request for comments) and a meeting invite was sent to registered Aboriginal parties
  - meetings were held with registered Aboriginal parties in May 2016.
- registered Aboriginal parties were invited to participate in the field survey, and representatives from five stakeholders participated
- review of draft cultural heritage assessment report - a copy of the draft Cultural Heritage Assessment Report (Technical Report 8) was sent to registered Aboriginal parties for comment.

Further details, including advertisement and meeting dates, and copies of letters and responses, are provided in Technical Report 8.

Site survey

The study team conducted a targeted site survey between 25 July and 2 August 2016. The survey was undertaken in accordance with the requirements for archaeological survey as established in *Code of Practice for Archaeological investigation of Aboriginal objects* (DECCW now OEH 2010). The survey was designed to ensure an adequate sample of landforms within the proposal area.

The survey consisted of vehicle and pedestrian surveys. The vehicle survey was used to obtain a broader understanding of the general environment of the proposal site and was considered appropriate given the highly disturbed nature of the majority of the existing rail corridor. The pedestrian survey focussed on areas of greatest archaeological sensitivity, including previously recorded AHIMS sites and landforms associated with watercourses crossing the proposal site.

The survey also considered the additional assessment areas described above.

17.1.2 Legislative and policy context to the assessment

The main piece of legislation relevant to Aboriginal heritage in NSW is the *National Parks and Wildlife Act 1974* (the NPW Act) and the supporting regulation. The NPW Act defines an Aboriginal object as 'any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales.'

Under Section 84 of the NPW Act, an Aboriginal place must be declared by the Minister as a place that, in the opinion of the Minister, is or was of special significance with respect to Aboriginal culture. Section 86(4) of the NPW Act states that a person must not harm or desecrate an Aboriginal place.

Under the NPW Act, it is an offence to harm or desecrate an Aboriginal object or Aboriginal place. Under section 87(1) of the Act, it is a defence to a prosecution offence if the harm or desecration of an Aboriginal object was authorised by an Aboriginal Heritage Impact Permit (AHIP) and the activities were carried out in accordance with that AHIP. As described in chapter 3, the provisions of the EP&A Act provide an exemption from the requirement for an AHIP for activities approved as State significant infrastructure, however, the other provisions of the NPW Act still apply.

The NPW Act requires due diligence to be exercised to check if Aboriginal sites would be harmed by works. Aboriginal sites recorded by the AHIMS include:

- Aboriginal objects (as defined under the NPW Act) or groups of objects
- an area of land containing Aboriginal objects
- a 'potential archaeological deposit' (or PAD) which is an area where, based on previous investigation, Aboriginal objects are likely to be present

- a declared Aboriginal Place as defined under the NPW Act, which may or may not contain Aboriginal objects
- an Aboriginal site that has been partially or completely destroyed under the conditions of a past consent.

The EPBC Act also provides provisions to list and protect Aboriginal sites or places considered to be of national significance. No Aboriginal sites or places listed under the EPBC Act were identified in the study area, and therefore there are no requirements under the EPBC Act relevant to the assessment.

The assessment was undertaken in accordance with:

- the requirements of the NPW Act
- *Code of practice for archaeological investigation of Aboriginal objects in New South Wales* (DECC, 2010b)
- *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECC, 2010a)
- *Guide to investigating assessing and reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011).

17.2 Existing environment

A summary of the historical context and existing environment with respect to Aboriginal heritage is provided in this section. Further information is provided in Technical Report 8.

17.2.1 Aboriginal historical context

According to Tindale's 1974 map of Aboriginal Australia, the proposal site extends over the country of the Wiradjuri people and the Wongaibon people. Tindale's map indicates that a section of the proposal site from Parkes to Alectown is within the country of the Wiradjuri. Previous archaeological assessments have identified that many Aboriginal people with ties to the Peak Hill area consider themselves to be Wiradjuri descendants, and the Wiradjuri language was the dominant language at the nearby Bulgandramine Aboriginal Station. It is noted that the boundaries identified by Tindale (1974) are not accepted as being accurate by many Aboriginal people and anthropologists, and should not be considered as clearly defined and accepted boundaries.

The earliest historical records relating to Aboriginal people in the study area date from 1817, when Oxley and Cunningham camped on the Bogan River and noted the presence of deposits of freshwater mussel shell and stone artefacts, and identified the existence of a spring on Gundong Creek that was used by Aboriginal people.

17.2.2 Aboriginal sites identified

Listed sites

The results of the AHIMS search identified 19 listed sites within 50 metres of the proposal site. Five of these sites are mapped as occuring within the proposal site.

Three of the sites (sites 35-6-0062, 35-6-0063, and 35-6-0065) were not identified during field surveys. These sites were identified and assessed for a proposed gas pipeline (assessment report not available for review). The pipeline is now constructed, and it is possible the sites were salvaged prior to construction. However, as the sites are listed on the AHIMS database they have been considered by the Aboriginal heritage assessment.

Artefacts associated with the following listed sites were identified within the proposal site during field surveys:

- GDM 1 (site 35-3-0206) – the recorded site consists of a scatter of 20 artefacts of quartz flakes and broken coarse volcanic flakes. Two artefacts were identified within the proposal site.
- P2N IA1 (site 43-3-0111) – a single silcrete flake located on an access track on the bank of a tributary of Ridgey Creek was identified. This site was identified during preliminary investigations for the proposal and re-identified during the field survey adjacent to the proposal site.

The following listed sites are located adjacent to the proposal site, and their location was confirmed during field surveys:

- GDM 2 (site 35-3-0207) – a scarred tree located within an area of archaeological potential on Backwater Cowal adjacent to the proposal site.
- GDM 3 (site 35-3-0208) – a scatter of 29 artefacts consisting of quartz with the exception of one broken quartzite flake. The artefacts include a bipolar quartz core and are distributed over a large access track exposure bordering the existing rail line. No artefacts were identified in the proposal site.

Aboriginal places

No Aboriginal places declared under section 84 of the NPW Act, or Aboriginal places of heritage significance defined by the *Standard Instrument – Principal Local Environmental Plan,* are located within or near the proposal site.

Two Aboriginal places are located to the north of Narromine – the Bridge Reserve and Mack Reserve, located about two and five kilometres metres to the north of the proposal site, respectively. Both of these places are fringe camps where Aboriginal people lived between the 1860s and 1960s.

New sites identified during the survey

No new unlisted Aboriginal sites were identified in the proposal site during the site survey.

17.2.3 Native title

A search of the Native Title Tribunal records on 31 March 2016 identified no native title claims relevant to the proposal site, and no Indigenous Land-Use Agreements registered or notified by the Native Title Tribunal.

17.2.4 Archaeological potential of the proposal site

The regional archaeological pattern indicates that stone artefact scatters and scarred trees are the most likely site types in the study area. Stone artefact scatters would be most frequent in number and would be larger in proximity to reliable sources of water. Scarred trees may occur anywhere within the proposal site where mature native trees are found, and are most likely to occur on box or river red gums.

Quarry sites may also occur where suitable rock outcrops are present.

The proposal site has been subject to significant disturbance. Within the existing rail corridor, the construction and maintenance of the existing rail line is likely to have resulted in the removal/relocation of archaeological evidence that may have been present. Similarly, there is limited archaeological potential in agricultural land surrounding the existing rail corridor, as this area has been impacted by historical and current agricultural practices.

Due to the extent of disturbance within the existing rail corridor, it is considered highly unlikely that intact archaeological deposits would be present. The level of archaeological potential within the proposal site (even immediately bordering reliable watercourses) is therefore considered to be low.

Eight areas in the additional assessment areas outside the proposal site were considered to have a moderate or high archaeological potential. Of these areas, five are associated with currently exposed archaeological evidence.

17.2.5 Significance assessment

The Burra Charter of Australia (Aust ICOMOS, 1987) defines cultural significance in terms of aesthetic, scientific, historic, and social values. Aboriginal cultural heritage is typically assessed according to its social and scientific significance; however other values may also be of importance. The assessment of significance provides a guideline for determining appropriate mitigation and management strategies. The relationship between levels of significance and management strategies can be summarised as follows:

- High significance – the site should be conserved and protected from the impacts of development, where possible.
- Moderate significance – the site should be protected if possible, however, if impacts to the site are unavoidable, appropriate mitigation strategies should be implemented prior to impact.
- Low significance – the site should be protected if possible, however, if impacts to the site are unavoidable, the presence of the site should not impede the proposed development.

As Aboriginal cultural significance relates to the values of a site, place or landscape to Aboriginal people, only the Aboriginal community can determine Aboriginal cultural significance.

Archaeological significance

The archaeological significance of the Aboriginal sites identified was assessed using the following criteria:

- rarity
- representativeness
- research potential
- education potential
- integrity.

The archaeological significance of the three listed sites that could not be re-identified (35-6-0062, 35-6-0063, 35-6-0065) was also considered. These sites were assessed as having low archaeological significance.

The archaeological significance of identified Aboriginal sites is provided in Table 17.1. The nature of archaeological deposits in these areas (should any exist) can only be confirmed following further investigation.

Table 17.1 Assessment of archaeological significance for areas of moderate or high archaeological potential

Site reference	Landform	Archaeological potential rating		Archaeological significance (based on potential only)	
		Within proposal site	Outside proposal site[1]	Within proposal site	Outside proposal site[1]
43-3-0111	Ridgey Creek Tributary 3	Low	Moderate	Low	Moderate
None	Burrill Creek North	Low	Moderate on north side of creek	Low within proposal site and south side of creek	Moderate on north side of creek
None	Ten Mile Creek (creek banks)	Low	Moderate to high	Low	Moderate to high

Site reference	Landform	Archaeological potential rating		Archaeological significance (based on potential only)	
35-6-0163	Ten Mile Creek (access road)	Low	Moderate to high	Low	Moderate to high at specified coordinates
None	Lower slope bordering unnamed drainage (5th order)	Low	Moderate on the southern side	Low	Moderate on the southern side
35-3-0208, 35-3-0207	Backwater Cowal (north)	Low	Moderate to high	Low	High
35-3-0206	Backwater Cowal (south)	Low	Moderate to high	Low within corridor	High
35-3-0206 (cont.)	Lower slopes bordering Backwater Cowal	Low within surfaced road	Moderate to high	Low within surfaced road	Moderate outside corridor on southern side

Note 1: The archaeological significance of these areas would be subject to review following further investigation if the detailed design identifies the need for surface disturbance within these areas.

17.3 Impact assessment

17.3.1 Risk assessment

The environmental risk assessment for the proposal (summarised in Appendix B) included an assessment of the potential risks of the proposal on Aboriginal heritage. The assessed risk level for Aboriginal heritage was given a high rating due to the potential disturbance of known or unidentified items or places of Aboriginal heritage significance.

17.3.2 How potential impacts have been avoided

The route for Inland Rail has been designed to minimise the amount of ground disturbance required, with the majority of the rail line using existing infrastructure. However, some disturbance would still be required. The potential significance of this risk needs to be assessed in the context of the amount of ground disturbance required and areas of moderate to high archaeological significance.

Potential impacts on heritage would continue to be avoided by:

- designing, constructing and operating the proposal to minimise the potential for impacts on Aboriginal heritage
- locating ancillary infrastructure including temporary construction compounds to avoid listed AHIMS sites and areas identified as having moderate to high archaeological potential
- managing the potential impacts on Aboriginal heritage in accordance with relevant legislative requirements, as outlined in section 17.1.2, and the findings of the Aboriginal cultural heritage and archaeological assessment
- implementing the mitigation measures provided in section 17.4.2.

17.3.3 Construction impacts

The main risks relating to Aboriginal heritage would occur during construction of the proposal. Works within the proposal site have the potential to directly or indirectly disturb identified Aboriginal sites and areas of archaeological potential. The impact assessment summarised in this section focuses on the potential impacts of the proposal on Aboriginal heritage in the proposal site (as defined in chapter 2).

Proposal site impacts

No areas of moderate or high archaeological potential were identified within the proposal site. The majority of works would be undertaken within the previously disturbed rail corridor where the archaeological potential is low.

The three listed sites mapped as occurring within the proposal site but not re-identified during the field survey (sites 35-6-0062, 35-6-0063, 35-6-0065) have the potential to be impacted if they have not been previously disturbed/salvaged. These sites have been assessed as having low archaeological significance.

Construction may directly or indirectly disturb:

- the two artefacts in the proposal site associated with site 35-3-0206
- site 43-3-0111 (the single silcrete flake)
- site 35-3-0207 (the scarred tree), located adjacent to the proposal site
- site 35-3-0208 (a scatter of 29 artefacts), located across an access track bordering the existing corridor.

Mitigation measures to minimise the potential for impacts to these sites are provided in section 17.4.

Impacts in the additional assessment areas

The need for any works to be undertaken in the additional assessment areas would be determined once the detailed design of the culverts and level crossings have been finalised. The design of any works in these areas would minimise, as far as practicable, the potential for impacts on identified Aboriginal heritage. Prior to finalising the detailed design of any works located in these areas, additional assessment would be undertaken in accordance with the recommendations of Technical Report 8, and the process for design refinements described in section 27.2.3 would be followed.

17.3.4 Operation impacts

Access to the rail corridor would be required during routine maintenance and repairs. As these areas would have been previously assessed and disturbed during construction, further impacts on Aboriginal heritage are considered unlikely.

17.4 Mitigation and management

17.4.1 Approach to mitigation and management

ARTC is committed to minimising the environmental impact of the proposal and is investigating opportunities to reduce actual impact areas where practicable. The area that would be directly impacted by construction activities would depend on factors such as presence of significant vegetation, constructability, construction management and safety considerations, land form, slopes and anticipated sub-soil structures. Direct impacts would be reduced as far as practicable.

There are two options to mitigate the potential impacts on artefact scatters of low archaeological significance in the proposal site. The first option is to avoid the site. Where this is not practicable, the second option is to salvage artefacts from the site prior to construction. In this instance, the collected items would be stored at an appropriate keeping place identified in consultation with Aboriginal parties and/or OEH.

For significant archaeological sites located in the vicinity of the proposal site, the extent of the site would be identified with high visibility fencing, and construction impacts avoided. The sites should also be clearly marked on all mapping and plans used by contractors working on the project.

If impacts to Aboriginal objects are unavoidable, additional assessment may be required to clarify the nature, extent and significance of the sites in consultation with relevant Aboriginal stakeholder representatives.

17.4.2 Summary of mitigation measures

To mitigate the potential for Aboriginal heritage impacts, the following mitigation measures would be implemented.

Table 17.2 Aboriginal heritage mitigation measures

Stage	Impact	Mitigation measures
Detailed design/ pre-construction	Avoiding impacts to Aboriginal heritage	Detailed design and construction planning would avoid direct impacts to the identified items/sites of Aboriginal heritage significance where practicable.
	Impacts outside the proposal site	Any works outside the proposal site would be subject to further review and assessment to avoid impacts on Aboriginal items.
Pre-construction/ construction	General construction impacts	A construction heritage management plan would be prepared and implemented as part of the CEMP. It would include measures to minimise the potential for impacts, manage heritage, and procedures for any unexpected finds. With respect to the management of Aboriginal heritage, the plan would be prepared in consultation with registered Aboriginal parties, incorporate the recommendations of the Aboriginal Cultural Heritage Assessment, and take into account the outcomes of further investigations following detailed design.
	Impact to listed Aboriginal sites	Impacts to AHIMS listed sites 35-3-0206 and 43-3-0111 would be avoided where possible. These sites would be fenced prior to construction and their locations marked on all plans. A buffer of 10 metres around the sites would be applied to all fencing. If sites 35-3-0206 and 43-3-0111 cannot be avoided, salvage of artefacts would be undertaken prior to construction in accordance with the procedures detailed in Technical Report 8. Impacts to the scarred tree at 35-3-0207 and the artefact scatter at 35-3-0208 would be avoided. The sites would be fenced prior to construction and marked on all plans.

Stage	Impact	Mitigation measures
Construction	Unexpected finds	If potential Aboriginal items are uncovered, works within 10 metres of the item would cease. The item would then be assessed and managed by a suitability qualified person in accordance with the unexpected finds procedure in the Aboriginal cultural heritage management plan. During pre-work briefings, employees would be made aware of the unexpected finds procedures and obligations under the NPW Act.
	Human skeleton material	In the event that a potential burial site or potential human skeletal material is exposed during construction, the mitigation measure provided in Table 18.2 would be implemented.

18. Non-Aboriginal heritage

This chapter provides a summary of the non-Aboriginal heritage impact assessment of the proposal undertaken by Umwelt. It describes the existing environment in terms of non-Aboriginal/historic heritage, assesses the potential impacts of the proposal, and provides recommended mitigation measures. The full report is Technical Report 9.

18.1 Assessment approach

18.1.1 Methodology

The assessment involved:

- reviewing the following heritage databases to identify whether any listed heritage items are located in the vicinity of the proposal site:
  - Australian Heritage Database (including Commonwealth and National heritage lists)
  - Australian Heritage Places Inventory
  - NSW State Heritage Inventory (including the State Heritage register)
  - ARTC's section 170 heritage register
  - Parkes Local Environmental Plan 2012
  - Narromine Local Environmental Plan 2011.
- historical research including a literature review
- reviewing the proposal description and plans
- a site survey (see below) and photographic inventory
- assessing the potential impacts of the proposal, and preparing the historical heritage impact statement, in accordance with the guidelines listed in 18.1.2.

Site survey

A targeted site survey was conducted from 10 to 14 September 2014. The aim of survey was to inspect and record the location, nature, and current condition of any listed sites identified during the database and literature review; and to identify any additional sites/items with potential heritage significance. The survey also involved a broad scale evaluation of the landscape of the study area with respect to potential cultural heritage considerations.

An additional targeted one-day field inspection, focusing on the sites of the former rail stations, was undertaken on 23 May 2016.

18.1.2 Legislative and policy context to the assessment

The main legislation relevant to non-Aboriginal heritage in NSW is the *Heritage Act 1977*. This Act includes provisions to conserve the State's environmental heritage. It provides for the identification, registration and protection of items of State heritage significance, constitutes the Heritage Council of NSW, and confers on it functions relating to the State's heritage.

As described in section 3.4, some approvals under the Heritage Act (that is, approvals under Part 4 and Division 8 of Part 6, and excavation permits under section 139) are not required for approved State significant infrastructure.

The EP&A Act establishes the framework for heritage values to be formally assessed in land use planning and local development consent processes. Under this Act, the definition of 'environment' includes cultural heritage. The Heritage Act defines 'environmental heritage' as places, buildings, works, relics, movable objects or precincts considered significant based on historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic values.

Items and places of national heritage significance, as well as heritage places owned by the Australian Government, are managed under the EPBC Act. The EPBC Act provides for the identification, registration, and protection of items of national heritage significance. National heritage is one of the nine matters of national environmental significance protected by the EPBC Act.

The assessment of non-Aboriginal heritage for the proposal has been undertaken in accordance with the *NSW Heritage Manual 1996* (Heritage Office and Department of Urban Affairs and Planning, 1996) ('the NSW Heritage Manual') and relevant guidelines, including *Assessing Heritage Significance* (Heritage Office, 2001), and *Statements of Heritage Impact* (Heritage Office, 2002).

The assessment has also taken into consideration the principles contained in *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia ICOMOS, 2013) ('the Burra Charter') and the *Historical Archaeology Code of Practice* (Heritage Office, 2006).

18.2 Existing environment

18.2.1 Heritage context

A summary of the historic and heritage context for the assessment is provided below. Further information is provided in Technical Report 9.

Grazing/agriculture

The Lachlan River region was first discovered in 1815. In 1817, John Oxley (Surveyor General of NSW from 1812) further explored the Lachlan River plains, including the areas of Forbes, Bogan Gate, Parkes, and Peak Hill. In 1835 and 1836, Thomas Mitchell (Surveyor General from 1828), explored the region and mapped the Bogan and Lachlan rivers. Mitchell's expedition route became the basic supply route for squatting activity in the region (which includes the study area for the proposal).

Pastoralists began bringing their cattle in western NSW following John Oxley's explorations. The expanding market for meat due to population growth in NSW, and the demand for grazing land to meet the needs of the developing sheep industry, provided impetus for increased squatting activity during the 1830s. The first squatter in the Parkes area followed the expedition tracks of Mitchell, establishing a station on Goobang Creek in 1835.

Following initial squatting activity, large pastoral runs varying from 11,000 to 25,000 hectares were opened between 1835 and 1858.

In 1865, the first crop of wheat was successfully grown in the Parkes area, about 3.5 kilometres north of Parkes. The growth of the wheat industry was assisted by the gold rush (described below) and construction of the inland rail lines (described below), as well has the invention of machinery allowing for large scale harvesting.

The 1884 Land Act encouraged smaller leases of mixed farming, and the 1895 Homestead Selection Act encouraged wheat cultivation. This caused a shift in production to wheat, wool and lambs. Soldier settlement after the First World War, and private subdivision of land, allowed wheat to become a key crop.

Bulk handling of wheat grain was first phased in during the 1920s. This meant that grain did not need to be bagged before being stored and shipped, leading to substantial savings of time and money, as well as protection from pests. The first country grain silo in NSW was built at Peak Hill in 1918. By 1933, over one-third of the region around Parkes was cleared for agriculture.

Mining

The discovery of gold in the region signalled a new period of history. The majority of towns in the Lachlan River plains area, including Forbes, Parkes, Peak Hill, Wyalong, West Wyalong, and Lake Cargelligo, were established mainly as a result of gold. The earliest gold rush in the area was at Forbes in 1861. The first gold discovery in the Peak Hill area was at Tomingley in 1881. Mines at Currajong, north of Parkes, opened in 1863 and 1864. Gold was discovered at Peak Hill in 1889. A town promptly appeared in Peak Hill, a thousand miners arrived by 1890, and five mines were opened.

Urban areas

Settlement and growth came to the region in the later part of the nineteenth century. As noted above, the towns of Parkes and Peak Hill were created and grew as a result of the discovery of gold. The construction of rail lines in the region was a very significant development in the late nineteenth century, leading to the establishment and survival of a number of villages and towns. The prosperity and growth of villages and towns depended on whether a rail line linked the settlement with wider NSW.

Parkes was originally known as Currajong and Bushmans. Bushmans was officially renamed Parkes in 1873. Peak Hill developed as a town in 1889, and the village of Narromine was laid out in 1883.

Rail lines

In NSW, rail lines were historically built to two main standards: main lines, and branch/pioneer lines. As noted in chapter 2, Parkes is located on the Broken Hill line, and Narromine is located on the Main Western line. Both these lines were constructed as main lines. Parkes Station (to the east of the proposal site) was opened in 1893. Narromine Station (to the north of the proposal site), which opened in 1882, is now closed to passenger services.

The economic depression of 1889 to 1894 dramatically slowed rail construction in NSW. When expansion of the rail system resumed, it was under a new era of austerity. The change involved the introduction of ‘pioneer lines’, constructed mainly between 1910 to 1930 on routes serving agricultural areas. To minimise the need to construct expensive bridges, these routes were selected to be located, where possible, beside or between the major inland rivers. Pioneer rail lines were constructed using light rails and low-quality sleepers with no ballast. Rail traffic was minimal, except for the heavy seasonal demand dictated by agricultural industries.

The Parkes to Narromine line, which opened in 1910 as a single track rail line, was constructed as a pioneer line. Rail stations along the line opened progressively from 1910. Rail passenger services along the line were discontinued in 1974. All stations, except Goobang Junction, closed between 1974 and 1976.

Further information on the rail lines and rail services in the study area is provided in chapter 2.

18.2.2 Heritage listed items

No heritage listed items are located within or in the immediate vicinity of the proposal site. Listed items within one kilometre of the proposal site are shown in Figure 18.1 and listed in Table 18.1. All listed items are locally significant.

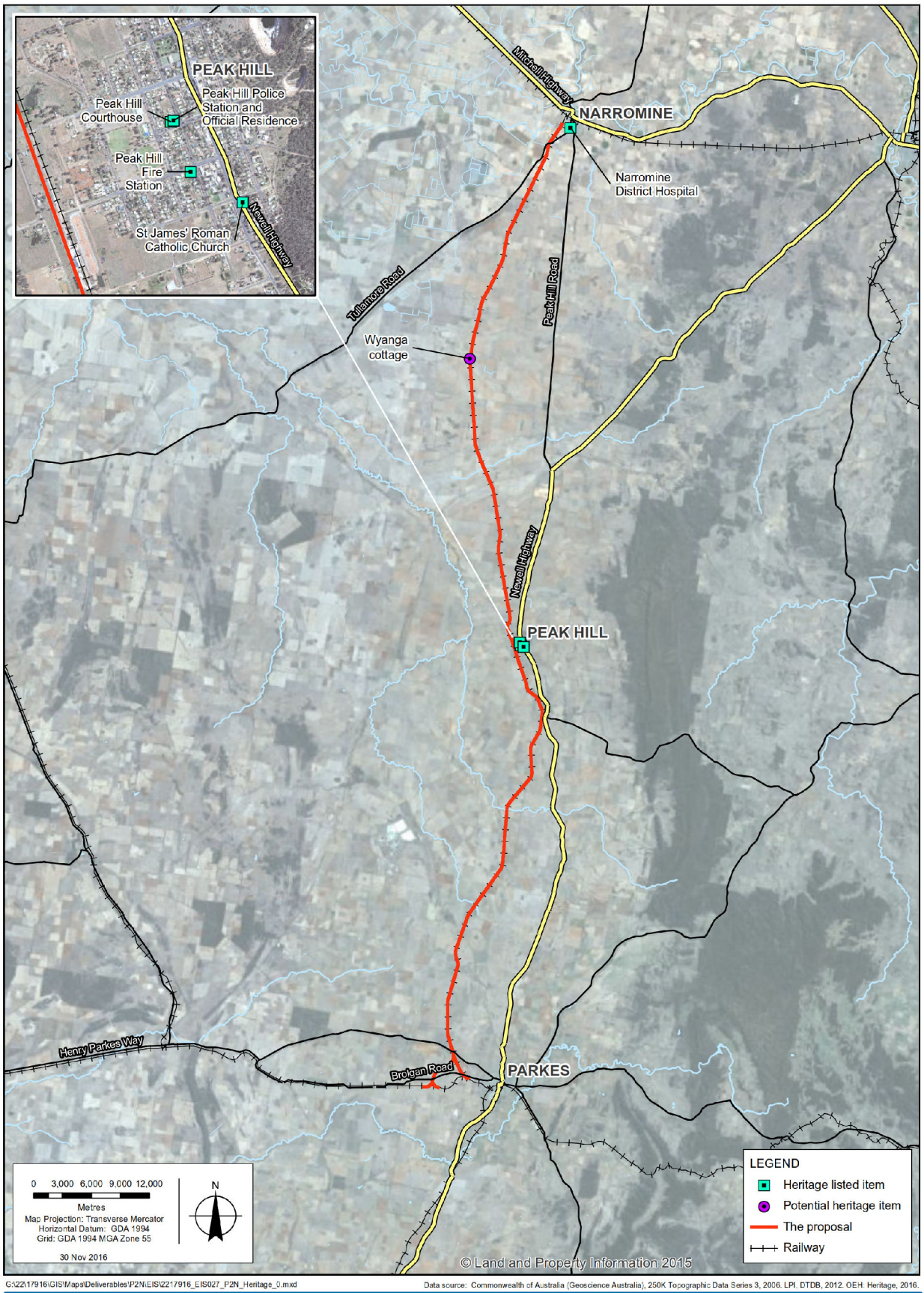


Figure 18.1
Heritage item

Table 18.1 Heritage listed items within one kilometre of the proposal site

Item name	Location	Listing	Distance from the proposal site
Narromine District Hospital	Bounded by Dandaloo, Cathundral and Temain streets, Narromine	Department of Health's section 170 register	900 metres to the east
Peak Hill Courthouse	Derribong Street	Department of Justice's section 170 register	775 metres to the east
Peak Hill Fire Station	130 Caswell Street	Fire & Rescue NSW's section 170 register	975 metres to the east
Peak Hill Police Station and Official Residence	80 Derribong Street	NSW Police Force's section 170 register	750 metres to east
St. James Roman Catholic Church	Narra Street	Parkes LEP	950 metres to east

18.2.3 Potential heritage items and resources

The potential heritage resource of the study area generally reflects the documented history of the region (summarised in section 18.2.1), and the remaining rail alignment and infrastructure associated with the original Parkes to Narromine line. With the exception of the rail line and its associated structures, evidence of stations and other infrastructure, the proposal site itself is unlikely to contain significant historical heritage or archaeological remains associated with the history of the study area.

Ongoing works and maintenance activities along the Parkes to Narromine line have, for the most part, removed all evidence of stations and associated platforms and station officer's houses. It is also considered unlikely for any substantial intact archaeological remains to be present within the proposal site.

The potential heritage resource in the proposal site, and likely absence of any archaeological resource, is considered to be typical of a rail line. It includes the rail formation itself, with culverts of varying construction materials and age, evidence of the former stations, and other rail related structures and infrastructure.

All potential heritage items located within/adjoining the proposal site are rail related. A summary of potential heritage items is provided below. Further detail is available in Technical Report 9.

Rail related items with potential heritage significance

The potential historical heritage resource in the proposal site includes the rail line and formation itself, with culverts of varying construction materials and age, evidence of the former stations, and other rail related structures and infrastructure.

Rail line and culverts

The rail line itself (including culverts/under bridges and associated rail infrastructure), has historical association with the expansion of the NSW rail network through the region, and its role in encouraging agricultural and pastoral development.

Culverts and underbridges can provide examples of the different techniques used to raise a rail line over watercourses. There are a number of underbridges (that is, small bridges spanning an opening under the rail line) surviving along the proposal site which still have timber components in addition to early concrete modifications, or are entirely constructed of timber. Some examples of these are shown in Plate 18.1 and Plate 18.2, with others provided in Technical Report 9. These are likely to be representative of the earlier types of underbridges constructed along the rail line.

Plate 18.1 Goobang Junction underbridge

Plate 18.2 Goonumbla underbridge

Former stations

There are 10 former rail station sites and one former rail loop (Myroo) located along the proposal site, and a station and a junction located within the vicinity of the proposal site (Goobang Junction and Narromine Station). In general, there is limited remaining evidence of the former rail stations, with the exception of raised earthen embankments indicating former station platforms or rail siding loading banks.

Other rail related structures and infrastructure

The grain rail sidings and landmark grain silos dominate the landscape immediately adjacent to the proposal site (examples shown in Plate 18.3 and Plate 18.4).

Plate 18.3 Grain rail sidings and silos at Tomingley West

Plate 18.4 Grain rail sidings and silos at Wyanga

Two old cottages are located in close proximity to the rail corridor – one at Wyanga adjacent to the rail corridor, and one at Tomingley West on private land about 100 metres from the rail corridor. The cottage at Tomingley West was not considered further given its distance from the corridor.

The cottage at Wyanga (referred to as 'Wyanga cottage' for the purpose of the assessment and shown in Plate 18.5) is located between the rail line and Peak Hill Railway Road, about 25 kilometres south-west of Narromine. It comprises a derelict weatherboard cottage with brick chimneys, in a serious state of disrepair. The cottage is located about 15 metres to the west of the existing tracks and south of the former station location, and is outside the boundary of the rail corridor. The cottage is likely to have been related to the original rail line, and may comprise a former Rail Officer's House.

Plate 18.5 Derelict cottage at Wyanga

No other potentially significant rail or grain siding related structures or items were identified within, or in close proximity to, the proposal site.

Summary statement of significance for potential heritage items

An assessment of significance was undertaken of the potential heritage items along the proposal site. The assessment concluded that, for items not currently subject to a heritage listing:

- The existing rail line comprises a former pioneer rail line, constructed to provide access to wheat and wool growing areas in regional NSW. As such, the proposal site demonstrates and contributes to the history of settlement in the region.
- The existing rail line is considered to be generally of local significance as a result of its:
  - relationship with the construction of pioneer rail lines in rural NSW at the beginning of the twentieth century
  - role in encouraging settlement and agricultural development in the study area
  - surviving elements, such as the timber constructed culverts/underbridges, and remnant evidence of former stations.
- Wyanga cottage is considered to be of local significance as a result of its potential association with the original rail line, and possible use as a Station Officer's house.

18.3 Impact assessment

18.3.1 Risk assessment

Potential impacts

The environmental risk assessment for the proposal (summarised in Appendix B) included an assessment of the potential risks of the proposal on environmental heritage. The assessed risk level for the majority of potential heritage risks was medium. Risks with an assessed level of medium or above included:

- impacts on the heritage significance of any nearby heritage items as a result of altered arrangements and access; impacts to visual amenity, landscape and vistas, and curtilage, and any impacts as a result of noise mitigation measures
- damage to heritage items from vibration during construction or operation
- disturbance of known or unidentified items or places of non-Aboriginal heritage significance.

How potential impacts have been avoided

The option development and assessment process for Inland Rail as a whole is summarised in chapter 6. As noted in chapter 6, the shortlist of route options was subject to a detailed assessment, and the proposed alignment was refined based on evaluation of key considerations, including environmental impacts. The majority of Inland Rail would be located on upgraded track in existing rail corridors, minimising as far as practicable the potential for impacts to heritage located outside the rail corridor. However, the proposal would impact on existing rail infrastructure within the rail corridor.

Potential impacts on heritage outside the rail corridor would continue to be avoided by:

- designing, constructing and operating the proposal to minimise the potential for impacts outside the rail corridor
- managing the potential impacts on non-Aboriginal heritage in accordance with relevant legislative, as outlined in section 18.1.2, and the findings of the historic heritage assessment
- implementing the heritage mitigation measures provided in section 18.4.3.

18.3.2 Construction impacts

Direct impacts can occur during construction as a result of the physical loss of part or all of a heritage item or place, and/or changes to its setting. Potential indirect impacts include:

- potential for vibration impacts to buildings/items located close the proposal site as a result of construction works and the movement of plant, vehicles and machinery
- inadvertent damage as a result of the movement of machinery and equipment
- altered historical arrangements and access
- impacts to visual amenity, landscape and vistas associated with the item
- impacts to the curtilage of an item.

Impacts on listed heritage items

No sites/items with a statutory heritage listing, with the potential to be directly or indirectly impacted by the proposal, were identified within or close to the proposal site.

Impacts on items with potential significance

Potential for direct impacts

The proposal would result in the removal of the existing rail line and associated infrastructure, and the construction of a new rail line within the same corridor. Retaining all evidence of the existing rail line is not feasible, as significant upgrades to the formation are required for it to comply with the Inland Rail performance specifications. The corridor would be retained for rail usage.

The majority of the former stations have been previously removed, with only occasional earthen embankments or loading banks remaining as evidence of their former locations. Any remaining evidence could be impacted as a result of the proposal.

The rail line itself has been continually upgraded since its construction, and no original features (with the possible exception of some of the timber components of a number of the culverts/underbridges) have been identified or are expected to be found.

The measures listed in section 18.4 (including interpretation and a photographic/archival recording) would be implemented prior to construction to minimise the potential significance of direct impacts.

There are no expected impacts to the setting of the grain silos and their landmark silos as a result of the proposal.

Wyanga cottage would not be directly impacted by the proposal. The proposal comprises the construction of a new rail line within the same rail corridor. As such, the associations, setting, and curtilage of Wyanga Cottage in relation to the rail line would essentially remain the same and would not be impacted.

Potential for indirect impacts

The main potential for indirect impacts as a result of the proposal relates to vibration generated by construction. The potential for structural vibration impacts was considered by the noise and vibration assessment (described in chapter 12). The assessment concludes that existing heritage listed items are located a sufficient distance from the proposal site such that no impacts are predicted.

With respect to potential heritage items, Wyanga cottage is located adjacent to the proposal site. The cottage is in a state of disrepair and may be impacted by vibration. The vibration assessment concluded that the cottage is located within the buffer distance where vibration levels from construction activities may cause impacts, therefore mitigation measures are recommended to minimise the potential for any impacts. The management of vibration in the vicinity of the cottage would be undertaken in accordance with the approach defined by the *Inland Rail NSW Construction Noise and Vibration Management Framework*. Potential management actions could include a dilapidation survey and careful selection of construction techniques in the vicinity of the cottage. Further information on the framework with respect to the management of vibration is provided in section 12.5.

Although the potential for indirect impacts on the cottage would be minimised as far as practicable, given the dilapidated state of the cottage, there remains the risk that it could collapse. As such, the heritage mitigation measures listed in section 18.4 (including interpretation and a photographic/archival recording) would be implemented prior to construction.

18.3.3 Operation impacts

Operation of the proposal would not directly impact on any listed or potential heritage items. The main potential for indirect impacts relates to vibration generated by the movement of trains, and a change in the visual setting and/or character associated with the presence of new infrastructure.

The potential for structural vibration impacts was considered by the noise and vibration assessment (described in chapter 12). No operational impacts on listed or potential heritage items were predicted.

The potential for visual impacts was considered by the landscape and visual impact assessment (described in chapter 19). The assessment concluded that the overall visual impact of the proposal would be low, as the majority of the proposal involves minor works to existing infrastructure. Measures are provided in section 19.4 to mitigate the potential for visual impacts.

18.4 Mitigation and management

18.4.1 Approach to mitigation and management

A photographic/archival recording of certain elements of the proposal site and items with potential heritage significance is proposed (culverts/underbridges with timber components, former rail station, and Wyanga cottage). This is to ensure that a full understanding and accurate record of these items would be available for future generations.

In addition to recording, an interpretation strategy would be developed, in consultation with relevant stakeholders, to provide a concept and framework for interpretation of the original rail line and rail infrastructure to be removed. This would ensure information regarding this infrastructure is accessible and available for the community to understand.

Potential vibration impacts would be managed in accordance with the Inland Rail Construction Noise and Vibration Management Framework, described in section 12.5.

18.4.2 Consideration of the interactions between mitigation measures

Measures to minimise the potential for vibration impacts (provided in chapter 12) and visual impacts (chapter 20) would minimise the potential for indirect impacts as a result of the proposal.

18.4.3 Summary of mitigation measures

To mitigate the potential for non-Aboriginal heritage impacts, the following mitigation measures would be implemented.

Table 18.2 Non-Aboriginal heritage mitigation measures

Stage	Impact	Mitigation measures
Detailed design/pre-construction	Heritage interpretation	An interpretation strategy would be developed for the proposal to provide a concept and framework for interpretation of the original rail line and associated infrastructure and structures.
	Impacts to potential heritage items	A photographic/archival recording would be undertaken of culverts/underbridges with timber components, former rail station sites, and Wyanga cottage, in accordance with *Photographic Recording of Heritage Items Using Film or Digital Capture* (Heritage Division, 2006). The photographic recording would include contextual photographs showing the relationships between the rail line, station sites, Wyanga cottage, and associated grain rail sidings and silos.
	Wyanga cottage	The detailed design of the proposal would minimise the potential for direct impacts to Wyanga cottage. The management of potential vibration impacts at the cottage would be undertaken in accordance with the Inland Rail NSW Construction Noise and Vibration Management Framework.
	Accidental impacts at Wyanga cottage	Direct impacts to the cottage would be avoided by the installation of temporary fencing, and marking the cottage as a ‘no go’ area on plans.

Stage	Impact	Mitigation measures
Construction	Unexpected finds	In the event that unexpected archaeological remains, relics, or potential heritage items are discovered during construction, all works in the immediate area would cease, and the remains and potential items would be assessed by a qualified archaeologist or heritage consultant. If necessary, the Heritage Division of OEH would be notified in accordance with the requirements of section 146 of the *Heritage Act 1977*.
	Human skeleton material	In the event that a potential burial site or potential human skeletal material is exposed during construction, the procedure recommended by the historic heritage impact assessment would be followed in accordance with the *Policy Directive – Exhumation of Human Remains* (NSW Department of Health, 2008), *Skeletal Remains – Guidelines for the Management of Human Skeletal Remains under the Heritage Act 1977* (NSW Heritage Office, 1998) and the *Aboriginal Cultural Heritage Standards and Guidelines Kit* (NPWS, 1997).

19. Landscape and visual

This chapter provides a summary of the landscape and visual impact assessment of the proposal. It describes the existing landscape and visual environment, assesses the impacts of construction and operation, and provides recommended mitigation measures. The full assessment report is provided as Technical Report 10.

19.1 Assessment approach

19.1.1 Methodology

A qualitative assessment of the landscape and visual impacts of the proposal was undertaken. The assessment involved:

- desktop analysis
- site visit and analysis
- landscape character assessment
- determining the ability of the landscape to absorb the proposal (the absorptive capacity)
- identifying potentially sensitive visual receptors
- assessing the potential for landscape and visual impacts (see below)
- developing mitigation measures to minimise the potential for negative impacts and enhance the potential for positive impacts.

Sensitive visual receivers typically include:

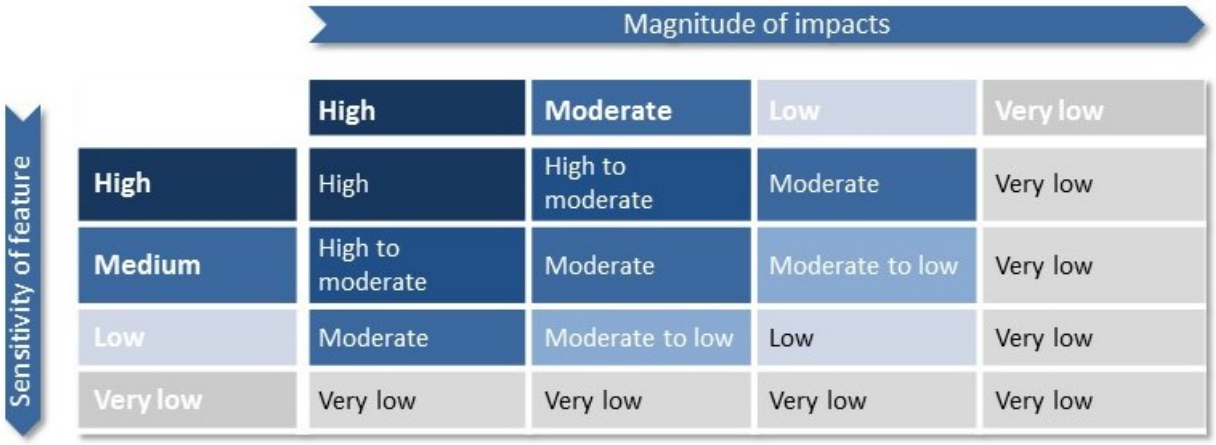
- occupiers of residences with views of a proposal site
- communities with a landscape setting or views valued by the community and/or visitors
- users of outdoor recreation areas whose attention or interest may be focused on the landscape
- motorists/pedestrians travelling along scenic roads/routes.

The potential sensitivity of receivers to change was determined and rated (from very low to high). Sensitivity depends on the location of receivers, the importance of their view, land uses, and the extent of existing screening.

Landscape character impacts refer to the relative capacity of the landscape to accommodate changes to the physical landscape through the introduction of new features or loss/modification of existing features. Impacts were assessed from representative viewpoints and rated (from very low to high).

The significance of potential visual impacts was determined by assessing the magnitude of impacts in combination with the sensitivity of the receiver. Potential impacts were rated according to their significance (severity), as shown in Figure 19.1.

Technical Report 10 provides further information on how the impact, sensitivity, and level of significance were assigned.



Sensitivity of feature	High	Moderate	Low	Very low
High	High	High to moderate	Moderate	Very low
Medium	High to moderate	Moderate	Moderate to low	Very low
Low	Moderate	Moderate to low	Low	Very low
Very low	Very low	Very low	Very low	Very low

Figure 19.1 Impact significance rating matrix

19.1.2 Policy context to the assessment

The landscape and visual impact assessment was undertaken with reference to the following guidelines, policies, and standards:

- *Environmental Impact Assessment Guidance Note – Guidelines for landscape character and visual impact assessment* 3rd edition (Roads and Maritime, 2013)
- *AS4282-1997 Control of the obtrusive effects of outdoor lighting*
- *Beyond the Pavement: urban design policy, procedures and design principles* (Roads and Maritime, 2014)
- *Bridge Aesthetics: Design guidelines to improve the appearance of bridges in NSW* (Roads and Maritime, 2012)
- *NSW Sustainable Design Guidelines Version 3.0* (Transport for NSW, 2013)
- *Technical guideline for Urban Green Cover in NSW* (OEH, 2015)
- *Dark Sky Planning Guideline: Protecting the observing conditions at Siding Spring* (Department of Planning and Environment, 2016).

Further information is provided in Technical Report 10.

19.2 Existing environment

The landscape and visual environment of the proposal site is characterised by its generally rural/agricultural nature, with areas of more concentrated urban development located in towns and villages.

For much of the proposal site, the existing rail track and associated rail infrastructure forms the main visual feature in the landscape (shown in Plate 19.1).

Features contributing to the visual appearance of the rural/agricultural areas include open rural land interspersed with scattered development, dwellings, buildings and sheds; small stands of native vegetation and scattered trees; watercourses (mainly ephemeral); road and rail infrastructure; and agricultural infrastructure such as grain silos. Features contributing to the visual environment of the urban areas include a mix of older commercial and residential buildings among new developments, and general urban infrastructure.

Further information on the proposal site and surrounding land uses is provided in chapters 2 and 20.

Plate 19.1 Existing rail track

19.2.1 Visual sensitivity

The majority of the proposal site passes through open rural land with sparsely scattered dwellings. There are a limited number of sensitive receivers with potential views of the proposal site.

Within the extent of visual influence of the proposal site (that is, the area from within which views to the proposal site are available), visual receivers are generally limited to users of rail and road infrastructure facilities. The number of potential receivers increases closer to the towns/villages.

The area surrounding the proposal site for the Parkes north west connection is considered to be the most visually sensitive, as the proposal would be located in a greenfield area (shown in Plate 19.2). In this area, there are a few residences whose existing views are dominated by surrounding rural land.

Areas with a low to very low visual sensitivity occur where the proposal site passes through predominantly rural land with an absence of residences and major roads, or where roads occur only in the regional setting. Main roads in the study area are often lined with canopy trees offering visual protection to properties in the agricultural landscape.

Plate 19.2 Indicative view of location for the Parkes north west connection

19.2.2 Landscape character zones

For the purposes of the assessment, four landscape character zones were identified. These are areas with similar landscape and physical qualities. The character zones consist of two main landscape character types (settlement and agricultural landscape), with two sub-types in each.

The absorptive capability relates to the ability of a landscape character zone to absorb a proposal within the existing landscape setting. The overall landscape and features within a landscape character zone with a high absorptive capability would not be markedly changed by a proposal. A low absorptive capability means that a landscape is less able to absorb the impacts of a proposal, and therefore there is more potential for impacts to landscape character.

The landscape character zones are described in Table 19.1 and are shown in Figure 19.2.

Table 19.1 Landscape character zones

Character zone	Description	Absorptive capability
Settlement – township	The proposal site is located to the west of Parkes, and is surrounded by open land and scattered development, road and rail infrastructure. Approaching the town, the Parkes Golf Club is located to the east of the proposal site, whilst rail infrastructure facilities and general industrial activity occur to the west. Overall, the finger-like settlement pattern dictates the character of the zone, with recreational and open reserves predominately located on the outer edges of the town.	**High** The flat topography, built form, and scattered trees provide opportunities for changes to be absorbed in the existing landscape setting.

Character zone	Description	Absorptive capability
Settlement – village	The proposal site traverses the western edge of Peak Hill, and is surrounded by rail infrastructure and rural land. A grid-like pattern of residential development, consisting of large lots, is located further to the east of the proposal site. Overall, the settlement pattern dictates the character of the zone and does not provide for any distinguishable landscape features.	**High** The flat topography, built form, and scattered trees provide opportunities for changes to be absorbed in the existing landscape setting.
Agriculture – Goonumbla rolling countryside	This character zone is located between Parkes and Peak Hill. This zone has an open, rolling character. The southern extent of the zone towards Parkes comprises rounded low hills. Rural residences and structures are dispersed across the landscape, as are historical rail infrastructure and large grain silos and storage facilities. Vegetation ranges from scatterings and small clusters of trees to lineal distributions along main roads and paddock edges. A distinct feature in the landscape is the dense lining of trees along Burill Creek between Goonumbla and Mickibri.	**Moderate to high** This landscape is low lying with open grassland plains and minimal canopy coverage. Changes in the existing landscape setting are less easily absorbed.
Agriculture – Bogan marshland plains	This character zone is located between Peak Hill and Narromine. It is typical of the landscape of the Darling Riverine Plains, having a relatively flat landform with river channel and floodplain features dominating the landscape. The northern extent of the zone passes through the Narromine Hills landscape which is shaped by low rounded hills standing above the alluvial plain. Rural residences and structures are dispersed across the landscape. The zone is characterised by extensively cleared land, although there are some locations where trees line main roads, shelter belts traverse paddocks, and scattered trees line watercourses such as Bulldog and Burrabadine creeks. An exception to this is Tomingley Creek, where a distinct corridor of vegetation and trees line the banks.	**Moderate to high** This landscape is low lying with open plains and minimal canopy coverage. Changes in the existing landscape setting are less easily absorbed.

Figure 19.2
Landscape character zones

19.3 Impact assessment

19.3.1 Risk assessment

Potential impacts

The environmental risk assessment for the proposal (summarised in Appendix B) included an assessment of the potential risks associated with changes to the landscape and visual environment. The assessed risk level for the majority of potential risks was between low and medium. Risks with an assessed level of medium or above include:

- adverse impacts on landscape character during construction, particularly in greenfield areas
- impacts on visual amenity due to the introduction of new built elements, and the removal of vegetation.

How potential impacts have been and would be avoided

The option development and assessment process for Inland Rail and the proposal is described in chapter 6. As noted in chapter 6, the shortlist of route options was subject to a detailed assessment, and the proposed alignment was refined based on evaluation of key considerations, including environmental impacts. The majority of Inland Rail would be located on upgraded track in existing rail corridors, minimising as far as practicable the potential for impacts outside the rail corridor. However, the proposal would impact on the existing rail infrastructure within the rail corridor. For works outside the corridor, impacts to communities and landscape were included in the selection criteria used for the assessment of options.

Potential impacts on landscape character and visual environment would continue to be avoided by:

- designing, constructing and operating the proposal to minimise the potential for impacts outside the rail corridor
- managing the potential impacts on the visual setting of non-Aboriginal heritage as described in chapter 18
- designing, constructing, and operating the proposal to minimise the potential for visual amenity impacts, including implementing the mitigation measures listed in section 19.4.

19.3.2 Construction impacts

During construction, positioning plant and equipment within view of properties and existing road users would result in temporary visual impacts. Earthworks would also expose subsoil. The exposed soil would form a visible element in the landscape for a limited period.

Where roads are close to the proposal site, construction work and cleared areas would be visible to motorists. However, visual impacts would be temporary and fleeting in nature. The existing rail line already forms a visual feature in the landscape, meaning that visual modification would generally be low level and difficult to perceive from the wider road network.

The proposal would require removal of some vegetation within the boundaries of the proposal site. This would include trimming and/or clearing of vegetation. Some of this vegetation contributes to the amenity and character of the local area and/or screens views from properties surrounding the proposal site. The removal of this vegetation would have the potential to reduce some screening between residential dwellings and the rail corridor.

The use of lighting for works outside standard working hours may result in light spill impacting neighbouring properties and residents. Light generated during construction would be designed so it complies with *Australian Standard AS 4282-1997 Control of the Obtrusive Effects of Outdoor Lighting*, and considers the good lighting design principles documented in the *Dark Sky Planning Guideline: Protecting the observing conditions at Siding Spring* (Department of Planning and Environment, 2016). Generally, lighting would be designed to minimise off-site light spill.

Potential visual impacts during construction would be minimised through implementation of the mitigation measures provided in section 19.4.

19.3.3 Operational impacts

The proposal would result in the introduction of infrastructure in what is currently mainly a rural area. This would result in a change in the character of those properties that are directly impacted by the proposal, and a change in views from those viewpoints and properties with views to the proposal. Potential landscape character and visual impacts are considered below.

Main visual features of the proposal

The main features of the proposal with the potential for landscape and visual impacts are:

- replacing the existing track and formation with new materials, including height increases of 0.3 metres to one metre
- new sections of track at crossing loops
- new fencing and rail infrastructure in certain areas, including signage and signals
- spoil mounds (up to two metres high) within the rail corridor along the proposal site
- larger trains operating through the study area – trains would be double stacked, with a height of 6.5 metres (an example of a double stacked train is shown in Plate 19.3) and up to 1,800 metres in length
- Parkes north west connection

  Brolgan Road overbridge.

Plate 19.3 Example of a double stacked train

Landscape character impact

The impact on the landscape would vary along the length of the proposal site. The potential impacts on each landscape character zone are summarised in Table 19.2.

Impacts on landscape character generally occur where the ability to absorb change is lowest. For the proposal, this occurs in the areas where the proposal requires the removal of trees and is located in a greenfield area (for the Parkes north west connection). For other areas, the magnitude of impacts is lower, as the landscape is better able to absorb the proposal.

Table 19.2 Summary of landscape character impact ratings

Character zone (described in Table 19.1)	Main works in zone	Impact summary	Magnitude of impacts	Impact rating
Settlement – township	Track works Ancillary works including level crossing upgrades, communications, fencing and utilities	As most of the proposal occurs in the existing rail corridor it would have a relatively low impact on the surrounding landscape for this zone as a whole. In some cases, trees lining the roads (such as Henry-Parkes Way) screens views of the proposal site.	Low	Low
Settlement – village	Track works and ancillary works	The proposal would not impact on the character of this zone. The rail line already forms a key visual feature in the zone, and the proposal would involve minor changes to the appearance of the line. The proposal would involve generally low levels of visual modification. The proposed height increases (as a result of the track raising and larger trains) would be difficult to perceive in the wider landscape, or would be perceived as a small component within the wider landscape.	Low	Low
Agriculture – Goonumbla rolling countryside and Bogan marshland plains	Track works and ancillary works Crossing loops Parkes north west connection Brolgan Road overbridge	The proposal would have minimal impacts to the character of these zones overall. Similar to the village zone, the proposal involves minor changes to existing infrastructure which already forms a key visual feature of these zones. The main potential landscape impact would be in the Goonumbla rolling countryside zone, as a result of the Parkes north west connection. Due to the flat topography of the area, views would be available of elevated structures (the overbridge), and the infrastructure would present as new features in this landscape, impacting on the typical character of this area.	Low to moderate	Low to moderate

Visual impact

Given the low profile and horizontal form of most of the proposal, the level of visual modification would be confined to a distance relatively close to the area subject to change. The effect of distance on modification levels was incorporated into the assessment by applying different modification ratings to foreground (0 to 0.35 kilometres), middle ground (0.35 to 0.7 kilometres) and background (0.7 to one kilometres) views. The visual modification rating would be highest in the foreground, except where foreground vegetation screens the proposal.

Within the existing rail corridor, the proposal is generally considered to result in a low level of visual modification as it involves upgrading existing infrastructure. For the Parkes north west connection and the Brolgan Road overbridge, moderate to high levels of visual modification are associated with the construction of new infrastructure outside the existing rail corridor.

Once detailed design for the Parkes north west connection and the Brolgan Road overbridge have advanced to a sufficient level of detail, artist impressions would be prepared and used to support ongoing community consultation. However, in the meantime, Plate 19.4 to Plate 19.6 provide an indication of what these items would like, as they are of a similar section of rail line and similar road over rail bridge in a rural setting.

Plate 19.4 Example of similar infrastructure to the Parkes north west connection and the Brolgan Road overbridge – a new section of rail line with road overbridge

Plate 19.5 Example of similar infrastructure to the Brolgan Road overbridge – road overbridge pavement view

Plate 19.6 Example of similar infrastructure to the Parkes north west connection and the Brolgan Road overbridge – road overbridge side view

Whilst most of the proposal would be undertaken where rail infrastructure already exists, minor visual impacts would result from:

- the slight increase in the elevation of the tracks and formation
- a change from old and weathered infrastructure to new rail infrastructure
- larger trains using the rail line.

Visual modification ratings were generally assessed as being low to very low, other than in locations where the most visually sensitive viewpoint is in the background.

The proposed spoil mounds would provide some screening of the tracks and trains. At the maximum height of two metres, a spoil mound would provide visual screening of the proposed elements at the perpendicular view. Whilst cess drains and spoil mounds would run adjacent to long expanses of the proposal, there would be gaps to allow water to drain away from the rail formation. Additionally, spoil mounds would range in height, would not necessarily be located on both sides of the corridor, and would not extend throughout the corridor.

The assessment concluded that the crossing loops would result in a moderate level of visual impacts, as a new parallel track would be constructed. However, in the case of the crossing loop near Alectown, a very low level of visual impacts is estimated as the most sensitive viewpoint is a single dwelling located about one kilometre from the proposal site.

The visual impacts of the Parkes north west connection are considered to be medium to high, as it would result in vegetation removal and the presence of new infrastructure (including an elevated structure) in existing rural paddocks near residences (nine are located within one kilometre). Despite the high visual impact rating only one residence, located about 500 metres east of the Brolgan Road overbridge, would have a direct view of the Brolgan Road overbridge. The majority of residences are located near the northern part of the Parkes north west connection and would be unlikely to have a clear view of the infrastructure given the height and distance to the proposed rail line, and their location in an undulating landscape. The remaining residences would likely only see either the top of the double stacked trains or a view of Brolgan Road overbridge at a distance.

19.4 Mitigation and management

19.4.1 Summary of mitigation measures

To mitigate the potential landscape and visual impacts of the proposal, the following measures would be implemented.

Table 19.3 Landscape and visual mitigation measures

Stage	Impact	Mitigation measures
Detailed design/pre-construction	Landscape character and visual impacts	Detailed design would be undertaken according to the design vision, objectives and principles which underpin the concept design, and would take into account the guidelines listed in section 19.1.2.
	Artist impressions	Following completion of detailed design of the Parkes north west connection and Brolgan Road overbridge, artist impressions and perspective drawings would be developed for consultation purposes.
Construction	Light spill	Temporary lighting would be designed and sited to avoid light spill into residential properties and identified sensitive receivers. Temporary and any permanent lighting would be designed and sited so it complies with: ▸ *Australian Standard AS 4282-1997 Control of the Obtrusive Effects of Outdoor Lighting* ▸ *Dark Sky Planning Guideline: Protecting the observing conditions at Siding Spring* (Department of Planning and Environment, 2016).
	Spoil mounds	Spoil mounds would be shaped to reduce their angular profile and ensure that they are integrated within the landscape. Sharp transition angles in the surface profile would be avoided, and rounded profiles would be used to provide a more natural form. Grass cover would be established over the surface area in accordance with the rehabilitation strategy.