6. Environmental assessment

6.1 Air quality

6.1.1 Existing environment

The proposal site is located approximately 15 kilometres south-east of the nearest Bureau of Meteorology (BoM) automatic weather station (AWS) at Cessnock Airport (AWS site number: 061260). Prevalent winds are generally from the north-west and south, and less frequently from the east and south-east. The incidence of north-easterly and south-westerly winds is least frequent. Strong (>6 m/s) winds are most likely from the south, south-east and north-west. Light (0.5-3 m/s) winds are generally from the north, north-west and west. On a seasonal basis, winds are predominantly from the south and north-east during summer and from the north-west during winter. Spring and autumn conditions are a mixture of summer and winter, with the predominant wind from the south and north-west.

The annual average wind roses, based on data from 1968 to 2018, at Cessnock Airport AWS are shown in Figure 6-1 (9.00 am) and Figure 6-2 (3.00 pm).

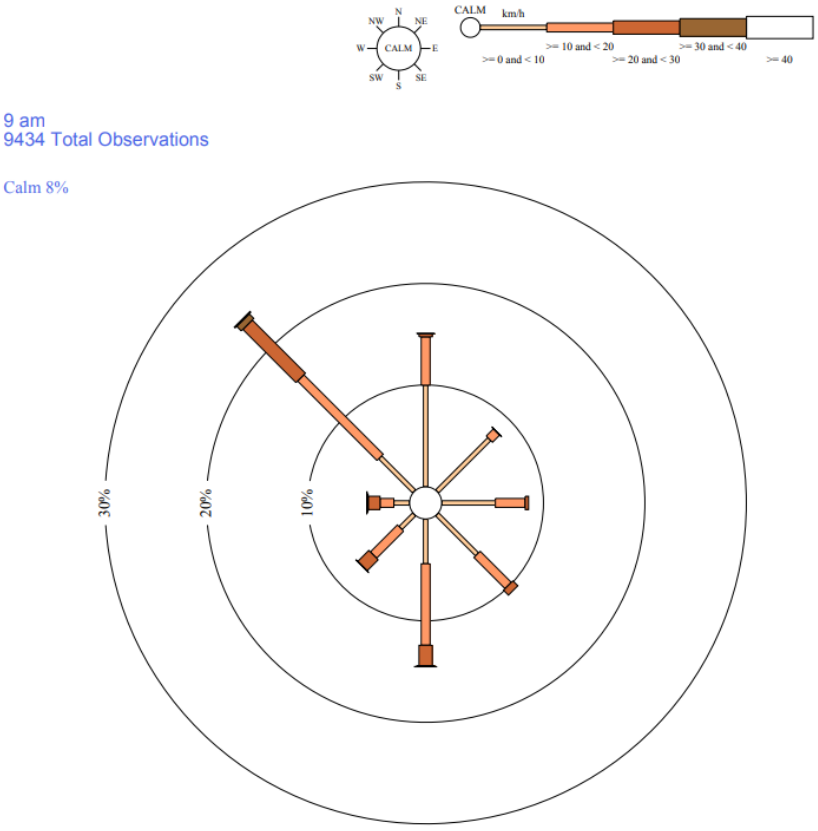


Figure 6-1 Annual wind rose for Cessnock Airport AWS 1968 – 2018 (9.00 am)

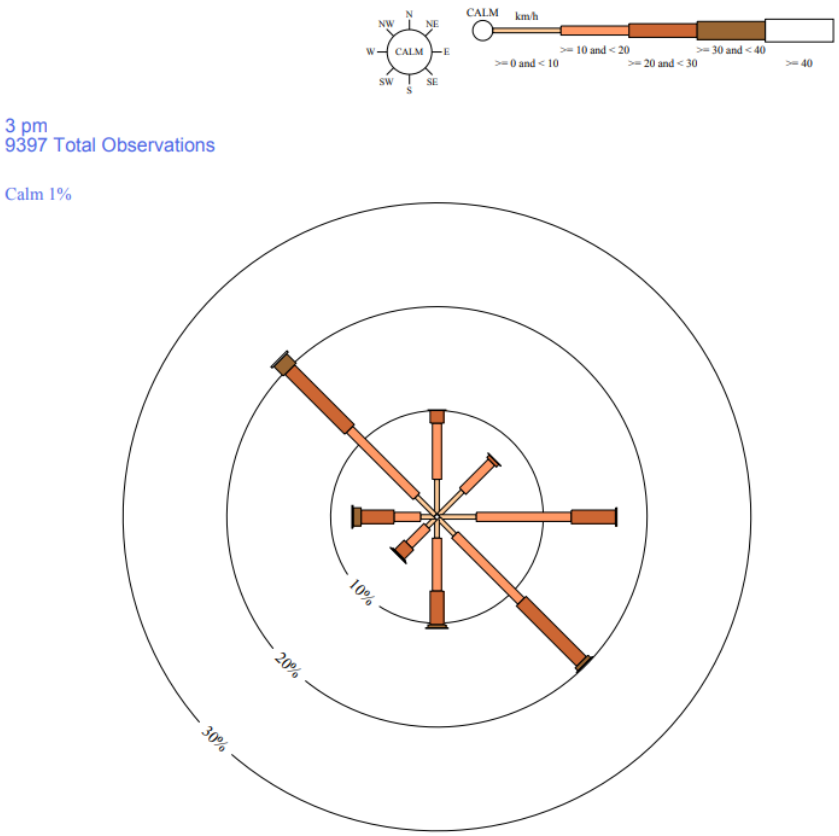


Figure 6-2 Annual wind rose for Cessnock Airport AWS 1968 – 2018 (3.00 pm)

The primary contributors to adverse air quality in the study area include industrial, domestic and transportation sources. The primary source of air emissions within the study area is expected to be vehicles and agricultural land use practices, generating particulate matter and products of combustions (exhaust emissions).

The relative exposure of sensitive receptors (e.g. residences) to air emissions from a source will generally vary significantly at a given range from the source and is dependent on the wind direction and strength.

6.1.2 Potential impacts

Construction

Construction of the proposal may have short-term localised impacts on air quality, primarily due to dust generation. There would also be small emissions from plant, machinery and vehicles. The individual processes that generate significant amounts of dust (PM_{10} and TSP) are likely to be:

- Mechanical disturbance: dust emissions brought about by civil works with the operation of construction and maintenance vehicles and equipment (e.g. material handling and wheel-induced emissions).
- Wind erosion: dust emissions from exposed, disturbed soil surfaces under high wind speeds during construction.

Dust emission sources would include:

- Material handling during earthworks.
- Loading and dumping of material.

- Levelling, grading and compacting of disturbed soil surfaces.
- Wind erosion of exposed unstable soil surfaces and localised stockpiles.

The potential for exposure to dust emissions is dependent on the intensity of construction work (i.e. the amount of dust generated and material transfer volumes occurring), duration and frequency of the operations in any given locality, and the relative location of nearby sensitive receptors.

Analysis of the annual wind rose (Figure 6-1) indicates prevailing winds are from the north-west at 9.00 am and north-west and south-east at 3.00 pm. This highlights the potential for adverse dust impacts at sensitive receptors to the south-west and north-west of construction work. Residential receivers are generally located to the north-west (Kurri Kurri and Pelaw Main), south (Seahampton and West Wallsend) and west (Minmi and Fletcher) of the proposal.

Sensitive receptors closest to the construction work area have the highest potential for adverse air quality impacts. However, since the proposal is linear in nature, construction work fronts would be transient and unlikely to affect an individual receptor for an extended period of time. Measures to avoid or reduce air quality impacts are provided in Section 6.1.3.

Operation

Air quality impacts associated with the operation of the proposal are anticipated to be negligible.

6.1.3 Safeguards and management measures

Construction

- All plant and machinery would be fitted with emission control devices complying with relevant Australian Standards.
- Machinery would be turned off when not in use and not left to idle for prolonged periods.
- Construction plant and equipment would be maintained in good working condition.
- Vehicle movements would be limited to designated entries and exits, haulage routes and parking areas.
- Areas of clearing would be limited to only those that are required to reduce fugitive dust emissions.
- Stockpiles would be stabilised to minimise wind erosion and the generation of dust (e.g. covered or watered).
- Dust generation would be monitored visually, and where required, dust control measures such as water spraying would be implemented to control the generation of dust. If air quality monitoring is considered warranted, it would be undertaken in accordance with *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (Department of Environment and Conservation, 2005).
- Materials transported to and from the site would be covered to reduce dust generation in transit.
- No burning of any materials would be undertaken.
- Access points would be inspected to determine whether sediment is being transferred to the surrounding road network. If required, sediment would be promptly removed from roads to minimise dust generation.
- Shade cloth would be fastened to site fencing at construction compounds if required to minimise dust transported from the site during construction.

- Daily inspections and regular surveillance would be undertaken to identify any vehicle, plant or equipment that is causing visible emissions. If any defective vehicles, plant or equipment are identified, operation of this machinery would cease and service/ maintenance would be undertaken.
- Any exposed surfaces would be stabilised, and final landscaping implemented, as soon as practicable following completion of construction.
- Any dust complaints would be investigated as soon as possible and measures taken to manage any impacts identified.

Operation

No specific mitigation measures are required during operation.

6.2 Hydrology, groundwater and water quality

The following sections have been summarised from the specialist hydrological assessment prepared by GHD, which is included in full in Appendix B.

6.2.1 Existing environment

Hydrology

The proposal crosses a number of creeks and drainage channels including Wallis Creek, Surveyors Creek, Blue Gum Creek, and Burnt Creek.

The Hexham Swamp is located approximately three kilometres east of the eastern extent of the proposal within part of the area gazetted as the Hunter Wetlands National Park.

Alluvial aquifers consist of deposits of unconsolidated silts, sand and minor fine gravels of mixed colluvial-alluvial origin and are present in many of the valleys of creeks and gullies within the vicinity of the proposal. These do not have significant groundwater storage capacity.

Flooding

The proposal is not within a flood planning area mapped under either LEP.

Water sharing plans

The proposal site is subject to the water sharing plan (WSP) for the Hunter Unregulated and Alluvial Water Sources. This WSP commenced in August 2009 and regulates extraction and interception of surface water and alluvium from unregulated rivers in the vicinity of the proposal.

The proposal site is also subject to the WSP for the North Coast Fractured and Porous Rock Groundwater Sources. This WSP commenced in July 2016 and regulates extraction and interception of groundwater from the fractured and porous rock aquifer in the vicinity of the proposal.

Registered groundwater users

A total of 13 registered bores are located within approximately two kilometres of the proposal site (http://allwaterdata.water.nsw.gov.au/water.stm). The majority of the bores are registered as monitoring or test bores. The remainder of the bores are registered for stock or domestic use. The depth to groundwater ranges between 2.8 and 72 metres below ground level. Regional groundwater would generally be expected to flow in an easterly and south-easterly direction towards the Hunter River.

Groundwater dependent ecosystems

High priority groundwater dependent ecosystems listed in the WSP for the North Coast Fractured and Porous Rock Groundwater Sources and the WSP for the Hunter Unregulated and Alluvial Water Sources include the wetlands associated with the Hexham Swamp. Hexham swamp is located approximately three kilometres east of the proposal site.

6.2.2 Potential impacts

Construction

Hydrology

Earthworks for the proposal would be limited to minor cut and fill along the proposal route of generally 0.2 metres depth or less. There would be limited regrading of existing embankments and cuttings. Accordingly, there is little likelihood of significant impact to surface water during construction.

Construction activities would include the installation or modification of existing watercourse crossing structures. This will require works within existing drainage lines, Surveyors Creek and Wallis Creek, which may require temporary diversions. Erosion and sediment controls would be installed to minimise potential impacts on pathways and flow volumes downstream. The construction of the watercourse crossing structures would be undertaken outside of periods of extended wet weather in order to minimise the requirement to divert flows around the works site. If flows are to be diverted, they are to be intercepted, diverted and discharged as near as practical to the existing flow path(s). These measures will minimise the potential changes to flow pathways and flow volumes in the downstream environment.

Groundwater

The excavation associated with construction of the Wallis Creek and Surveyors Creek crossings could intercept groundwater during piling if required. If groundwater is intercepted, dewatering of excavations would be required. Any potential impact on groundwater level would be limited to the vicinity of the excavation and would have negligible impact on the seepage or flow of groundwater to the Hexham Swamp or high priority groundwater dependent ecosystems. Following construction any excavations associated with creek crossings would be backfilled. No other excavations are expected to intercept groundwater.

Water quality

Construction activities have the potential to impact on water quality within local receiving waters. The main potential impacts relate to soil disturbance, which represents a risk to surface water quality, and runoff during construction. During construction, there is potential for a range of pollutants to enter waterways, particularly during high rainfall events. These include:

- Sediment laden water and soil nutrients (including construction wastewater) resulting from earthworks including:
  - Removal of vegetation currently stabilising soils and increasing the risk of erosion and sedimentation through the exposure of soils to weathering processes.
  - Construction of bridges including construction of piers and approach works.
  - Construction of stormwater management infrastructure.
  - Reinstatement of work areas following completion of construction.
- Dust deposition during construction activities.
- Construction waste.

- Fuels spilled during refuelling of plant and equipment.
- Hydraulic and lubricating oil leaking from plant and equipment.
- Water from washing down of plant and equipment.
- Concrete slurries or concrete wash, which could alter the pH of water if spilled into waterways.
- Water containing biological contaminants such are nutrients and bacteria from site toilets and taps associated with site compounds.
- Tannin runoff from cleared and mulched vegetation stockpiled on-site for use where possible on-site.

The impact of construction activities on the quality of runoff discharging to the receiving environment would be minimised by implementing the mitigation measures in Section 6.2.3.

Operation

There is not expected to be any ongoing interception of groundwater during proposal operation. The proposal design would ensure that surface water flow is maintained following construction of the trail.

Potential impacts to water quality due to leaching of pollutants from pavement or other materials is possible over the medium to long term. This can be reduced or avoided through selection of insert or environmentally sensitive construction materials.

6.2.3 Safeguards and management measures

Detailed design

- The detailed design process should include hydraulic modelling of the proposal in order to design crossing structures (such as culverts, bridges, fences etc.) that, as far as reasonably practical, match the existing hydraulic response. This will minimise the potential indirect impacts on the hydrology.
- Selection of materials would consider the potential for leaching of pollutants or other offsite impacts. Environmental sensitive materials would be chosen where available and cost effective.

Construction

- An erosion and sedimentation control plan would be prepared for the proposal in accordance with the requirements of The NSW Soils and Construction – Managing Urban Stormwater Volume 1 ‘the Blue Book’ (Landcom, 2004) and Volume 2 (Department of Environnment and Climate Change, 2008).
- If required, a dewatering procedure would be prepared to identify controls and management measures for dewatering including monitoring, testing, containment and disposal. If dewatering is required, the need for a water licence should be confirmed with WaterNSW.

Operation

- Operational procedures would include measures to restrict access to the trail (such as gates that can be closed during inundated periods) and ensure safety of users during proposal operation.

6.3 Geology and soils

The following sections have been summarised from the specialist geotechnical and contamination assessments prepared by GHD, which are included in full in Appendix C and Appendix D.

6.3.1 Existing environment

Geology

The *1:100,000 Newcastle Geological Map* (Gorbert & Chestnut, 1975) indicates that the proposal is primarily underlain by the Newcastle Coal Measures, with Permian sediments including coal, tuff, conglomerate, sandstone and shale. However, the eastern extent of the proposal site at Stockrington, is underlain by the Tomago Coal Measures, with Permian sediments including shale, mudstone, sandstone, coal, tuff and clay.

Topography

The proposal site is characterised by two major landscape types:

- Sugarloaf: This landscape type is characterised by moderate to steep terrain underlain by residual soil and weathered rock, drainage via incised gullies, and woodland vegetation with dense undergrowth along watercourses.
- Kurri Kurri Plateau: This landscape type is characterised by generally undulating terrain comprised of rolling hills underlain by Permian aged sedimentary rock, dissected by drainage lines comprising ephemeral and permanent narrow creeks, which have developed narrow, terraces flat alluvial deposits. The rail corridor crosses two major watercourses being Surveyors Creek and Wallis Creek. Vegetation comprises cleared farmland or relatively open woodland. The last 500 metres of the pathway is relatively flat.

Soils

Overview

The *1:100,000 Soil Landscapes of Newcastle* (Matthei, 1995) and the *Singleton 1:250,000 Soil Landscapes Map Sheet* (Kovac and Lawrie, 1991) indicate that the proposal lies within numerous soil landscapes including Neath, Heddon Greta, Bolwarra Heights, Wallis Creek, Beresfield, Cockle Creek, Killingworth, Stockrington, Cedar Hill, Wyong and Rivermead.

Acid sulfate soils

Acid sulfate soils mapping under the Cessnock LEP 2011 indicates that part of the proposal, at Stockrington/Lenaghan west of the Hunter Expressway, is mapped as Class 2 and 3. The Australian Soil Resource Information System mapping indicates a high probability of acid sulfate soils at this location.

The remainder of the proposal is considered to have an extremely low probability of acid sulfate soils.

Contamination

A search of the contaminated land record for regulatory notices issued under the CLM Act found the following site:

- Four current notices at a Caltex Service Station at Lang Street, Kurri Kurri within the Cessnock LGA, 1.5 kilometres north of the northern extent of the proposal site.

The same site has been voluntarily notified to the EPA under Section 60 of the CLM Act:

- Caltex Service Station Kurri Kurri, 279-281 Lang Street – Contamination currently regulated under CLM Act.

There are no contaminated land records or voluntary notifications to the EPA within the Lake Macquarie LGA in proximity to the proposal site.

Environmental protection licences issued under the POEO Act include:

- Richmond Vale – Orica Australia Pty Ltd licenced for explosive production.

Based on the distance to the proposal and the nature of the activities undertaken at the sites, the potential for contamination from the above sites is considered low.

A number of previous contamination investigations have been completed in the vicinity of the proposal site. Past weed and pest control activities are the primary environmental concern identified for the proposal. However the potential for significant contamination of the soils that would be disturbed for construction of the proposal is considered to be low.

Mine subsidence

According to the Killingworth-Wallsend Mine Subsidence District Map (Plan No. MSD3b), the proposal is located within the Killingworth-Wallsend Mine Subsidence District.

6.3.2 Potential impacts

Construction

Contamination

There is potential for diffuse or isolated chemical contamination associated with:

- Historical use of the proposal site as a railway corridor with potential impacts from fuel, oil and grease residues along the former tracks, sleepers and surrounding areas (diffuse – along the length of the former railway).
- Historical construction of the railway including use of coal rejects, building rubble and rock fill (diffuse – along the length of the former railway).
- Historical use of herbicides or pesticides to maintain the railway, adjacent roads and nearby agricultural land (diffuse – along the length of the former railway).
- Roads adjacent to the proposal route containing fuel and oil residues potentially directed to road verges and drainage lines (isolated to areas adjacent to roads).
- Dilapidated timber bridge structures and coatings including potential use of lead based paint, pesticides and timber treatment chemicals.
- Potential for poor demolition practices, burial of wastes and illegal dumping along the proposal route including the potential for asbestos containing material (isolated to areas where dumping or building rubble were observed).
- Historical and current industrial/commercial practices within proximity of the proposal.

The overall risk of significant contamination being encountered during ground disturbance activities for the proposal construction is considered to be low. This risk can be managed by implementing the measures provided in Section 6.3.3.

Soil contamination could also occur as a result of any accidental spills or leaks of fuels, oils and other chemicals from equipment and vehicles during construction. To avoid this potential impact, fuels and chemicals would be managed in accordance with the management measures provided in Section 6.3.3.

Acid sulfate soils

The proposal route traverses some areas mapped as high probability for the occurrence of acid sulfate soils. The disturbance of acid sulfate soils can form sulphuric acid when soils react with oxygen in the air. Sulphuric acid can leach into surrounding environments, causing soils to become very acid and toxic and impacting waterways and soil health resulting in environmental and agricultural degradation.

Measures to avoid or minimise these potential impacts are provided in Section 6.3.3.

Operation

Operation of the proposal is not likely to result in any significant impacts to soils or subsequent water quality. The risk of soil erosion or disturbance of acid sulfate or contaminated soil during operation would be minimal as all areas impacted during construction would be sealed or rehabilitated and landscaped to prevent soil erosion.

6.3.3 Safeguards and management measures

Detailed design

- Consultation would be undertaken with Subsidence Advisory NSW to determine the need for development approval or input for works within the mine subsidence district.

Construction

Soils

- Further geotechnical investigation will be undertaken prior to detailed design to confirm geotechnical requirements if required. The investigations would include further soil sampling and analysis to confirm the location of acid sulfate soils and soil contamination.
- An acid sulfate soil management plan would be prepared for the proposal in accordance with the Acid Sulfate Soil Laboratory Methods and Manual (ASSMAC, 1998).
- An unexpected finds protocol would be developed and implemented to manage potentially contaminated soils (if encountered), including landfill or anthropogenic waste and potential asbestos containing material.

Operation

No specific mitigation measures are required during proposal operation.

6.4 Noise and vibration

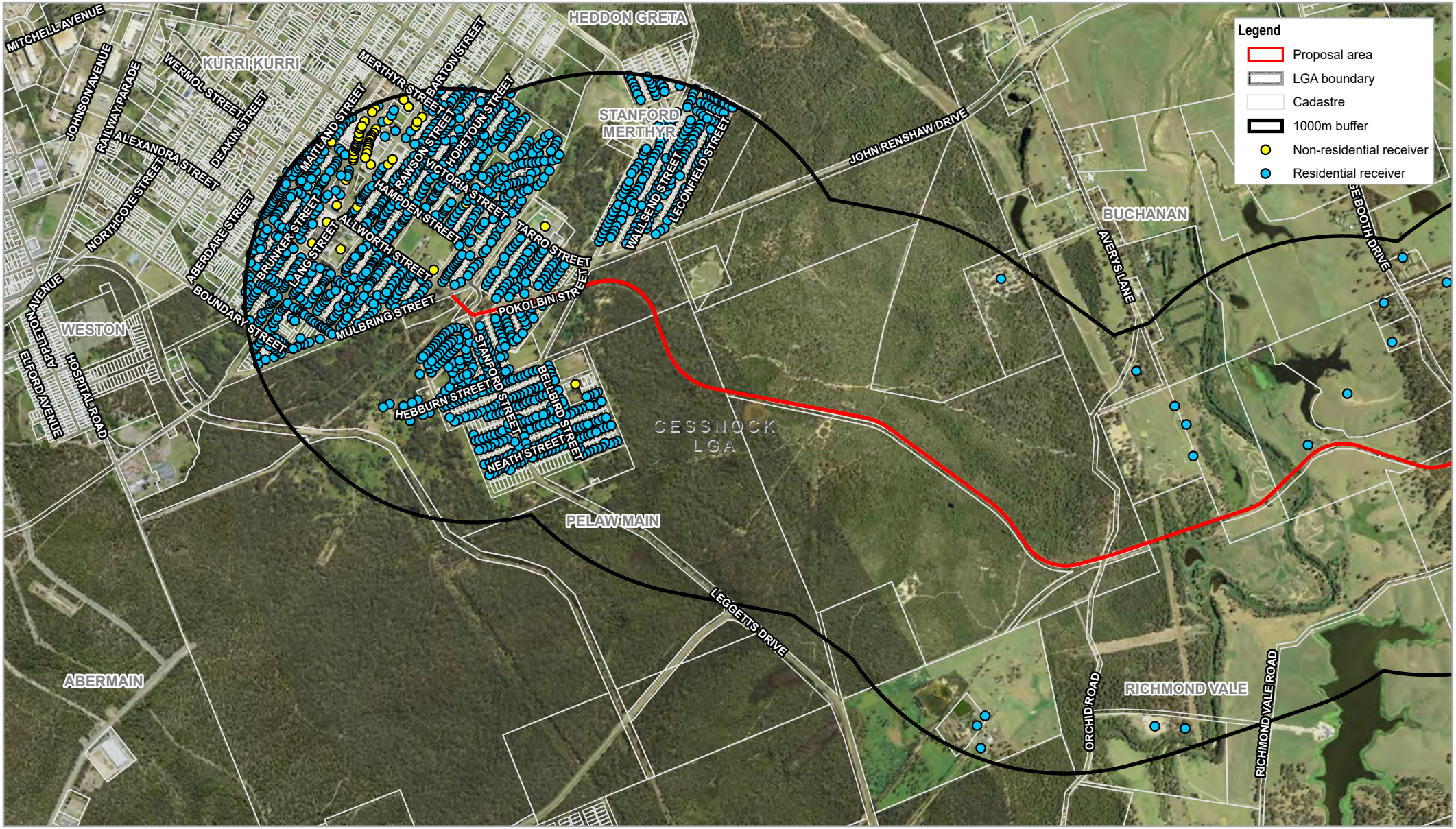
6.4.1 Existing environment

The majority of the proposal site is located on the alignment of the former Richmond Vale railway, commencing at Stockrington. Apart from the residential land uses in association with the suburbs of Kurri Kurri and Pelaw Main at the western extent and the suburb of Stockrington at the eastern extent of the proposal, the predominant land use is sparsely populated rural land with other uses including:

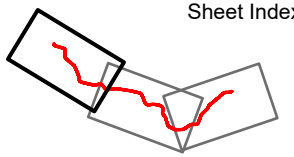
- Roads (e.g. George Booth Drive and the Hunter Expressway)
- Buttai Gravel quarry, Stockrington
- Henholme Battery Hen Fam, Buchanan
- Orica Kurri Technical Centre, Richmond Vale

The ambient acoustic environment along the proposal alignment is influenced by road traffic where the proposal intersects major public roads, but is dominated by natural sources, such as animals and wind through foliage.

Noise sensitive receivers are predominately located around Kurri Kurri and Pelaw Main, Buchanan and Stockrington (see Figure 6-3).



Sheet Index



Paper Size ISO A4

0 0.2 0.4 0.6 0.8

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

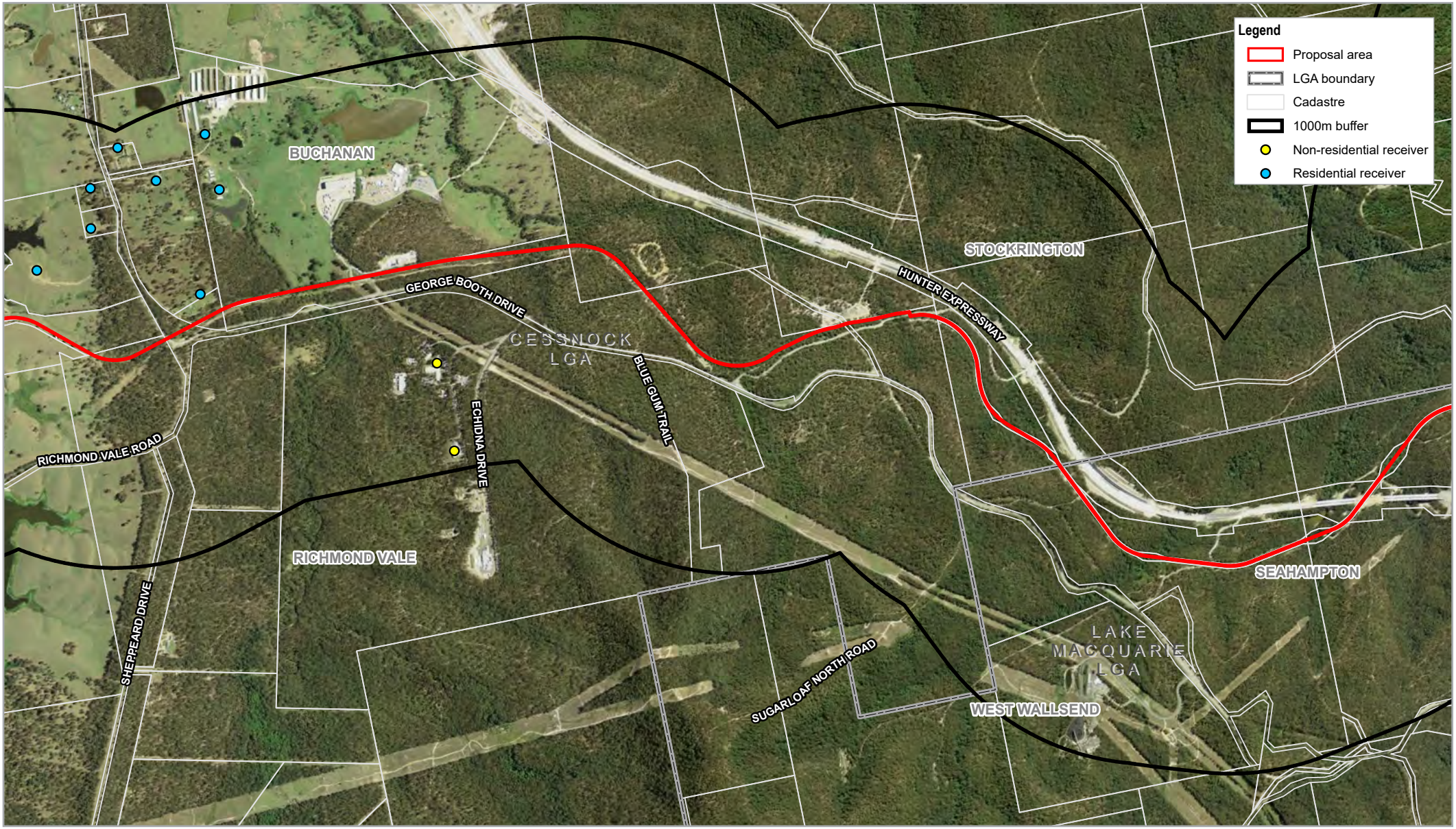
Cessnock City Council
Richmond Vale Rail Trail
Review of Environmental Factors

Noise sensitive receivers
sheet 1 of 3

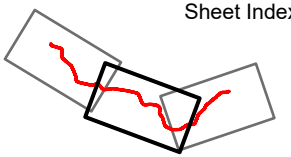
Project No. **12529257**
Revision No. **0**
Date **03/07/2020**

Figure 6-3a

G:\22\12529257\GIS\Maps\REF_0.aprx
Print date: 03 Jul 2020 - 10:28



Sheet Index



Paper Size ISO A4

0 0.2 0.4 0.6 0.8

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

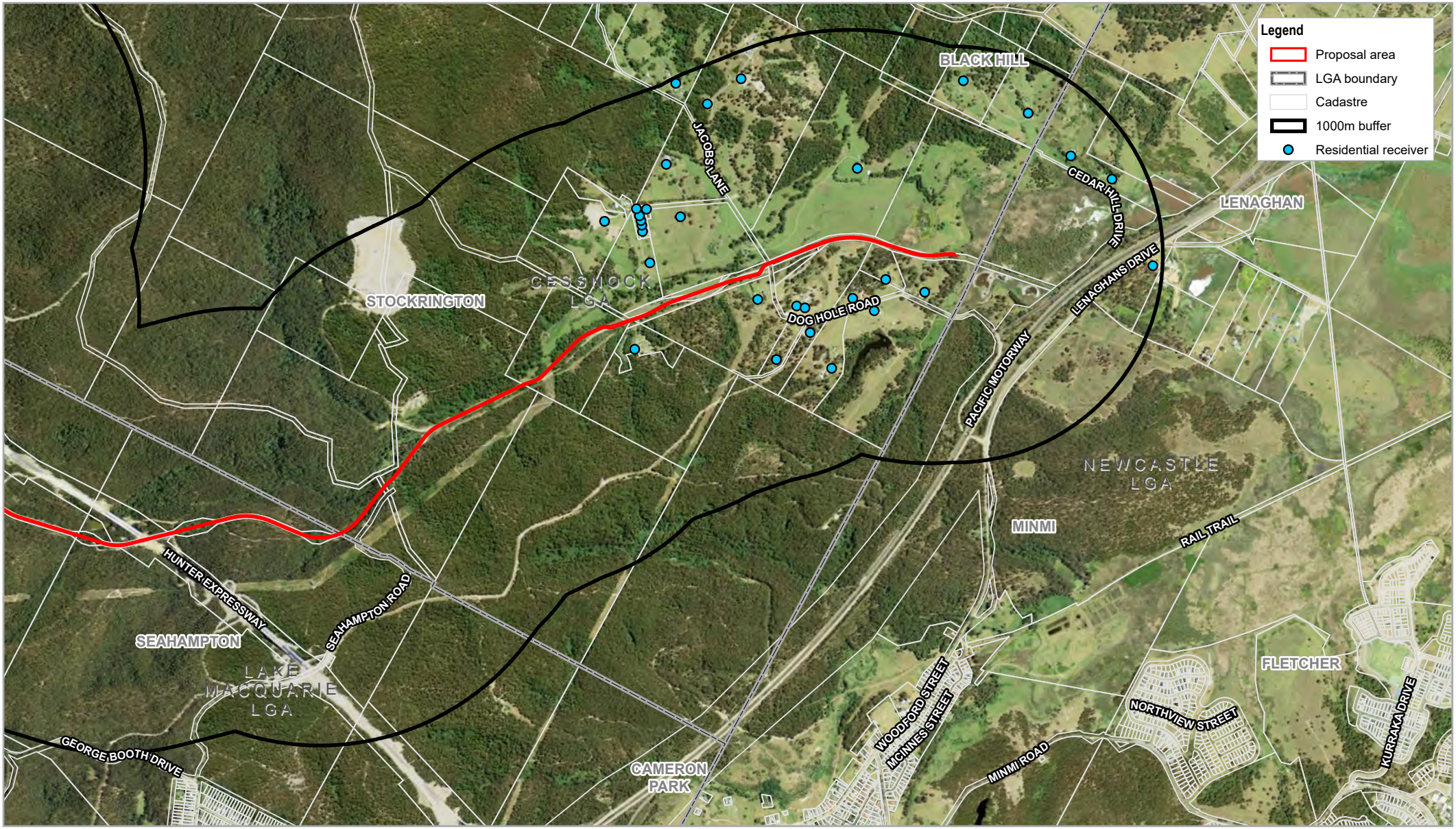
Cessnock City Council
Richmond Vale Rail Trail
Review of Environmental Factors

Noise sensitive receivers
sheet 2 of 3

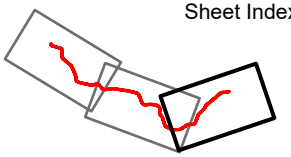
Project No. **12529257**
Revision No. **0**
Date **03/07/2020**

Figure 6-3b

G:\22\12529257\GIS\Maps\REF_0.aprx
Print date: 03 Jul 2020 - 10:29



Sheet Index



Paper Size ISO A4

0 0.2 0.4 0.6 0.8

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Cessnock City Council
Richmond Vale Rail Trail
Review of Environmental Factors

Noise sensitive receivers
sheet 3 of 3

Project No. **12529257**
Revision No. **0**
Date **03/07/2020**

Figure 6-3c

G:\22\12529257\GIS\Maps\REF_0.aprx
Print date: 03 Jul 2020 - 10:29

6.4.2 Potential impacts

Noise and vibration criteria

Background noise

The *Noise Policy for Industry* (NPI) (Environment Protection Agency, 2017) provides a procedure for determining background levels prior to establishing noise criteria. The NPI states that the minimum day time background level for the purpose of setting criteria is 30 dB(A). A background level of 30 dB(A) is assumed for the proposal for the purpose of establishing noise criteria.

Construction noise

Construction noise has been assessed with consideration to the *Interim Construction Noise Guideline* (ICNG) (Department of Environment and Climate Change, 2009). The ICNG defines noise sensitive receivers as the following:

- Residences
- Classrooms
- Hospitals
- Places of worship
- Passive recreation areas such as outdoor areas used for teaching
- Active recreation areas such as parks and sports grounds
- Commercial premises and industrial premises

Sensitive receivers for the proposal would include residences and passive recreation areas. Of these two land uses, residences are considered to be the more sensitive receiver type, and are therefore the focus of this assessment.

The ICNG provides two methods for assessing construction noise based on the duration of predicted noise impacts to sensitive receivers: a qualitative assessment for when construction noise is predicted to impact a noise sensitive receiver for less than three weeks in total, and a quantitative noise assessment for when construction noise is predicted to impact a noise sensitive receiver for more than three weeks in total.

The proposal would be constructed progressively along a linear alignment with the majority of construction activities not anticipated to cause noise impacts to any receivers for a period of greater than three weeks. The proposal would include some localised construction activities that would likely extend for greater than three weeks, such as the construction of bridges and the establishment and use of site compounds. However, these sites are sufficiently distant from residences so that significant noise impacts are not considered likely.

The construction noise criteria for the proposal is presented in Table 6-1 and Table 6-2.

Table 6-1 ICNG construction noise criteria at residential receivers, dB(A)

Time period	Management level LAeq(15 min)
Recommended standard hours: • Monday to Friday: 7.00 am to 6.00 pm • Saturday: 8.00 am to 1.00 pm • No work on Sundays or public holidays	Noise affected level: RBL(period) + 10 Highly noise affected level: 75
Outside recommended standard hours	Noise affected level: RBL(period) + 5

Table 6-2 Project specific construction noise criteria for residential receivers

Time period	Management level LAeq(15 min)
Recommended standard hours: • Monday to Friday: 7.00 am to 6.00 pm • Saturday: 8.00 am to 1.00 pm • No work on Sundays or public holidays	Noise affected level[1]: 40 Highly noise affected level: 75
Outside recommended standard hours	Noise affected level[1]: 35
Note[1]: The NPI notes that 'where the rating background level is found to be less than 30 dB(A), then it is set to 30 dB(A)'. This assessment has adopted a rating background level of 30 dB(A).	

Construction vibration

Assessing vibration: A technical guideline (Department of Environment and Conservation, 2006) (AVTG) outlines methods for assessing potential impacts and ways to manage vibration from construction activities. AVTG is based on guidelines contained in BS 6472-1992 *Evaluation of human exposure to vibration in buildings* (1–80 Hz).

Typically, construction works generate ground vibration of an intermittent nature. Under BS 6472–1992, intermittent vibration is assessed using the vibration dose value (VDV). Acceptable VDVs, as outlined in AVTG, are presented in Table 6-3.

Table 6-3 Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)

Location	Day[1]		Night[1]	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas[2]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

[1] Daytime is 7:00 to 22:00 and night-time is 22:00 to 7:00.

[2] Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be need to assess intermittent values against the continuous or impulsive criteria for critical areas.

Whilst the assessment of human response to vibration in BS 6472-1992 is based on VDV and weighted acceleration, for construction related vibration, it is considered more appropriate to provide guidance in terms of peak particle velocity (PPV), since this parameter is more likely to be routinely measured.

Humans are capable of detecting vibration at levels well below those that risk causing damage to a building. The degrees of perception for humans are suggested by the vibration level categories given in BS 5228-2:2009 *Code of practice for noise and vibration on construction and open sites – Part 2: Vibration* and are summarised in Table 6-4.

Table 6-4 Guidance on the effects of vibration levels

Approximate vibration level	Degree of perception
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.30 mm/s	Vibration might be just perceptible in residential environments.
1.00 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10.00 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Currently, there is no Australian Standard that sets the criteria for the assessment of building damage caused by vibration. Guidance of limiting vibration values is attained from reference to German Standard *DIN 4150-3: 1999-02 Structural Vibration – Part 3: Effects of vibration on structures.* Short-term vibration guideline values are presented in Table 6-5.

Table 6-5 Guideline values for short term vibration on structures (DIN 4150-3)

Line	Type of structure	Guideline values for velocity, vi(t)[1] [mm/s]		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[2]
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design.	20	20 to 40	40 to 50
2	Dwellings and buildings of similar design and/or occupancy.	5	5 to 15	15 to 20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (such as heritage listed buildings under preservation order).	3	3 to 8	8 to 10

[1] The term v_i refers to vibration levels in any of the x, y or z axes.
[2] At frequencies above 100 Hz the values given in this column may be used as minimum values.

For standard buildings, a common vibration target adopted for structural vibration is 5 mm/s PPV where specific source vibration frequencies are not available.

Energy from construction equipment is transmitted into the ground and transformed into vibration, which attenuates with distance. The magnitude and attenuation of ground vibration is dependent on the following:

- The efficiency of the energy transfer mechanism of the equipment (i.e. impulsive, reciprocating, rolling or rotating equipment)
- The frequency content
- The impact medium stiffness
- The type of wave (surface or body)
- The ground type and topography

Due to the above factors, there is inherent variability in ground vibration predictions without site-specific measurement data. The *Environmental Noise Management Manual* (Roads and Traffic Authority, 2001) provides typical construction equipment ground vibration levels at 10 metres. The rate of vibration attenuation can be calculated from the following regression analysis formula:

$V = kD^{-n}$ where V = PPV

D = Distance n = attenuation exponent

This assessment conservatively adopts an n value of 0.8 for predicting construction vibration at distances further than 10 metres from the source.

Operational noise

The NPI provides industrial noise criteria to aid in the assessment of industrial noise sources scheduled under the POEO Act. The policy sets two separate noise criteria to meet environmental noise objectives; one to account for intrusiveness and the other to protect the amenity of particular land uses.

Intrusiveness is assessed by determining the background noise level, where the equivalent continuous noise level from operations should not be more than five decibels (dB) above the measured background level. The amenity criterion is based on noise criteria specific to the land use and associated activities. The project specific level is the more stringent of the intrusive and amenity criteria.

The intrusive, amenity and project specific levels are shown in Table 6-6. The NPI rural residence category has been adopted as the controlling amenity criteria.

Table 6-6 Project specific operational noise criteria , dB(A)

	Criterion, dB(A)
Adopted rating background level, $L_{A90(Period)}$	30
Intrusiveness criteria, $L_{Aeq(15min)}$	35
Amenity criteria (Residence - rural), $L_{Aeq(period)}$	50
Project specific criterion, $L_{Aeq\ (15min)}$	**35**

Traffic noise

The NSW Road Noise Policy (RNP), (Department of Environment, Climate Change and Water, 2011) provides road noise criteria for residential receiver's subject to noise from public roads. The relevant criteria is for existing residences affected by additional traffic on existing local roads generated by land use developments, and is reproduced in Table 6-7. Road noise from vehicles travelling on private roads is assessed as cumulative site noise, and compared to either the ICNG or the NPI.

Table 6-7 Road traffic noise assessment criteria for residential land uses

Road category	Type of proposal/land use	Assessment criteria, dB(A)	
		Day (7:00 am – 10:00 pm)	Night (10:00 pm – 7:00 am)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq,\ (1\ hour)}$ 55 (external)	LAeq, (1 hour) 50 (external)

Construction

To assess construction noise impacts, sound pressure levels at various distances have been predicted for equipment that is anticipated to be used during proposal construction, see Table 6-8. The noise levels presented in Table 6-8 are a conservative estimate based on distance loss alone. The effects of topography, ground cover and molecular absorption have not been considered.

Table 6-8 indicates that the highly noise affected noise management level would be exceeded within 20 metres of certain activities during construction of the pathway, bridges and the car parking areas. There are no receivers within 20 metres of the works (see Figure 6-3).

The noise affected noise management level (40 dB(A)) would be exceeded within 1000 metres of residences during most activities (see Table 6-8). However as construction would proceed relatively quickly along the alignment and noise would not be generated at any one location for long periods, a significant impact is not expected.

Predicted vibration levels from the highest vibration generating equipment on site are presented in Table 6-9. The structural damage criteria of 5 mm/s would be exceeded at residences up to 25 metres from vibration generating activities. There are no receivers within 25 metres of the works (see Figure 6-3).

The closest residential receiver to the proposal is about 35 metres to the north of proposed works at Buchanan just east of Wallis Creek (Lot 4 DP1000943). This property (and other properties within 1000 metres of the proposed works) would be subject to exceedances of the noise affected noise management level during certain activities. Receivers are shown in Figure 6-3. Receivers are clustered around the eastern extent of the proposal, at Buchanan and within Pelaw Main/ Kurri Kurri. Measures are provided in Section 6.4.3 to reduce this impact.

Operation

The proposal is not expected to generate significant noise or vibration during operation. Proposed instructional signage would inform users of the need to consider noise impacts for residences when using the trail.

Table 6-8 Construction equipment and predicted noise level (dB(A)) at distance

Construction activity	Construction equipment	Adopted SWL, dB(A)	Noise data reference	Predicted sound pressure level (dBA) at distance, dB(A)						
				20 m	50 m	100 m	200 m	350 m	500 m	1000 m
Construction of shared pathway	Asphalt truck and sprayer	103	RMS CNVG	**69**	**61**	**55**	**49**	**44**	**41**	35
	Chainsaw	114	RMS CNVG	**80**	**72**	**66**	**60**	**55**	**52**	**46**
	Compressors and hand tools	105	AS2436-2010	**71**	**63**	**57**	**51**	**46**	**43**	37
	Concrete truck	108	AS2436-2010	**74**	**66**	**60**	**54**	**49**	**46**	40
	Dog and trailer	101	GHD database	**67**	**59**	**53**	**47**	**42**	39	33
	Excavator 52 kW	105	BS 5228-1:2009	**71**	**63**	**57**	**51**	**46**	**43**	37
	Generator	99	AS2436-2010	**65**	**57**	**51**	**45**	40	37	31
	Grader	110	AS2436-2019	**76**	**68**	**62**	**56**	**51**	**48**	**42**
	Light vehicles	100	AS2436-2010	**66**	**58**	**52**	**46**	**41**	38	32
	Smooth drum roller	107	RMS CNVG	**73**	**65**	**59**	**53**	**48**	**45**	39
Construction of bridges	Concrete truck	108	AS2436-2010	**74**	**66**	**60**	**54**	**49**	**46**	40
	Dog and trailer	101	GHD database	**67**	**59**	**53**	**47**	**42**	39	33
	Excavator 52 kW	105	BS 5228-1:2009	**71**	**63**	**57**	**51**	**46**	**43**	37
	Franna crane 20 t	98	RMS CNVG	**64**	**56**	**50**	**44**	39	36	30
	Light vehicles	100	AS2436-2010	**66**	**58**	**52**	**46**	**41**	38	32
	Piling rig (bored)	111	AS2436-2010	**77**	**69**	**63**	**57**	**52**	**49**	**43**
Construction of compound	Dog and trailer	101	GHD database	**67**	**59**	**53**	**47**	**42**	39	33
	Excavator 52 kW	105	BS 5228-1:2009	**71**	**63**	**57**	**51**	**46**	**43**	37
	Franna crane 20 t	98	RMS CNVG	**64**	**56**	**50**	**44**	39	36	30
	Front end loader (52 kW)	108	BS 5228-1:2009	**74**	**66**	**60**	**54**	**49**	**46**	**40**
	Generator	99	AS2436-2010	**65**	**57**	**51**	**45**	**40**	37	31
	Grader	110	AS2436-2010	**76**	**68**	**62**	**56**	**51**	**48**	**42**
	Light vehicles	100	AS2436-2010	**66**	**58**	**52**	**46**	**41**	38	32
	Smooth drum roller	107	RMS CNVG	**73**	**65**	**59**	**53**	**48**	**45**	39
	Water cart	107	RMS CNVG	**73**	**65**	**59**	**53**	**48**	**45**	39
	Asphalt truck and sprayer	103	RMS CNVG	**69**	**61**	**55**	**49**	**44**	**41**	35
	Concrete truck	108	AS2436-2010	**74**	**66**	**60**	**54**	**49**	**46**	**40**

Construction activity	Construction equipment	Adopted SWL, dB(A)	Noise data reference	Predicted sound pressure level (dBA) at distance, dB(A)						
				20 m	50 m	100 m	200 m	350 m	500 m	1000 m
Construction of car parks and other facilities	Excavator 52 kW	105	BS 5228-1:2009	**71**	**63**	**57**	**51**	**46**	**43**	37
	Grader	110	AS2436-2010	**76**	**68**	**62**	**56**	**51**	**48**	**42**
	Light vehicles	100	AS2436-2010	**66**	**58**	**52**	**46**	**41**	38	32
	Pavement laying machine	114	RMS CNVG	**80**	**72**	**66**	**60**	**55**	**52**	**46**
	Smooth drum roller	107	RMS CNVG	**73**	**65**	**59**	**53**	**48**	**45**	39

Note: 'RMS CNVG' refers to the Construction Noise and Vibration Guideline (Roads and Maritime, 2016).

Note: Red bold indicates exceedance of highly noise affected management level of 75 dB(A)

Note: Bold indicates exceedance of noise affected management level of 40 dB(A)

Table 6-9 Vibration levels - construction equipment

Item	Reference PPV (mm/s)	Source	PPV (mm/s) at distance (m)										
			10 m	12 m	15 m	20 m	25 m	30 m	50 m	100 m	150 m	200 m	250 m
Piling (bored)	12 mm/s at 10 m	ENMM	**12.0**	**10.4**	**8.7**	**6.9**	**5.8**	5.0	3.3	1.9	1.4	1.1	0.9
7 tonne compactor	7 mm/s at 10	ENMM	**7.0**	**6.0**	**5.1**	4.0	3.4	2.9	1.9	1.1	0.8	0.6	0.5
Roller	6 mm/s at 10m	ENMM	**6.0**	**5.2**	4.3	3.4	2.9	2.5	1.7	1.0	0.7	0.5	0.5

Note: Red bold indicates levels that exceed the 5 mm/s limit for residential dwellings.

Note: *The Environmental Noise Management Manual* (ENMM) (Roads and Traffic Authority, 2001) provides a range of vibration predicted at 10 metres for piling of 12 mm/s - 30 mm/s. The upper range represents impact piling, therefore the lower range has been assumed for bored piling.

6.4.3 Safeguards and management measures

Construction

- All employees, contractors and subcontractors are to receive an environmental induction, which would include:
  - All relevant project specific and standard noise and vibration mitigation measures.
  - Relevant licence and approval conditions.
  - Permissible hours of work.
  - Location of nearest sensitive receivers.
  - Construction employee parking areas.
  - Designated loading/unloading areas and procedures.
  - Site opening/closing times (including deliveries).
  - Environmental incident procedures.
- No swearing or unnecessary shouting or loud stereos/radios would be allowed on site. Dropping of materials from height, throwing of metal items and slamming of doors would be avoided.
- Contact would be established with local residents and the construction program and progress communicated on a regular basis, particularly when noisy or vibration-generating activities are planned. Affected receivers (i.e. those within 1000 metres, see Figure 6-3) would be notified of the intended work, its duration and times of occurrence.
- A contact number would be provided for complaints. All complaints would be logged and responded to as soon as practicable.
- On receipt of a noise complaint, construction activities would be reviewed to identify reasonable and feasible mitigation strategies to reduce noise. Noise monitoring would be considered if appropriate.
- All work would be undertaken within standard construction hours, unless out of hours work has been approved.
- Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
- Broadband reverse warnings should be used in preference over ‘beeper’ style warnings.
- Simultaneous operation of noisy plant within discernible range of a sensitive receiver would be avoided.
- The offset distance between noisy or vibration generating plant and adjacent sensitive receivers is to be maximised. Noise-emitting plant to be directed away from sensitive receivers.
- Plant used intermittently would be throttled down or shut down in between uses.
- Traffic flow, parking and loading and unloading areas would be planned to minimise reversing movements within the site.
- Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers.

- Site access points and roads would be selected as far as possible away from sensitive receivers.
- Loading and unloading of vehicles to consider noise generation for nearby residents i.e. no dropping of loads, consider straps instead of chains to secure loads etc.

Operation

- Instructional signage would inform users of the need to consider noise impacts for residences when using the trail.

6.5 Resource consumption and waste generation

6.5.1 Existing environment

Council is committed to ensuring responsible management of unavoidable waste and to promote the reuse of such waste through appropriate measures in accordance with the resource management hierarchy principles embodied in the *Waste Avoidance and Resource Recovery Act 2001*. The resource management hierarchy principles in order of priority, as outlined in the Act, are:

- Avoidance of unnecessary resource consumption
- Resource recovery (including reuse, reprocessing, recycling and energy recovery)
- Disposal

By adopting the above principles, Council encourages the most efficient use of resources and reduces cost and environmental harm in accordance with the principles of ecologically sustainable development.

6.5.2 Potential impacts

Construction

Resource use

Construction of the proposal would require the use of a number of resources, including:

- Resources associated with the operation of construction machinery and motor vehicles (this includes the use of diesel and petrol).
- Material required for the trail surface and pavements (asphalt, spray seal, sand, concrete, aggregate).
- Fill required to meet design levels.
- Materials required for signage, lighting and fencing.
- Materials required for drainage, conduits, services and pits.
- Construction water (for concrete mixing and dust suppression).

The materials required for construction of the proposal are not currently limited in availability. However, materials such as metal and fuel are non-renewable and would be used conservatively. Excess spoil, not suitable for reuse (although not currently anticipated), would be disposed of in accordance with legal requirements. Other waste would be reused or recycled wherever practical.

Waste generation

The proposal has the potential to generate waste from the following activities:

- Removal of vegetation
- Earthworks for trail and bridge construction
- Trail construction
- General site activities by workers

Waste streams likely to be generated during construction of the proposal include:

- Spoil. This is not considered likely as all excavated material (amounts would be minimal), unless contaminated, would be reused on-site as fill
- Green waste as a result of vegetation clearing
- Fencing, guide posts, guard rails
- Packaging and general waste from staff (lunch packaging, portable toilets)
- Chemicals and oils
- Waste water from wash-down and bunded areas
- Redundant erosion and sediment controls

The potential to reuse materials would be investigated during construction planning. Unsuitable fill material that cannot be used on-site (though not considered likely) would be classified in accordance with the *Waste Classification Guidelines* (Environmental Protection Agency, 2014) and disposed of at an approved materials recycling or waste disposal facility.

Operation

The proposal would create small amounts of waste as a result of maintenance and management activities during operation. Quantities are not expected to be significant and waste would be managed in accordance with Council's current waste management procedures. Similarly small quantities of resources would be utilised during operation. This would include, for example, herbicides, fencing materials, paints, fuels, cleaning equipment and chemicals etc.

Public amenities would be provided at each of the proposed car parking areas (Section 3.2.5). Waste receptacles would be provided at car parks and signage would encourage all users to take waste with them from the trail.

6.5.3 Safeguards and management measures

Construction

- The following resource management hierarchy principles would be followed:
  - Avoid unnecessary resource consumption as a priority
  - Avoidance would be followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery)
  - Disposal would be undertaken as a last resort (in accordance with the *Waste Avoidance and Resource Recovery Act 2001*)
- A site waste minimisation and management plan would be prepared for the proposal in accordance with relevant EPA and Council guidelines. The plan would be prepared and approved by Council prior to construction commencing.

- Procurement would endeavour to use materials and products with a recycled content where that material or product is cost and performance effective.
- Excess excavated material would be reused appropriately for fill or disposed of at an appropriate facility. Excess material requiring waste disposal would first be assessed against the *Waste Classification Guidelines* (Environmental Protection Agency, 2014).
- Additional fill material would be sourced from appropriate local sources.
- Cleared weed-free vegetation would be chipped and reused on-site as part of the proposed landscaping and to stabilise disturbed soils where possible. Weed vegetation would be disposed of appropriately off-site in accordance with its classification status under the *Biosecurity Act 2015*, where relevant.
- Garbage receptacles would be provided at the site compound and recycling of materials encouraged. There would be no disposal or re-use of construction waste on to other land.
- Waste would not be burnt on-site.
- Waste material, other than vegetation and tree mulch, would be removed from site once the works have been completed.
- Portable toilets would be provided for construction workers and would be managed by the service provider to ensure the appropriate disposal of sewage.
- Site inductions would ensure staff are aware of waste disposal protocols and attendance would be recorded by the site supervisor.
- All working areas would be maintained, kept free of rubbish and cleaned up at the end of each working day.
- Any hazardous waste material stockpiles would be fenced and sign posted for public safety.
- Dedicated concrete washout facilities would be provided during construction so that runoff from the washing of concrete machinery and equipment can be collected and disposed of at an appropriate waste facility.
- Waste would be disposed of appropriately with supporting waste classification documentation, if required.

Operation

- Regular maintenance of the pathway, as part of Council's ongoing regime, would identify and control waste.
- Waste management and resource use would be in accordance with Council's existing operational procedures.
- Waste receptacles would be provided at car parks and signage would encourage all users to take waste with them from the trail.

6.6 Traffic and access

The following section has been summarised from the specialist traffic assessment prepared by GHD, which is included in full in Appendix E.

6.6.1 Existing environment

Roads

Overview

While much of the proposal site is remote from the road network; the route intersects a number of roads including:

- Dog Hole Road, Stockrington
- George Booth Drive, Buchanan
- Pokolbin Street, Pelaw Main
- Stanford Street, Pelaw Main

These roads are described in the following sections. In addition, the proposal is located within approximately 2.1 kilometres of the road reserve of Seahampton Road, at Stockrington.

Dog Hole Road, Stockrington

Dog Hole Road is the continuation of Stockrington Road, which connects to Lenaghans Drive at an unsignalised T-junction with a channelised right turn treatment. Dog Hole Road and Stockrington Road have a single lane in each direction and a 60 kilometre per hour (km/hr) speed limit. In the vicinity of the proposed trail crossing, Dog Hole Road is a single-lane sealed roadway.

Seahampton Road, Stockrington

Seahampton Road runs between Dog Hole Road and George Booth Drive, passing under the M1 Motorway. The road is currently gated to prevent vehicular access. It has a narrow carriageway and few accesses along its length.

George Booth Drive, Richmond Vale

The trail is planned to run generally parallel to George Booth Drive for approximately 4.5 kilometres. George Booth Drive is a rural road connecting the M1 Motorway at Seahampton with Kurri Kurri, a function that has now largely been superseded by the Hunter Expressway. It has a single lane of traffic in each direction, with a posted speed limit of 80 km/hr.

Roads branch off George Booth Drive to give access to adjacent land uses, including a privately-owned quarry, and former Hunter Expressway construction compounds.

Pokolbin Street and Stanford Street, Kurri Kurri

Pokolbin Street is a suburban residential street with a posted speed limit of 50 km/hr. Stanford Street is a collector road between Leggetts Drive and Railway Street and has a posted speed limit of 50 km/hr.

Arterial road network

The arterial road network in the vicinity of the proposal includes the John Renshaw Drive (B6), M1 Motorway, Newcastle Link Road (A15) and Hunter Expressway (M15).

John Renshaw Drive connects Tarro and Kurri Kurri and has a posted speed limit of 100 km/hr. The M1 Motorway commences at John Renshaw Drive, Tarro and heads south, with major interchanges at the Hunter Expressway and George Booth Drive, before continuing towards the Central Coast and Sydney. The Pacific Motorway has a posted speed limit of 110 km/hr.

Newcastle Link Road is a major arterial road connecting Newcastle and the Hunter Expressway, with a posted speed limit of 90 km/hr. Hunter Expressway connects to Newcastle Link Road and runs past Kurri Kurri heading north with a posted speed limit of 110 km/hr.

Crash history

George Booth Drive

There were no crashes recorded on George Booth Drive in the immediate vicinity of the Quarry Access Road intersection. However, there were a number of crashes on nearby sections of the road, particularly to the south where the alignment is winding. Vehicles leaving the carriageway were the most common crash types in this area.

There were no crashes recorded in the vicinity of the Expressway construction access road intersection.

Kurri Kurri

There was one crash recorded on Stanford Street in the vicinity of the proposed route. It was a head-on crash resulting in moderate injury. Three crashes were recorded at the intersection of Stanford Street/Mulbring Street/Railway Street, with one resulting in minor injury. There was also one crash in Mulbring Street opposite the trail terminus, resulting in serious injury.

Rail

The Lower Hunter Freight Corridor is a proposed rail corridor connecting the Main North Railway Line at Fassifern and the Hunter Valley Rail corridor at Hexham. Transport for NSW are currently investigating options for a dedicated freight link connecting the two lines. Depending on the selected corridor location, the freight rail may impact on the proposal. However, the presence of the rail trail is not expected to impact on the feasibility of either project.

Buses

Neither George Booth Drive (adjacent to the proposal site) or Dog Hole Road are serviced by regular public transport. The nearest public transport to Dog Hole Road is at Minmi, approximately 3.5 kilometres away.

Public transport services George Booth Drive to the north of the study area at Buchanan, and to the south at Cameron Park.

Public transport in Kurri Kurri is operated by Rover Coaches, with services between Cessnock, Kurri Kurri and Maitland. Route 166 travels closest to the proposal, via Pokolbin Street and Stanford Street. Other routes service central Kurri Kurri.

Cycling

There are many local bike tracks in the areas surrounding the proposal ranging from off road gravel tracks to sealed bike/pedestrian tracks that follow local road alignments. The northern end of the old rail line track has been used for a bike track commencing at Pokoblin Street, heading south and connecting to Leggetts Drive and then heading north returning to Kurri Kurri.

In addition, the Cessnock Cycling Strategy was completed in mid-2016. The Strategy recognises the potential for the Richmond Vale Rail Trail, and supports its implementation:

“The Rail Trail would provide cyclists in the region with a high quality cycleway that will make cycling more attractive and encourage people to get on their bikes and participate in cycling”.

The Cessnock Cycling Strategy also identifies potential connections to the proposal, including within Kurri Kurri.

Further to the above, Council's Trails Strategy (2020) highlights the significance of the trail and its strategic importance within the broader trail network (both cross-regionally and locally). A number of high priority actions are provided within the Strategy to support the progression of the Richmond Vale Rail Trail.

6.6.2 Potential impacts

Construction

Access

Construction access is discussed in Section 3.3.11. It is not expected that use of any of the proposed access points would result in significant impacts to the surrounding road network.

The proposal site may intersect with property accesses and driveways where it runs along road corridors. Potential impacts could include temporary impacts to property access while works are in that location. These delays and associated inconveniences to property owners would be temporary only and construction activities would be planned to consider pedestrian and vehicle movements in consultation with residents and business owners, to ensure impacts are minimised.

Construction vehicle movements

The construction of the proposal would involve increased vehicle movements in and around the construction site and compound areas. Construction vehicle movements would comprise:

- Heavy vehicles (construction plant and machinery, material and equipment delivery
- Worker vehicles (cars/light vehicles which would arrive and leave at the start and end of each day)

Construction vehicle numbers are estimated to be between 40 and 50 each day.

Construction is expected to occur over the standard working hours of 7:00 am to 6:00 pm Monday to Friday, and 8:00 am to 1:00 pm Saturday. The volume of traffic associated with construction would vary from location to location, and across the duration of the works.

The delivery of some equipment and machinery may be considered oversized deliveries. These deliveries would be undertaken in accordance with the requirements of Council and/or Transport for NSW, so as not to cause undue interruption or compromise the safety of the road network or road users.

Increased vehicle movements may increase the potential for incidents and accidents but the overall number of construction vehicles is minor in relation to existing traffic volumes. Construction vehicles would predominantly access the site during work hours on week days which would minimise impacts on weekend traffic.

Workforce parking

Designated worker parking would be provided within the site compounds and, where appropriate, dedicated access points to minimise inconvenience to residents and local businesses during the construction period.

Operation

Traffic

The majority of users of the proposal are likely to be recreational users, as opposed to commuters. As such, while the proposal may result in a minor reduction in commuters using the local road network, traffic movements to and from the proposal during the road network peak periods would be minimal. The peak traffic activity associated with the proposal is expected on weekends, and during holiday periods, when background traffic volumes are generally lower and there is spare capacity on the road network. Accordingly, significant traffic impacts during proposal operation are not anticipated.

Routine maintenance of the proposal would not generate significant traffic numbers.

Parking and access

The parking proposed is anticipated to be sufficient for the usage envisaged for the trail. However, Council would monitor use over time to keep track of parking availability and there may be potential for future expansion.

Maintenance and emergency vehicle access would be via the connection with infrastructure in the form of gates and bollards installed at these connection points to exclude trespass by other vehicles. Once access been gained from the connection points, maintenance and emergency vehicles movements would be restricted to the trail.

Loss of rail facilities

The opportunity to reinstate a rail service to the rail line would be lost if the proposal is constructed. Given the long closed and derelict nature of the majority of the line, including the bridges, this is not considered feasible. On balance, considering the cost of restoration of the rail line and the benefits of its use as a rail trail for recreational and commuter users, the proposal is considered the best and highest use for the land.

6.6.3 Safeguards and management measures

Detailed design

- Upgrades to intersections would be investigated during detailed design in particular at George Booth Drive.

Construction

- Construction traffic management plans (CTMPs) would be prepared and approved by the appropriate roads authority prior to works commencing. The CTMPs would include specific temporary traffic management measures to support construction activities at key locations including:
  - Former Hunter Expressway construction access roads at Blue Gum Creek and Surveyors Creek
  - Quarry Access Road
  - Private access to Wallis Creek
  - Leggits Drive
  - Pokolbin Street
- Worker parking would be constrained to within the compound site as far as is practicable.
- Carpooling and other methods would be investigated to limit the number of vehicles coming to site, as far as practicable.

- The queuing and idling of construction vehicles in residential streets would be minimised to reduce nuisance.
- An emergency response plan would be developed for construction traffic incidents and/ or accidents. During site inductions, all heavy vehicle drivers would be provided with the emergency response plan for construction traffic incidents.
- The community and local residents would be notified in advance of vehicle movements and anticipated effects on the local road network relating to site works. This would aim to reduce delays and access impacts for residents, public transport, pedestrians and cyclists.
- Access to all private properties adjacent to the works would be maintained during construction, unless otherwise agreed by relevant property owners.

Operation

- Council would monitor the use of car parks over time to determine if parking provided is sufficient.
- In order to manage the potential conflict between light and heavy vehicle traffic at the Quarry Access Road, the following measures are recommended:
  - Provision of truck warning signage on the access road.
  - Management of roadside vegetation to maintain forward sight lines for traffic moving along the access road.
- Signage would be installed at all locations where the proposal interacts at grade with a road or other road safety issues (such as a school zone), providing a clear delineation between the proposal and the road. Trail users would be warned of the approaching road, via 'Road Ahead' signage. Road and other users would be warned of the approaching trail using appropriate signage in accordance with Australian Standards (see Section 3.2.7).

6.7 Biodiversity

The following sections have been summarised from the specialist flora and fauna assessment prepared by GHD, which is included in full in Appendix F.

6.7.1 Methodology

The following methodology was used to complete the flora and fauna assessment for the proposal.

Desktop assessment

The desktop assessment was undertaken to identify threatened flora and fauna species, populations and ecological communities (threatened biota) listed under the BC Act, FM Act, and EPBC Act, that could be expected to occur in the locality, based on previous records, known distribution ranges, and habitats present. The following biodiversity databases and literature pertaining to the proposal site and locality (within a 10 km radius of the proposal site) were reviewed prior to conducting field investigations:

- The NSW BioNet atlas database to help identify threatened species that may occur in the proposal site (OEH, 2020a)
- OEH threatened biota profiles for descriptions of the ecology, distribution and habitat requirements of threatened biota (OEH, 2020b)
- Department of the Environment and Energy (DEE) Protected Matters Online Search Tool for MNES listed under the EPBC Act predicted to occur in the locality (DEE, 2020a)

- DEE online species profiles and threats database (SPRAT) (DEE, 2020b)
- The NSW BioNet Vegetation Classification database to help identify Plant Community Types (PCTs) that occur in the proposal site (DPIE, 2020a)
- Previous vegetation mapping of the proposal site (DPIE, 2010) (LMCC, 2016) and supporting vegetation descriptions in Bell (2016)
- Department of Primary Industries (DPI) freshwater threatened species distribution maps. For distribution of threatened aquatic species that may occur in the locality (DPI, 2019)
- DPI key fish habitat mapping (DPI, 2007)
- Groundwater Dependent Ecosystem Atlas (BOM, 2020)
- Aerial photographs and satellite imagery
- DPE Biodiversity Values Map, which identifies declared areas of outstanding biodiversity values (AOBV) (DPIE, 2020b)
- Priority weed declarations under the Biosecurity Act for species listed in the Hunter region, including the Cessnock and Lake Macquarie LGA (DPI, 2020)

Likelihood of occurrence assessment

Following collation of database records and species and community profiles, a 'likelihood of occurrence' assessment was prepared with reference to the broad habitats contained within the proposal site. This was further refined following field surveys, as described below. The likelihood of threatened and migratory biota occurring in the proposal site was assessed based on the biodiversity characteristics of the study area identified during desktop assessment.

Site surveys

Site surveys of the study area were conducted by GHD ecologists in September, October and November 2016, January 2017 and May 2020 for a total of 13 days overall. Site surveys were conducted with reference to the Part C2 (Flora and Fauna Survey Guidelines) of the Cessnock Development Control Plan 2010 and included:

- Initial site stratification and vegetation mapping
- Floristic vegetation plots
- Flora and fauna habitat assessments
- Threatened flora surveys
- Targeted surveys for threatened fauna
- Opportunistic fauna observations
- Aquatic habitat assessment

Survey methodology is described in detail In Section 3 of the flora and fauna assessment (Appendix F).

Assessments of significance

Based on the site survey results, the likelihood of occurrence assessment was revised. Assessments of significance were then conducted for identified threatened ecological communities (TEC), fauna and flora species with moderate or high likelihood to utilise habitat within the proposal site, or those were recorded during the field surveys. These are included in Appendix C and D of the flora and fauna assessment (Appendix F).

6.7.2 Existing environment

Vegetation communities

The total area of land within the proposal site is 13.64 hectares, within this area the extent of native vegetation is approximately 3.59 hectares. Areas of native vegetation occur along the margins of remnant native woodland and shrubland patches.

Within previously cleared areas where groundcover vegetation persists, the vegetation is largely dominated by exotic grasses, including *Briza maxima* (Quaking Grass), *Megathyrsus maximus* (Guinea Grass), *Andropogon virginicus* (Whiskey Grass) and *Melinis repens* (Red Natal Grass).

The native vegetation within the proposal site is mostly restricted to the edges of the previously cleared rail line. Parts of the proposed route also run along exotic grassland and cleared areas associated with rural residential development and within the town of Pelaw Main/Kurri Kurri. Remnant native vegetation throughout the proposal site is broadly consistent with regional vegetation mapping and is characteristic of six PCTs. These include:

- PCT 1568: Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast
- PCT 1588: Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast
- PCT 1589: Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast
- PCT 1593: Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of the coastal lowlands
- PCT 1633: Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area

Detailed descriptions of these PCTs are provided in Section 4.4.2 of the flora and fauna assessment (Appendix F).

Threatened ecological communities

Two TECs listed under the BC Act occur within the proposal site:

- Lower Hunter Spotted Gum ironbark Forest in the Sydney Basin and NSW North Coast Bioregions endangered ecological community (EEC)
- Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC

No TECs listed under the EPBC Act occur within the proposal site.

One RAMSAR wetland (the Hunter Estuary Wetlands) is located approximately seven kilometres to the east of the proposal site. The proposal is unlikely to have any impact on this RAMSAR wetland.

Flora

A total of 217 flora species were recorded within the proposal site during field surveys. Five species recorded are listed as threatened under the BC Act or the EPBC Act.

The floral assemblage also includes 52 exotic species. Five of the exotic species recorded within the proposal site are priority weeds for the Hunter region (DPI, 2020).

Twenty-eight flora species listed as threatened under the BC Act and 24 flora species listed under the EPBC Act have been previously recorded or are predicted to occur in the locality of the proposal site. Eight of these species were found within the proposal site, study area or are considered to have the potential to occur based habitat associations. These species are outlined in Table 6-10.

Table 6-10 Threatened flora species found or with potential to occur within the study area

Species	Potential to occur within proposal site	BC Act status	EPBC Act status
Eucalyptus parramattensis subsp. *decadens* (Earp's Gum)	Found within study area (outside the proposal site)	V	V
Grevillea parviflora subsp. *parviflora* (Small-flower Grevillea)	Found within proposal site	V	V
Rutidosis heterogama (Heath Wrinklewort)	Found within study area (outside the proposal site)	*V*	*V*
Tetratheca juncea (Black-eyed Susan)	Found within proposal site	*V*	*V*
Angophora inopina (Charmhaven Apple)	Found within proposal site	V	V
Acacia bynoeana (Bynoe's Wattle)	Potential to occur	E	V
Callistemon linearifolius (Netted Bottle Brush)	Potential to occur	V	Not listed
Pterostylis gibbosa (Illawarra Greenhood)	Potential to occur	E	E

V= Vulnerable, E= Endangered

Fauna

A total of 62 species of fauna were recorded during field surveys. These included 41 bird species, 19 mammal species and two amphibian species.

The proposal site itself generally provides limited natural habitat values for native fauna. Most areas of the proposal site have been subject to ongoing disturbance associated with the operation of the former Richmond Vale railway. This has resulted in most habitat features, such as canopy trees, understorey, leaf litter, logs and bush rock, being removed from the majority of the proposal site.

The vegetation within the proposal site adjoins much larger remnants which have relatively good connectivity to conservation reserves such as Sugarloaf SCA. The exotic grassland areas of the site generally adjoin other exotic grassland primarily used for livestock grazing.

The proposal site contains two tunnels and small rock crevices that may provide foraging and roosting habitat for a number of microbat species, some of which were recorded via Anabat detector (Titley Scientific, QLD).

A total of six vulnerable fauna species listed under the BC Act were recorded within the proposal site consisting of one arboreal mammal; Koala (*Phascolarctos cinereus*) and five microbat species; Large-eared Pied Bat (*Chalinolobus dwyeri*), Eastern Free-tailed Bat (*Mormopterus norfolkensis*), Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), Little Bentwing Bat (*Miniopterus australis*) and Southern Myotis (*Myotis macropus*). Both Koala and Large-eared Pied Bat are also listed under the EPBC Act.

Areas of wetland habitat occur adjacent to the eastern end of the proposal site within the Pambalong Nature Reserve and further downstream the RAMSAR listed Hunter Estuary Wetlands. These areas are considered significant habitat for many wetland bird species.

One hundred threatened fauna species (including 45 birds, five amphibians, 16 mammals, five reptiles and one insect) listed under the BC Act have been previously recorded or are predicted to occur in the locality. Of these, 39 threatened fauna species including 15 mammal, 22 bird, one reptile and one amphibian species were considered as being potentially impacted by the proposal. Assessments of significance have been completed for these species in accordance with Section 7.3 of the BC Act (Appendix F).

Eleven threatened fauna species and four migratory species listed under the EPBC Act have been recorded, or are predicted to occur within the locality of the proposal site. Likelihood of occurrence assessments determined that there is suitable habitat within the proposal site or potential for indirect impacts to all 11 of these species and four migratory species (Table 6-11).

Table 6-11 EPBC Act listed threatened fauna with potential to occur within the proposal site

Group	Scientific name	Common name	EPBC Act status	Likely use of the proposal site
Wetland birds	*Botaurus poiciloptilus*	Australasian Bittern	E	Potential habitat within wetland downstream
	Rostratula benghalensis	Painted Snipe	E	Potential habitat within wetland downstream
Amphibians	*Litoria aurea*	Green and Golden Bell Frog	V	Known to occur in locality
Woodland and forest birds	*Grantiella picta*	Painted honeyeater		Foraging, marginal breeding habitat
	Anthochaera Phrygia	Regent Honeyeater	CE	Foraging, marginal breeding habitat
	Lathamus discolour	Swift Parrot	CE	Foraging only
Megabat	*Pteropus poliocephalus*	Grey-headed Flying Fox	V	Foraging only
Terrestrial Mammals	*Dasyurus maculatus*	Spotted-tailed Quoll	E	Foraging only
	Potorous tridactylus	Long-nosed Potoroo	V	Foraging only
	Pseudomys novaehollandiae	New Holland Mouse	V	Foraging, potential breeding habitat
Reptile	*Delma impar*	Striped Legless Lizard	V	Potential foraging and breeding habitat
Migratory species	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	Mi	Aerial foraging
	Merops ornatus	Rainbow Bee-eater	Mi	Aerial foraging, potentially breeding
	Ardea ibis	Cattle Egret	Mi	Foraging
	Hirundapus caudacutus	White-throated Needletail	Mi	Aerially foraging

V= Vulnerable, E= Endangered, CE= Critically endangered, Mi= Migratory

Aquatic habitats

Four major creeks intersect the proposal site in addition to several ephemeral tributaries. These include Wallis Creek, Surveyors Creek, Werakata Creek and Blue Gum Creek.

Many of these creeks and tributaries have well defined channels and support riparian and emergent aquatic vegetation of varying composition and condition. These areas are likely to be important breeding habitat for amphibians and wetland birds and may represent foraging habitat for terrestrial birds and mammals.

Wallis Creek is likely to be major key fish habitat (Class 1) and the remaining creeks are likely to be moderate key fish habitat (Class 2). Wallis Creek and Blue Gum Creek are also mapped as Purple-Spotted Gudgeon (*Mogurnda adspersa*) habitat, which is an endangered fish listed under the FM Act.

6.7.3 Potential impacts

Overview

Potential impacts on biodiversity associated with construction of the proposal include:

- Removal of vegetation
- Removal of terrestrial fauna habitats
- Injury and mortality of fauna
- Sedimentation of nearby waterways
- Pollution
- Noise, light and vibration
- Weed invasion and edge effects

These impacts are described further in the following sections.

Direct impacts

Vegetation removal

The proposal will result in the removal of up to 13.64 hectares of vegetation including approximately 3.59 hectares of native vegetation. A summary of the direct impacts to vegetation within the proposal site is provided in Table 6-12.

Table 6-12 Extent of direct impact on vegetation within the proposal site

PCT ID	PCT name	BC Act status	EPBC Act status	Extent within proposal site (ha)
1568	Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast	Not listed	Not listed	0.19
1588	Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast	Not listed	Not listed	0.21
1589	Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast	Not listed	Not listed	1.1

PCT ID	PCT name	BC Act status	EPBC Act status	Extent within proposal site (ha)
1593	Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter	Lower Hunter Spotted Gum ironbark Forest in the Sydney Basin and NSW North Coast Bioregions EEC	Not listed	1.04
1619	Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of the coastal lowlands	Not listed	Not listed	0.66
1633	Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area	Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC	Not listed	0.39
-	Exotic grassland/cleared	-	-	10.05
	Total			**13.64**

Habitat impacts

The proposal would result in the removal of 3.59 hectares of regenerating forest that may provide foraging habitat and potential breeding habitat for woodland birds. This habitat may also be used for foraging by Koalas and microbat species. Microbat species may also roost within tree hollows in this area, despite no suitable hollows being observed during field surveys.

Tunnels within the proposal site may provide roosting habitat for some bat species, such as Little Bentwing-bat (*Miniopterus australis*). Microbat species are susceptible to impacts from artificial lighting.

Disturbance to wetland bird species may occur due to indirect impacts on the eastern end of the proposal site adjacent to Pambalong Nature Reserve. This disturbance is likely to be minimal with appropriate stormwater, sediment and erosion control implemented during construction.

A total of 10.05 hectares of exotic grassland and bare earth will be removed by the proposal. Exotic grassland may be suitable for reptile species such as Striped legless lizard (*Delma impar*). The impacts to fauna species in this location are likely to be negligible as the areas adjacent to the proposal site contain higher quality or similar quality habitat.

Fauna injury or displacement

Most terrestrial fauna would be able to move away from construction activities to avoid mortality.

Microbat species, such as Southern Myotis (*Myotis macropus*), may have their breeding disrupted by noise and increased visitation during the construction phase, if works coincide with the breeding season.

Increased traffic movements during construction have the potential to result in fauna strike.

Indirect impacts

Erosion and sedimentation

Without appropriate controls, there is potential for soil and water pollution at the proposal site. Potential sources of soil pollution include inappropriate management of soil and material stockpiles, hydrocarbon leaks or spills from vehicles or equipment, or increased runoff. Measures to avoid or reduce potential erosion and sedimentation are provided in Section 6.2.3.

Habitat fragmentation

Edge effects are changes in population or community structure that occur at the boundary of natural areas and can result in habitat fragmentation. Edge effects due to the proposal are not likely to be significant over and above those already occurring due to the existing historical disturbance of the rail corridor.

Weeds and pathogens

The proposal has the potential to introduce and spread exotic plants and pathogens through increased visitation and soil disturbance and introduction of foreign organic material.

Fauna disturbance

Temporary and short-term noise and vibration impacts are expected during construction. This may deter native fauna from using the proposal site and can interrupt breeding, roosting and foraging activities.

Impacts to biota listed as threatened under the BC Act

Construction of the proposal would have direct impacts on two TECs listed under the BC Act and on known and potential habitat for eight flora species and 39 fauna species listed as threatened under the Act. Assessments of significance in accordance with the BC Act were completed for the species listed in Table 6-13.

Table 6-13 BC Act species occurring or considered possible to occur within the proposal site

Group	Community/species
Threatened ecological communities	Lower Hunter Spotted Gum ironbark Forest in the Sydney Basin and NSW North Coast Bioregions EEC
	Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC
Flora	*Acacia bynoeana* (Bynoes Wattle)
	Callistemon linearifolius (Netted Bottle Brush)
	Rutidosis heterogama (Heath Wrinklewort)
	Tetratheca juncea (Black-eyed Susan)
	Pterostylis gibbosa (Illawarra Greenhood)
	Grevillea parviflora subsp. *parviflora* (Small-flower Grevillea)
	Eucalyptus parramattensis subsp. *decadens* (Earp's Gum)
	Angophora inopina (Charmhaven Apple)
Arboreal mammals	Koala (Phascolarctos cinereus)
	Squirrel Glider (*Petaurus norfolcensis*)
	Yellow-bellied Glider (*Petaurus australis*)
Terrestrial mammals	Spotted-tailed Quoll (*Dasyurus maculatus*)
	Long-nosed Potoroo (*Potorous tridactylus*)
	New Holland Mouse (*Pseudomys novaehollandiae*)

Group	Community/species
Bats	Grey-headed Flying-Fox (*Pteropus poliocephalus*)
Cave-roosting microbats	Eastern Bentwing Bat (Miniopterus schreibersii oceanensis)
	Little Bentwing Bat (*Miniopterus australis*)
	Large-eared Pied Bat (*Chalinolobus dwyeri*)
	Eastern Cave Bat (Vespadelus troughtoni)
Tree-roosting microbats	East-coast freetail bat (*Mormopterus norfolkensis*)
	Yellow-bellied sheathtail bat (*Saccolaimus flaviventris*)
	Greater Broad-nosed Bat (*Scoteanax rueppellii*)
	Southern Myotis (*Myotis macropus*)
	Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
Wetland birds	Magpie Goose (Anseranas semipalmata)
	Australasian Bittern (Botaurus poiciloptilus)
	Comb-crested Jacana (Irediparra gallinacean)
	Blue-billed Duck (*Oxyura australis*)
	Painted Snipe (Rostratula benghalensis)
Frogs	Green and Golden Bell Frog (Litoria aurea)
Woodland and forest birds	Black-chinned Honeyeater (*Melithreptus gularis gularis*)
	Brown Treecreeper (*Climacteris picumnus victoriae*)
	Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)
	Gang-gang Cockatoo (*Callocephalon fimbriatum*)
	Grey crowned babbler (*Pomatostomus temporalis temporalis*)
	Little Lorikeet (*Glossopsitta pusilla*)
	Painted honeyeater (*Grantiella picta*)
	Regent Honeyeater (*Anthochaera Phrygia*)
	Scarlet Robin (*Petroica boodang*)
	Speckled Warbler (*Chthonicola sagittata*)
	Swift Parrot (*Lathamus discolour*)
	Varied Sittella (*Daphoenositta chrysoptera*)
Forest owls and raptors	Barking Owl (*Ninox connivens*)
	Powerful Owl (*Ninox strenua*)
	Masked Owl (*Tyto novaehollandiae*)
	Sooty Owl (*Tyto tenebricosa*)
	Spotted Harrier (*Circus assimilis*)
	Little Eagle (*Hieraaetus morphnoides*)
	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)

Significance of impacts

Tests of significance (the 5-part test) have been completed in accordance with Section 7.3 of the BC Act for the above threatened biota. The assessment found it is unlikely that the proposal would have a significant effect on any threatened biota listed under the BC Act, or their habitats. Therefore an SIS is not required to be prepared for the proposal.

Impacts to biota listed as threatened under the EPBC Act

Seven flora species and 15 fauna species listed under the EPBC Act were either known to occur or considered to have moderate potential to occur within the proposal site. Assessments of significance in accordance with the EPBC Act guidelines were completed for the species listed in Table 6-14.

Table 6-14 EPBC Act species occurring or considered possible to occur within the proposal site

Group	Species
Flora	*Acacia bynoeana* (Bynoes Wattle)
	Rutidosis heterogama (Heath Wrinklewort)
	Tetratheca juncea (Black-eyed Susan)
	Pterostylis gibbosa (Illawarra Greenhood)
	Grevillea parviflora subsp. *parviflora* (Small-flower Grevillea)
	Eucalyptus parramattensis subsp. *decadens* (Earp's Gum)
	Angophora inopina (Charmhaven Apple)
	Acacia bynoeana (Bynoes Wattle)
	Rutidosis heterogama (Heath Wrinklewort)
Fauna	Koala (*Phascolarctos cinereus*)
	Large-eared Pied Bat (*Chalinolobus dwyeri*)
	Australasian Bittern (*Botaurus poiciloptilus*)
	Painted Snipe (*Rostratula benghalensis*)
	Green and Golden Bell Frog (*Litoria aurea*)
	Painted Honeyeater (*Grantiella picta)*
	Regent Honeyeater (*Anthochaera Phrygia*)
	Swift Parrot (*Lathamus discolour*)
	Grey-headed Flying Fox (*Pteropus poliocephalus*)
	Spotted-tailed Quoll (*Dasyurus maculatus*)
	Long-nosed Potoroo (*Potorous tridactylus*)
	New Holland Mouse (*Pseudomys novaehollandiae*)
	Striped Legless Lizard (*Delma impar*)
Migratory species	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)
	Rainbow Bee-eater (*Merops ornatus*)
	Cattle Egret (*Ardea ibis*)
	White-throated Needletail (*Hirundapus caudacutus*)

Significance of impacts

An assessment of potential impacts in accordance with EPBC Act guidelines concluded that the proposal is unlikely to have a significant impact on the threatened or migratory biota listed above (Appendix F). Referral to the Commonwealth Minister for the Environment is not required.

Key threatening processes

The proposal has the potential to contribute to a number of key threatening processes (KTPs) listed under the BC Act and/or the EPBC Act including:

- Clearing of native vegetation.
- Infection of frogs by amphibian chytrid causing the disease chytridiomycosis.
- Infection of native plants by *Phytophthora cinnamomi*.
- Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae.
- Invasion of native plant communities by exotic perennial grasses.
- Invasion, establishment and spread of Lantana (*Lantana camara*).
- Invasion, establishment and spread of weeds.
- Removal of dead wood and dead trees.

- Mitigation measures to avoid and minimise these potential KTPs are provided below in Section 6.7.4.

The proposal has been developed with due consideration of environmental constraints and has sought to avoid impacts on native vegetation and sensitive environments through route selection by:

- Reducing the size of the development footprint to reduce impacts to biodiversity values, as well as to minimise edge effects associated with the linear development.
- Avoiding TECs wherever possible.
- Locating the alignment of the proposal on land that has been previously cleared in association with the now decommissioned Richmond Vale railway.
- Avoiding areas of high biodiversity values including mature trees with hollows (by locating the proposal predominantly on previously cleared or disturbed land).
- Retaining intact native vegetation that adjoins the subject site to the north and south.

Further iterations of the proposal design would continue to consider the above approach.

6.7.4 Safeguards and management measures

Detailed design

- Artificial lighting sensitive to microbat habitat would be installed and would consider:
  - Incorporating design features to minimise light spill onto the roof of the tunnels where there are substantial numbers of bat roosts, such as constructing ‘shields’ or false ceilings around roost sites to maintain darkness within roosts.
  - Incorporating variable lighting regimes along the alignment and in the tunnels to reduce the potential for light spill impacting foraging habitat, and minimise the chance of roost abandonment. This could involve switching off or dimming lights for part of the night, or use of movement sensor lights along the alignment and in the tunnels that switch on upon approach and turn off after people pass.
  - Incorporating design features to limit light spill into areas of adjoining sensitive habitat along the alignment, as far as practicable, to minimise the impacts of lighting to foraging habitat along the alignment. This could include the use of low intensity lamps to reduce the spread of illumination, directed lighting or light shields to create dark refuges between lamps.
  - Use of certain light types such as long wavelength ‘warm white’ lights rather than short wavelength ‘blue’ lights.
- Bridge design would reduce impacts to aquatic habitat by including:
  - Design elements such as height, orientation, construction materials to minimise shading of marine vegetation such as mangroves and saltmarshes.
  - Instream structures to avoid impact to river flow and fish passage.
  - Bat habitat boxes to the underside of new bridges.
- An aboricultural assessment would be completed of all trees in close proximity to the route during final design to determine potential impacts to mature tree health and identify appropriate management measures.
- Fence design would be of suitable height above ground level and material to enable fauna movement.

Construction

- Clearing areas would be minimised as far as practicable. A vegetation buffer would be delineated with a high visibility barrier to prevent accidental clearing or disturbance of adjacent vegetation or aquatic habitat.
- Adjoining sensitive areas would be marked using temporary fencing to prevent impacts during construction and protect these biodiversity resources where possible.
- Materials would not be stockpiled adjacent to native vegetation with stockpiles located within existing cleared areas.
- Noxious and environmental weeds would be appropriately managed during construction, with weed material cleared and stockpiled separately to all other vegetation, removed from site and disposed of at an appropriately licenced disposal facility. When transporting weed waste from the site to the waste facility, trucks must be covered to avoid the spread of weed-contaminated material.
- No parking of vehicles or machinery in areas of native vegetation.
- All machinery brought to site will be washed down and inspected to be free of soils, seeds and other organic material.
- Habitat clearing procedures will be prepared and impanated as required, including pre-clearing surveys and supervision of the removal of hollow-bearing trees and logs, to minimise fauna injury or mortality.
- Fauna handling and release protocols would be prepared and implemented where required.
- Remediation activities would be completed where native vegetation clearing is required including soil stabilisation and planting of native endemic species characteristic of the vegetation types identified within the study area.
- Erosion and sediment control measures would be implemented to minimise pollution and sediment impacts on waterways and downstream aquatic environments, including estuarine communities. This could include measures such as the use of silt curtains during substrate disturbance activities (e.g. pile driving) to minimise the potential for migration of turbid plumes outside of the immediate construction footprint.
- Measures would be implemented to manage fuels, chemicals, and liquids required for construction to avoid spills.
- The risk of injury or mortality of native fauna during the construction phase due to vehicle strike would be reduced by:
  - Restricting vehicle movements to operational (daylight) hours.
  - Implementing and enforcing appropriate speed limits for vehicles traversing the site.
  - Establishment of ‘no-go’ areas, which are demarcated with high visibility barrier tape to prevent accidental impacts to vegetation and other biota adjacent to the disturbance footprint.

Operation

- Appropriate signage would be installed which states that dogs should be kept on a lead or are prohibited.
- Appropriate signage would be installed which states that trail bikes (off-road motorcycles), which are known to disturb wildlife, are not permitted on the trail.

- Interpretive signage educating users on the importance of the surrounding vegetation and the species and ecological communities that occur there, as well as the importance of habitat within the nearby tunnel for roosting bats.
- Retained native vegetation would be managed to reduce impacts of human activities and weed infestation (noting that herbicides should be avoided near wetland areas).
- Maintenance of fencing would be ongoing to ensure its effectiveness at restricting access to surrounding vegetation.

6.8 Socio-economic

The following sections have been summarised from the specialist socio-economic assessment prepared by GHD, which is included in full in Appendix G.

Demographic descriptions in this section are based on 2016 census data (Australian Bureau of Statistics, 2016) with a local and regional area defined in the socio-economic impact assessment as follows:

- The local area includes the suburbs that intersect the proposal and may be directly impacted.
- The regional area is considered as the wider area of influence and includes the Newcastle, Cessnock, Lake Macquarie and Maitland LGAs.

6.8.1 Existing environment

Population characteristics

In 2016, 30,951 people lived in the local area, representing roughly 6.4 percent of the regional area's population of around 486,000. Compared to the regional area, the local area is characterised by:

- A younger average age of 37 compared to the regional area, which is 39 years.
- The proportion of the population under 18 years is greater in the local area compared to regional area (24.4 percent and 22.3 percent respectively).

Indigenous people make up 5.7 percent of the total population of the local area. This is slightly higher than the regional area (4.4 percent), with higher representation in Kurri Kurri and Pelaw Main, Buchanan (7.6, 7.6, and 7.3 percent) and the lowest representation in Seahampton (4.7 percent).

Larger households in separate houses dominant in the local area, with 82.9 percent of properties being separate dwellings with an average household size of 2.7 persons. This is higher than the regional area (74.1 percent and 2.5 persons respectively). Nearly 73 percent of people own their property, either outright or with a mortgage compared to the regional area (70.3 percent). About 73.5 percent of households are families in the local area, which is 2.9 percent higher than the regional area (70.6 percent).

As noted in *Towards a Healthy Hunter* (Hunter Medicare Local, 2014), the region has high rates of behavioural health risk factors. These risk factors may contribute to the region's higher rates of hospitalisation for health behaviour related conditions, which exceed the state average.

The Hunter Regional Plan 2036 (NSW Government, 2016) estimates the Hunter Region will grow from 732,400 in 2016 to 862,250 in 2036, an increase of 17.8 percent. Much of this growth is predicted to occur within close proximity to the proposal; within areas to the east of Kurri Kurri, and just to the northwest of Tarro and Beresfield near Thornton in the Maitland LGA.

Local economy

Nearly 60 percent of people aged 15 years and over are actively participating in the labour force in the local area, compared to 58.6 percent in the regional area. Most people are employed full time in the local area, whereas there is a higher number of part time employees in the regional area. The unemployment rate is consistent across the local area (7.7 percent) and the regional area (7.3 percent).

Those attending university or other tertiary institutes in the regional area, either full time or part time, are predominately located in the suburb of Shortland (43.8 percent), whereas suburbs including Hexham, Mulbring, Stanford Merthyr and Pelaw Main all have less than 15 percent of students in the population. Similarly, the majority of people attending further education reside within the Newcastle LGA (34.5 percent), compared to Lake Macquarie (20.7 percent), Maitland (19.5 percent) and Cessnock (13.4 percent).

The average weekly household income in the local area was marginally higher ($1,376) than in the regional area ($1,331). However there was a significant range across the suburbs within the local area with Tarro, Hexham, Kurri Kurri and Pelaw Main having averages less than $1,000 per week, and other suburbs more than $1,000 per week. Fletcher had the highest average weekly household income at $2,296.

Social infrastructure and businesses

The proposal end point in Kurri Kurri is close to a number of social infrastructure developments including Pelaw Main Public School, Pelaw Main heated pool, the Kurri Kurri Sports Ground, the Kurri Kurri District Hospital and Pelaw Main Colliery (part of the Richmond Vale Rail Museum). The Kurri Kurri Visitor Information Centre and many of the murals for which Kurri Kurri is well known are located in the commercial town centre approximately 800 metres from the proposal.

The Log of Knowledge Park at Kurri Kurri is the entrance to a local bush walking path. There is potential for further activation and use of this area by trail users (as well as walking tracks at the eastern extent of the trail in the Hunter Wetlands Centre).

Tourism numbers in the Hunter region have varied over the last eight years, initially declining from a 2011 high before gradually increasing every year from 2015. The Hunter region currently hosts in excess of 10 million visitors per year (Destination NSW, 2016). Domestic day trippers represent around two thirds of all visitors, and their numbers increased by 11.4 percent between 2010 and 2018.

Travel and transport

Heavy rail stations are located at Hexham, Tarro and Beresfield in the regional area. The next closest train stations are located within surrounding suburbs including Warabrook, (located at the University of Newcastle), Sandgate and Maitland.

There are several bus services operating within the local area. However, there are no existing bus routes that travel through the entire proposal, with an average of three or four buses and/or train journeys required to travel from Shortland to Kurri Kurri.

Connections to onward active travel networks are currently limited, however future onward connections to the University of Newcastle from Shortland, through Minmi to Blue Gum Hills, from Kurri Kurri to Cessnock and on to the vineyards, and also from Kurri Kurri to Maitland are envisaged. There is currently a short shared walking and cycling path at Log of Knowledge Park in Kurri Kurri. Residential developments in the Fletcher and Minmi areas are also integrating active travel networks into their master planning.

Community values

The *Cessnock Community Strategic Plan 2027* (Cessnock 2027) (Cessnock City Council, 2017) expresses the shared community vision for a thriving, attractive and welcoming Cessnock community. The plan outlines community values and key responsibilities for local government, state and federal government as well as the community itself. The strategic plan addresses social, economic, environmental, and civic issues. Some of the desired outcomes of the plan include:

- A connected, safe and creative community.
- A sustainable and prosperous economy.
- A sustainable and healthy environment.
- Accessible infrastructure, services and facilities.
- Civic leadership and effective governance.

The proposal will assist the strategic plan to achieve its desired outcomes.

Land use

The proposal is situated on land E2 Environmental Conservation, E1 National Parks and Nature Reserve, SP2 Infrastructure, RU2 Rural Landscape and RE1 Public Recreation under the Cessnock and Lake Macquarie LEPs. The proposed shared pathway is in keeping with these land use zones.

6.8.2 Potential impacts

Community and stakeholder consultation has been undertaken during development of the proposal design (refer Appendix G). All feedback collected to date has been collated and reviewed during design development and preparation of the socio-economic impact assessment. Feedback will also be considered during future stages of the proposal, should it proceed.

This community involvement has provided representative insight into the social values of the key stakeholders, potential future users of the proposal, and likely social and economic impacts.

Economic impacts (benefits and costs) have been further defined using detailed quantitative economic assessment. The methodology for and findings of the economic assessment are described in detail in the socio-economic impact assessment in Appendix G.

Construction

Access and connectivity

During construction, access to the proposal would be restricted in some locations, affecting any current informal recreational users of the alignment. Construction vehicle access would be via a number of access points spread along the proposed alignment, resulting in a dispersed distribution of construction traffic.

CTMPs would be developed for the proposal and identify transport routes which avoid or minimise traffic impacts near sensitive social infrastructure. It is expected that the traffic network would readily support the temporary increase in traffic during construction.

Amenity and aesthetics

Properties and land uses within the study area are likely to experience temporary amenity impacts resulting from construction of the proposal, including:

- Increase in dust, noise and vibration from construction activities (refer to Sections 6.1 and 6.4)
- Minor increase in construction traffic (refer to Section 6.6)
- Visual changes (refer to Section 6.9)

The linear nature of the proposal means that, in most locations, works would be completed within a period of less than three weeks, and any amenity impacts would be short lived. Appropriate mitigation developed through engagement with affected property owners is expected to adequately manage these impacts.

Privacy and safety

Loss of privacy may occur at several properties in Pelaw Main and Stockrington due to the presence of construction workers. However, these impacts would occur for short durations only as works continue along the proposed alignment. Fencing and visual screening may be required at some properties to prevent trespassing, limit views and to control the movement of stock during construction and operation.

Management of recreational use of the route during construction would be enforced to ensure the safety of any permitted or unauthorised users.

Property and land use

Temporary use of private or government owned land during construction would be undertaken in accordance with required agreements, which would be negotiated with land owners prior to works commencing. Any reparation works required as part of negotiated agreements would be completed as soon as practicable after construction is finalised.

The proposal is not expected to create any significant land use changes in the area. The majority of the proposed works would be within the corridor of the former Richmond Vale railway.

Economic impacts

It is anticipated that a workforce of approximately 50 - 100 construction and site management personnel would be required during construction, which is anticipated to be undertaken over a 12 to 18 month period. This would deliver short-term employment benefits for local labour. In addition, local and/or regional businesses are likely to experience a small increase in trade through sourcing of construction materials and services, and workforce expenditure in the local area.

Operation

Access and connectivity

Consistent with the *Hunter Regional Plan 2036* and *Greater Newcastle Metropolitan Plan 2036*, the proposal would enhance access to recreational facilities and connect various locations, supporting thriving communities. The proposal would provide improved accessibility for residents and visitors within and between Newcastle, Maitland, Cessnock and Lake Macquarie LGAs, connecting not only recreational and natural areas, but also education, health and employment facilities.

The key accessibility benefits for the proposal include:

- Equity and diversity of access
- Enhanced access to natural areas
- Active travel links and infrastructure for communities along the route
- Increased commuting options

Privacy and safety

The proposal passes primarily through rural and natural areas. However there is potential for users to impact on resident privacy at some locations along the route, primarily at Pelaw Main and Stockrington, where the proposal route is in close proximity to residential areas. During periods of high usage, these impacts are likely to be more pronounced due to a higher volume of users.

The presence of trail users during proposal operation would generate a degree of safety through passive surveillance and assist in preventing unauthorised motor vehicle use and illegal dumping that currently occurs along the route. This would be enhanced by lighting and signage in selected areas.

Car parking and rest areas may be used for social gatherings that could cause nuisance for residences, particularly at night. Adequate waste facilities would be provided to avoid rubbish being left by users.

Cultural heritage

The proposal would permanently impact on the intrinsic heritage value of the former Richmond Vale railway and potentially impact on other areas of Aboriginal and non-Aboriginal heritage value. This would be further investigated and approval sought during detailed design and is discussed in further detail in Sections 6.10 and 6.11. Heritage considerations would be included in the detailed design of the proposal (in consultation with relevant stakeholders) and would include (but not be limited to):

- Preservation and protection of heritage items, objects and sites where appropriate
- Adaptive reuse of heritage material in the proposal design
- Interpretative and educational signage about heritage issue and sites

Property and land use

Permanent property impacts would be confirmed during detailed design. Agreements for acquisition or permanent use of land would be negotiated with relevant agencies and landowners prior to work commencing. Preliminary and ongoing discussions have already commenced.

The proposal is generally consistent with the existing surrounding land use and would not result in any significant land use change or impact on the land use of adjoining properties. The majority of the route is located on the former railway, which is now predominately public land – NPWS or Crown. Impacts to private land would be minimised through the management measures provides in Section 6.8.3.

Economic impacts

It is estimated that the Richmond Vale Rail Trail will cost in the order of $32 million and will result in benefits to the value of $77 million. This means that the benefits of the project to the region outweigh the costs by a factor of 2.4 and the net value to the region would be approximately $45 million. The detailed costs benefit analysis is provided in Appendix H.

The key benefits that have added an economic value to the proposal include:

- Improvement in cyclist safety
- Health benefits
- Congestion cost savings
- Vehicle operating cost savings
- Public transport fare cost savings
- Air pollution reduction
- Greenhouse gas emission reduction
- Noise mitigation
- Water pollution reduction
- Journey ambience
- Regional spend per trip

Secondary benefits of the proposal that were not fully costed but would also provide an economic benefit include increased tourist visitation and local business stimulus.

6.8.3 Safeguards and management measures

Detailed design

- Rest areas and trail interpretation locations and content to be developed in consultation with relevant stakeholders.
- Detailed design would consider lighting of the route (particularly in tunnels and in heavily forested areas) to enhance safety.
- Heritage considerations identified to date and in future investigations would be reflected in the detailed design.
- Adequate waste facilities would be provided to avoid nuisance to other users in rest areas and at stopping points.
- Property impacts would be confirmed and verified by survey where required.
- Property acquisition or temporary use would be negotiated by Council with affected landowners where relevant in order to reach fair compensation and access arrangements.
- Measures to manage issues raised by impacted landowners during consultation would be incorporated into the detailed design where relevant. This could include security fencing, lighting, signage etc.
- The use of motorised cycles/scooter/chairs and hiring facilities for these at some access points would be considered to improve accessibility.
- Emergency access would be provided at suitable locations along the trail.
- Vandal resistant materials and appropriate signage would be used to outline expectations of users and other safety information and prevent damage.
- Safety requirements at road intersections and other crossings would be further investigated.

Construction

- Fencing and/ or screening near private properties close to the route would be implemented as required to minimise overlooking and privacy impacts.
- Residents, businesses and organisations located close to the proposal would be consulted in advance of construction to ascertain any specific times/events that should be considered in construction programming (e.g. school or cultural events).
- Construction scheduling would consider other major projects in the locality to avoid the potential for cumulative impacts.
- Residents living near the proposal and the local community would be provided with timely and relevant information to enable them to understand the likely nature, extent and duration of vibration, dust and noise impacts and access changes.
- Communication methods would be chosen to ensure any vulnerable community members are appropriately engaged with during the consultation period.
- Communications would include, as relevant, roadside signage, newsletters, newspaper advertisements, web based information, a complaints line, and advice to specific service providers, such as community transport and seniors organisations.
- All works would be undertaken during standard construction hours.

Operation

- Council would continue to engage with affected stakeholders during proposal operation to enable identification and management of any issues as they arise.

6.9 Visual amenity

The following sections have been summarised from the specialist visual impact assessment prepared by Peter Andrews and Associates, which is included in full in Appendix H.

6.9.1 Methodology

The visual impact assessment has been prepared as follows:

- A desktop review was undertaken of the trail to identify key areas that could view the proposal. These key areas have been identified as visual zones.
- Site investigations of the zones were undertaken 2 to 5 December 2016 to determine visual impacts from the proposal. Site investigations were undertaken from public areas as access was not possible from private dwellings.
- A site contextual analysis was prepared including landscape character for each of the zones.
- Potential visual impacts from the proposal were identified (the trail and ancillary facilities such as car parks and amenities) for each of the zones from the surrounding area. It was not possible to view the entire length of the proposal due to the length of the trail and restricted access to some areas. However, assumptions and mitigation measures are proposed for the trail within these areas.
- Appropriate mitigation measures were determined for any visual impact.

Potential visual impacts of the proposal were assessed by considering the magnitude of the visual change in the landscape, its proximity to the viewer, and the sensitivity of the landscape and the viewer to the change. The combination of sensitivity and magnitude provides an impact rating for the proposal at the key view points. The definitions of magnitude, sensitivity and impact ratings are provided in Table 6-15 and Figure 6-4.

Table 6-15 Magnitude and sensitivity of visibility

Rating	Description
Negligible	Very minor loss or alteration to one or more key elements/features/characteristics of the baseline visual character and/or introduction of elements that are consistent with the existing visual character.
Low	Minor loss of/or alteration to one or more key elements/features/characteristics of the baseline visual character and/or introduction of elements that are consistent with the existing visual character.
Moderate	Partial loss of/or alteration to one or more key elements/features/characteristics of the baseline visual character and/or introduction of elements that may be prominent but not considered to be substantially uncharacteristic.
High	Substantial to total loss of key elements/features/characteristics of the baseline visual character and/or introduction of elements considered to be totally uncharacteristic.

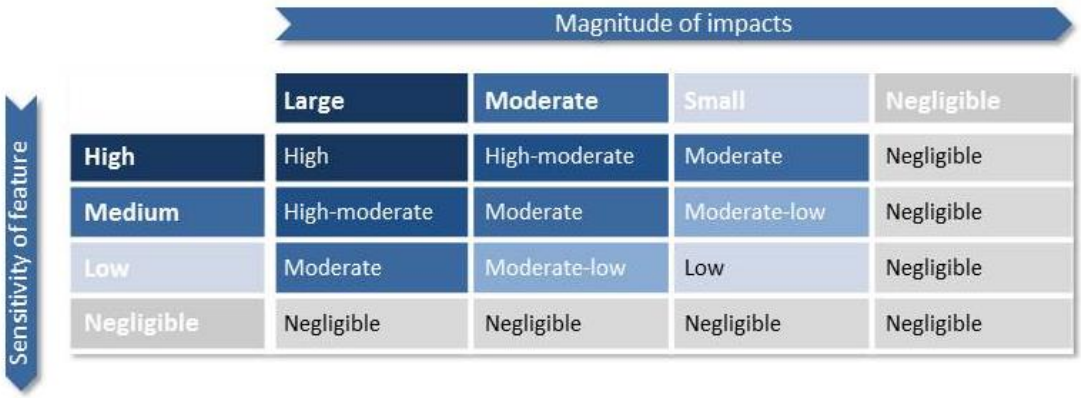


Figure 6-4 Impact matrix

6.9.2 Existing environment

The proposal site has been separated into four visual zones from west to east, zones 1 to 4, with several view points identified in each zone (see Figure 6-5). A description of the key landscape characteristics of each zone is provided in Table 6-16 to Table 6-19.

Table 6-16 Description of visual zone 1

Characteristic	Description
Landform	Generally flat throughout the area. The trail is raised from the surrounding land along Pokolbin Street. Informal drainage is located either side of the trail.
Land use/built environment	Surrounding development includes older style single storey dwellings and the two storey Empire Hotel. Log of Knowledge Park incorporates some older play equipment and seating. Kookaburra Walk is located to the west of the park. The trail is located in bushland to the east of Pokolbin Street and goes through the Werakata SCA.

Characteristic	Description
Vegetation	Vegetation within Kurri Kurri and Pelaw Main and incorporates mainly an Open Woodland. Land to the east of Pokolbin Street is heavily vegetated and is identified as a rural landscape zone and forms part of the Werakata SCA.
Landscape features	The broad open areas including the wide streets and open space areas throughout Kurri Kurri and Pelaw Main. The Werakata SCA and surrounding bushland.
Infrastructure	Stanford Street raises over the trail along the Log of Knowledge Park. A concrete pathway connects the Park to Pokolbin Street under the Stanford Street road bridge. Pokolbin Street runs along the southern extent of the trail in Pelaw Main. An existing formed and unlined parking area is located adjoining the northern boundary of the Park. An existing pedestrian refuge is located on Mulbring Street.
Major economic components	The Empire Hotel is located opposite the Log of Knowledge Park on Mulbring Street. The trail is located in part of the Werakata SCA. State conservation areas are reserved to protect and conserve areas that: • Contain significant or representative ecosystems, landforms or natural phenomena or places of cultural significance • Provide opportunities for sustainable visitor or tourist use and enjoyment, the sustainable use of buildings and structures, or research • Providing opportunities for uses permitted under other provisions of the NPW Act
Spatial quality	The trail from its commencement to the east of Pokolbin Street is fairly open and will be visible from the surrounding areas. The trail east of Pokolbin Street is enclosed by the existing vegetation and is not visible from the surrounding areas.

Table 6-17 Description of visual zone 2

Characteristic	Description
Landform	The land is generally flat and slopes towards Wallis Creek.
Land use/built environment	Private property adjoins the trail with a rural dwelling located in close proximity to the trail. Land is zoned rural landscape.
Vegetation	Open scattered Woodland is located along the trail. Denser vegetation is located along both sides of Wallis Creek with more extensive vegetation on the western side of the creek.
Landscape features	Wallis Creek and the old Wall Creek Bridge.
Infrastructure	The old Wallis Creek Bridge, which is no longer used and in disrepair. Driveway access to the rural dwelling.
Major economic components	Rural landholdings
Spatial quality	Generally an open spatial zone along the corridor and an enclosed corridor along Wallis Creek due to the creekside vegetation.

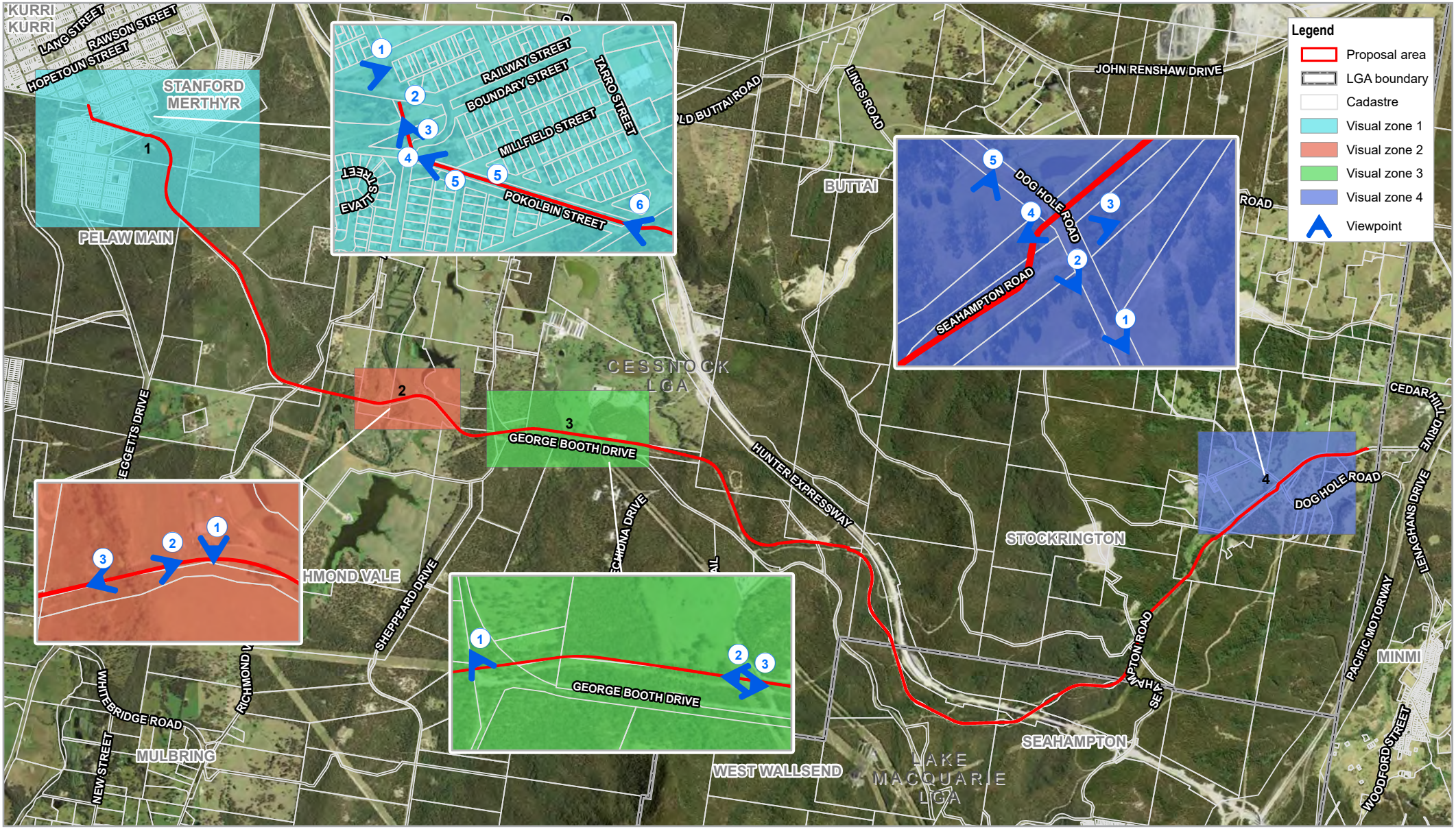
Table 6-18 Description of visual zone 3

Characteristic	Description
Landform	The trail runs parallel to George Booth Drive at Buchannan and crosses over at George Booth Drive near Richmond Vale Road. The trail is elevated from the adjoining land to the west of the proposed carpark. The trail then goes into a cutting to the east of the proposed carpark. The trail is generally enclosed due to the existing vegetation. A carpark is proposed on adjoining land. Access to the carpark is from an existing turn lane from George Booth Drive at entry Gate J4.
Land use/built environment	Land to the immediate south of the trail is zoned National Parks and Nature Reserves and to the north is Rural landscape.

Characteristic	Description
Vegetation	The corridor is densely vegetated. Land to the south is also densely vegetated. Land to the north is a mix of open landscape, dense vegetation and scattered vegetation.
Landscape features	The raised trail surrounded by dense tall trees. The cutting could also be a prominent feature but is overgrown with vegetation.
Infrastructure	There is an existing turn bay off George Booth Drive and road network providing access to the rural land further to the north. There are a number of large overhead easements throughout this area.
Major economic components	Existing road network
Spatial quality	The trail corridor is generally enclosed by the existing mature vegetation to the west and the cutting to the east. The area does open up where the proposed carpark is to be located due to the easements and existing road network.

Table 6-19 Description of visual zone 4

Characteristic	Description
Landform	The land is generally level to the north and west of the trail. The land slopes up from the trail to Dog Hole Road.
Land use/built environment	The area consists of rural residential land holdings.
Vegetation	Large mature vegetation is located throughout the area along Blue Gum Creek, along the trail and within the rural residential land holdings.
Landscape features	Blue Gum Creek adjoins the trail to the north and to the west of Jacobs Lane.
Infrastructure	Electrical easements, rural fences, sealed roads.
Major economic components	Rural industries.
Spatial quality	The area is generally enclosed by the mature vegetation adjoining property boundaries, the creek line and the trail.



Paper Size ISO A4

0 0.4 0.8 1.2 1.6

Kilometers

N

GHD

Cessnock City Council
Richmond Vale Rail Trail
Review of Environmental Factors

Project No. **12529257**
Revision No. **0**
Date **03/07/2020**

Visual zones and view points

Figure 6-5

G:\22\12529257\GIS\Maps\REF_0.aprx
Print date: 03 Jul 2020 - 10:29

Data source: Peter Andrews & Associates: Visual zones and view points , 2020; LPI: DTDB / DCDB ,2017. sixmaps/LPI_Imagery_Best: © Department of Finance, Services & Innovation 2017. Created by: kpsroba

6.9.3 Potential impacts

Impacts in each visual zone

The impacts predicted at each view point in each visual zone are summarised in Table 6-20 to Table 6-23. Sensitivity, magnitude and impacts are described in Table 6-15 and Figure 6-4.

Table 6-20 Impacts at each view point in visual zone 1

Viewpoint	Description	Visual sensitivity	Magnitude of visual effect	Impact
View point 1	A vacant parcel of land on Coronation, Mulbring and Allworth Streets with some larger trees.	Moderate	Moderate	Moderate
View point 2	The land opposite the Log of Knowledge Park includes single storey residential dwellings and the two storey Empire Hotel. These buildings face onto Mulbring Street, the Log of Knowledge Park and existing carpark. However, some of the dwellings have large front fences, which would restrict its views to the park.	Negligible	Negligible	Negligible
View point 3	View across Log of Knowledge Park to the Stanford Street road bridge.	Low	Negligible	Negligible
View point 4	View from the Stanford Street road bridge to the trail along Pokolbin Street.	Negligible	Negligible	Negligible
View point 5	Dwellings adjoining the southern side of the trail along Pokolbin Street alignment and to the northern side of the trail at this location.	Low	Low	Low
View point 6	The entry into the bushland and conservation area to the east of Pelaw Main.	Negligible	Negligible	Negligible

Table 6-21 Impacts at each view point in visual zone 2

Viewpoint	Description	Visual sensitivity	Magnitude of visual effect	Impact
View point 1	View from the trail to the rural dwelling	Moderate	Moderate	Moderate
View point 2	View of the trail on the eastern approach to Wallis Creek	High	High	High
View point 3	View of the trail on the embankment of Wallis Creek	High	High	High

Table 6-22 Impacts at each view point in visual zone 3

Viewpoint	Description	Visual sensitivity	Magnitude of visual effect	Impact
View point 1	View from George Booth Drive towards the trail	Low	Low	Low
View point 2	View of the trail and proposed carpark to the east	Low	Low	Low
View point 3	View of the trail to the west from the proposed carpark	Low	Low	Low

Table 6-23 Impacts at each view point in visual zone 4

Viewpoint	Description	Visual sensitivity	Magnitude of visual effect	Impact
View point 1	View from Dog Hole Road towards the trail adjoining rural property	Negligible	Negligible	Negligible
View point 2	View from Dog Hole Road towards the trail	Negligible	Negligible	Negligible
View point 3	View along the trail to the west of Dog Hole Road	Low	Low	Low
View point 4	View along the trail to the east of Jacobs Lane	Low	Low	Low
View point 5	View of the proposed car park north of the trail and south of Blue Gum Creek off Jacobs Lane	Moderate	Moderate	Moderate
View point 6	View from Dog Hole Road to the south west of the trail	Negligible	Negligible	Negligible

Summary of impacts

In summary, visual impacts are predominantly negligible to low, with high impacts predicted at view point 3 near Wallis Creek and moderate impacts predicted at view point 1 near Wallis Creek, view point 1 at Kurri Kurri, and view point 5 near Dog Hole Road. Key observations affecting the likelihood of impacts in each visual zone include:

Zone 1

- There is minimal additional visual impact through Kurri Kurri and Pelaw Main as there is an existing trail.
- Dwellings do not generally face onto the trail.
- Use of the existing carpark would reduce the potential for visual impacts.

Zones 2, 3 and 4

- The trail through these areas is generally not visible from the surrounding road network and there are few dwellings.
- There are a number of creek crossings with existing timber bridges. The retention of the existing timber bridges (or some elements of them) would provide visual interest for the trail.
- The trail passes in close proximity to a couple of rural dwellings. The design of the trail should ensure privacy to the dwellings by clearly identifying public versus private space and providing appropriate screening in consultation with the owners.

Potential impacts in each zone are summarised in Table 6-24. Zones and view points are shown in Figure 6-5.

Table 6-24 Summary of proposal visual impacts

Zone	View point	Visual impact (rating)
Zone 1 – Kurri Kurri / Pelaw Main	1	Moderate
	2	Negligible
	3	Negligible
	4	Negligible
	5	Low
	6	Negligible
Zone 2 – Wallis Creek	1	Moderate
	2	High
	3	High
Zone 3 – Surveyors Creek	1	Low
	2	Low
	3	Low
Zone 4 – Dog Hole Road	1	Negligible
	2	Negligible
	3	Low
	4	Low
	5	Moderate
	6	Negligible

6.9.4 Safeguards and management measures

Detailed design

Existing structures/landforms

- Existing structures, such as the timber bridges, culverts, etc. be retained wherever possible as these will provide additional visual interest for users of the trail.
- The existing raised landform of the trail should be maintained where possible.

Spatial quality

- Vegetation removal should be limited. Where vegetation removal is required, additional vegetation should be planted to improve the visual amenity of the area.
- Landscape treatments should consider the spatial quality of the existing landscape character and its setting, and retain the openness or enclosed spaces where relevant.

Materials and finishes

- Appropriate materials and finishes for the trail need to consider the environment that it is passing through and the number of users.
- The trail should be easily defined for the user so that the user keeps to the trail reducing impacts on adjoining vegetation.

Signage

- Appropriate signage should be located to assist in way finding and to ensure public and private areas are recognisable for the users.
- Signage should incorporate a theme for the trail, which would also assist in way finding and keeping users on the trail.

- Signage should be developed around the heritage and the locality to inform and educate users.

Bridges and structures

- The new bridges should not replicate the existing bridges but should be sympathetic and a simple design.
- Materials such as steel and timber should be used in preference to monolithic concrete construction.
- Road crossings should be low key within the rural areas but will need to consider road safety.
- Existing structures/points of interest along the trail should be used as stopping/view points.

Car parks

- Treatment should be low key and appropriate to the area.
- Facilities should be incorporated into the car park areas only, be low key and use suitable materials that are appropriate to the area.
- The location of car parks should minimise removal of vegetation.
- Existing car parks should be utilised where possible.
- Car parks should be appropriately located to minimise conflicts with dwellings and other land uses.

Construction

- All parking and site equipment associated with construction should be appropriately screened as required.
- All construction sites are to be maintained daily and decommissioned after completion of the works.
- Rehabilitation of the construction site should be undertaken upon completion of the works.

Operation

No specific mitigation measures are required during proposal operation.

6.10 Aboriginal heritage

The following sections have been summarised from the specialist Aboriginal heritage assessment prepared by Artefact, which is included in full in Appendix I.

6.10.1 Methodology

The assessment was prepared in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010) and the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (2010) and includes:

- An overview of the Aboriginal history of the study area.
- The results of a site survey.
- Identification of Aboriginal sites and areas of archaeological potential within the study area.
- Assessment of the significance of identified Aboriginal sites.
- Conclusions and recommendations for the proposal in regards to Aboriginal heritage.

Archaeological survey of the study area was conducted by Artefact archaeologist between 12 and 16 September 2016 accompanied by Peter Townsend (ALALC), Jason Brown (MLALC) and Peter Leven (Awabakal and Guringai People Native Title claimant).

6.10.2 Existing environment

Historical context

The study area is located partly within the Awabakal language group area. The Awabakal language group extends from the Hunter River in the north, to past Lake Macquarie in the south and west to the Sugarloaf Range. The name Awaba means 'flat or plain surface' in the local dialect, and the Awabakal are known as the 'people of the flat surface'.

Much of the historical information on the Awabakal language group comes from the works of Reverend Lancelot Edward Threlkeld. Threlkeld operated an Aboriginal mission north of Lake Macquarie for 15 years and documented traditional and early Aboriginal history in the area after 1825. Threlkeld worked for many years with a prominent Awabakal man, Biraban (meaning eagle-hawk), who had learnt to speak English while he was raised in the military barracks of Sydney. Together they painstakingly recorded and translated the Awabakal language into English. It is from Threlkeld's writings that many early accounts of the Awabakal people were recorded. At the same time, the convict artist Joseph Lycett painted representations of the Aboriginal people who lived in the Newcastle area in the early 1800s, and recorded some details of their life and community in his paintings.

Aboriginal people who lived in the vicinity of the study area occupied both the coastal margin, coastal hinterland and inner mountain ranges. Threlkeld described the way in which Aboriginal people would move seasonally from the coast to the mountains. Areas of primary significance for Aboriginal people in the lower Hunter Valley included the highly food abundant Hexham Swamp, and the higher mountain crests of Mount Sugarloaf, Black Hill and the Watagans.

Mount Sugarloaf and Black Hill have been recognised as areas of strong traditional associations for the local Aboriginal people. Ceremonial sites, associated with male initiation ceremonies, have been located on and near these mountains.

Recorded Aboriginal sites

Table 6-25 lists the Aboriginal sites registered in the Aboriginal heritage information management system (AHIMS) that are within 200 metres of the proposal.

Table 6-25 AHIMS registered sites within or in 200 metres of the proposal

Site name	AHIMS No.	Location	Description
Blue Gum Creek RTA 8 ST	38-4-1346	Within 200 metres	Located approximately 70 metres west of the junction of Seahampton Road and a four-wheel drive access track. The site consists of a modified tree located on a midslope, above a gently inclined ridge line. Information on the AHIMS site card states that the tree was approximately 90 to 125 years old when it died, and has been dead for up to 80 years. The tree has two Aboriginal cultural scars, including a ring bark style indicating a post WWI process with a methodical double ring tomahawk cut. The top portion of the tree was likely cut by chainsaw around the 1960s. The site was assessed as having low Aboriginal cultural significance and low archaeological significance.

Site name	AHIMS No.	Location	Description
Blue Gum Creek RTA 9	38-4-1352	Within 200 metres	Located less than 20 metres east of the current study area, at the junction of a vehicle track and Seahampton Road. The site is an artefact scatter located on a gently inclined ridgeline and has an outlook to the northwest. The site is situated 140 metres east of a first order tributary of Blue Gum Creek and consists of 28 artefacts made from tuff, chert and silcrete. Information on the AHIMS site card states that the site has been impacted by tree clearing, vehicle disturbance and associated erosion, resulting in the exposure of the A2 soil horizon. The site is in poor condition with low archaeological integrity and low potential for subsurface archaeological material in the surrounding landscape due to the high levels of vehicle disturbance and erosion.
Blue Gum Creek RTA 5	38-4-1349	Within 200 metres	Located approximately 70 metres west of the junction of Seahampton Road and a four-wheel drive access track. The site consists of an artefact scatter located on a vehicle track on a gently inclined ridge line. The site consists of two tuff broken flakes, both heavily burnt. Information on the AHIMS site card states that the site has been impacted by vegetation clearing, vehicle disturbance and erosion that has resulted in the exposure of the A2 and B soil horizons. The site is in poor condition with low archaeological integrity due to soil profile disturbance and loss of soil within the site. There is low potential for subsurface archaeological material.
Blue Gum Creek RTA 6	38-4-1350	Within 200 metres	Located less than 20 metres south of the current study area. Approximately 300 metres from the junction of the former Richmond Vale Railway and Seahampton Road. The site consists of one tuff broken flake. The site is located on a vehicle track that has been impacted by vegetation clearing, vehicle disturbance and erosion. The disturbances have resulted in the exposure of the A2 and B soil horizons. Information on the AHIMS site card states that the site is in poor condition with low archaeological integrity and low potential for subsurface archaeological material in the surrounding landscape due to the high levels of vehicle disturbance and erosion.
Blue Gum Creek RTA 10 IF	38-4-1353	Within 200 metres	Located approximately 60 metres north of the current study area on an access track. The site consists of one tuff core located on a gently inclined lower midslope. The site has been impacted by tree clearing, vehicle disturbance and associated erosion, resulting in the exposure of the A2 soil horizon. Information on the AHIMS site card states that the site is in poor condition with low archaeological integrity and low potential for subsurface archaeological material in the surrounding landscape.

Site name	AHIMS No.	Location	Description
Blue Gum Creek (Grinding Groove)	38-4-0222	Within 200 metres	Located approximately 95 metres north of the current study area. The site consists of grinding grooves located in a creek bed on a midslope. The grinding grooves are scattered over an area of approximately 20 m². Information on the AHIMS site card states that the condition of the site is weathered.
Blue Gum Creek RTA 7	38-4-1351	Within 200 metres	Located approximately 150 metres south of the current study area on an access track, at the top of the spur crest. The site consists of a scatter of six oyster shell fragments. The site has been impacted by vegetation clearing, vehicle disturbance and erosion resulting in the exposure of the A2 and B soil horizons. Information on the AHIMS site card states that the site is in poor condition with low archaeological integrity and low potential for subsurface archaeological material in the surrounding landscape.
Blue Gum Creek 1 Artefact Scatter	38-4-0760	Within 200 metres	Located approximately 85 metres south of the current study area, underneath a bridged section of the Hunter Expressway. Two flakes, including a broken, retouched flake made from Nobbys tuff and a broken basalt flake, are located on the midslopes of a dirt track. Both artefacts have been burnt. The artefacts are not thought to be in-situ, as they are likely to have been washed down the access road from a site (AHIMS # 38-4-0761) on a level area at the top of slope. The road is extremely eroded with the B horizon and sandstone exposed in some areas. A major tributary of Blue Gum Creek is 50 metres downslope. A minor tributary of the creek runs 10 metres to the south.
Blue Gum Creek 4 Artefact Scatter and associated PAD	38-4-0763	Within 200 metres	Located approximately 195 metres north of the current study area, underneath a bridged section of the Hunter Expressway. Three Nobbys retouched tuff flakes were located washing down a narrow foot track that leads down to Blue Gum Creek. A level bench was located adjacent to one of the artefacts and above two of the artefacts. An area of PAD was identified on this bench. The track leading down to Blue Gum Creek crosses the lower slope in this area, before increasing again. At this point the creek has a cavernous overhang suitable for Aboriginal occupation, however, no evidence of Aboriginal occupation was observed. The area was identified as highly sensitive by the Awabakal representative on site.
Blue Gum Creek Grinding Grooves	38-4-0235	Within 200 metres	Located approximately 80 metres north of the current study area. The site consists of three grinding grooves located in a creek bed. The local rock type is sandstone, and the local land is used for coal mining activities. Blue Gum Creek is the source of drinking water.
Blue Gum Creek Grinding Grooves	38-4-0236	Within 200 metres	Located approximately 50 metres north of the current study area, and approximately 50 metres west of AHIMS # 38-4-0235. The site consists of 6 grinding grooves located in the creek bed.

Site name	AHIMS No.	Location	Description
Blue Gum Creek 3 Isolated Find	38-4-0762	Within 200 metres	Located approximately 10 metres south of the current study area. The site consists of one Nobbys tuff flake, broken in two pieces. The site was located on the lower slope on the eastern side of a dirt track that leads down to the Richmond Vale Railway cutting and Blue Gum Creek. The general area has been highly disturbed by works associated with levelling and building up the ground surface for the railway, pit-propping activities and road grading. It was determined unlikely that further artefacts would be present in a subsurface context.
Surveyors Creek RTA 11 (Previously PAD 6 Surveyors Creek)	38-4-0826	Within 200 metres	Located approximately 165 metres east of the current study area. The PAD is on a lower slope 5 metres west of a northerly flowing tributary of Surveys Creek, and 70 metres south of the confluence of two tributaries. Sandstone outcrops are located in the creek bed. There are limited alluvial deposits along the banks of the creek. A level area adjacent to the creek was determined suitable for a camp site. Visibility was zero due to vegetation.
Surveyors Creek RTA 4	38-4-0808	Within 200 metres	Located approximately 160 metres east of the current study area. Five artefacts were located on a fire trail, on both sides of a tributary of Surveyors Creek. Four of the artefacts were in situ, eroding out of the bank at approximately 10 centimetres' depth. One artefacts was located sitting on the aggraded sandy soil, 20 metres east of the watercourse having washing down from above. The artefacts consisted of 2 silcrete flaked pieces, 1 silcrete flake, 1 mudstone broken flake and 1 mudstone heat shatter. Soils consisted of grey sandy loam with pebbles from conglomerate below the loam. The area is highly disturbed from scouring and vehicle access. An area on the western bank was determined to contain potential archaeological deposits in a stratified context.
Surveyors Creek RTA 3 IF	38-4-0807	Within 200 metres	Located approximately 50 metres east of the current study area. An isolated broken silcrete flake was located in an area of exposure on a lower slope. The nearest water source in relation to the site was Surveyors Creek, 150 metres north east. Visibility in the surrounding area was restricted due to vegetation cover and leaf litter. The artefact may have been excavated when a hole for a nearby surveyors peg was dug. The area is disturbed and in poor condition due to clearing of the forest.

Site name	AHIMS No.	Location	Description
Surveyors Creek RTA 24	38-4-1611	Within 200 metres	Located approximately 140 metres north of the current study area. The site consists of two artefacts, a mudstone flake and a silcrete flake, located on an access track adjacent to an old quarry/lay down area. The surrounding landform consists of a midslope landform context, on a spur ridge separating Surveyors Creek, 320 metres to the north, from a first order tributary 460 metres to the west. This track is currently used as access for the Kurri Kurri Motorcycle Club. It is likely that the artefacts have eroded from the track edges which are slightly lower than surrounding landform. Very little or no A1 or A2 horizon soils remain on the track, with only a lag deposit of gravel resting on the clay B horizon surface in most parts. The site is in poor condition with no archaeological integrity remaining.

Survey results

A number of previously unrecorded sites were also recorded during the site survey. These are summarised in Table 6-26. All new sites have been reported to the AHIMS. More detail on the newly records sites is provided in Appendix I.

Table 6-26 Unrecorded Aboriginal sites noted during site survey (Sep 2016)

Site name	Description
Richmond Vale Rail Trail Isolated Find 4 (RVRT IF 4)	The site consisted of an orange-white immaterial (IMT) whole flake with minor retouch scars. The site was located on the road verge of Seahampton Road, less than one metres to the north of the bitumen road and approximately one metre south of the edge of the project study area. The road verge consisted of imported gravels and road base which forms the subgrade to Seahampton Road. This artefact is likely to have been imported into the area as part of the road base.
Richmond Vale Rail Trail Artefact Scatter 4 (RVRT AS 4)	The site is located on the unsealed portion of Seahampton Road, approximately 450 metres south-west of the intersection of Seahampton Road and Dog Hole Road. The site consists of 16 artefacts, composed of grey, white and orange-white IMT, and consisted of a core fragment, complete flakes, cortical fragments and partial flakes. The site extends over a section of road up to 82 metres long, and spans the length of the exposed road up to nine metres wide. The southern side of the road is located directly below the embankment of a former rail cutting, while the northern side of the road is located on a built-up embankment of the former rail line. As such, the ground surface below the deposited road base does not consist of a natural former ground surface and would be considered archaeologically sterile due to the depth of the cutting in this location (up to three metres). Artefacts in this location are considered imported materials which were gathered during sand and gravel dredging for the importation of road base into the area.

Site name	Description
Richmond Vale Rail Trail Artefact Scatter 5 (RVRT AS 5)	This site is located on an unsealed portion of Seahampton Road, approximately 620 metres south-west of the intersection of Seahampton Road and Dog Hole Road. The site consists of seven orange-white and grey IMT complete and partial flakes. Like the other sites of the Seahampton Road Sites, these artefacts were identified in deposited road gravel on an artificial ground surface which had been excised for the construction of the Richmond Vale Railway. Artefacts located at this site are considered to be imported materials which were deposited in the gravel road base to stabilise the Seahampton Road vehicle access track.
Richmond Vale Rail Trail Isolated Find 6 (RVRT IF 6)	The site was identified on the Seahampton Road vehicle access track, and designates the furthest south-westerly extent of artefacts identified in the Seahampton Road Sites. The site consisted of a single coarse grained orange silcrete complete flake. The site was identified in deposited road base above the artificial ground surface of Seahampton Road. Like other sites of the RVRT AC 2, this site was identified as consisting of imported artefactual material within deposited road base gravels.
Richmond Vale Rail Trail Artefact Scatter 6 (RVRT AS 6)	The site consists of five orange IMT artefacts, located to the north of the Seahampton Road vehicle access track. The site was identified in an area of recent ground disturbance, likely caused by machine plant, which had removed the low grass at an area of approximately 4 x 2 metres. Soil exposed by the machine cut showed the material to be black-brown soil with rail ballast and ash deposits, and the exposed artefacts were located within one metre of residual Richmond Vale Railway rail line.
Richmond Vale Rail Trail Isolated Find 7 (RVRT IF7)	The site consists of a single grey IMT complete flake, located on exposed ground in the centre of the intersection of an access track. The area where this artefact was identified was located on the top of a vehicle rollover on the access road. The access track in general has been highly disturbed by vehicle tires, road levelling and grading, stormwater erosion and the construction of rollovers to control sediment flows on the access track. The site is located in a highly disturbed context.
Richmond Vale Rail Potential Archaeological Deposit 1 (RVRT PAD 1)	The site consists of an area of PAD located on the western bank of Wallis Creek, directly to the north of the Richmond Vale Railway Wallis Creek bridge. The site is level creek terrace at a slightly higher elevation than the adjacent flood plain, consisting of sandy Wallis Creek soil landscape alluvial deposit. The southern boundary of the PAD is defined by the construction of the Richmond Vale Railway embankment. The eastern boundary of the PAD is defined by the edge of the embankment to Wallis Creek. Ground visibility at the area of PAD is low due to the prevalence of grass cover at the site. However small areas of exposure have shown the underlying sandy alluvial soil formation. Aerial imagery shows that this sandy material is spread widely across the western bank of Wallis Creek, with a meander of the creek delineating the sandy deposit to the north and west. The extent of this area of PAD is indicative, and likely extends further to the north and west along the level creek terrace. The area of PAD is constrained to the area surveyed during the site inspection. The majority of this area of PAD is located outside of the study area.

Site name	Description
	Areas of PAD were not identified on other portions of the creek banks at Wallis Creek. On the eastern creek bank, the creek terrace was less than one metre above the creek banks, and showed signs of frequent flooding. To the south of the railway embankment on the western side of Wallis Creek, a residual creek meander was present.
Richmond Vale Rail Trail Isolated Find 8 (RVRT IF 8)	The site consists of a single coarse-grained yellow-white silcrete complete flake, identified in the centre of the former Richmond Vale Railway route. The artefact was identified on the access track approximately 50 metres north-east of a freshwater tributary of Wallis Creek. While the area in which the artefact was located had been previously heavily disturbed by machine grading and levelling, the sand deposit that the artefact was identified in was determined to be intact. The artefact was likely to be derived from underlying sub-surface sands and exposed when machine grading levelled the area. Previous archaeological investigations in the area showed that sub-surface artefacts in Kurri Kurri sand sheets are likely to contain only low density and isolated artefacts.
Richmond Vale Rail Trail Isolated Find 10 (RVRT IF 10)	The site consists of a yellow-white coarse grained silcrete complete flake. The artefact had negative flakes and the dorsal surface showed signs of weathering. The site was identified in an access track which diverges from the main Richmond Vale Railway route. The access track had been graded and levelled, with evidence of wheel rutting and erosion damage to the surface. An exposed vertical profile of the nearby soil showed that the vehicle track had been graded up to 20 centimetres into the surrounding sand sheet.

Archaeological sensitivity

No areas of archaeological sensitivity were identified within the proposal site.

Archaeological potential

A number of natural landforms within the study area are identified as areas of archaeological potential, including:

- Spur crests, ridge lines and hill saddles that are connected to Mount Sugarloaf and Black Hill.
- Sand deposits located near freshwater courses.
- Margins of watercourses that are above the flood zone.

Despite the high archaeological sensitivity of these natural landforms throughout the study area, the level of ground disturbance caused by construction of the former Richmond Vale Railway, and the confinement of most of the study area to that area of disturbance, means that the level of archaeological potential across the whole of the study area is considered to be low.

As such, Aboriginal archaeological potential has been identified in only relatively undisturbed areas, or in areas of only shallow ground disturbance. These areas are located away from this original rail alignment. Intact Aboriginal sites have been located only in these areas where natural ground surfaces were identified. Areas of archaeological potential include:

- RVRT PAD 1 (see definition in Table 6-26).

Archaeological significance

The archaeological significance of RVRT PAD 1 should be confirmed through test excavation prior to any construction works commencing. The assessment however made the following observation about the locality of RVRT PAD 1:

The area around Wallis Creek, prior to European settlement, was partially wetland surrounding slow moving freshwater creeks and meanders. A level and relatively high-elevation sand deposit is located between the western bank of Wallis Creek and a meander further to the west of the main channel. This location would have been elevated above the surrounding watercourses, except during periods of flood. Dense grass cover obscured the ground surface during site survey, however the proximity of fresh water to an intact sand body could indicate the presence of sub-surface Aboriginal objects.

The remainder of the sites located within the study area were considered to be of no or low archaeological significance. Sites classified as not significant include sites that have demonstrably been destroyed. Sites classified as having low archaeological significance are those located in highly disturbed contexts, or those shown to be artificially imported to their present location. Due to the displaced and disturbed contexts of these sites, it was determined that archaeological excavation for further sub-surface deposits would fail to yield artefacts. Therefore test excavation is not required.

6.10.3 Potential impacts

The proposal has the potential to impact on one site of moderate archaeological potential, RVRT PAD 1, with partial loss of value the likely result.

However, due to the minor nature of construction works and defined footprint of the proposal, it is possible that impacts can be contained to already disturbed areas at this site. If impacts cannot be avoided, test excavation would be required to confirm level of impacts. This would be investigated further during detailed design.

The proposal would result in the total loss of four sites of low archaeological significance, being:

- RVRT IF4
- RVRT AS 4
- RVRT AS 5
- RVRT IF 8

6.10.4 Safeguards and management measures

Detailed design

- The footprint of the proposal and the construction methodology would be developed so as to minimise impacts in the vicinity of RVRT PAD 1.
- The detailed design should include heritage interpretation and signage to be installed in conjunction with shared pathway amenities. Liaison with Aboriginal stakeholders is recommended for designing interpretation and signage content.
- If impacts cannot be avoided to RVRT PAD 1, an Aboriginal heritage impact permit (AHIP) under Section 90 of the NPW Act would be required prior to construction commencing. This AHIP application would be submitted with an Aboriginal Cultural Heritage Assessment Report (ACHAR) completed in accordance with the *Guide to Investigation, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (Office of Environment and Heritage, 2011). Full consultation with Aboriginal stakeholders, in accordance with *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (OEH 2010), and archaeological test excavation would be required. Existing AHIPs that may overlap the site should also be confirmed at this time.

Construction

- All workers would complete a specific heritage induction providing information on the Aboriginal heritage of the study area and details of how aboriginal heritage sites and items should be protected from inadvertent and indirect impacts by construction crews during works.
- An unexpected finds procedure would be developed and implemented in the event unknown heritage items are uncovered during works.

Operation

No specific mitigation measures are required during proposal operation.

6.11 Non-Aboriginal heritage

The following sections have been summarised from the specialist non-Aboriginal heritage assessment prepared by Artefact, which is included in full in Appendix J.

6.11.1 Methodology

A Statement of Heritage Impact was prepared for the proposal in accordance with the *NSW Heritage Manual* and *Assessing Significance for Historical Archaeological Sites* and *Relics* (2009), both prepared by the NSW Heritage Office. It includes:

- A historical background of the proposal and associated elements.
- An analysis of existing items associated with and including the proposal such as remains of collieries, tunnels, bridges, cuttings and embankments.
- Significance assessments for listed and unlisted heritage listed items in and near the study area.
- Assessment of potential impacts to listed and unlisted heritage items from the proposal.
- A preliminary non-Aboriginal archaeological assessment of the study area.

An inspection of the proposal route was conducted by Artefact archaeologists on 12-16 September 2016.

6.11.2 Existing environment

Historical context

Early settlement in Cessnock and Lake Macquarie occurred in the 1820s. The area around the Cessnock township was originally settled by pastoralists, with the main town centre at Wollombi, 31 kilometres south-west of the study area. Cessnock established itself in the late 1850s, acting as a service centre to travellers making their way to Maitland and Singleton.

In 1892, George Brown discovered coal near the Cessnock township. Coal deposits in Kurri Kurri were identified in 1886, during geological survey of the lower Hunter Valley carried out by David Edgeworth. After these discoveries, various collieries were quickly established in East Greta, Stanford Merthyr, Pelaw Main, Abermain, Aberdare and Richmond Vale, known collectively as the South Maitland Coalfields. A land boom ensued between 1903-1923, creating various townships in the area, including Kurri Kurri and Pelaw Main. By 1926, the population of Cessnock had reached 12,000. Kurri Kurri and Pelaw Main are now characterised by modest turn of the century miner's cottages and grand hotels once frequented by mine employees.

Coal deposits in the Lake Macquarie region were first identified by Captain William Reid at the aptly named “Coal Point” during his exploration of the region in 1800. The study area is located within the Teralba Parish of Lake Macquarie, along the northern foothills of Mount Sugarloaf. Most of the land encompassed by the study area was granted to mining magnate William Austin Horn in around 1890. Despite land holdings of almost 4050 acres, no mention of Horn or his activities have been found in local histories. It is likely that he was an absentee landowner, having spent much of his life in South Australia, where he owned sheep stations and copper mines. Due to the geography of the land (steep slopes and old growth forests), land use is likely to have centred around cattle grazing and timber getting. Permanent occupation is unlikely.

The Richmond Vale rail line was established in two sections, the Minmi to Hexham Railway, which was completed in 1856, and the remainder of the line (to the west of Minmi) which was completed in 1905. The Minmi to Hexham Railway was established in 1856 by John Eales. Prior to its construction, coal was transported from Eales’ Minmi Colliery via carts hauled by bullock teams. In 1897, J & A Brown purchased the Richmond Vale Estate where they planned to establish the Richmond Vale Colliery and headquarters for the business. In 1900, James Brown applied for an Act of Parliament to allow for the construction of a railway line from the Richmond Vale Estate to the existing Minmi and Hexham Railway. Construction commenced in 1904 and was completed in 1905. Following the completion of the Richmond Vale Railway, the Minmi to Hexham portion of the line was duplicated in 1909 – 1910.

Listed heritage items

There are three locally listed items within the study area. There are no Commonwealth or State listed heritage items within the study area.

Richmond Vale Railway (I214)

The Richmond Vale Railway is listed under the Cessnock LEP 2011 (Item No. I214). The Richmond Vale Railway runs from Hexham Local Depot (outside the Cessnock LGA and study area) to Richmond Main Colliery and Pelaw Main. The LEP listing includes route reservations, embankments, cuttings, culverts, bridges, tunnels, level crossings, platforms, station structures, signals and other communication systems, gatekeeper's houses and any other structure once necessary for the railway's operation. Some railway tracks between Richmond Main Colliery and Pelaw Main are still extant, but others have been removed over time. Specific elements located within the study area and LEP curtilage are:

- Timber overbridge, Blue Gum Creek
- Surveyors Creek Bridge
- Tunnel No. 3
- Brick faced culvert
- Wallis Creek Bridge
- Brick platform
- Cement footings

The significance assessment for the proposal found that this item has local significance only (refer Appendix J).

Collieries of the South Maitland Coalfields / Greta Coal Measures (I215)

Collieries of the South Maitland Coalfields / Greta Coal Measures is listed under the Cessnock LEP 2011 (Item No. I215). The Collieries of the South Maitland Coalfields/Greta Coal Measures were established between 1892-1927. The listed item consists of the remains of the fully signalled, double track mainline railway and all reservations for the mainline and branchline routes of the South Maitland Railway, both with and without tracks and lines, including embankments, cuttings, culverts, bridges, level crossings, platforms, station structures, signals and other communications systems, gatekeeper's houses, water tanks, pipe stands and any other structure necessary for the railway's operation.

Empire Tavern (I131)

The Empire Tavern in Kurri Kurri comprises a two-storey, Federation filigree style rendered and painted brick building with elaborate parapet. It includes a double storey verandah with decorative timber posts and art-nouveau frieze. The upper verandah includes cast iron lace panels. The exterior has been cement rendered, ground floor windows altered and the interior has been modernised over time. The bar has retained its elaborate Wunderlich ceiling. The architects for the building were Sheerin & Hennessy of Sydney.

The tavern was historically used by miners as a hotel and tavern from 1904 onwards. It was especially popular prior to the emergence of the motor car in the mid-twentieth century.

The tavern is in good condition and its exterior remains relatively intact.

Survey results

The Jewboy Bushrangers Cave at Stockrington was recorded during site survey in September 2016. This site is not listed but is considered of local heritage significance.

Archaeological potential

Non-Aboriginal archaeological potential is defined as the potential of a site to contain historical archaeological relics, as classified under the Heritage Act. Non-Aboriginal archaeological potential is assessed by identifying former land uses and associated features through historical research, and evaluating whether subsequent actions (either natural or human) may have impacted on remaining evidence for these former land uses.

Based on the history of the site and likely levels of disturbance that have occurred throughout the study area, potential archaeological remains are likely to represent the Richmond Vale Railway and associated industries. Site survey identified the following sites of archaeological potential:

- Remains of Stockrington Colliery Substation
- Remains of Stockrington Colliery Stables
- Remains of Cement Footings – Former Sidings
- Remains of Brick Building– Former Sidings

There is also the possibility that additional unexpected historical archaeological remains may be encountered during works. Unexpected historical remains could include:

- Former cottages and cabins related to the railway
- Former sidings related to the railway
- Former construction camps for Richmond Vale Railway

6.11.3 Potential impacts

The potential impacts of the proposal to the listed heritage items and newly recorded sites in the study area is summarised in Table 6-27.

Table 6-27 Potential impacts to non-Aboriginal heritage

Item	Potential impact	Scale of impact
Richmond Vale Railway (Item No. I214)	The demolition of the Wallis Creek bridge would result in a moderate physical and visual impact to this item. The demolition of the Surveyors Creek bridge would result in a moderate physical and visual impact to this item. The removal and/or stabilisation of the eastern portal of Tunnel no. 3 would result in moderate physical and visual impacts to this item.	Cumulatively, a major physical and visual impact
Collieries of the South Maitland Coalfields/Greta Coal Measures (Item No. I215)	The proposed works will include the removal of unsuitable subgrades, sleepers and rails along the existing rail alignment within this item. Rails and sleepers have not been identified as a significant component of this item.	Negligible physical and visual impact
Empire Tavern (Item No. I131)	Temporary compound and stockpile area adjacent to item, resulting in negligible visual impact.	Negligible visual impact
Jewboy Bushrangers Cave	Construction of three metre wide path, treatment of cuttings would have negligible visual impact.	Negligible visual impact

Given the major impact to the Richmond Vale Railway due to demolition of the Wallis Creek and Surveyors Creek bridges, a detailed structural assessment (see Appendix K) was completed to consider the cost and benefits of rehabilitation or renewal of one or both structures. The assessment found:

- Both bridges are in a dilapidated and very poor condition and would require considerable expenditure to either rehabilitate or renew. New bridge replacement options were estimated at about one third the cost of rehabilitation and about half the costs of renewal.
- A new bridge would be more functionally viable, and would represent a more sustainable use of resources and reduced future asset management risk.
- Both bridges were found to have moderate overall heritage significance with high significance attributed to the abutments. Consequently, appropriate recognition of the timber and masonry elements of the bridges should be either incorporated into the new designs or developed as a standalone aspect, for example interpretive signage.

6.11.4 Safeguards and management measures

Detailed design

- Consideration should be given to preserve as much original heritage fabric as practical, including timber bridges and residual rail infrastructure, located along the route of the former Richmond Vale Railway (Item No. I214). In particular the following items should be retained, where considered feasible for safety, cost and environmental reasons:
  - Tunnel No. 1
  - Tunnel No. 2
  - Tunnel No. 3 in particular the brick portals of the tunnel

  - Surveyors Creek Bridge
  - Wallis Creek Bridge
  - The existing profile of the original railway cuttings
  - Surveyor marked tree
  - Existing culverts and drainage structures
  - The existing profile of the original railway cuttings
  - Existing culverts and drainage structures
  - Brick platforms and retaining walls
- Shotcreting of cuttings should be avoided as it would have a major visual impact on the Richmond Vale Railway.
- Stabilisation of Tunnel 3 would be undertaken in such a way as to reduce impacts to the eastern portal and retain, as far as practicable, the inherent heritage value.
- The selection of new materials and finishes should be as sympathetic as possible to the existing character of the railway, with the aim of minimising visual impacts.
- Heritage interpretation and signage would be installed in conjunction with shared pathway amenities. Liaison with local historical societies, including the University of Newcastle's Coal River Working Party and the Richmond Vale Railway Society and Museum is recommended for designing interpretation and signage content.
- Detailed assessment, including assessment of the significance and location of any potential remains (such as worker's camps), would be undertaken during detailed design. The detailed archaeological assessment would assess the impact of any proposed excavation works and provide recommendations for appropriate management of the archaeological resource. Dependant on the assessed level of impact, this may necessitate application for an excavation permit under Section 140 or exception notification under Section 139(4) of the Heritage Act.

Construction

- Prior to construction commencing, all heritage significant elements of the former Richmond Vale Railway that would be impacted should be subject to archival recording. This would involve accurate surveying and planning, as per guidelines set out by the NSW Heritage Office (1998 and 2006).
- All workers would complete a specific heritage induction providing information on the Aboriginal heritage of the study area and details of how aboriginal heritage sites and items should be protected from inadvertent and indirect impacts by construction crews during works.
- An unexpected finds procedure would be developed and implemented to outline measures in the event that unknown heritage items are uncovered during works.

Operation

No specific mitigation measures are required during proposal operation.

6.12 Bush fire

6.12.1 Existing environment

The proposal site is predominantly mapped as bush fire prone land –vegetation category 1 and vegetation category 2 (see Figure 4-1). As development consent is not required for the proposal, the approval requirements of the EP&A Act and *Rural Fires Act 1997* do not apply.

6.12.2 Potential impacts

The proposal is situated within a landscape that is subject to bush fire threat. Bush fire can cause catastrophic human and biodiversity health and safety impacts and damage infrastructure.

6.12.3 Safeguards and management measures

Detailed design

- The detailed design would address all relevant requirements of AS 3959 – 1999 Construction of Buildings in Bush Fire-prone Areas.
- Council would engage with NPWS to ensure requirements for operational access and restriction of access, including during bush fire and other emergencies, is incorporated into the detailed design.

Construction

- An emergency response plan would be prepared to include a procedure for managing bush fires. This would include an emergency procedure for ensuring the health and safety of construction workers.
- No hot works would be undertaken during periods of high fire danger.

Operation

- Operational procedures would include measures to restrict access to the trail (such as gates that can be closed) to ensure safety of users during proposal operation. Other measures would be development in accordance with the Werakata SCA Fire Management Strategy, where relevant.
- Instructional signage would include safety procedures for trail users to follow in the case of bush fire. This would include emergency contact details and assembly points.

7. Environmental management

7.1 Construction environmental management plan

The safeguards and management measures described in this REF would be contained within a construction environmental management plan (CEMP), which would be prepared by the contractor and approved by Council prior to construction commencing. All site personnel, contractors and Council staff would be responsible to ensure that environmental protection measures are implemented and that the environment is protected to the highest standard during works. Constant monitoring and improvement of the protection and mitigation measures would ensure that impacts on the environment are minimised.

The construction contractor would nominate an appropriately qualified person to assume day to day operational responsibility for ensuring that the protection and mitigation measures contained within the CEMP are implemented, for monitoring the effectiveness of these measures, for investigating possible improvements to these measures, and for preparing and supplying the supplementary plans that would be required to accompany the CEMP.

The proposal site induction would refer to the CEMP and include relevant staff responsibilities and environmental management measures. All personnel would be required to attend the environmental site induction. Copies of the CEMP would be kept on-site for ready access by all proposal workers.

An operational management plan or procedures would also be developed for the proposal by Council to manage ongoing maintenance and day-to-day management of the proposal following construction. This would be prepared in consultation with relevant stakeholders such as landowners and managers.

7.2 Summary of safeguards and management measures

Table 7-1 provides a summary of the mitigation measures prescribed for the proposal. These measures, at a minimum, would be incorporated into the CEMP and operational procedures for the proposal.

Table 7-1 Summary of safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Air quality	All plant and machinery would be fitted with emission control devices complying with relevant Australian Standards.	Contractor	Construction
	Machinery would be turned off when not in use and not left to idle for prolonged periods.	Contractor	Construction
	Construction plant and equipment would be maintained in good working condition.	Contractor	Construction
	Vehicle movements would be limited to designated entries and exits, haulage routes and parking areas.	Contractor	Construction
	Areas of clearing would be limited to only those that are required to reduce fugitive dust emissions.	Contractor	Construction
	Stockpiles would be stabilised to minimise wind erosion and the generation of dust (e.g. covered or watered).	Contractor	Construction
	Dust generation would be monitored visually, and where required, dust control measures such as water spraying would be implemented to control the generation of dust. If air quality monitoring is considered warranted, it would be undertaken in accordance with Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (Department of Environment and Conservation, 2005).	Contractor	Construction
	Materials transported to and from the site would be covered to reduce dust generation in transit.	Contractor	Construction
	No burning of any materials would be undertaken.	Contractor	Construction
	Access points would be inspected to determine whether sediment is being transferred to the surrounding road network. If required, sediment would be promptly removed from roads to minimise dust generation.	Contractor	Construction
	Shade cloth would be fastened to site fencing at construction compounds if required to minimise dust transported from the site during construction.	Contractor	Construction
	Daily inspections and regular surveillance would be undertaken to identify any vehicle, plant or equipment that is causing visible emissions. If any defective vehicles, plant or equipment are identified, operation of this machinery would cease and service/maintenance would be undertaken.	Contractor	Construction
	Any exposed surfaces would be stabilised, and final landscaping implemented, as soon as practicable following completion of construction.	Contractor	Construction
	Any dust complaints would be investigated as soon as possible and measures taken to manage any impacts identified.	Contractor	Construction
Hydrology, groundwater and water quality	The detailed design process should include hydraulic modelling of the proposal in order to design crossing structures (such as culverts, bridges, fences etc.) that, as far as reasonably practical, match the existing hydraulic response. This will minimise the potential indirect impacts on the hydrology.	Contractor	Detailed Design

Impact	Environmental safeguards	Responsibility	Timing
	Selection of materials would consider the potential for leaching of pollutants or other offsite impacts. Environmental sensitive materials would be chosen where available and cost effective.	Contractor	Detailed Design
	An erosion and sedimentation control plan would be prepared for the proposal in accordance with the requirements of The NSW Soils and Construction – Managing Urban Stormwater Volume 1 'the Blue Book' (Landcom, 2004) and Volume 2 (Department of Environment and Climate Change, 2008).	Contractor	Construction
	If required, a dewatering procedure would be prepared to identify controls and management measures for dewatering including monitoring, testing, containment and disposal. If dewatering is required, the need for a water licence should be confirmed with WaterNSW.	Contractor	Construction
	Operational procedures would include measures to restrict access to the trail (such as gates that can be closed during inundated periods) and ensure safety of users during proposal operation.	Council	Operation
Geology and soils	Consultation would be undertaken with Subsidence Advisory NSW to determine the need for development approval or input for works within the mine subsidence district.	Council	Detailed Design
	Further geotechnical investigation will be undertaken prior to detailed design to confirm geotechnical requirements if required. The investigations would include further soil sampling and analysis to confirm the location of acid sulfate soils and soil contamination.	Contractor	Construction
	An acid sulfate soil management plan would be prepared for the proposal in accordance with the Acid Sulfate Soil Laboratory Methods and Manual (ASSMAC, 1998).	Contractor	Construction
	An unexpected finds protocol would be developed and implemented to manage potentially contaminated soils (if encountered), including landfill or anthropogenic waste and potential asbestos containing material.	Contractor	Construction
Noise and vibration	All employees, contractors and subcontractors are to receive an environmental induction, which would include: • All relevant project specific and standard noise and vibration mitigation measures. • Relevant licence and approval conditions. • Permissible hours of work. • Location of nearest sensitive receivers. • Construction employee parking areas. • Designated loading/unloading areas and procedures. • Site opening/closing times (including deliveries). • Environmental incident procedures.	Contractor	Construction
	No swearing or unnecessary shouting or loud stereos/radios would be allowed on site. Dropping of materials from height, throwing of metal items and slamming of doors would be avoided.	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	Contact would be established with local residents and the construction program and progress communicated on a regular basis, particularly when noisy or vibration-generating activities are planned. Affected receivers (i.e. those within 1000 metres, see Figure 6-3) would be notified of the intended work, its duration and times of occurrence.	Contractor	Construction
	A contact number would be provided for complaints. All complaints would be logged and responded to as soon as practicable.	Contractor	Construction
	On receipt of a noise complaint, construction activities would be reviewed to identify reasonable and feasible mitigation strategies to reduce noise. Noise monitoring would be considered if appropriate.	Contractor	Construction
	All work would be undertaken within standard construction hours, unless out of hours work has been approved.	Contractor	Construction
	Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.	Contractor	Construction
	Broadband reverse warnings should be used in preference over 'beeper' style warnings.	Contractor	Construction
	Simultaneous operation of noisy plant within discernible range of a sensitive receiver would be avoided.	Contractor	Construction
	The offset distance between noisy or vibration generating plant and adjacent sensitive receivers is to be maximised. Noise-emitting plant to be directed away from sensitive.	Contractor	Construction
	Plant used intermittently would be throttled down or shut down in between uses.	Contractor	Construction
	Traffic flow, parking and loading and unloading areas would be planned to minimise reversing movements within the site.	Contractor	Construction
	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers.	Contractor	Construction
	Site access points and roads would be selected as far as possible away from sensitive receivers.	Contractor	Construction
	Loading and unloading of vehicles to consider noise generation for nearby residents i.e. no dropping of loads, consider straps instead of chains to secure loads etc.	Contractor	Construction
	Instructional signage would inform users of the need to consider noise impacts for residences when using the trail.	Contractor	Operation
Resource use and waste	The following resource management hierarchy principles would be followed: • Avoid unnecessary resource consumption as a priority • Avoidance would be followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery) • Disposal would be undertaken as a last resort (in accordance with the Waste Avoidance and Resource Recovery Act 2001)	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	A site waste minimisation and management plan would be prepared for the proposal in accordance with relevant EPA and Council guidelines. The plan would be prepared and approved by Council prior to construction commencing.	Contractor	Construction
	Procurement would endeavour to use materials and products with a recycled content where that material or product is cost and performance effective.	Contractor	Construction
	Excess excavated material would be reused appropriately for fill or disposed of at an appropriate facility. Excess material requiring waste disposal would first be assessed against the Waste Classification Guidelines (Environmental Protection Agency, 2014).	Contractor	Construction
	Additional fill material would be sourced from appropriate local sources.	Contractor	Construction
	Cleared weed-free vegetation would be chipped and reused on-site as part of the proposed landscaping and to stabilise disturbed soils where possible. Weed vegetation would be disposed of appropriately off-site in accordance with its classification status under the Biosecurity Act 2015, where relevant.	Contractor	Construction
	Garbage receptacles would be provided at the site compound and recycling of materials encouraged. There would be no disposal or re-use of construction waste on to other land.	Contractor	Construction
	Waste would not be burnt on-site.	Contractor	Construction
	Waste material, other than vegetation and tree mulch, would be removed from site once the works have been completed.	Contractor	Construction
	Portable toilets would be provided for construction workers and would be managed by the service provider to ensure the appropriate disposal of sewage.	Contractor	Construction
	Site inductions would ensure staff are aware of waste disposal protocols and attendance would be recorded by the site supervisor.	Contractor	Construction
	All working areas would be maintained, kept free of rubbish and cleaned up at the end of each working day.	Contractor	Construction
	Any hazardous waste material stockpiles would be fenced and sign posted for public safety.	Contractor	Construction
	Dedicated concrete washout facilities would be provided during construction so that runoff from the washing of concrete machinery and equipment can be collected and disposed.	Contractor	Construction
	Waste would be disposed of appropriately with supporting waste classification documentation, if required.	Contractor	Construction
	Regular maintenance of the pathway, as part of Council's ongoing regime, would identify and control waste.	Contractor	Operation
	Waste management and resource use would be in accordance with Council's existing operational procedures.	Contractor	Operation

Impact	Environmental safeguards	Responsibility	Timing
	Waste receptacles would be provided at car parks and signage would encourage all users to take waste with them from the trail.	Contractor	Operation
Traffic and access	Upgrades to intersections would be investigated during detailed design in particular at George Booth Drive.	Council	Construction
	Construction traffic management plans (CTMPs) would be prepared and approved by the appropriate roads authority prior to works commencing. The CTMPs would include specific temporary traffic management measures to support construction activities at key locations including: • Former Hunter Expressway construction access roads at Blue Gum Creek and Surveyors Creek. • Quarry Access Road. • Private access to Wallis Creek. • Leggits Drive. • Pokolbin Street.	Contractor	Construction
	Worker parking would be constrained to within the compound site as far as is practicable.	Contractor	Construction
	Carpooling and other methods would be investigated to limit the number of vehicles coming to site, as far as practicable.	Contractor	Construction
	The queuing and idling of construction vehicles in residential streets would be minimised to reduce nuisance.	Contractor	Construction
	An emergency response plan would be developed for construction traffic incidents and/ or accidents. During site inductions, all heavy vehicle drivers would be provided with the emergency response plan for construction traffic incidents.	Contractor	Construction
	The community and local residents would be notified in advance of vehicle movements and anticipated effects on the local road network relating to site works. This would aim to reduce delays and access impacts for residents, public transport, pedestrians and cyclists.	Contractor	Construction
	Access to all private properties adjacent to the works would be maintained during construction, unless otherwise agreed by relevant property owners.	Contractor	Construction
	Council would monitor the use of car parks over time to determine if parking provided is sufficient.	Council	Operation
	In order to manage the potential conflict between light and heavy vehicle traffic at the Quarry Access Road, the following measures are recommended: • Provision of truck warning signage on the access road. • Management of roadside vegetation to maintain forward sight lines for traffic moving along the access road.	Contractor	Operation

Impact	Environmental safeguards	Responsibility	Timing
	Signage would be installed at all locations where the proposal interacts at grade with a road or other road safety issues (such as a school zone), providing a clear delineation between the proposal and the road. Trail users would be warned of the approaching road, via 'Road Ahead' signage. Road and other users would be warned of the approaching trail using appropriate signage in accordance with Australian Standards (see Section 3.2.7).	Contractor	Operation
Biodiversity	The proposal has been developed with due consideration of environmental constraints and has sought to avoid impacts on native vegetation and sensitive environments through route selection including: • Reducing the size of the development footprint to reduce impacts to biodiversity values, as well as to minimise edge effects associated with the linear development • Avoiding endangered ecological communities wherever possible • Locating the alignment of the proposal on land that has been previously cleared in association with the now decommissioned Richmond Vale railway • Avoiding areas of high biodiversity values including mature trees with hollows (by locating the proposal predominantly on previously cleared or disturbed land) • Retaining intact native vegetation that adjoins the subject site to the north and south Further iterations of the proposal design would continue to consider the above approach.	Council	Detailed design
	Artificial lighting sensitive to microbat habitat would be installed and would consider: • Incorporating design features to minimise light spill onto the roof of the tunnels where there are substantial numbers of bat roosts, such as constructing 'shields' or false ceilings around roost sites to maintain darkness within roosts. • Incorporating variable lighting regimes along the alignment and in the tunnels to reduce the potential for light spill impacting foraging habitat, and minimise the chance of roost abandonment. This could involve switching off or dimming lights for part of the night, or use of movement sensor lights along the alignment and in the tunnels that switch on upon approach and turn off after people pass. • Incorporating design features to limit light spill into areas of adjoining sensitive habitat along the alignment, as far as practicable, to minimise the impacts of lighting to foraging habitat along the alignment. This could include the use of low intensity lamps to reduce the spread of illumination, directed lighting or light shields to create dark refuges between lamps. • Use of certain light types such as long wavelength 'warm white' lights rather than short wavelength 'blue' lights.	Contractor	Detailed design

Impact	Environmental safeguards	Responsibility	Timing
	Bridge design would reduce impacts to aquatic habitat by including: • Design elements such as height, orientation, construction materials to minimise shading of marine vegetation such as mangroves and saltmarshes. • Instream structures to avoid impact to river flow and fish passage. • Bat habitat boxes to the underside of new bridges.	Contractor	Detailed design
	Aboricultural assessment would be completed of all trees in close proximity to final design to determine potential impacts to mature tree health and identify appropriate management measures.	Contractor	Detailed design
	Fence design would be of suitable height above ground level and material to enable fauna movement.	Contractor	Detailed design
	General minimisation of clearing areas as far as practicable. Delineating a vegetation buffer with a high visibility barrier to prevent accidental clearing or disturbance of adjacent vegetation or aquatic habitat.	Contractor	Construction
	Demarcation of adjoining sensitive areas through temporary fencing to prevent impacts during construction and/or inclusion of a tree retention plan or similar to protect these biodiversity resources where possible.	Contractor	Construction
	No stockpiling of materials adjacent to native vegetation wherever possible and locating stockpiles within existing cleared areas.	Contractor	Construction
	Management of noxious and environmental weeds during construction, with weed material to be cleared and stockpiled separately to all other vegetation, removed from site and disposed of at an appropriately licenced disposal facility. When transporting weed waste from the site to the waste facility, trucks must be covered to avoid the spread of weed-contaminated material.	Contractor	Construction
	No parking of vehicles or machinery in areas of native vegetation.	Contractor	Construction
	All machinery brought to site will be washed down and inspected to be free of soils, seeds and other organic material.	Contractor	Construction
	Implementation of procedures for clearing habitat where required, including pre-clearing surveys and clearing supervision of hollow-bearing trees and logs, to minimise fauna injury or mortality.	Contractor	Construction
	Implementation of fauna handling and release protocols where required.	Contractor	Construction
	Implementation of remediation activities where native vegetation clearing is required including soil stabilisation and planting of native endemic species characteristic of the vegetation types identified within the study area.	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	Implementation of erosion and sediment control measures to minimise pollution and sediment impacts on waterways and downstream aquatic environments, including estuarine communities. This could include measures such as the use of silt curtains during substrate disturbance activities (e.g. pile driving) to minimise the potential for migration of turbid plumes outside of the immediate construction footprint.	Contractor	Construction
	Implementation of measures to manage fuels, chemicals, and liquids required for construction.	Contractor	Construction
	The proposal would increase the risk of injury or mortality of native fauna during the construction phase due to vehicle strike by increasing the rate of vehicle visitation to the site. This risk would be reduced by: • Restricting vehicle movements to operational (daylight) hours. • Implementing and enforcing appropriate speed limits for vehicles traversing the site. • Establishment of 'no-go' areas, which are demarcated with high visibility barrier tape to prevent accidental impacts to vegetation and other biota adjacent to the disturbance footprint.	Contractor	Construction
	Appropriate signage would be installed which states that dogs should be kept on a lead or are prohibited.	Contractor	Operation
	Appropriate signage would be installed which states that trail bikes (off-road motorcycles), which are known to disturb wildlife, are not permitted within the trail.	Contractor	Operation
	Interpretive signage educating users on the importance of the surrounding wetlands and the species and ecological communities that occur there, as well as the importance of habitat within the nearby tunnel for roosting bats.	Contractor	Operation
	Ongoing management of retained native vegetation to reduce impacts of human activities and weed infestation (noting that herbicides should be avoided near wetland areas).	Council	Operation
	Ongoing maintenance of fencing to ensure its effectiveness at restricting access to wetland habitat.	Council	Operation
Socio-economic	Rest areas and trail interpretation locations and content be developed in consultation with relevant stakeholders.	Contractor	Detailed Design
	Detailed design would consider lighting of the route (particularly in tunnels and in heavily forested areas) to enhance safety.	Contractor	Detailed Design
	Heritage considerations identified to date and in future investigations would be reflected in the detailed design.	Contractor	Detailed Design
	Adequate waste facilities would be provided to avoid nuisance to other users in rest areas and at stopping points.	Contractor	Detailed Design
	Property impacts would be confirmed and verified by survey where required.	Contractor	Detailed Design

Impact	Environmental safeguards	Responsibility	Timing
	Property acquisition or temporary use would be negotiated by Council with affected landowners where relevant in order to reach fair compensation and access arrangements.	Council	Detailed Design
	Measures to manage issues raised by impacted landowners during consultation would be incorporated into the detailed design where relevant. This could include security fencing, lighting, signage etc.	Contractor	Detailed Design
	The use of motorised cycles/scooter/chairs and hiring facilities for these at some access points would be considered.	Contractor	Detailed Design
	Emergency access would be provided at suitable locations along the trail.	Contractor	Detailed Design
	Vandal resistant materials and appropriate signage would be used to outline expectations of users and other safety information and prevent damage.	Contractor	Detailed Design
	Safety requirements at road intersections and other crossings would be further investigated.	Contractor	Detailed Design
	Fencing and/ or screening near private properties close to the route would be implemented as required to minimise overlooking and privacy impacts.	Contractor	Construction
	Residents, businesses and organisations located close to the proposal would be consulted in advance of construction to ascertain any specific times/events that should be considered in construction programming (e.g. school or cultural events).	Contractor	Construction
	Construction scheduling would consider other major projects in the locality to avoid the potential for cumulative impacts.	Contractor	Construction
	Residents living near the proposal and the local community would be provided with timely and relevant information to enable them to understand the likely nature, extent and duration of vibration, dust and noise impacts and access changes.	Contractor	Construction
	Communication methods would be chosen to ensure any vulnerable community members are appropriately engaged with during the consultation period.	Contractor	Construction
	Communications would include, as relevant, roadside signage, newsletters, newspaper advertisements, web based information, a complaints line, and advice to specific service providers, such as community transport and seniors organisations.	Contractor	Construction
	All works would be undertaken during standard construction hours.	Contractor	Construction
	Council would continue to engage with affected stakeholders during proposal operation to enable identification and management of any issues as they arise.	Council	Operation
Visual amenity	All parking and site equipment associated with construction should be appropriately screened as required.	Contractor	Construction
	All construction sites are to be maintained daily and decommissioned after completion of the works.	Contractor	Construction
	Rehabilitation of the construction site should be undertaken upon completion of the works.	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
Cultural heritage	The footprint of the proposal and the construction methodology would be developed so as to minimise impacts in the vicinity of RVRT PAD 1.	Contractor	Detailed design
	The detailed design should include heritage interpretation and signage to be installed in conjunction with shared pathway amenities. Liaison with Aboriginal stakeholders is recommended for designing interpretation and signage content.	Contractor	Detailed design
	If impacts cannot be avoided to RVRT PAD 1, an Aboriginal heritage impact permit (AHIP) under Section 90 of the NPW Act would be required prior to construction commencing. This AHIP application would be submitted with an Aboriginal Cultural Heritage Assessment Report (ACHAR) completed in accordance with the Guide to Investigation, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (Office of Environment and Heritage, 2011). Full consultation with Aboriginal stakeholders, in accordance with Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH 2010), and archaeological test excavation would be required. Existing AHIPs that may overlap the site should also be confirmed at this time.	Contractor	Detailed design
	All workers would complete a specific heritage induction providing information on the Aboriginal heritage of the study area and details of how aboriginal heritage sites and items should be protected from inadvertent and indirect impacts by construction crews during works.	Contractor	Construction
	An unexpected finds procedure would be developed and implemented in the event unknown heritage items are uncovered during works.	Contractor	Construction
	Consideration should be given to preserve as much original heritage fabric as practical, including timber bridges and residual rail infrastructure, located along the route of the former Richmond Vale Railway (Item No. I214). In particular the following items should be retained, where considered feasible for safety, cost and environmental reasons: • Tunnel No. 1 • Tunnel No. 2 • Tunnel No. 3 in particular the brick portals of the tunnel • Surveyors Creek Bridge • Wallis Creek Bridge • The existing profile of the original railway cuttings • Surveyor marked tree • Brick platforms and retaining walls	Contractor	Detailed design
	Shotcreting of cuttings should be avoided as it would have a major visual impact on the Richmond Vale Railway.	Contractor	Detailed design
	Stabilisation of Tunnel 3 would be undertaken in such a way as to reduce impacts to the eastern portal and retain, as far as practicable, the inherent heritage value.	Contractor	Detailed design

Impact	Environmental safeguards	Responsibility	Timing
	The selection of new materials and finishes should be as sympathetic as possible to the existing character of the railway, with the aim of minimising visual impacts.	Contractor	Detailed design
	Heritage interpretation and signage would be installed in conjunction with shared pathway amenities. Liaison with local historical societies, including the University of Newcastle's Coal River Working Party and the Richmond Vale Railway Society and Museum is recommended for designing interpretation and signage content.	Contractor	Detailed design
	Detailed assessment, including assessment of the significance and location of any potential remains (such as worker's camps), would be undertaken during detailed design. The detailed archaeological assessment would assess the impact of any proposed excavation works and provide recommendations for appropriate management of the archaeological resource. Dependant on the assessed level of impact, this may necessitate application for an excavation permit under Section 140 or exception notification under Section 139(4) of the Heritage Act.	Contractor	Detailed design
	Prior to construction commencing, all heritage significant elements of the former Richmond Vale Railway that would be impacted should be subject to archival recording. This would involve accurate surveying and planning, as per guidelines set out by the NSW Heritage Office (1998 and 2006).	Contractor	Construction
	All workers would complete a specific heritage induction providing information on the Aboriginal heritage of the study area and details of how aboriginal heritage sites and items should be protected from inadvertent and indirect impacts by construction crews during works.	Contractor	Construction
	An unexpected finds procedure would be developed and implemented to outline measures in the event that unknown heritage items are uncovered during works.	Contractor	Construction
Bush fire	The detailed design would address all relevant requirements of AS 3959 – 1999 Construction of Buildings in Bush Fire-prone Areas.	Contractor	Detailed design
	Council would engage with NPWS to ensure requirements for operational access and restriction of access, including during bush fire and other emergencies, is incorporated into the detailed design.	Council	Detailed design
	An emergency response plan would be prepared to include a procedure for managing bush fires. This would include an emergency procedure for ensuring the health and safety of construction workers.	Contractor	Construction
	No hot works would be undertaken during periods of high fire danger.	Contractor	Construction
	Operational procedures would include measures to restrict access to the trail (such as gates that can be closed) to ensure safety of users during proposal operation. Other measures would be development in accordance with the Werakata SCA Fire Management Strategy, where relevant.	Contractor	Operation
	Instructional signage would include safety procedures for trail users to follow in the case of bush fire. This would include emergency contact details and assembly points.	Contractor	Operation

8. Conclusion

8.1 Justification

The Richmond Vale Rail Trail aims to deliver a continuous off-road shared pathway from Shortland to Kurri Kurri, and once constructed would provide a link between Kurri Kurri, Maitland and Newcastle. The shared pathway would link the communities of Kurri Kurri, Pelaw Main, Buchanan, Stockrington, Fletcher, Tarro, and Shortland and enable cyclists and pedestrians to undertake journeys without having to ride on the Pacific Motorway, Hunter Expressway or New England Highway.

The trail is specifically referred to in the *Hunter Regional Plan 2036* (OEH, 2016) and *Greater Newcastle Metropolitan Plan 2036* (DP&E, 2018), which identifies a range of strategies to support sustainable growth across the local and regional area including Newcastle, Cessnock and Maitland. The project addresses key actions related to:

- Improved access to open space, recreation areas and waterways.
- Enhanced nature based tourism through protection and promotion of natural assets such as the Hexham Wetlands.

The trail provides an active transport and recreational choice for locals and visitors, passing through old railway tunnels and over bridges, amongst wildlife habitats and linking the Kurri Kurri Log of Knowledge Park to the Hunter Wetlands Centre. It would provide opportunities in the key growth areas of transport, tourism, recreation, heritage, and economic and social development. Key benefits of the trail include:

- Improved facilities linking local communities via a safe, accessible and amenable route.
- A commuter and recreational transport corridor for tourists and locals to make journeys without having to use existing road networks (in particular the M1 Pacific Motorway and New England Highway).
- Improved access for tourists and locals to enjoy heritage (such as passing through old railway tunnels) and environmental attractions, including the Pambalong Nature Reserve and Werakata SCA.
- Opportunities for healthier, active lifestyles for both residents and tourists allowing users to experience the amenity of the route as it travels through various landscapes and environments.
- Opportunity for development of the key economic growth areas of tourism and recreation, while providing social, health and conservation benefits for users and the region.

The proposal is a critical component of the Richmond Vale Rail Trail. The potential impacts of the proposal are considered minor when compared to the identified benefits. Mitigation measures are provided in this REF, which would avoid, reduce or mitigate any impacts.

Council is committed to providing facilities that are accessible to the whole community. The general design objectives for the shared pathway are to provide a safe, enjoyable and aesthetically pleasing journey for the whole community. Ongoing consultation during the detailed design, construction and operation stages would ensure that input from affected stakeholders is incorporated where relevant into the proposal.

8.2 Objects of the EP&A Act

The proposal's consistency or otherwise with the objects of the EP&A Act is summarised in Table 8-1.

Table 8-1 Objects of the EP&A Act

Object	Comment
(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,	The proposal would improve the safety of pedestrians and cyclists, provide opportunities for healthier lifestyles and allow users to experience the cultural and natural environment of the region. A number of management measures would be implemented to minimise any environmental, social or economic impacts associated with the proposal.
(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,	Ecologically sustainable development is specifically addressed in Section 8.3.
(c) to promote the orderly and economic use and development of land,	The proposal would create a non-motorised recreational and active transport pathway for use by members of the public. It would be a community facility accessible to the whole community.
(d) To promote the delivery and maintenance of affordable housing,	Not relevant to the proposal.
(e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	Measures would be implemented to protect and conserve the environment and native animals and plants. The potential impacts on vegetation, threatened species, population and ecological communities are discussed in Section 6.7.
(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),	Potential impacts to heritage are assessed in Section 6.10 and 6.11. Measures would be implemented to sustainably manage known and unknown heritage resources.
(g) To promote good design and amenity of the built environment,	The proposal design considers all relevant design and construction standards as well as user and adjoining landowner amenity.
(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,	Not relevant to the proposal.
(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,	Not relevant to the proposal.
(j) To provide increased opportunity for community participation in environmental planning and assessment.	Consultation with the community and relevant government agencies was undertaken during the development of the proposal. Consultation would be ongoing during detailed design, construction and operation.

8.3 Ecologically sustainable development

The principles of ecologically sustainable development are defined under the EP&A Regulation (Schedule 2) as:

(a) the precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:

> *(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*
>
> *(ii) an assessment of the risk-weighted consequences of various options,*

(b) inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

(c) conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

(d) improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:

> *(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,*
>
> *(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,*
>
> *(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.*

These principles are addressed in turn, as they pertain to the proposal, in the following sections.

8.3.1 The precautionary principle

This principle states that 'if there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation'.

Evaluation and assessment of alternative options has aimed to reduce the risk of serious and irreversible impacts on the environment. Stakeholder consultation considered issues raised by stakeholders and a range of specialist studies were undertaken for key issues to provide accurate and impartial information to assist in the design development process.

The concept design has sought to minimise impacts on the amenity of the study area while maintaining engineering feasibility and safety for all users. A number of safeguards have been proposed to minimise potential impacts. These safeguards would be implemented during construction and operation of the proposal. No safeguards have been postponed as a result of lack of scientific certainty.

A CEMP would be prepared before construction starts. This requirement would ensure the proposal achieves a high-level of environmental performance. No management measures or mechanisms would be postponed as a result of a lack of information.

8.3.2 Intergenerational equity

The principle states, 'the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations'.

The proposal would not result in any impacts that are likely to adversely impact on the health, diversity or productivity of the environment for future generations. The proposal would benefit future generations by improving road safety, providing safe and healthy opportunities for recreation and encouraging access and appreciation of the natural and cultural environment.

8.3.3 Conservation of biological diversity and ecological integrity

This principle states the 'diversity of genes, species, populations and communities, as well as the ecosystems and habitats to which they belong, must be maintained and improved to ensure their survival'.

The proposal is bound by large areas of significant native flora and fauna habitat. Specific design efforts have been taken to minimise impacts upon locally significant habitats. The majority of the proposal would be constructed within previously disturbed areas of exotic grassland associated within the former Richmond Vale railway. The proposal would not have a significant impact on biological diversity and ecological integrity. Appropriate site-specific safeguards are provided in Section 7.2.

8.3.4 Improved valuation, pricing and incentive mechanisms

This principle requires 'costs to the environment should be factored into the economic costs of a proposal'.

The REF has examined the environmental consequences of the proposal and identified management measures to manage the potential for adverse impacts. The requirement to implement these management measures would result in an economic cost to Council. The implementation of management measures would increase both the capital and operating costs of the proposal. This signifies that environmental resources have been given appropriate valuation.

The concept design has been developed with an objective of minimising potential impacts on the surrounding environment.

8.4 Summary

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

This has included consideration (where relevant) of conservation agreements and plans of management under the NPW Act, biodiversity stewardship sites under the BC Act, wilderness areas, areas of outstanding value, impacts on threatened species and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of NES listed under the EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some impacts on heritage, local area amenity, the visual landscape and biodiversity. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also provide significant economic, transport and lifestyle benefits. On balance the proposal is considered justified and the following conclusions are made.

Significance of impact under NSW legislation

The proposal would be unlikely to cause a significant impact on the environment. Therefore it is not necessary for an EIS to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act. An SIS is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from Council is not required.

Significance of impact under Australian legislation

The proposal is not likely to have a significant impact on matters of NES or the environment of Commonwealth land within the meaning of the EPBC Act. A referral to the Commonwealth Minister for the Environment is not required.

9. References

ANZECC. (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Canberra: Australia and New Zealand Environment and Conservation Council and Agriculture and Resource Managment Council of Australia and New Zealand.

ASSMAC. (1998). *Acid Sulfate Soil Manual*. Wollongbar: Acid Sulfate Soil Management Advisory Committee.

Australian Bureau of Statistics. (2016). *Census QuickStats*. Retrieved from http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/quickstat/LGA15900?opendocument&navpos=220#vehicles

Australian Government Bureau of Meteorology. (2016, December 2). *Climate Data Online*. Retrieved from Bureau of Meteorology Website: http://www.bom.gov.au/climate/data/

Cessnock City Council. (2017). *Cessnock Community Strategic Plan 2027.* Cessnock.

City of Newcastle. (2004). *Newcastle Stormwater Management Plan.* Newcastle: Newcastle City Council.

Department of Environment and Climate Change. (2009). *Interim Construction Noise Guideline.* Sydney South: Department of Environment and Climate Change NSW.

Department of Environment and Conservation. (2005). *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW.* Sydney: Department of Environment and Conservation.

Department of Environment and Conservation. (2006). *Assessing vibration: A technical guideline.* Sydney: Department of Environment and Conservation.

Department of Environment and Heritage. (2006). *Management of Phytophthora Cinnamomi for Biodiversity Conservation in Australia.* Canberra: Department of Environment and Heritage.

Department of Environment, Climate Change and Water. (2010). *NSW Climate Impact Profile.* Sydney: Department of Environment Climate Change and Water.

Department of Environment, Climate Change and Water. (2011). *NSW Road Noise Policy.* Sydney: Department of Environment, Climate Change and Water NSW.

Department of Environnment and Climate Change. (2008). *NSW Soils and Construction - Managing Urban Stormwater - Volume 2.* Sydney South: Department of Environnment and Climate Change NSW.

Department of Primary Industries. (2013). *Policy and Guidelines for Fish Habitat Conservation and Management.* NSW Department of Primary Industries.

Destination NSW. (2016). *Travel to the Hunter Tourism Region.*

Environment Protection Agency. (2017). *Noise Policy for Industry.* Sydney South: Environment Protection Agency.

Environmental Protection Agency. (2014). *Waste Classification Guidelines.*

GHD Pty Ltd. (2016). *NCC Richmond Vale Rail Trail Pathway Options Assessment Report.* Newcastle: GHD Pty Ltd.

GHD, 2019, Richmond Vale Rail Trail - Shortland to Tarro and Pambalong Environmental Impact Statement

GHD, 2020, Richmond Vale Rail Trail - Stockrington Environmental Impact Statement

Gorbert & Chestnut. (1975). *Newcastle 1:100 000 Geological Map.*

Gorbert, V., & Chestnut, W. (1975). *Newcastle 1:100 000 Geological Sheet* (1st ed.). Sydney: Geological Survey of New South Wales.

Hunter Medicare Local. (2014). *Towards a Healthy Hunter: Priorities, Partnerships and Actions.*

Laidlaw, W. S., & Wilson, B. A. (2003). Floristic and structural characteristics of a coastal heathland exhibiting symptoms of Phytophthora cinnamomi infestation in the eastern Otway Ranges, Victoria. *Australian Journal of Botany, 51*, 283-293.

Lake Macquarie City Council. (2018). *Lake Macquarie City Council - Bush Fire Prone Land Map.*

Landcom. (2004). *NSW Soils and Construction - Managing Urban Stormwater - Volume 1.* Sydney: New South Wales Government.

Matthei, L. E. (1995). Soil Landscapes of Newcastle 1:100,000 Sheet. Sydney: NSW Department of Land and Water Conservation.

NSW Government. (2016). *Hunter Regional Plan 2036.*

NSW National Parks and Wildlife Service. (2016). *Draft Hunter Wetlands National Park Plan of Management.* Newcastle: NSW National Parks and Wildlife Service.

Office of Environment and Heritage. (2011). *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW.* Sydney South: Office of Environment and Heritage.

Richmond Vale Railway Museum. (2010). *History of the Richmond Vale Railway Museum*. Retrieved from Richmond Vale Railway Museum: http://www.richmondvalerailwaymuseum.org/history/index.html

Roads and Maritime. (2016). Construction Noise and Vibration Guideline. North Sydney: Roads and Maritime.

Roads and Traffic Authority. (2001). *RTA Environmental Noise Management Manual.* Surry Hills: Roads and Traffic Authority of New South Wales.

Rural Fire Service. (2006). *Planning for Bush Fire Protection.* NSW Rural Fire Service.

Rural Fire Service. (2009). *Newcastle LGA - Bush Fire Prone Land Map*. Retrieved from http://www.newcastle.nsw.gov.au/Living/Environment/Bush-fire/Bush-fire-prone-land

Summerell, B., Pongpisutta, R., & Howard, C. (2005). The Biology of Phytophthora cinnamomi. *Australasian Plant Conservation, 13*, 2-4.

The City of Newcastle. (2011). *The Newcastle 2020 Carbon and Water Management Action Plan.* Newcastle: The City of Newcastle.

The City of Newcastle. (2012). *Newcastle Cycling Strategy and Action Plan.* Newcastle: The City of Newcastle.

The City of Newcastle. (2018). *Newcastle 2030: Newcastle Community Strategic Plan.* Newcastle: The City of Newcastle.

10. Terms and acronyms used in this REF

ABS	Australian Bureau of Statistics
AHIMS	Aboriginal Heritage Information Management System. AHIMS contains details of Aboriginal objects, places and other heritage values across NSW.
ASSMAC	Acid Sulfate Soil Management Advisory Committee
BC Act	Biodiversity Conservation Act 2016
CEMP	Construction environmental management plan
CLM Act	Contaminated Land Management Act 1997 (NSW). A process for investigating and remediating contaminated land.
CMA	Catchment Management Authority. Authorities managing resources in their catchments
DPE	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
DPIE	NSW Department of Planning, Industry and Environment (former)
DECC	NSW Department of Environment and Climate Change (former)
EEC	Endangered ecological community
EIS	Environmental impact statement
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW). Provides the legislative framework for land use planning and development assessment in NSW.
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
FM Act	Fisheries Management Act 1994 (NSW). Act to conserve, develop and share NSW fishery resources for the benefit of present and future generations.
GHD	GHD Pty Limited
Transport and Infrastructure SEPP	State Environmental Planning Policy (Transport and Infrastructure) 2021. Aims to facilitate the effective delivery of transport and infrastructure across the State.
kg	Kilograms
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
m	Metres
NPW Act	National Parks and Wildlife Act 1974 (NSW). Act to conserve and manage the State's natural and cultural heritage in reserved lands.
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PCT	Plant community type
POEO Act	Protection of the Environment Operations Act 1997 (NSW). Aims to protect, restore and enhance the environment through a range of objectives.
REF	Review of environmental factors. Assessment prepared under Part 5 of the EP&A Act.
SIS	Species impact statement
TEC	Threatened ecological community
The proposal	The activity subject to assessment under the REF.
WM Act	Water Management Act 2000 (NSW). Provides for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations.

Appendices