



Cessnock City Council

Richmond Vale Rail Trail - Stockrington to Kurri Kurri Review of Environmental Factors

March 2022

Executive summary

The Richmond Vale Rail Trail

Overview

The proposed Richmond Vale Rail Trail is a 32 kilometre cycling and walking track along the former Richmond Vale railway between Kurri Kurri and Hexham/Shortland.

The Richmond Vale railway is a former rail line that runs from Hexham to Pelaw Main in the Lower Hunter region of NSW. Industrial operation of the railway ceased in 1987 following the closure of the collieries in the region. An opportunity now exists to establish a multi-use recreational trail for active transport by utilising the disused sections of the former rail line. The trail would be located within the Newcastle, Cessnock and Lake Macquarie local government areas.

The Council of the City of Newcastle, Cessnock City Council and Lake Macquarie City Council are the proponents of the proposal. Funding contributions have also been made from the National Parks and Wildlife Service and the Donaldson Conservation Trust.

The rail trail would provide a safe cycling and walking experience between Kurri Kurri and Newcastle that does not utilise existing road networks and would attract both local and regional users to enjoy the environmental and heritage attractions along the route. The Richmond Vale Rail Trail provides an opportunity for the communities of the Lower Hunter region to develop the key economic growth areas of tourism and recreation while providing social, health and conservation benefits for users and the region.

Objectives of the Richmond Vale Rail Trail

The aim of the Richmond Vale Rail Trail is to enhance active transport options and create connectivity between communities by providing improved cycling and walking facilities and linking the communities of the Lower Hunter region via a safe, accessible and amenable route. Key objectives of the project are to:

- Support future growth within the Lower Hunter region of NSW.
- Maximise road safety benefits by providing a safe alternative route for active transport between the communities of the region.
- Provide the local and regional community with better recreational access to the local natural environment.
- Encourage the growth of bicycle-tourism industries within the region.
- Generate opportunities for residents and tourists to enjoy healthier, more active lifestyles.

Need for the Richmond Vale Rail Trail

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 the population centres of Kurri Kurri, Maitland and Newcastle. The shared pathway would enable cyclists and pedestrians to undertake journeys without having to ride on the Pacific Motorway, Hunter Expressway or New England Highway.

The Richmond Vale Rail 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.

The Richmond Vale Rail 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 to the Hunter Wetlands Centre. It would also open up the western section of the Hunter Wetlands National Park, the Pambalong Nature Reserve and the Werakata State Conservation Area to the public and provide opportunities in the key growth areas of transport, tourism, recreation, heritage, and economic and social development.

The proposal

Overview

To seek relevant development approvals, the Richmond Vale Rail has been divided into two sections, Shortland to Tarro and Pambalong, and Stockrington to Kurri Kurri. The Stockrington to Kurri Kurri section of the rail trail is addressed in this review of environmental factors (REF), apart from a small area adjacent to the Pambalong Nature Reserve that requires development consent.

The Shortland to Tarro, and the Pambalong section, are subject to assessment and approval under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Environmental impact statements (EIS) have been prepared for both projects (GHD, 2019; GHD, 2020) to accompany a development application to the City of Newcastle and Cessnock City Council for approval. These areas are not addressed in this REF.

Key features

The proposal involves the establishment of a pathway between three to four metres wide constructed, for the most part, on an existing disused rail alignment. The proposal would generally comprise the following:

- Removal of unsuitable subgrades and the construction of pavements using imported gravel, asphalt and concrete.
- Restoration and repair, as required, of three existing railway tunnels.
- At grade crossings of the following roads:
 - Dog Hole Road, Stockrington.
 - Quarry access road, Richmond Vale.
 - Hunter Expressway construction yard off George Booth Drive, Richmond Vale.
 - Pokolbin Street, Kurri Kurri.
- Construction of a 15 metre two-span concrete bridge at Surveyors Creek and demolition of the existing timber bridge at this location.
- Construction of a new 70 metre single span bridge at Wallis Creek, and demolition of the existing timber bridge.
- Construction of a new, short bridge at Werekata Creek, with removal of the existing bridge abutments as the bridge structure having been removed previously.
- Construction of four new parking facilities at various access points along the proposal route.

Timing

Construction of the proposal, if approved, would commence when funding is received and is expected to take approximately **12 to 18 months to complete**.

Objectives of the proposal

The proposal addresses the objectives of the overall Richmond Vale Rail Trail project, and also specific objectives to:

- **Support growth** by connecting local and regional users at key access points including Kurri Kurri, Buchanan and Stockrington.
- Provide commuters and recreational users with a **safe alternative route to the local road network**, including the New England Highway and the M1 Pacific Motorway.
- Provide **better recreational access** to the Pambalong Nature Reserve and the Werakata State Conservation Area.
- **Protect and maintain natural conservation values** of adjacent lands, including conservation areas.
- **Generate healthier, more active lifestyles** and opportunities for **public appreciation** and **enjoyment** of the local natural environment.

Need for the proposal

The proposal would provide a continuous shared pathway from Stockrington to Kurri Kurri. It is a critical component of the Richmond Vale Rail Trail project, which aims to deliver a continuous off-road shared pathway from Shortland to Kurri Kurri. Once constructed, the Richmond Vale Rail Trail would provide a regionally important active transport link between the centres of Kurri Kurri, Maitland and Newcastle.

The key benefits of the proposal include improved and more sustainable transport choices, increased visitation to the locality and region, additional recreational opportunities and the growth of bicycle-tourism industries. The proposal would improve the safety of pedestrians and cyclists who currently have to continue their journey from one pathway to the next along busy roads. The proposal would also provide opportunities for healthier active lifestyles for both residents and tourists and allow users to experience the amenity of the route as it travels through various landscapes and environments.

Cessnock City 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. A number of fatalities have occurred on the New England Highway and other arterial roads and motorways within the locality. The shared pathway would improve safety for all road users.

Options considered

The proposal follows the alignment of the former Richmond Vale railway, and offers a **number of advantages over alternative alignments**, including:

- **Improved safety** by reducing cyclist interactions with road users.
- **Minimal land acquisition.**
- **Minimal earthworks.**
- **Fewer environmental impacts.**
- **Improved aesthetic appeal.**

A detailed design options assessment was undertaken for the various bridge and treatment options along the proposal alignment.

The preferred option comprises a combination of the **preferred options for bridges and pavement treatment**, which includes:

- Construction of a **15 metre two-span concrete bridge at Surveyors Creek** and demolition of the existing timber bridge at this location.
- Construction of a **new 70 metre single span bridge at Wallis Creek**, and demolition of the existing timber bridge.
- Construction of a new, **short bridge at Werekata Creek**, with removal of the existing bridge abutments as the bridge structure having been removed previously.
- Either **flexible pavement**, comprising granular (gravel) material overlaid with asphalt or other bituminous seals, or concrete, either reinforced with mesh or fibres.

Statutory and planning framework

The proposal is defined as a **'road infrastructure facility'** under clause 2.107 of the State Environmental Planning Policy (Transport and Infrastructure) 2021 (Transport and Infrastructure SEPP). Clause 2.108(1) of the Transport and Infrastructure SEPP permits development for the purpose of a road infrastructure facility to be carried out by or on behalf of a public authority without consent on any land.

Assessment, in the form of this REF, is required under Division 5.1 of the EP&A Act. Cessnock City Council is the proponent and determining authority for the REF pursuant to Section 5.3 of the EP&A Act.

Community and stakeholder consultation

Consultation with potentially affected property owners, residents, relevant government agencies and other stakeholders, and the community, has been undertaken for many years and is ongoing. Information about the proposal is available on the Council website and is updated regularly.

Council would continue to consult with the community and stakeholders throughout the future stages of the proposal.

Summary of key benefits and impacts

Key benefits of the proposal 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 Werekata State Conservation Area.
- **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.

These benefits have been quantified and exceed the cost of the proposal by an estimated two and a half times.

The **key impacts** of the proposal are considered minor in comparison and include:

- **Minor amenity impacts** during construction due to increased traffic and activity, visual changes, noise and dust.
- **Potential water quality impacts** due to pollutant runoff, sedimentation, and disturbance of acid sulfate soils.
- **Minor change to surface water flows** due to increased impermeable surfaces and construction of new bridges and boardwalks.
- **Removal of native vegetation**, which would result in a negligible loss of habitat for native (and threatened) flora and fauna.
- **Potential for injury, mortality and disturbance of native fauna** during construction and operation of the proposal.
- **Potential introduction and spread of weeds and pathogens.**
- **Permanent visual changes and impacts to a small number of residents** and national park visitors due to increased visitation. Impacts could include noise, inappropriate use and loss of privacy.
- **Potential and actual impacts to Aboriginal and non-Aboriginal cultural heritage values.**
- **Impacts to a small number of landowners** due to temporary or long term use or acquisition of property for the proposal.

Justification and conclusion

The key benefits of the proposal include improved and more sustainable transport choices, increased tourism, better access to recreational opportunities and the growth of bicycle-tourism industries. The proposal would improve the safety of pedestrians and cyclists who currently have to continue their journey from one pathway to the next along busy roads. The proposal also provides opportunities for healthier lifestyles for both residents and tourists and would allow users to better experience certain aspects of the cultural and natural environment of the region.

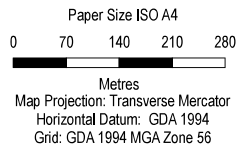
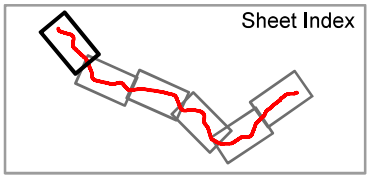
The potential impacts of the proposal are considered minor when compared to the identified benefits. Mitigation measures are provided in this REF, which would avoid, reduce or mitigate any impacts. Ongoing consultation during the detailed design, construction and operation stages would ensure that input from affected stakeholders is incorporated where relevant into the proposal.

The proposal as described in the REF best meets the proposal objectives. On balance the proposal is considered justified.



Legend

- Proposed route
- Asphalt
- Compound/Stockpile
- Proposed carpark area
- Proposed rural style fencing
- Cadastral
- Watercourse



Cessnock City Council
Richmond Vale Rail Trail
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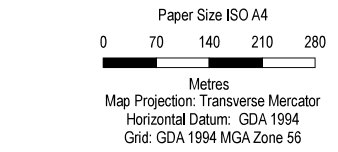
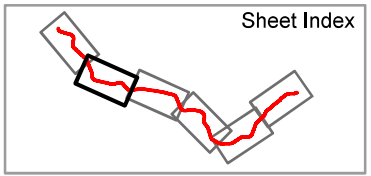
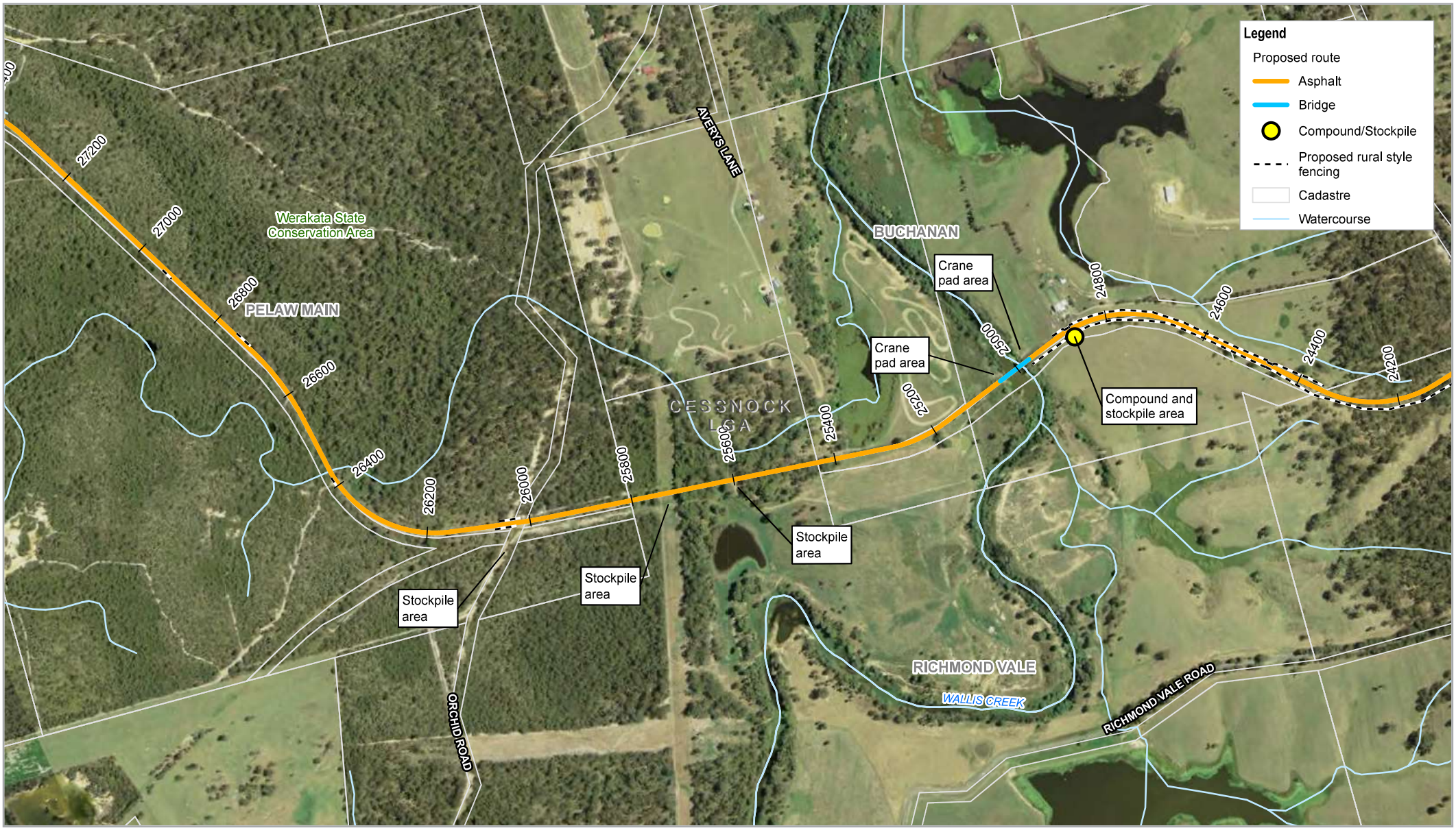
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Revision No. 0
Date 03/07/2020

Proposal area
Sheet 1 of 6

Figure 3-1a

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 Richmond Vale Rail Trail
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Proposal area
 Sheet 2 of 6

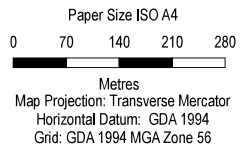
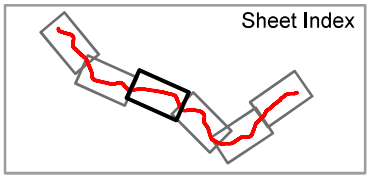
Project No. 12529257
 Revision No. 0
 Date 03/07/2020

Figure 3-1b



Legend

- Proposed route
- Asphalt
- Bridge
- Concrete
- Compound/Stockpile
- Proposed carparking area
- Proposed rural style fencing
- Cadastre
- Watercourse



Cessnock City Council
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Revision No. **0**
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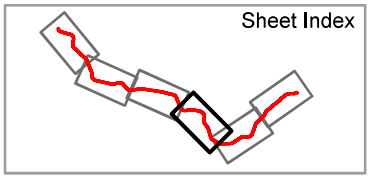
Proposal area
Sheet 3 of 6

Figure 3-1c



Legend

- Proposed route
- Asphalt
- Concrete
- Compound/Stockpile area
- Proposed carparking area
- Proposed rural style fencing
- Cadastre
- Watercourse



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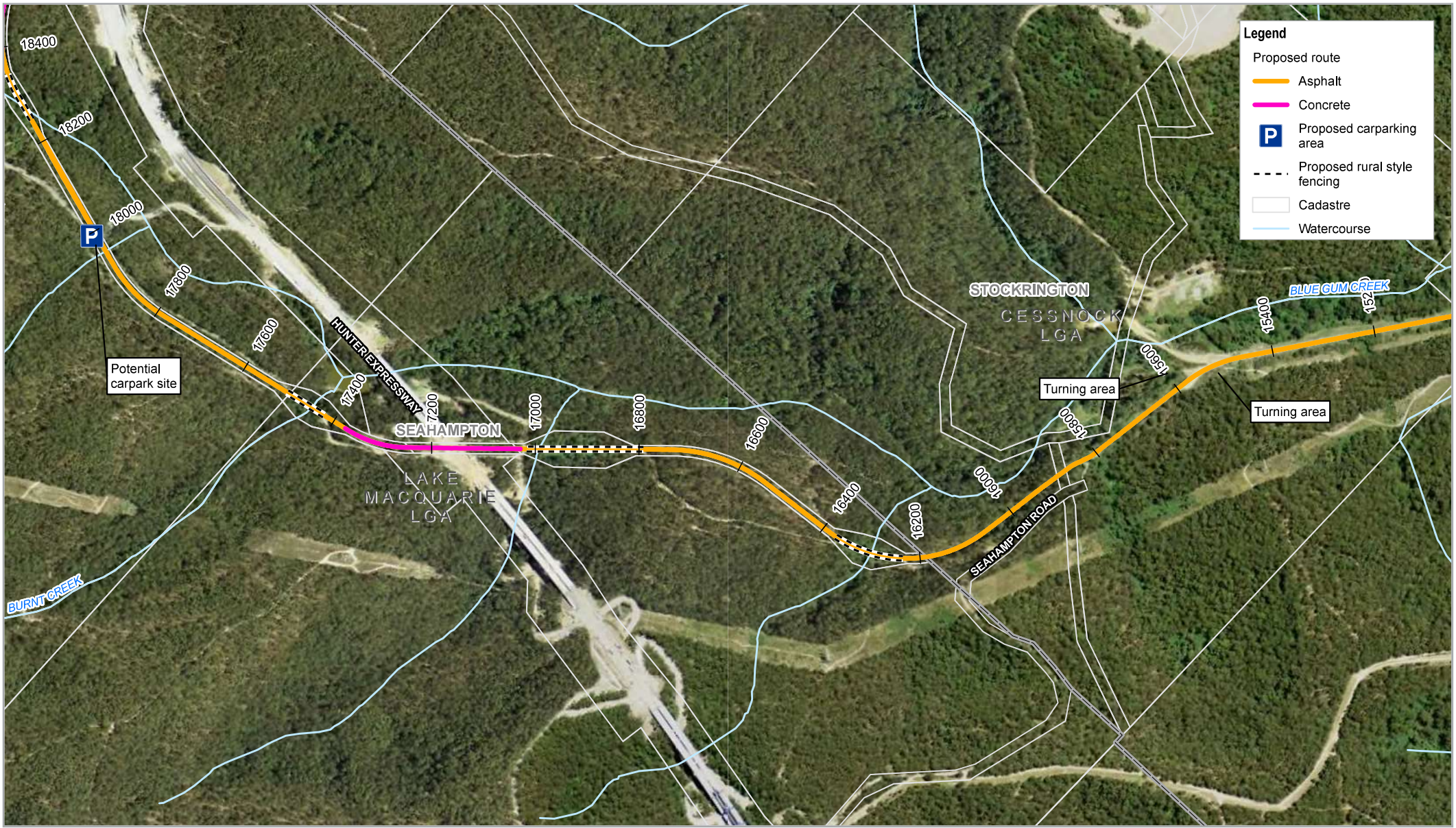


**Cessnock City Council
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**Proposal area
 Sheet 4 of 6**

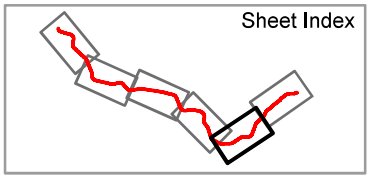
Project No. 12529257
 Revision No. 0
 Date 03/07/2020

Figure 3-1d



Legend

- Proposed route
 - Asphalt
 - Concrete
- Proposed carparking area
- Proposed rural style fencing
- Cadastr
- Watercourse



Paper Size ISO A4
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 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



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Figure 3-1e

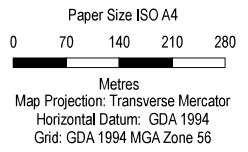
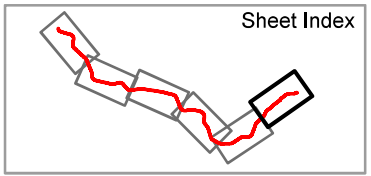
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Legend

- Proposed route
- Asphalt
- Compound/Stockpile
- Proposed carparking area
- Proposed rural style fencing
- Design (outside of assessment)
- Cadastral
- Watercourse



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Proposal area
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Figure 3-1f

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.

5. Summary

The proposal includes the construction of a pedestrian and cycle path along the alignment of the former Richmond Vale Railway line and former Chichester to Newcastle pipeline alignment. The works will include:

- Modification of the existing formation to provide a suitable pathway. This includes sections where the formation is to be raised and widened.
- Upgrade or replacement of the existing watercourse crossing structures (i.e. culverts and bridges) to provide additional drainage capacity (where the formation is being raised) or extended to accommodate the widened formation.

The potential impacts associated with construction activities are expected to consist principally of water quality impacts to the downstream environment, due to the discharge of sediment-laden runoff from active construction areas. In order to minimise the potential impacts of these discharges, a soil and water management plan (including an erosion and sediment control plan) is to be prepared prior to the commencement of construction activities. **The soil and water management plan and erosion and sediment control plan will provide details how surface water is to be managed on site during construction.**

Water quality monitoring upstream and downstream and works areas, during rainfall events, should be undertaken to identify potential discharges of sediment-laden runoff from active construction areas. This monitoring should continue until construction activities have been completed, the work area rehabilitated and erosion and sediment controls removed.

Construction is expected to include minor excavation (less than 0.2 metres in depth) therefore, the potential to intercept groundwater is considered low.

The trail is not expected to result in appreciable changes to regional flooding, however changes to the formation height and cross drainage structures has the potential to impact local flow pathways flow volumes and velocities within the downstream environment. **During the detailed design phase, detailed hydraulic modelling is to be undertaken to identify watercourse-crossing structures that, as far as practical, provide a comparable hydraulic performance to the existing structures, including the provision of suitable scour protection measures to reduce the potential for erosion and scouring within the downstream environment.** The hydraulic modelling would also allow for the estimation of the potential reduction in the flood immunity of the trail due to sea level rise and changes in rainfall intensity due to future climate change.

Appendix C - Geotechnical Assessment - Summary Pages

5.10 Summary

The proposed pathway has been subjected to a desk study and targeted site walk over to assess the site conditions with regard to identifying geotechnical risks, constraints and opportunities related to the proposed development. Particular attention was paid to items that are considered to be of significance such as pavement subgrade, bridge founding conditions, treatment of cuts and condition of brick lined tunnels.

Table 5-3 summarises the risks and opportunities identified and provides a summary of the recommended mitigation and / or control measures. Table 5-4 identifies project constraints.

Key points identified during the assessment are:

1. Currently there are few or no CBR test results available for pavement thickness design. As pavement thickness and materials are likely to have a significant impact on the cost of the project, it is considered that extensive CBR and in-situ DCP testing will be required prior to subsequent stages of design.
2. Geotechnical information is notably absent for Fishery's Creek, the proposed overbridge at the New England Highway, Surveyors Creek and Wallis Creek, and geotechnical investigation will need to be performed prior to detailed design stage.
3. Preliminary treatments have been provided on a cut by cut basis for costing purposes (refer to Table 5-1), further assessment will be required with input from Council regarding suitable tolerable risk criteria.
4. Tunnels will require structural inspection, survey and crack monitoring to ascertain the cause of the lining deformation and defects. Two rounds of monitoring, over a period of no less than six months, will be required before repair can be undertaken. Repair is likely to comprise repointing of brickwork, removal of overgrown vegetation and installation of stainless steel bars across cracks.
5. ASS is expected to be a minor constraint only and may be managed by suitable construction management and documentation.
6. Construction over the Jemena Gas Pipeline will need to be managed and design will need to consider that no additional surcharge will be acceptable at this location.
7. Much of the pathway corridor is narrow with limited access points. Consideration will need to be given to staging construction activities and allowing for potential delays in the construction schedule.
8. The existing rail embankment is in relatively good condition, profiling of batter crests and embankment surface will be required.

Table 5-3 Summary of geohazards/oportuniites

Domain	Item/Geohazard	Risk/opportunity	Mitigation/control
Hexham Swamp	Presence of coal rejects within rail embankment	Disturbing/handling during construction may lead to combustion	To be included in construction management plan and managed by visual assessment
	Contaminated soils with in fill embankment	Public health/environmental contamination	Targeted environmental site assessment, to be included in construction methodology and documentation
	Settlement of the rail embankment due to construction of pavement	Disturbance of founding surface may oxidise ASS and mobilise acid leachate/water Surcharge of underground services, in particular Jemena gas pipeline	Minimise pavement thickness and earthworks Neutral fill balance such as remove equivalent load of soil prior to construction of new earthworks Use of lightweight fills
	ASS	Management of ASS encountered in earthwork	ASS management plan to be included in construction documentation. Low order risk/constraint on project as excavation into natural soils only required on limited occasions
	Bridge founding systems	Unexpected subsurface conditions	Subsurface conditions to be assessed prior to detailed design and identified data gaps assessed by site investigation

Domain	Item/Geohazard	Risk/opportunity	Mitigation/control
Sugarloaf Range	Stability of tunnel lining and portals	Partial collapse of tunnel lining Loose lining bricks impacting pathway users	Structural inspection to identify areas of brick lining requiring repointing Initial two rounds of survey and monitoring to confirm cause of lining cracks/defects/portal damage Repair of lining and portals
	Stability of cuts	Landslide or rock fall causing loss of life/injury to pathway users or damaging pathway infrastructure Cost of remediation/support	Targeted support/remediation of cuttings, installation of fencing/barriers/signage Notification of public of risk
Kurri Kurri	Shallow mine workings	Potholes identified near or cave-in near rail alignment	Potholes to be backfilled and surface water directed away from the area of fall in
	Bridge foundations for Wallis Creek and Surveyors Creek bridges	Unconfirmed subsurface conditions	Geotechnical investigation prior to detailed design
Whole alignment	Rail embankment and formation	Suitability of upper embankment material as pavement subgrade	CBR testing to confirm subgrade conditions
	Narrow embankment and limited access points	Congested access and construction corridor	Detailed construction methodology and staging of works to be in selection criteria

Table 5-4 Distribution of project constraints

Chainage (m)	Domain	Poorly maintained cuts	Landslide and Rock fall risk to life	ASS	Soft soils	Mine subsidence	Drainage and Stormwater control constraints	New Bridges	Construction corridor and access	Tunnels	Notes	
0	Shortland						Green	Red	Red		Ironbark and Fishery Creek	
1000				Green	Yellow		Green		Red			
2000	Hexham Swamp			Green	Yellow		Green		Red			
3000				Green	Yellow		Green		Red			
4000				Green	Yellow		Green		Red			
5000				Green	Red		Green	Yellow	Red		Purgatory Creek Jemena gas pipeline	
6000				Green	Yellow		Green		Red			
7000				Green	Yellow		Green	Yellow	Red		H2M bridge 5 & 6	
8000				Green	Yellow		Green	Yellow	Red		H2M bridge 4	
9000				Green	Yellow		Green	Yellow	Red		H2M bridge 3	
10000				Green	Yellow		Green	Yellow	Red		H2M bridge 2	
11000				Green	Yellow		Green		Red			
12000		Yellow	Yellow	Green	Yellow		Yellow		Red	Green	M1 Motorway tunnel and Lenaghans Drive tunnel	
13000		Green	Green		Yellow		Yellow		Green		Dog Hole Road	
14000	Sugarloaf	Green	Green				Yellow		Green			
15000		Yellow	Yellow				Green		Green		Stockrington Road	
16000		Yellow	Red				Red		Yellow			
17000		Yellow	Red			Green	Red		Yellow	Yellow	Tunnel 1	
18000		Yellow	Yellow				Green		Yellow	Green	Tunnel 2	
19000		Yellow	Red				Red		Yellow			
20000		Green	Green	Green				Green	Red	Green		Daracon Quarry access road

Chainage (m)	Domain	Poorly maintained cuts	Landslide and Rock fall risk to life	ASS	Soft soils	Mine subsidence	Drainage and Stormwater control constraints	New Bridges	Construction corridor and access	Tunnels	Notes
21000		Minor constraint	Minor constraint				Minor constraint		Minor constraint		
22000		Moderate constraint	Major constraint				Major constraint		Moderate constraint		
23000		Moderate constraint	Major constraint				Major constraint		Moderate constraint	Moderate constraint	Tunnel 3
24000		Moderate constraint	Major constraint				Major constraint		Moderate constraint		
25000	Kurri Kurri Plateau			Minor constraint			Minor constraint	Major constraint	Moderate constraint		Wallis Creek
26000							Minor constraint		Moderate constraint		Richmond Vale Junction
27000						Minor constraint	Minor constraint		Moderate constraint		
28000		Minor constraint					Minor constraint		Moderate constraint		
29000						Minor constraint	Moderate constraint		Minor constraint		Pelaw Main mine workings
30000							Moderate constraint		Minor constraint		
31000							Moderate constraint		Minor constraint		
32000						Moderate constraint		Minor constraint			
	<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="width: 20px; height: 20px; background-color: red; margin-right: 5px;"></div> Major constraint </div>										
	<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="width: 20px; height: 20px; background-color: yellow; margin-right: 5px;"></div> Moderate constraint </div>										
	<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="width: 20px; height: 20px; background-color: green; margin-right: 5px;"></div> Minor constraint </div>										

6. Conclusion and recommendations

GHD was engaged by Council to undertake a Phase 1 CSA as part of the specialist input into an EIS, to provide preliminary advice on the presence of contamination and the potential risk to human health or the environment for the proposed RVRT.

At the time of the Phase 1 CSA, the proposed route of the RVRT predominantly followed the disused Richmond Vale Railway alignment and minor roads and tracks and utilised existing tunnels, embankments and cuttings. Existing dilapidated bridges over water courses are proposed to be replaced. The proposed 32 km RVRT route passes through Cessnock, Newcastle and Lake Macquarie LGAs and encompasses a vast range of land uses including residential areas, commercial land use, recreational land use, dense bushland and marsh and wetland areas.

Based on the historical desk top reviews, the Richmond Vale Railway was constructed in 1904 and 1905 and linked Pelaw Main and Richmond Vale Collieries to Minmi and then Hexham and Newcastle. The embankment and formation were generally constructed using waste rock, coal reject and building rubble. While the majority of the proposed route of the RVRT was previously developed for rail use, the immediate surrounds predominantly consisted of undisturbed bushland, residential or agricultural land use. The exceptions to this included development of the Kurri Orica Technical Centre, various quarries, the Hunter Water Chichester Trunk Gravity Main (CTGM) and the industrial areas of Hexham.

The site inspection did not identify any significant areas of environmental concern along the length of the route. Potential isolated contamination sources observed included areas of illegal dumping (including burnt out vehicles, furniture, glass and plastic), dilapidated timber bridges, and the presence of wastes (timber, metal, equipment, bricks) particularly near tunnels, bridges and culverts.

Based on the available information on the historical use of the RVRT, the inspection, and subject to the scope of works in Section 1.2 and the limitations presented in Section 8, the following conclusions were made.

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

- Historical use of the proposed RVRT route 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 Richmond Vale Railway including use of coal rejects, building rubble and rock fill (diffuse – along the length of the former railway).
- Historical use herbicides or pesticides throughout the proposed RVRT route, particularly along the rail corridor and roadsides and associated with agricultural land (diffuse – along the length of the former railway).
- Use of land adjacent to the RVRT as roadways with accumulation and runoff 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 proposed route of the RVRT including the potential for PACM (isolated to areas where dumping or building rubble are observed).

- Historical and current industrial/commercial practices within 1 km of the RVRT including Orica Technical Centre, Buttai Gravel Pit, former Minmi STP, Aurizon Operations, Shortland STP and former Shortland/Astra Street Landfill (isolated to areas where these industries are close to the route of the RVRT).
- Potential for lead contamination to surface soils in areas surrounding the former/current CTGM from use of lead collars and solder (isolated to areas where these industries are close to the route of the RVRT).

Based on the findings of the investigation and the current and historical land use of the site and surrounding area, the overall risk of significant contamination being encountered during works that disturb the ground surface or by future site users is considered to be low.

It is considered that the risks from disturbance of contaminated soils within the RVRT can be managed during the proposed works, and the site can be made suitable for the intended use, by implementation of the following:

- **Development of a Contaminated Soil Management Plan (CSMP)** to manage any contamination encountered during the construction of the RVRT and to ensure the completed works are suitable for the intended land use. The CSMP should include the following:
 - Provision for further detailed assessment where appropriate to confirm the conclusions of this preliminary assessment and to determine whether any specific remediation or management of areas is required. The further assessment should be based on the following:
 - potential areas and types of contamination identified in this assessment; and
 - the potential for exposure to workers and to end-users based respectively on the nature of the proposed construction works and the final design of the RVRT.
 - Appropriate management controls to minimise the potential for exposure of contamination to workers and recreational users within the RVRT both during and post construction.
 - Description of appropriate excavation, validation, management and/or disposal requirements for potentially contaminated materials, if identified by further assessment or encountered during the construction of the RVRT.
 - Sampling and analysis requirements for assessment of potentially contaminated soils for re-use or for waste classification prior to offsite disposal.
 - Contingency plans including unexpected finds protocols for potentially contaminated soils (if encountered) including landfill or anthropogenic waste and PACM.

Any future contamination reports should be prepared or reviewed and approved by an appropriately qualified and certified environmental consultant accredited under a scheme recognised by the EPA and Council.

5. Recommendations

5.1 Interaction with future transport projects

The proposed rail trail route potentially conflicts with the M1 to Raymond Terrace road project, and the Lower Hunter Freight Corridor. Planning for both is ongoing. Maintaining a connection across each project for the rail trail, where required, is encouraged. The presence of the rail trail is not expected to impact on the feasibility of either project.

5.2 Construction traffic management

A Construction Traffic Management Plan (CTMP) should be prepared to guide construction activities that impact on roads, including haulage and transport of materials to and from each work site, and works that directly impact on roads such as those locations where the trail crosses an existing road.

The CTMP should include such information as designated access routes, times of operation, and any temporary works or signage that is required to manage traffic associated with construction works.

The CTMP should be prepared by the construction contractor in liaison with the relevant local council, Roads and Maritime Services and other relevant stakeholders.

Specific temporary traffic management measures will be required to support construction activities at some locations:

- King Street, Shortland
- Hunter Wetlands Centre
- Ausgrid Access Road, Maryland
- New England Highway interchange, Tarro
- Woodford Street, Minmi
- Kural Crescent, Fletcher
- Former Hunter Expressway construction access roads at Blue Gum Creek and Surveyors Creek
- Private Quarry Access Road
- Private access to Wallis Creek
- Leggetts Drive
- Pokolbin Street

All access points are required to be constructed to a standard that ensures safe access in all conditions, particularly for emergency vehicles. Measures will need to be in place to prevent the tracking of mud and debris onto the existing road network.

5.2.1 Intersection upgrades

It is recommended that upgrades to intersections be investigated at Woodford Street opposite Minmi Rural Fire Station, and at the George Booth Drive access to Blue Gum Creek.

At Woodford Street, localised widening to provide a BAR treatment could be investigated as part of the civil works at this location.

At the George Booth Drive access to Blue Gum Creek, reconfiguration of this intersection to allow right turns off George Booth Drive could be investigated. If this is not feasible this will not have a significant impact, with other trail head locations available and alternative routes to Blue Gum Creek also available using other intersection on George Booth Drive to turn around.

5.3 Trail and supporting infrastructure

The proposed general path construction of 3.0 metres sealed pavement is considered satisfactory for the expected use of the trail.

The proposed approach to linemarking and behavioural signage is also supported.

5.3.1 Road crossings

Additional signage is required at locations where the trail interacts with a road at grade. At these locations, there should be clear delineation between the trail and the roadway, such that priority arrangements are clear. At road crossings, trail users should be warned of the road when approaching, via “Road Ahead” signage (see Figure 5-1), with “give way” signage at the road edge. Similarly, road users should be warned of the potential presence of trail users when approaching the crossing location, using the combination of signs illustrated in Figure 5-2.



Figure 5-1 W6-8 Road Ahead signage



Figure 5-2 W6-9/W8-23 user warning signage

5.3.2 Private quarry access road

The Private Quarry Access Road will continue to provide access for quarry trucks as well as providing access to a trail head and parking/amenity area. In order to manage the potential conflict between light and heavy vehicle traffic, the following measures are recommended:

- Provision of truck warning signage on the access road, as shown in Figure 5-3.
- Management of roadside vegetation to maintain forward sight lines for traffic moving along the access road.



Figure 5-3 W5-22 truck warning signage

6. Conclusion

The proposed Richmond Vale Rail Trail would provide a 32 km connection between Shortland and Kurri Kurri, largely following the alignment of a disused rail line. The proposal includes connections to Tarro, Fletcher and Minmi from the main alignment. The path would be 3.0 metres wide in most locations, widening to 4.0 metres in some locations. The proposal is consistent with the cycling strategies of both the City of Newcastle and Cessnock.

A number of locations are proposed where users will be able to access the trail from the surrounding road network. Parking and other amenities will be provided at seven locations. **Most of these locations would be used for access during construction, as well as once the trail is operational. Additional construction access points are proposed.**

Traffic generation for the proposed route is currently unknown, but it is anticipated that most use of the trail will occur on weekends and in holiday periods when there is generally capacity in the surrounding road network. Vehicular activity will be dispersed along the route, minimising any potential impacts on a single location.

Construction activities will be similarly dispersed along the route. Construction may involve some intense periods of vehicular activity in some situations, which may require specific localised traffic management. A Construction Traffic Management Plan is recommended to guide construction activities that will impact on roads and road users.

It is recommended that upgrades be investigated for the intersection of Woodford Street, Minmi and the trail access road, to minimise delays to through traffic both during construction and operation of the trail. It may also be feasible, subject to further investigation, to upgrade the intersection of George Booth Drive with the former Hunter Expressway Construction Access Road at Blue Gum Creek to allow right turns off George Booth Drive.

The trail includes grade-separated crossings of major roads including the Pacific Motorway, Hunter Expressway and New England Highway. Some at-grade crossings are proposed at local roads. Path terminal treatments will be provided at these crossings to indicate that cyclists and pedestrians should give way to traffic. It is recommended that warning signage be provided for both trail users and road users in these locations.

7. Mitigation measures

As described in Section 6 the proposal would result in direct impacts on native biota and their habitats within the proposal site. There is also the potential for indirect impacts on retained areas of native vegetation adjacent to the proposal site, both during construction and from the resulting operation of the trail.

Specific mitigation measures are provided below to minimise likely impacts on biodiversity values.

7.1 Avoidance of impacts

The proposal avoided impacts on native vegetation and habitat values by designing the pathway such that the majority of the proposal site occurs along the former railway line, which is predominantly cleared or dominated by exotic species and priority weeds.

The proposal site has been minimised and optimised as far as practical by implementing the following:

- The proposed pathway route follows the old railway line and access tracks to vastly reduce the amount of vegetation clearing required, as the majority of the proposal site width comprises the track / road itself.
- Avoiding areas of high biodiversity values (by locating the proposal predominantly on previously cleared land).
- Replacing bridges at Surveyors Creek, Wallis Creek and Werakata Creek in the same location as existing structures, thus limiting the area of impact as much as possible.
- Limiting impacts on riparian vegetation and in-stream flora to the area immediately adjacent to proposed bridges.

The area of vegetation to be removed has been minimised as far as practical during design development, particularly with consideration of minimising clearing of native vegetation and habitat for sensitive fauna species. Site access, compounds and stockpile sites would be located in existing cleared areas within the proposal site.

7.1.1 Detailed design phase

Measures to further avoid minimise impacts would be incorporated into the detailed design and are summarised below. In particular, the majority of opportunities to minimise impacts on roosting microbat species are design considerations rather than construction measures.

Artificial lighting

- The key impacts regarding the installation of artificial lighting to microbats is the potential for delayed roost emergence and roost abandonment. Roost abandonment may in turn lead to increased predation particularly if viable alternative roosting options are not available in the local area. This is of particular consequence for the threatened Southern Myotis that may roost in the tunnels year round and other species (e.g. Little Bent-wing Bat, *Miniopterus australis*) that may occasionally use the tunnels for roosting.
- 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. Creation of these light exclusion zones will reduce the potential for delayed roost emergence and roost abandonment. These shields/false ceilings will also provide a barrier between roosting bats and pedestrians using the tunnel during daylight hours.

- Incorporating variable lighting regimes along the alignment and in the tunnels 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

- Other design considerations (such as height, orientation, construction materials) to minimise shading of marine vegetation such as mangroves and saltmarshes.
- Incorporating design features for instream structures to avoid impact to river flow and fish passage.
- Incorporating design features to facilitate fish and amphibian passage, if required.
- Considering the installation of habitat boxes for bats on the underside of new bridges.

Fence design

- Fence design to be of suitable height above ground level and material to enable fauna movement.

Construction methods

- Using construction methods that will limit the need for vegetation clearance in riparian areas.
- Arboricultural assessment to be completed of all trees in close proximity to final design to determine potential impacts to mature tree health and identify appropriate management measures.

7.2 Construction environment management plan

A range of measures will be implemented to mitigate impacts on biodiversity values, particularly at the construction phase of the proposal. Prior to construction, a **Construction Environmental Management Plan (CEMP)** would be prepared specifying environmental safeguards to be implemented to avoid or minimise impacts arising from construction activities. The CEMP would include, as a minimum, industry-standard measures for the management of soil, surface water and pollutants, acid sulfate soils, as well as flora- and fauna-specific mitigation measures.

Key impact mitigation measures during construction that would be included in the CEMP and its sub-plans are described in Table 7-1.

Table 7-1 Key mitigation measures

Mitigation measure	Description	Responsibility	Timing
General	Ensure all workers are provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the proposal site and measures to be implemented to protect biodiversity	Construction contractor	Pre-construction
	Minimisation of clearing areas of native vegetation as far as practicable.	Construction contractor	During construction
	Minimise removal of native trees as far as practicable. Where possible, trim tree limbs rather than completely removing.	Construction contractor	During construction
	Clearly mark clearing limits with a high visibility barrier to prevent accidental clearing or disturbance of adjacent vegetation.	Construction contractor	Pre-construction
	Designate and clearly mark any areas of EEC located adjacent to the proposal site as NO-GO areas.	Construction contractor	Pre-construction
	Locate stockpiles within existing cleared areas or areas of non-native vegetation within proposal site.	Construction contractor	Pre-construction
	Avoid or minimise light spill into areas of adjoining sensitive habitat during construction.	Construction contractor	During construction
	Implement erosion and sediment controls in accordance with the mitigation measures outlined in Section 6.3.3 of the REF.	Construction contractor	Pre-construction
Waterway protection	Implementation of erosion and sediment control measures during construction 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 proposal site	Construction contractor	Pre-construction
	Implementation of measures to manage fuels, chemicals, and liquids required during construction	Construction contractor	Pre-construction
	Minimisation of impacts to riparian and instream habitats at creek crossings, for example using barge access rather than shore-based access during bridge construction.	Construction contractor	During construction
Weed and pathogen control	Designated parking in existing cleared areas. Vehicles to keep to existing tracks wherever possible.	Construction contractor	During construction
	Weed material is 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.	Construction contractor	During construction

Mitigation measure	Description	Responsibility	Timing
	Hygiene measures are to be implemented in accordance with national best practice guidelines for Phytophthora (DPIE, 2020b) to prevent the introduction or spread of the pathogen during the vegetation clearing phases of the proposal. This includes decontamination of plant equipment prior to entering the proposal site.	Construction contractor	During construction
	Hygiene measures are to be implemented to prevent the introduction or spread of chytrid fungus during the vegetation clearing including decontamination of plant equipment working within 40 m of waterbodies. Hygiene measures should be carried out with reference to the hygiene guidelines outlined by DECC (DECC, 2008).	Construction contractor	During construction
	Ongoing weed management to be incorporated into operational procedures.	Council	Operation
Flora and fauna	Fauna handling and release protocols are to be implemented during any clearing works.	Qualified ecologist	During construction
	A pre-clearance survey must be completed prior to clearing works and would be outlined in the CEMP.	Qualified ecologist	During construction
	A suitably qualified and appropriately licenced ecologist will be present during the clearance of all native vegetation and/or fauna habitats. Animals that require handling must not be approached or handled until the ecologist is present, unless in an emergency (e.g. when there are both no authorised persons present and where the failure to immediately intervene would place the animal at significant risk). In such an emergency, the site manager may obtain over the phone instructions from the project ecologist to ameliorate the situation. A wildlife rescue organisation (e.g. 1300 094 737) or a similar organisation in the event of injured fauna being discovered. Contact WIRES (1300 094 737) or a similar organisation in the event of injured fauna being discovered.	Qualified ecologist and construction contractor	During construction
	Disturbed areas are to be stabilised immediately following construction and revegetated with native endemic groundcover species characteristic of the vegetation types identified within the proposal site, which would be detailed in the CEMP.	Construction contractor	Post-construction

8. Conclusion

This Flora and Fauna Impact Assessment has been prepared to describe the biodiversity values present within the study area, assess impacts of the proposal and outline mitigation measures to limit the impacts of the proposal on the ecological values of the site.

The majority of the study area has been subject to historical disturbance associated with the construction and operation of the former Richmond Vale railway. The margins of proposal site, contain better condition vegetation connected to larger patches of native forest extending offsite. Vegetation identified in the proposal site includes exotic vegetation and dry and wet sclerophyll forests. Two of the vegetation communities within the proposal site are classified as threatened ecological communities listed under the BC Act:

- 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

Given the modified nature of the proposal site, disturbed condition of the community and location at the edge of large, undisturbed extents of this community in the broader locality, assessments of significance concluded that the proposal is unlikely to have a significant impact on these ecological communities.

A habitat assessment was used to identify the likelihood of occurrence of threatened biota listed under the BC Act, FM Act or EPBC Act that were predicted to occur, or have previously been recorded in the locality.

Eight threatened flora species listed under the BC Act and seven under the EPBC Act were assessed as occurring or having potential to occur within the proposal site. Assessments of significance concluded that the proposal was unlikely to result in significant impacts to these species.

A total of 44 threatened and migratory fauna species, including a range of threatened microbats and threatened and migratory birds, could potentially occur transiently in the proposal site on occasion. No breeding habitat is likely to be impacted for any of these species. Given the disturbed nature of the vegetation to be removed, location along the edge of the existing cleared rail corridor, and transient nature of the species' occurrence, the proposal was considered unlikely to result in any significant impacts to these species or alter the suitability of the habitat.

The proposal is located within land that has historically been cleared for the construction and operation of the former Richmond Vale railway. Construction of the proposal has been purposefully designed to avoid or reduce impacts on biodiversity values as far as practicable. This has included:

- Minimising clearing of native vegetation, particularly areas of TEC
- Implementing mitigation measures to limit impacts to biodiversity during the construction phase of the proposal

Despite measures taken to avoid and mitigate impacts, the proposal would result in some unavoidable residual impacts on some elements of the natural environment, including removal of native vegetation and associated fauna habitat resources. These residual impacts are small in extent and magnitude and would comprise a minor reduction in biodiversity values in the study area, particularly given the large undisturbed extents of native forest in the locality.

The proposal is unlikely to have a significant impact on any MNES and referral of the proposal to the Minister for the Environment is not considered necessary.

8. Conclusion and recommendations

The RVRT will be a unique and iconic multi-use recreational trail, with health, social, educational, tourism, safety, and other non-motorised travel benefits. A rigorous BCA undertaken for this assessment generated a NPV of \$44.7 million and a BCR of 2.4, which shows that the level of expected benefits provided by the RVRT is close to two and half times the level of expected costs.

The RVRT is expected to become a significant tourist attraction within the region, diversifying the already favourable tourism offerings and attracting expenditure, which would benefit local communities through increased employment and economic output. As a recreational resource for local and regional communities, the RVRT would also play an important role in facilitating active recreation for communities along the route and beyond, including key growth areas in the Blue Gum Hills planning district. The links would also enhance active local travel, increasing connectivity between communities and their social infrastructure along the route. The route is expected to stimulate local enterprises, particularly in the tourism, and food and beverage sectors, as well as create new opportunities for businesses and services related to the trail.

The RVRT would provide a venue for recreation for active members of the community, and also increase the activity and frequency of activity for those less active members of the local and regional community. With high rates of inactivity and obesity in the region, potential health benefits, particularly in the local community, are considerable. Enhancing recreational use of the trail by the most sedentary members of the community could generate even greater health benefits. Increasing accessibility to natural areas would also be of benefit to the mental health of users.

The RVRT would create a space where diverse users would share infrastructure, creating opportunities for social interaction, both structured and incidental. Increasing familiarity and/or interaction between users can alleviate feelings of isolation in individuals and increase the feeling of connectedness, simultaneously increasing social capital within communities (both spatial communities and communities of users). With appeal to diverse user groups, this social interaction is expected across generations. The RVRT would increase safety and security through passive surveillance and enhance the sense of place and identity, which are particularly important in the changing town of Kurri Kurri and the evolving communities of Minmi and Fletcher.

Some properties close to the route would face privacy, safety, and property impacts. Appropriate design and management measures would reduce or avoid these impacts.

Construction of the trail would generate short term noise, vibration, dust, traffic and visual impacts in the local area. In the most part, these would be temporary (in the order of less than a month) as works progress along the route. Standard construction management measures would reduce or avoid these impacts.

In order to enhance local and regional benefits, include those with the greatest potential to benefit from the project, and avoid or ameliorate negative impacts from the RVRT, a number of mitigation and enhancement measures are suggested as follows:

Recommended mitigation measures are:

- Rest areas and trail interpretation locations and content be developed in consultation with local and regional bird observers, Aboriginal stakeholders, railway historians, and other key members of the community or management authorities.
- Motorised cycles/scooter/chairs (adequate to carry birdwatching equipment) and hire facilities for these to be provided at some access points.

- **Lighting** of the route to be provided to enhance safety.
- **Fencing or screening** of private properties close to the route to be implemented to minimise overlooking and privacy impacts.
- **Adequate waste facilities** would be provided to avoid nuisance to other users from litter in areas that might be used for social gatherings.
- **Property acquisition** would be negotiated with affected land owners in accordance with legal requirements to reach fair compensation and acquisition arrangements.

Recommended enhancement measures are:

- **Accommodation options along the trail would be explored and promoted**, including the existing RV friendly site at Kurri Kurri and other potential sites along the route.
- **Existing and evolving cycle networks** in the region to be used to market the region as a cycle tourism destination.
- **Joint marketing of the trail and associated 'RVRT friendly' businesses** be undertaken to maximise benefits to local business and make users feel welcomed.
- **Accessibility features** of the RVRT to be promoted in promotional materials and signage.
- **Bike hire services** (automated) to be provided at key points along the route (e.g. Hunter Wetlands Centre, Kurri Kurri, Fletcher).
- Bike skills workshops and courses would be conducted, aimed at various age groups, including school aged children, mature adults and retirees. Such events could be timed with other events and programs such as Ride to School Days and Seniors Week.
- **Formation of new common interest groups or activity groups** would be supported such as Heart Foundation walking groups, parent/family cycle or walking groups, birdwatching or seniors walking or cycling groups.
- **Opportunities for future connections to and from the RVRT would be explored to encourage tourism into other parts of the region, e.g. Hunter Valley.**

Appendix H - Visual Impact Assessment - Summary

VISUAL IMPACT CONT.

2.3. Summary

Table 13 outlines the overall visual impact for each zone on the surrounding area and its users from the proposal. Assumptions have been made within the various zones that vegetation will be retained in some cases. This has been outlined for each of the zones. If vegetation is proposed to be removed then the visual impact may be higher than what has been identified.

The following also provides a summary of the key issues for all of the zones,

Table 13 – Impact Assessment

Zone	View	Visual impact
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
Zone 5 - Pambalong Nature Reserve	1	Low to Moderate
	2	Negligible
	3	Low to Moderate
	4	Negligible
Zone 6 - Minmi Connection	1	Low
	2	Negligible
	3	Moderate
Zone 7 - Fletcher Connection	1	Low
	2	Negligible
	3	Moderate
	4	Moderate
Zone 8 - Hexham to Hunter Wetlands	1	Negligible
	2	Low
	3	Negligible
	6	Low
Zone 9 - Shortland	1	Low
	2	Low
Zone 10 - Tarro Extension	1	Negligible
	2	Moderate to Low
	3	Moderate to Low
	4	Low
	5	Negligible

Zone 1 - Kurri Kurri / Pelaw Main

- Minimal visual impact through the villages as there is an existing trail.
- Dwellings do not generally face onto the trail.
- Improvements to the Log of Knowledge Park will be beneficial.
- Location of the carpark to be further considered as part of the proposal.
- Use of the existing carpark would be beneficial.
- Removal of vegetation should be minimised where possible where the trail extends through the bushland and conservation area.

Zones 2, 3, 4, + 5 - Wallis Creek to Pambalong Reserve

- The trail through these areas is generally not visible from the surrounding road network. As it passes through rural lands, the number of dwellings is also less.
- There are a number of creek crossings with existing timber bridges. The removal of the timber bridges is proposed due to safety and maintenance costs. The retention of the existing timber bridges would be beneficial to the trail providing visual interest along the corridor even if the bridges were not used to cross the creeks.
- The new bridges should be sympathetic with a modern design to reflect the character of the area and limit the removal of vegetation.
- The trail does pass 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 provide appropriate screening of the trail in consultation with the owners.
- Vegetation removal should be limited in the reinstatement of the trail. The landscape treatment of the trail should consider the spatial quality and landscape character of the zones.

Zones 6 + 7 - Minmi / Fletcher Extensions

- The pipeline is not largely visual.
- The wetland provides visual amenity for the dwellings in Fletcher.
- Fletcher - the dwellings generally face towards the wetlands.
- Minmi - the dwellings do not face onto the wetlands.
- The trail through the wetlands will have a visual impact. The treatment of the trail through the wetlands will need to consider materials and finishes to minimise the visual impact and be appropriate to a wetland setting.
- The location and treatment of the carpark should be further considered as part of the proposal to minimise the visual impact.

Zones 8 + 9 - Hexham to Shortland

- Generally the dwellings face away from the trail with rear boundaries along the corridor.
- There is a large amount of vegetation between the dwellings and the wetlands.
- The wetlands are broad open space areas, however minimal access to the wetlands and generally not visible from many areas. Long distance views are available from various areas.
- The trail through the wetlands will have a visual impact generally for the user. The treatment of the trail through the wetlands will need to consider materials and finishes to minimise the visual impact.
- The removal of vegetation and higher visual impacts will mainly occur due to the location of the carpark. The location and design of the carpark should be further considered as part of the proposal to minimise the visual impact.

Zone 10 - Tarro extension

- The pipeline is not largely visual and blends with the open landscape. The treatment of the trail will need to consider the materials and finishes to ensure it is appropriate to its setting.
- There will be some vegetation removal on the entry road to Tarro. The detailed design will need to consider the minimisation of removal of vegetation to retain the enclosed spatial quality of this location.
- Generally part of the existing pathway in other areas of Tarro and therefore minimal visual impact.

3.0 MITIGATION MEASURES

The detailed urban and landscape design for the proposal should consider the following to minimise the visual impact:

- Location and siting of car parks
- Minimise vegetation removal
- Natural drainage management
- Coordination with other disciplines (vehicular access, service/emergency access, lighting etc.)
- Natural or structural shade to the rest areas
- Location, siting and treatment of amenities
- Theme for signage and furniture throughout the trail
- Seating (benches, seats, informal sitting/leaning elements)
- Robust surface materials
- Planting to complement the natural habitat
- Bridge design using sympathetic materials.

CONSTRUCTION

The following mitigation measures would assist in minimising the visual impact during the construction phase.

- Construction / stockpile sites should be located in cleared areas.
- All parking and site equipment associated with construction should be located in cleared areas and appropriately screened if required.
- All construction sites are to be maintained and removed after completion of the works.
- Rehabilitation of the construction sites should be undertaken upon completion of the works,

DETAILED DESIGN

The following mitigation measures would assist in minimising the visual impact. As stated above the following should be considered as part of the detailed design for the proposal.

Existing Structures / Landforms

- Existing structures, such as the timber bridges, culverts, etc should be retained wherever possible as these will provide additional visual interest to the users of the trail. Whilst it is acknowledged that some of the structures would not be able to be upgraded and used, they should be retained. The bridges could be fenced with viewing platforms along the trail.
- The existing raised land form of the trail should be maintained where possible.



Retain structures and landform to provide visual interest - examples from Victoria

Spatial Quality

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



Consider the existing spatial quality of the landscape character, e.g. enclosed, partially enclosed, open landscape characters

Material and Finishes

- Appropriate materials and finishes for the trail needs to consider the environment that it is passing through, e.g. the wetlands, urban and rural areas and the number of users.
- The trail should continue along the existing raised trail as this ensures that users will keep to the trail.
- The trail should be easily defined for the user so that the user keeps to the trail reducing impacts on adjoining vegetation.



Consider the existing urban and landscape character when selecting materials for the rail trail.

MITIGATION MEASURES CONT.

Signage

- Appropriate signage is to 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 the users.



Signage to be themed and assist in wayfinding and should be educational for users - examples from Victoria

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.
- Make use of any existing structures / points of interest along the trail.



Road crossing and bridges should be simple and elegant treatments - examples from Victoria

Car parks

- Treatment should be low key and appropriate to the area, i.e. gravel base in the rural areas and concrete in the urban areas if appropriate.
- If facilities, e.g. amenities are to be incorporated along the trail, these should be incorporated into the carpark areas.
- Facilities should also be low key and the use of suitable materials that are appropriate to the area.
- Review location of carparks to minimise the loss of vegetation and conflicts of interest.
- Existing carparks should be utilised where possible.
- Carparks should be appropriately located to minimise conflicts with dwellings and other land uses.

11.0 RECOMMENDATIONS

11.1 Conclusion

Based on current designs, the proposal would cause ground-disturbing impacts to the following identified Aboriginal sites:

- RVRT AS1 (AHIMS ID 38-4-1874/ 38-4-1919)
- RVRT IF1 (AHIMS ID 38-4-1881/ 38-4-1920)
- RVRT AS2 (AHIMS ID 38-4-1875/ 38-4-1918)
- RVRT AS3 (AHIMS ID 38-4-1876/ 38-4-1917)
- RVRT IF2 (AHIMS ID 38-4-1882/ 38-4-1910)
- RVRT IF3 (AHIMS ID 38-4-1883/ 38-4-1922)
- RVRT AS 7 (AHIMS ID 38-4-1880/ 38-4-1923)
- RVRT IF4 (AHIMS ID 38-4-1884/ 38-4-1913)
- RVRT AS4 (AHIMS ID 38-4-1877/ 38-4-1915)
- RVRT AS5 (AHIMS ID 38-4-1878/ 38-4-1912)
- RVRT AS6 (AHIMS ID 38-4-1879/ 38-4-1916)
- RVRT PAD 1 (AHIMS ID 38-4-1926)
- RVRT IF8 (AHIMS ID 37-6-3806/ 37-6-3834)
- RVRT IF10 (AHIMS ID 37-6-3808/ 37-6-3832)
- RVRT IF11 (38-4-1925)
- HS2A (AHIMS ID 38-4-1583)

The following sites are immediately outside the study area and will not be impacted:

- RVRT IF5 (38-4-1885/ 38-4-1921)
- RVRT IF6 (AHIMS ID 38-4-1886/ 38-4-1911)
- RVRT IF7 (38-4-1887/ 38-4-1921)
- RVRT IF9 (37-6-3833/ 37-6-3807)

The study area boundary has been modified since the archaeological survey was conducted, resulting in removal of impacts to RVRT IF 3.

11.2 Recommendations and Mitigation Measures

Table 25: Overview of recommendations and mitigation measures

Development	Discussion
Approvals	<p>Should it not be possible to avoid impacting Aboriginal sites during design and construction works, an AHIP is required prior to impacts. This AHIP application must be submitted to OEH with an Aboriginal Cultural Heritage Assessment Report (ACHAR). Full consultation with Aboriginal stakeholders in accordance with the OEH consultation requirements would need to be conducted.</p> <p>Archaeological test excavation, where required, would need to take place prior to the AHIP application being submitted.</p> <p>An impact assessment would need to be prepared for any early works that result in ground disturbance, such as geotechnical investigation, to determine if an AHIP would be required prior to early works commencing.</p>
Avoidance of impact	<p>Detailed design for the proposal should avoid impacting identified Aboriginal sites.</p>
Clarification of impacts	<p>The location and extent of potential impacts to identified sites within the disturbance boundary should be determined through detailed design and finalisation of constructability documentation. There is the potential to avoid impact to recorded Aboriginal sites within the disturbance boundary by relocating the location of vehicle access and ancillary facilities, for example.</p> <p>A number of recorded Aboriginal sites are located in close proximity to the study area. Following clarification of the location and extent of impacts within the study area, a consistency check, or update to this report, must be undertaken that identifies all recorded Aboriginal sites in close proximity to the study area and whether they will be impacted by the proposed works. There is potential for an increase, or decrease, in impacts to recorded Aboriginal sites.</p>
Aboriginal stakeholder consultation	<p>Comprehensive Aboriginal stakeholder consultation, carried out in accordance with the OEH 'Aboriginal cultural heritage consultation requirements for proponents 2010', must be conducted for the project.</p>
Archaeological test excavation	<p>Three areas have been identified with moderate archaeological potential and archaeological significance. Should these sites be impacted by the proposed works, archaeological test excavation, under OEH code of practice, must take place. Areas where archaeological test excavation is recommended include:</p> <ul style="list-style-type: none"> • RVRT Archaeological Complex 1 • RVRT AS 7 • RVRT PAD 1 <p>The scope of archaeological test excavation at each location, particularly RVRT Archaeological Complex 1, and RVRT PAD 1, would require</p>

Development	Discussion
	<p>clarification once the extent of proposed works in those areas is known. Test excavation at RVRT Archaeological Complex 1 would focus on undisturbed areas within the site complex that will be impacted.</p>
<p>Further archaeological survey</p>	<p>The study area boundary has been adjusted since archaeological survey was conducted for this assessment. As such, any portion of the clearance and/ or disturbance boundary outside the original investigation area must be subject to further archaeological survey. Where there are no impacts proposed within the additional areas, a heritage consultant will advise if further field survey is required.</p>
<p>Future changes to the study area boundary</p>	<p>Due to the archaeologically sensitive nature of many areas bordering the study area, further archaeological investigation must take place should any aspect of the proposal go outside the area investigated for the archaeological survey.</p>
<p>Aboriginal Heritage Management Plan</p>	<p>An Aboriginal Heritage Management Plan (AHMP) should be prepared prior to commencement of works to delineate the location of Aboriginal sites, or portions of Aboriginal sites, within the study area. Where Aboriginal sites, or portions of Aboriginal sites, are located outside the proposed extent of impacts, those areas should be clearly identified as no-harm areas in order to remove the possibility of inadvertent impact.</p> <p>Several Aboriginal sites are located in close proximity to the study area boundary. As those sites were identified using a hand-held GPS, a surveyor may be required to clearly indicate the location of the study area on the ground in relation to the recorded site location. This will assist with determining impacts and establishing no-harm areas.</p> <p>The AHMP should include an unexpected finds procedure for the proposed works, including details of required Aboriginal stakeholder consultation, identification of the nature and extent of unexpected finds, and any reporting or permits that may be required prior to works recommencing.</p> <p>In addition to identified sites within the study area, an updated AHIMS search must be conducted for the AHMP that identifies Aboriginal sites in the vicinity of the study area for the AHMP. This would identify if Aboriginal sites are located on proposed access tracks, for example.</p>
<p>Identification of existing AHIPs</p>	<p>There is potential for existing AHIPs to overlap with the study area. Further liaison with OEHP should be conducted to identify where existing AHIPs overlap with the study area.</p> <p>Where existing AHIPs overlap with the study area, the proponent must liaise with the AHIP holder to ensure that all proposed works are conducted in accordance with the AHIP conditions.</p> <p>As part of this process, it must be clarified whether recorded Aboriginal site HS2A (AHIMS ID 38-4-1583) has been impacted by recent road construction works.</p>
<p>Review of this report</p>	<p>This report must be forwarded to ALALC, MLALC, and Native Title Claimants for review and comment.</p>

8.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are consolidated from Section 7.0 above. Where possible, the design of the proposed works should be amended to avoid and/or minimise heritage impact. However, the following recommendations are based on the identified impact indicated by the current plans of the proposed construction footprint.

8.1 Overview of Findings

The proposal largely adheres to the footprint of the former Richmond Vale Railway line. The Richmond Vale Railway line was originally established as the Minmi to Hexham Railway, one of the oldest railway lines in Australia (1856). It was later extended to Kurri Kurri and Richmond Vale in 1905. The former railway line is approximately 25 kilometres in length and extends from Hexham in the east to Kurri Kurri in the west. The former railway line is of local heritage significance, and portions of the route are listed as the following items:

- 'Minmi to Hexham Railway', Newcastle LEP 2012 item I332
- 'Richmond Vale Railway', Cessnock LEP 2011 item I214

In addition to the items listed above, the following heritage listed items of local significance are located within the project study area:

- 'Former railway cuttings John Brown's Model Farm', Newcastle LEP 2012 item I340
- 'Remains of railway siding - John Brown's Model Farm', Newcastle LEP 2012 item I338
- 'John Brown's Model Farm', Newcastle LEP 2012 item I337
- 'Collieries of the South Maitland Coalfields/Greta Coal Measures', Cessnock LEP 2011 item I215
- 'Archaeological remains (former Minmi Wastewater Treatment Plant site)', Hunter Water s170 heritage register, SHI no. 3630123

The project study area is located within 150 metres of the following heritage listed items of local significance

- 'Tarro Substation', Newcastle LEP 2012 item I546
- 'Tarro Valve House', Hunter Water s170 heritage register, SHI no. 3630140
- Tarro historic site - (original township), Newcastle LEP 2012 item A18
- 'Dairy cool rooms John Brown's Model Farm', Newcastle LEP 2012 item I339
- 'Stone ford', Newcastle LEP 2012 item I329
- 'Duckenfield Railway No. 1 Colliery branch lines', Newcastle LEP 2012 item I325
- 'Duckenfield Colliery Railway (relics)' Newcastle LEP item A14/324
- 'Pumping Station', Newcastle LEP 2012 item I550
- 'Substation', Newcastle LEP 2012 item I551
- 'South Maitland Railway System', Cessnock LEP 2011 item I212

- 'Empire Tavern', Cessnock LEP 2011 item 131
- 'Tarro Pumping Station'

The proposed works would result in **heritage impacts to the following locally significant listed items:**

- Moderate physical and visual heritage impacts to the Minmi to Hexham Railway (Newcastle LEP 2012 no. I332)
- Major physical and visual cumulative heritage impacts to the Richmond Vale Railway (Cessnock LEP 2011 no. I214)

The proposed works would result in heritage impacts to the following locally heritage significant unlisted item:

- **Minor to moderate physical and moderate visual heritage impacts** to the unlisted portions of the former Richmond Vale Railway Line, between the Newcastle/Cessnock LGA boundary and the Lake Macquarie/Cessnock LGA boundary

8.2 Recommendations and Mitigation Measures

The following table outlined the next steps, recommendations and mitigation measures for the proposed works.

Table 8-1: Recommendations and mitigation measures

Development	Discussion
	<p>Detailed design for the proposal should preserve as much original heritage fabric associated with the former Richmond Vale Railway route as practical, including timber bridges and residual rail infrastructure located along the route within Hexham Swamp. This would include preserving and re-pointing brickwork associated with tunnels and culverts along the corridor.</p> <p>The proposed works would result in a major to moderate physical and visual impact to the former Richmond Vale Railway route, due to the removal or obscuring of all of the highly-graded heritage significant elements of the item. In order to reduce the degree of impact, consideration should be given to retaining some or all of the following components of the item:</p>
<p>Avoidance of impacts - Design Phase</p>	<ul style="list-style-type: none"> • 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

Development	Discussion
	<ul style="list-style-type: none">• The existing profile of the original railway cuttings.• Existing culverts and drainage structures• Brick platforms and retaining walls <p>Importantly, a report would be prepared by qualified structural engineer to re-assess the restoration, conservation or re-use of the Surveyors Creek Bridge and Wallis Creek Bridge.</p> <p>Consideration should also be given to the preservation of the:</p> <ul style="list-style-type: none">• former Chichester to Newcastle Water Main Corridor
Avoidance of Impacts - Construction Phase	<p>Protective barriers, fencing or padding would be placed on or around significant fabric within the study area during the proposal's construction phase to protect it from inadvertent impact. Items to be protected would include:</p> <ul style="list-style-type: none">• Tunnels No. 1, 2 and 3• Cuttings• Timber bridges• Platform• Surveyor marked tree• Culverts• Drainage structures• Fence lines
Selection of sympathetic materials and finishes	<p>The selection of new materials and finishes used for the project should be as sympathetic as possible to the existing character, with the aim of minimising visual impacts. This includes, but is not limited to, the following examples;</p> <ul style="list-style-type: none">• Replace proposed shotcrete treatment with removable mesh• Where shotcrete application is required, consider the colour and texture of the finish with regards to surrounding significant fabric.• Minimise impact to significant fabric, such as tunnel fabric and cuttings, where possible. Consideration given to impacts that are reversible, such as light fittings and cable conduits. <p>Adequate allowance should be made for any variance in the physical properties of new surfacing fabric in terms of thermal expansion and contraction, to avoid cracking and physical impacts on underlying heritage significant fabric</p>
Clarification of impacts	<p>The location and extent of potential impacts to identified heritage items within the disturbance boundary should be determined through detailed design and</p>

Development	Discussion
	<p>finalisation of constructability documentation. There is the potential to avoid impact to items within the disturbance boundary by relocating the location of vehicle access and ancillary facilities, for example.</p> <p>An updated heritage impact assessment must be prepared to ensure consistency of the proposed design with the impact assessment outlined in this document. The updated impact assessment would take into consideration any reduction of impacts to heritage fabric following further consideration of design and constructability (see first recommendation). Where practicable, the location and extent of significant elements of the Richmond Vale Railway such as culverts, drainage channels and identifiable drill marks in cuttings would be accurately mapped and included in the recommended Heritage Interpretation Strategy and Plan.</p>
<p>Appropriate cleaning methodology</p>	<p>In areas cleaning significant fabric may be required, such as within tunnel lining, hand cleaning should be carried out wherever safe and practicable to do so. Blasting with a high-pressure hose should be avoided where possible to avoid inadvertent impact or damage to mortar and bricks within the tunnel each tunnel, or causing damage to cuttings.</p>
<p>Archival recording</p>	<p>All significant elements of the former Richmond Vale Railway subject to impact or modification as a result of the proposed works should be archivally recorded prior to works commencing. This would involve accurate surveying and planning, and should be prepared as per guidelines set out by the NSW Heritage Office (1998 and 2006). A program of 3D scanning significant fabric to be impacted should also be considered, and may assist documentation of impact areas that are difficult to photograph, such as the inside the former railway tunnels.</p>
<p>Archaeological Assessment</p>	<p>A preliminary assessment of Non-Aboriginal Archaeological potential has been undertaken in this document. Detailed assessment, including assessment of the significance and location of any potential remains (such as worker's camps), must be undertaken. This could occur either on finalisation of in-ground impacts, or during the finalisation of in-ground impacts.</p> <p>The detailed archaeological assessment must assess the impact of any proposed excavation works and provide recommendations for appropriate management of the archaeological resource.</p> <p>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 <i>Heritage Act 1977</i> to the Heritage Division of the Office of Environment and Heritage.</p>
<p>Heritage Interpretation Strategy and Heritage Interpretation Plan</p>	<p>As the increase in traffic along the RVRT route provides an opportunity for heritage interpretation and signage to be installed in conjunction with shared pathway amenities, a Heritage Interpretation Strategy (HIS) must be prepared.</p> <p>This document would outline interpretation possibilities, including signage content and placement. A detailed Heritage Interpretation Plan (HIP) would then be prepared detailing exact design, wording, layout, and placement of</p>

Development	Discussion
	<p>interpretative material in consultation with the Richmond Vale Railway Society and the Australian Railway Historical Society.</p> <p>Elements and features which would be the focus of this strategy and plan would include, but not be limited to:</p> <ul style="list-style-type: none">• Richmond Vale Railway associated items including platforms, sidings and landscape features• Minmi to Hexham Railway including landscape features• Tunnel No. 1• Tunnel No. 2• Tunnel No. 3• Surveyors Creek Bridge• Wallis Creek Bridge• The existing profile of the original railway cuttings• The existing profile of the original railway cuttings.• Existing culverts and drainage structures• John Brown's Model Farm• Richmond Main Colliery and associated items including platforms, sidings and landscape features• Former Chichester to Newcastle Water Main Corridor
Stakeholder consultation	<p>Several Hunter Water s170 registered items have been identified in or near the proposed works. Liaison with the Hunter Water asset owners, especially with the heritage officers of those agencies, should take place throughout the project</p> <p>Liaison with local historical societies, including the University of Newcastle's Coal River Working Party and the Richmond Vale Railway Society and Museum would be recommended, for discussing interpretation and signage strategies, and also for the possible conservation of any removed fabric</p> <p>Comprehensive Aboriginal stakeholder consultation, carried out in accordance with the OEH 'Aboriginal cultural heritage consultation requirements for proponents 2010', must be conducted for the project</p>
Further heritage survey and listing	<p>The study area boundary has been adjusted since archaeological survey was conducted for this assessment. As such, any portion of the clearance and/ or disturbance boundary outside the original investigation area must be subject to further assessment. Where there are no impacts proposed within the additional areas, a heritage consultant will advise if further field survey is required.</p>

Development	Discussion
	<p>It is also recommended that the portion of the Richmond Vale Railway and associated tunnels within the Lake Macquarie LGA be included on the LEP to ensure the item is appropriately protected and its significance acknowledged.</p>
<p>Ongoing heritage specialist advice</p>	<p>A Heritage Consultant should provide ongoing heritage advice during the detailed design and construction phases of the project and should ensure that the above material and design options advice is enacted.</p>
<p>Heritage induction</p>	<p>Prior to construction works commencing, information on the heritage significant elements of the former Richmond Vale Railway and other heritage listed items in and near the study area should be provided to construction crews.</p> <p>These heritage significant elements and items should be protected from inadvertent and indirect impacts by construction crews during works.</p> <p>The induction would also discuss the presence of potential archaeological remains and provide advice on how to recognise an archaeological feature and manage an archaeological feature during the construction phase of the works.</p>
<p>Unexpected Finds Procedure</p>	<p>An Unexpected Finds Procedure would be prepared for the proposal prior to construction works commencing. This would include management protocols should an unexpected archaeological or structural feature (such as culverts, early rail infrastructure or building footings) be uncovered.</p> <p>If such items are found during the construction phase, works would cease and the Unexpected Finds Procedure followed.</p>

Executive summary

Surveyor's Creek and Wallis Creek Bridges are in a very poor and dilapidated condition. In summary for both bridges it was found that the general overall estimated condition was as follows:

Dilapidated condition	Poor condition	Fair condition	Good condition
50%	30%	15%	5%

The condition assessments in conjunction with the assumed timber durability and deterioration models formed the basis of the rehabilitation and renewal strategy scope of work and strategic cost estimates.

Item	Description	Contingency included	Strategic cost estimate (excluding GST)
Rehabilitation			
1.1	Surveyor's Creek Bridge	50%	\$3,463,000
1.2	Wallis Creek Bridge	50%	\$5,429,000
Renewal			
2.1	Surveyor's Creek Bridge	50%	\$5,044,000
2.2	Wallis Creek Bridge	50%	\$7,677,000
Replacement			
3.1	Surveyor's Creek Bridge	50%	\$2,015,000
3.2	Wallis Creek Bridge	50%	\$2,914,000

The cost to renew like-for-like structures appear significantly more expensive than rehabilitation by around 30%, and the cost to rehabilitate appears to be around 40% more expensive than replacement with new bridges. The cost to replace the bridges is considerably less expensive than rehabilitation by around one third of the capital cost.

Ultimately, new bridges require significantly less ongoing maintenance than either the rehabilitation or renewal options which require costly and ongoing routine repairs and preventative maintenance.

This report is subject to, and must be read in conjunction with, the limitations set out in this report and the assumptions and qualifications contained throughout the report.

12. Conclusion

Both Surveyor's Creek and Wallis Creek Bridges are in a dilapidated and very poor condition and appear to require considerable expenditure to either rehabilitate to renew both bridges. At this stage we anticipate that new bridge replacement options would be about one third the cost of rehabilitation and about half the costs of renewal.

Therefore, the cost to replace the bridges would be more economical than expensive and difficult rehabilitation or renewal. Furthermore, from a functionality perspective a new bridge is a much more viable prospect for the current route, the local community and in terms of sustainable use of resources and mitigating future asset management risk.

Both bridges have been found to have moderate overall heritage significance but high significance abutments. Consequently, if a bridge replacement strategy is adopted it is suggested some appropriate recognition of the timber and masonry elements be either incorporated into the new bridge designs or developed as a standalone aspect as part of a heritage interpretation strategy, for example interpretive signage.

Both bridges will need to be de-listed from the LEP and the information from this report can be modified and used to form part of the Statement of Heritage Impact.