



Planning &
Infrastructure

**MAJOR PROJECT ASSESSMENT:
Hexham Relief Roads
Hexham
(SSI – 4992)**



Director-General's
Environmental Assessment Report
Section 115Z (1) of the
Environmental Planning and Assessment Act 1979

August 2013

ABBREVIATIONS

AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ARTC	Australian Rail Track Corporation
CMA	Catchment Management Authority
Department	Department of Planning & Infrastructure
DGRs	Director-General's Requirements
Director-General	Director-General of the Department of Planning & Infrastructure
DPI	NSW Department of Primary Industries
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Authority
EP&A Act/ the Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000</i>
EPI	Environmental Planning Instrument
ESD	Ecologically Sustainable Development
IGANRIP	Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects
Minister	Minister for Planning and Infrastructure
NML	Noise Management Level
NoW	NSW Office of Water
NPWS	NSW National Parks & Wildlife Service
OEH	NSW Office of Environment and Heritage
ONVR	Operational Noise and Vibration Review
PIR	Preferred Infrastructure Report
PMF	Probable Mean Flood
Proponent	Australian Rail Track Corporation
RMS	NSW Roads and Maritime Services
SEPP	State Environmental Planning Policy
SSI	The State significant infrastructure referred to in this report and described in Section 2.
TSF	(proposed Aurizon) Train Support Facility

Cover Photograph: Freight train (courtesy ARTC)

© Crown copyright 2013

Published August 2013

NSW Department of Planning & Infrastructure

www.planning.nsw.gov.au

Disclaimer:

While every reasonable effort has been made to ensure that this document is correct at the time of publication, the State of New South Wales, its agents and employees, disclaim any and all liability to any person in respect of anything or the consequences of anything done or omitted to be done in reliance upon the whole or any part of this document.

NSW Government

Department of Planning & Infrastructure

EXECUTIVE SUMMARY

Coal mining is an important part of the Hunter Valley economy with the majority of the coal mined taken to the Port of Newcastle by rail for export. To provide for increases in coal exports and alleviate current and future congestion on the coal rail network, the Australian Rail Track Corporation (ARTC – the Proponent) is undertaking a number of projects to upgrade the rail networks. One of the proposed projects is the Hexham Relief Roads. The Hexham Relief Roads project involves the construction of five relief roads (train tracks) at Hexham, NSW. The train tracks would vary in length between 2,000 metres and 2,539 metres. The project has been designed to alleviate congestion on the Hunter Valley coal rail network by providing options and the capacity for re-sequencing of coal trains heading for the Port of Newcastle.

The capital investment value of the project is estimated to be \$163 million and would create in the order of 100 full-time equivalent construction jobs over an 18 month period.

Pursuant to Part 3, clause 14 (1) of *State Environmental Planning Policy (State and Regional Development) 2011*, the project is declared State significant infrastructure. Pursuant to Part 5.1, section 115W of the EP&A Act, the Minister for Planning and Infrastructure (or his delegate) is the approval authority for State significant infrastructure.

The Environmental Impact Statement (EIS) for the project was placed on exhibition for a period of 33 days from 8 August 2012 to 10 September 2012. The Department received eight submissions from public authorities and 35 submissions from the general public (including five from special interest groups). Although none of the public authorities objected to the project, they did raise issues for the Department's consideration including noise, surface water and groundwater management, flooding, biodiversity, and traffic and access. Thirty one of the public submissions objected to the project, indicating concern over the potential for the project to adversely impact on visual amenity, air quality, acoustic amenity, traffic, biodiversity and water quality.

A Preferred Infrastructure Report (PIR) was submitted by the Proponent in March 2013 describing amendments made to the project since the exhibition of the EIS, and providing additional assessment of relevant environmental impacts in response to issues raised in submissions and amendments made to the proposal. Key amendments to the project comprise:

- lowering of the relief roads by up to 1.2 metres over an 820 metre distance to minimise flooding impacts;
- extension of the relief roads by some 160 metres at the northern end;
- extension of the proposed swale drain (used for surface water management) by approximately 1.2 kilometres;
- realignment of the construction access road to the project site; and
- relocation of the existing private access track servicing adjacent private properties.

The Department has assessed the Proponent's EIS and PIR and submissions on the project in accordance with the objects of the EP&A Act and ecologically sustainable development, and considers that there are a number of constraints to the project that will need to be carefully managed. These constraints include construction traffic, access and noise, ecology, surface water hydrology, flooding and groundwater hydrology. To manage these constraints, the Department has recommended a number of conditions of approval relating to impact mitigation, monitoring and the implementation of environmental management plans.

Based on its assessment, the Department is satisfied that the impacts of the project can be managed to achieve acceptable amenity and environmental standards through the recommended conditions of approval. Further, on balance, the project is in the public interest and can proceed in a sustainable manner with overall benefits to the State's economy and minimal long-term residual impacts to the wider community and the environment. It is therefore recommended that the Minister for Planning and Infrastructure approve the Hexham Relief Roads project, subject to conditions.

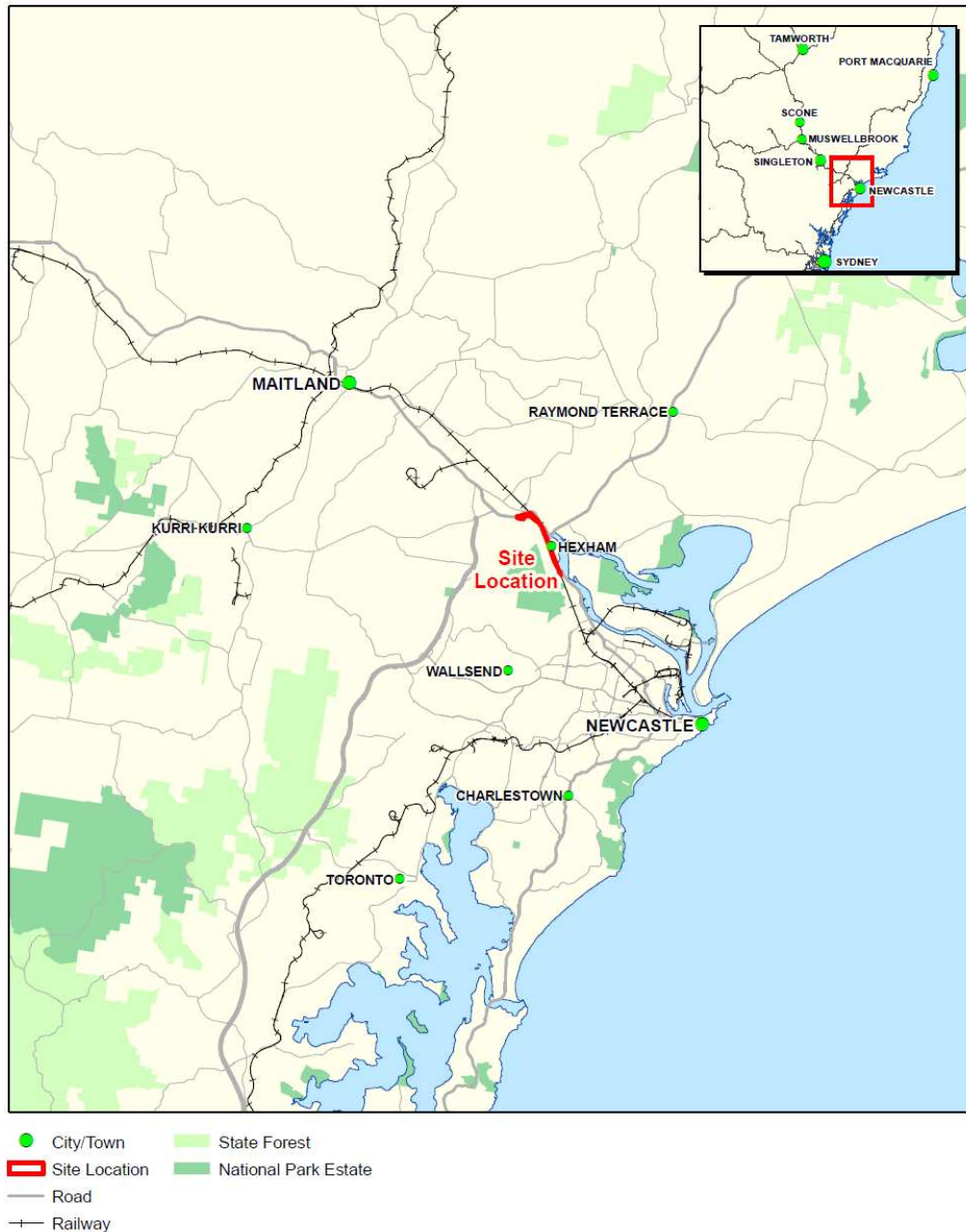
TABLE OF CONTENTS

1.	BACKGROUND	1
1.1	Site Location and Existing Land Use	2
1.2	Surrounding Land Uses	3
2.	PROPOSED PROJECT	5
2.1	Project Description	5
2.2	Project Need and Justification	11
3.	STATUTORY CONTEXT	12
3.1	State Significant Infrastructure	12
3.2	Permissibility	13
3.3	Environmental Planning Instruments	13
3.4	Objects of the EP&A Act	13
3.5	Ecologically Sustainable Development	15
3.6	Environment Protection and Biodiversity Conservation Act	16
4.	CONSULTATION AND SUBMISSIONS	16
4.1	Exhibition	16
4.2	Public Authority Submissions	16
4.3	Public Submissions	18
4.4	Proponent's Response to Submissions	21
5.	ASSESSMENT	24
5.1	Ecology	24
5.2	Noise and Vibration	36
5.3	Traffic and Access	44
5.4	Flooding	47
5.5	Surface Water Hydrology	58
5.6	Groundwater Management	61
5.7	Heritage	65
5.8	Other Issues	72
6.	CONCLUSION	79
7.	RECOMMENDATION	80
APPENDIX A		
	ENVIRONMENTAL IMPACT STATEMENT	81
APPENDIX B		
	SUBMISSIONS	82
APPENDIX C		
	PREFERRED INFRASTRUCTURE REPORT	83
APPENDIX E		
	RECOMMENDED CONDITIONS OF APPROVAL	84

1. BACKGROUND

The Australian Rail Track Corporation (ARTC – the Proponent) proposes to construct and operate five relief roads (train tracks) and associated infrastructure at Hexham, NSW. The proposed project site is located approximately 16 kilometres north-west of Newcastle (**Figure 1**) in the Newcastle local government area.

Figure 1: Project Location



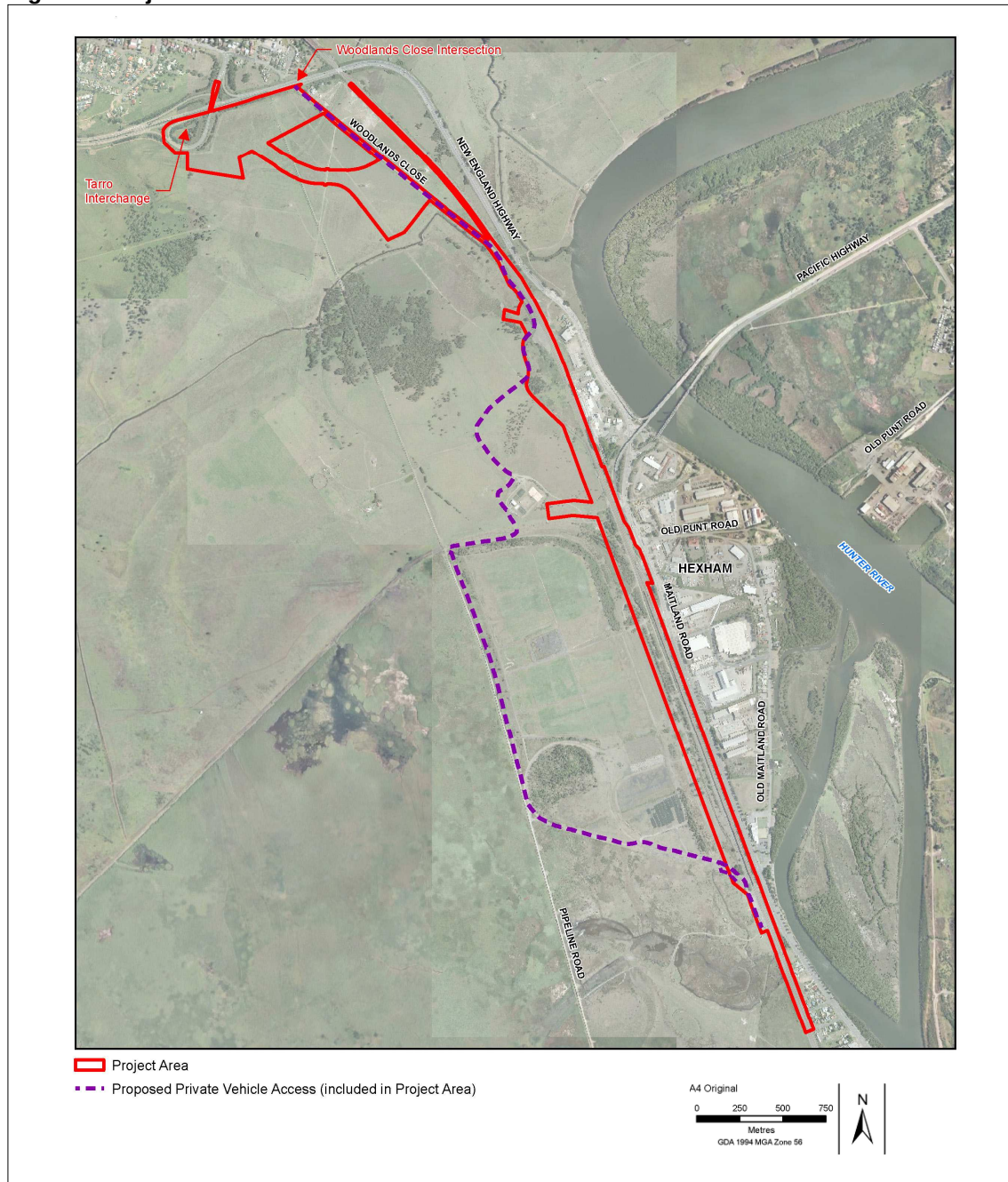
The project has an estimated capital investment value of \$163 million and is expected to take approximately 18 months to construct. The peak construction workforce is anticipated to be in the order of 100 personnel. There would be no permanent operational staff, with maintenance being undertaken by existing ARTC rail maintenance personnel.

The Hexham Relief Roads is one of a number of projects proposed by the ARTC as part of the upgrade of the rail network in the Hunter Valley to maintain rail capacity ahead of the demand requested by coal producers. In particular, the project would enable current and future congestion in the rail network to be relieved, hence the tracks are known as “relief roads”.

1.1 Site Location and Existing Land Use

The project site is located to the west of the Hunter River at Hexham and is bounded by the New England Highway and Maitland Road/Pacific Highway in the east, and the New England Highway in the north (see **Figure 2**).

Figure 2: Project Site



The project is proposed to be constructed and operated on an approximate 47 hectare footprint. **Table 1** lists the Lot and DP identifiers and property owners for the parcels of land that would be required for the construction of the project. Only three parcels of land (10.3 hectares in total) would need to be acquired (refer **Table 2**). All three parcels of land are in the ownership of Aurizon.

Table 1: Land Titles and Ownership for the Project Footprint

Property Owner	Lot	Deposited Plan	Approximate Area (hectares)	Combined Area (hectares)
Hunter Water Corporation	1 12	128309 842856	0.50 0.01	0.51
Aurizon	1 10 102 104 113 12 13 311 5 6 2	155530 735235 1084709 1084709 755232 1075150 842856 583724 227556 227556 735456	0.50 6.30 1.43 3.00 11.30 2.40 0.15 13.14 0.007 0.005 3.99	42.22
State Rail Authority of NSW	1 1	1036152 1062240	0.30 1.30	1.6
Transport for NSW	1	581577	0.10	0.10
Hunter Catchment Management Trust	1	126319	0.003	0.003
Private	101 312	1084709 583724	2.00 0.15	2.15
Total			46.6	46.6

Table 2: Properties to be Acquired

Lot	Deposited Plan	Approximate Area (hectares)
311	583724	6.5
12	1075150	1.1
113	755232	2.7

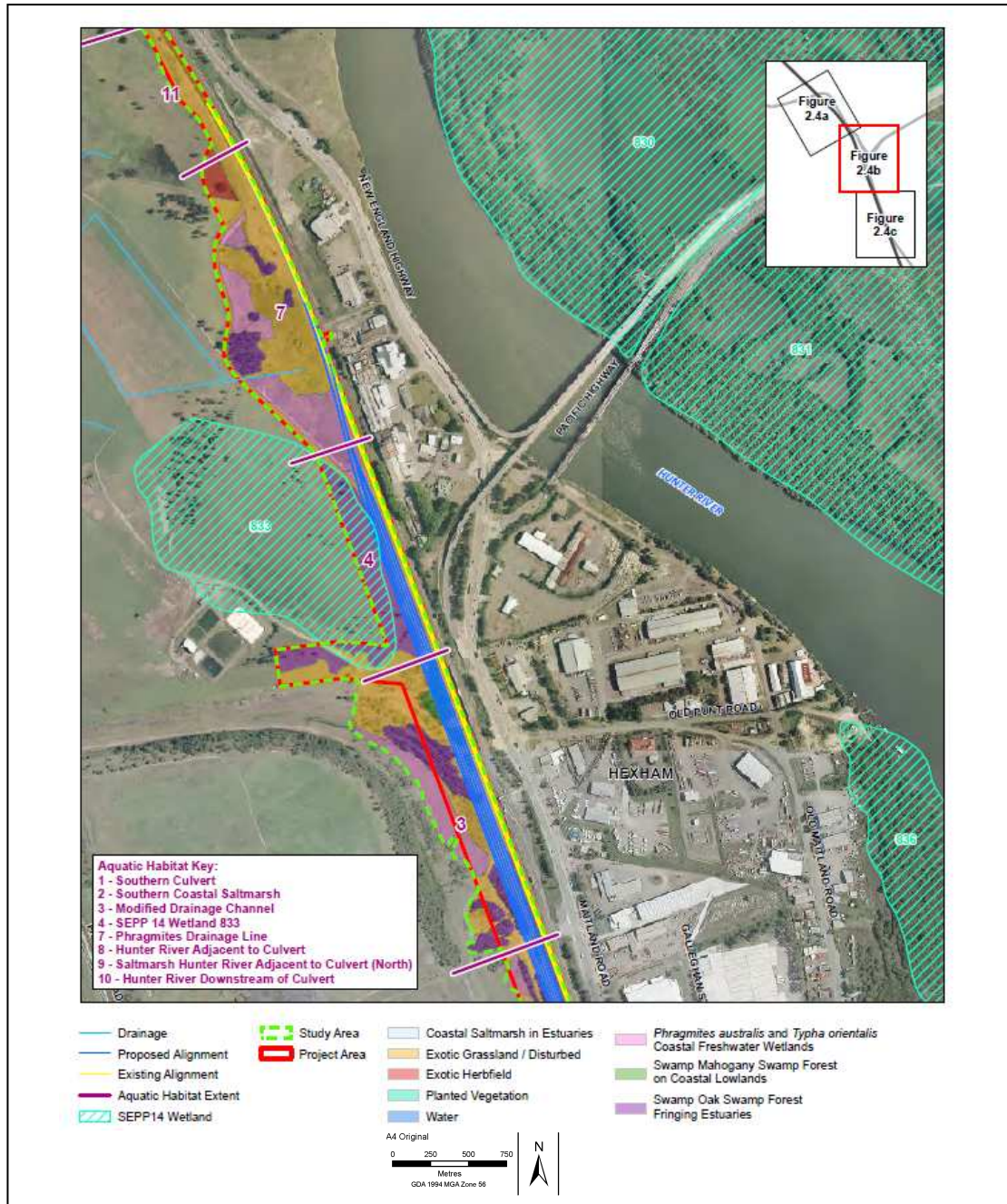
Part of the project site comprises a former coal-loading facility which ceased operations in the late 1970s. The buildings and rail lines associated with the former coal loader have been removed, with only cement footings and pavements remaining. The remainder of the site has a long history of grazing and a large portion of the project site is currently being grazed.

A wetland identified under *State Environmental Planning Policy No.14 – Coastal Wetlands* (SEPP 14) traverses a small part of the project site (**Figure 3**). However, the wetland is degraded due to past and current grazing.

1.2 Surrounding Land Uses

The land immediately to the west of the project site is predominantly rural in nature and includes part of the former coal loading facility. Aurizon has lodged a major project application to construct a train support facility (TSF) on the land immediately to the west of the project site. The proposed TSF is currently under consideration by the Department and includes the establishment of a service centre/depot for the maintenance and provisioning of coal and freight trains.

Effluent treatment works associated with the Oak factory (Brancourt's) are located to the north-west of the site. West of the former coal loading site, the land forms part of a SEPP 14 wetland and includes the Hexham Swamp Nature Reserve.

Figure 3: Location of SEPP 14 Wetland

Land uses immediately east of the site include rail infrastructure (Northern Railway) and road infrastructure (New England Highway and Maitland Road/ Pacific Highway). Immediately east of Maitland Road is the suburb of Hexham. Land uses in Hexham opposite the project site predominantly comprise industrial and commercial developments. However, at the southern extremity of the site, residential development occurs immediately east of the Northern Railway.

The northern part of the site is bordered by the New England Highway. To the north of the Highway lies the residential community of Tarro. A single residence is located to the north-west of the project site near the intersection of Woodlands Close and the New England Highway.

The south/south-east of the site is bordered by agricultural land and wetlands.

2. PROPOSED PROJECT

2.1 Project Description

The proposed Hexham Relief Roads project involves the construction and operation of five new train lines ("up" relief roads) and associated infrastructure to the west of the existing Up Main, Down Main and Up Coal train lines. The key components of the proposed project include:

- removal of the existing Down Coal line (currently located to the west of the Up Coal line);
- construction of five relief roads (rail tracks);
- construction of a new Down Coal line to the west and outside of the proposed relief roads;
- construction of new turnouts, return curves and associated track changes;
- installation of new signal infrastructure for the relief roads including signal location cases, huts and gantries;
- construction of three vehicle access tracks parallel to the relief roads;
- construction of a private access track to facilitate access to adjoining properties;
- construction of a temporary construction access road connecting Anderson Drive (Tarro Interchange) and Woodlands Close; and
- earth and civil works including cut to fill, track formation, drainage and minor structures.

Each relief road would accommodate trains generally comprising two or three locomotives and up to 91 wagons (1,543 metres long) requiring a minimum standing room of 1,670 metres. The maximum train speed along the relief roads would be 45 kilometres per hour.

The key operational components of the project are listed in **Table 3**. The proposed layout of the relief roads and associated infrastructure is shown in **Figures 4a to h**.

Table 3: Key Operational Components

<i>Aspect</i>	<i>Description</i>
<i>Track configuration</i>	• Turnouts connecting the Up Coal line to the branched system of five parallel relief roads at approximate chainage 176560 metres, and connecting the relief roads back to the Up Coal line at chainage 174072 metres.
<i>Track structures</i>	• Approximately 10.9 kilometres of rail (total for all five relief roads). • Relocation of approximately 2,725 metres of the existing Down Coal line. • Five relief roads ranging from about 2,000 to 2,530 metres in length. • Signal gantries.
<i>Signalling</i>	• A new main cable route to contain optical fibre, power cable and local equipment cables on the Down Side between chainages 173,900 metres and 177,000 metres. • Signal or track circuits tail cables recoveries / provisions on both the Up Side and Down Side between chainages 172,500 and 179,500 metres. • Up to five walk in signal huts (12 x 3 metres and 2.5 metres high) would be installed on the Down Side.
<i>Water Management</i>	• An approximate 2.5 kilometre long swale drain to the west of the relief roads to collect water draining from the project site.
<i>Internal access</i>	• Access within site – three 3.5 metre wide internal vehicular access tracks would be established for the purpose of facilitating operational phase maintenance. Two of the internal access tracks would be between the existing Up Coal line and Relief Road One, with the third located to the western side of the proposed relocated Down Coal line. All internal access tracks would be unsealed. A vehicular turning circle is proposed at the southern end of the relief roads. • Crossings – two vehicle level crossings across the Down Coal line and the relief road at either end of the branched relief road system.

Figure 4a: Project Layout

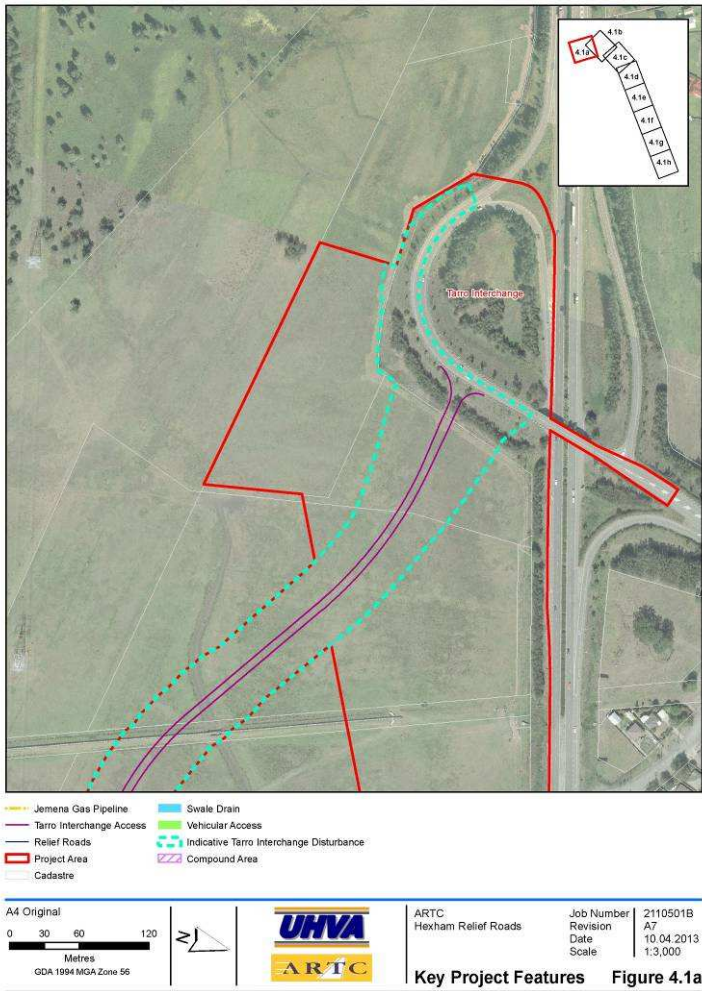


Figure 4b: Project Layout

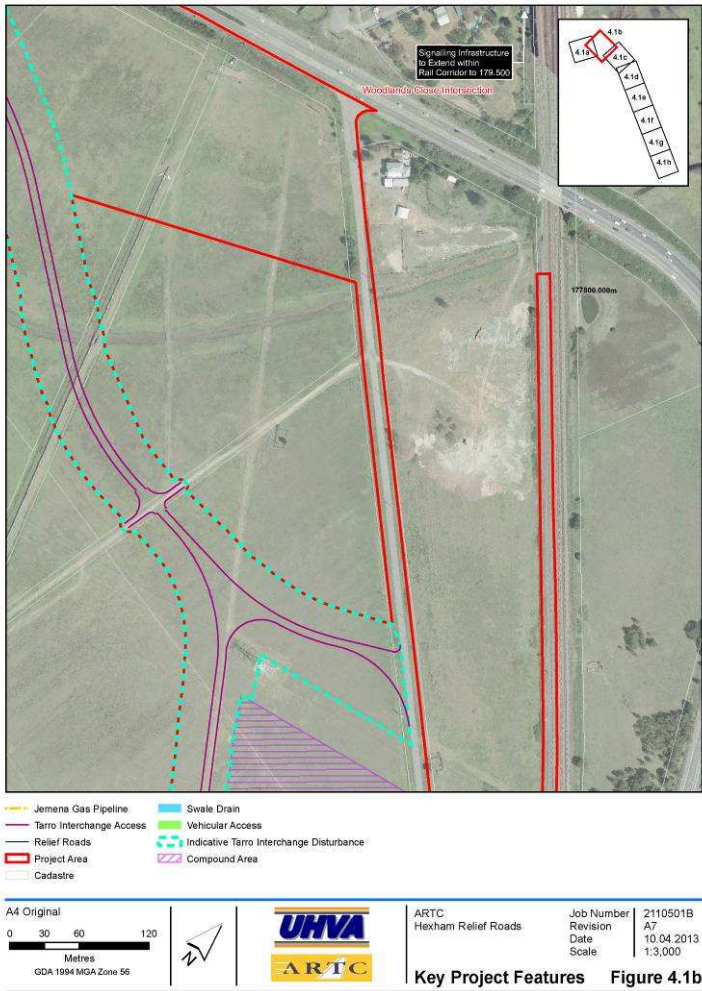


Figure 4c: Project Layout

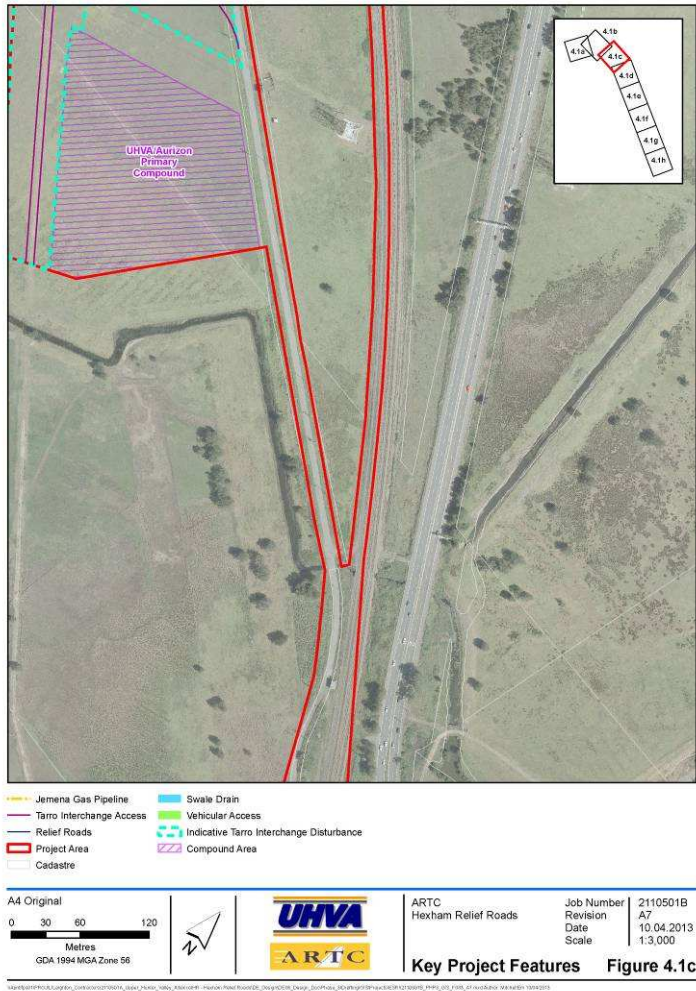


Figure 4d: Project Layout

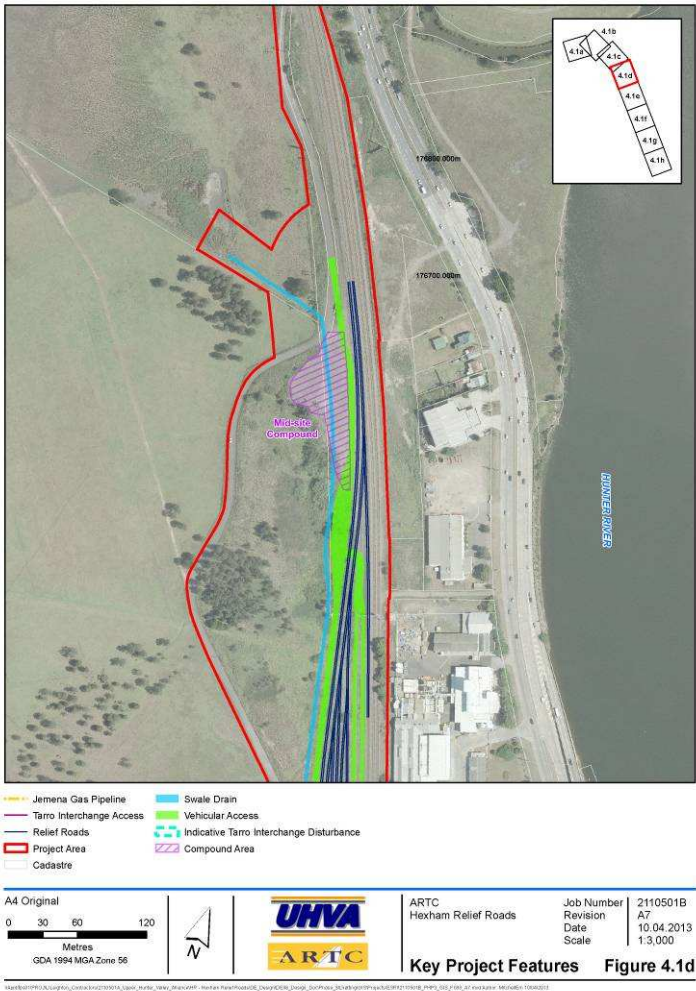


Figure 4e: Project Layout

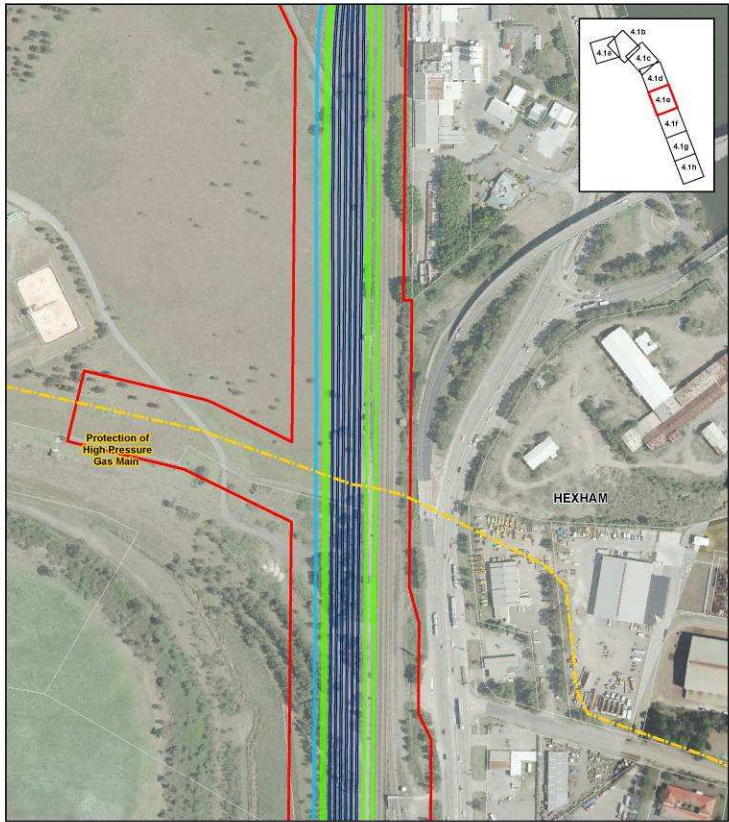


Figure 4f: Project Layout

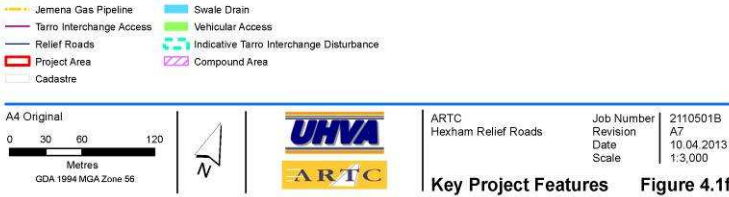
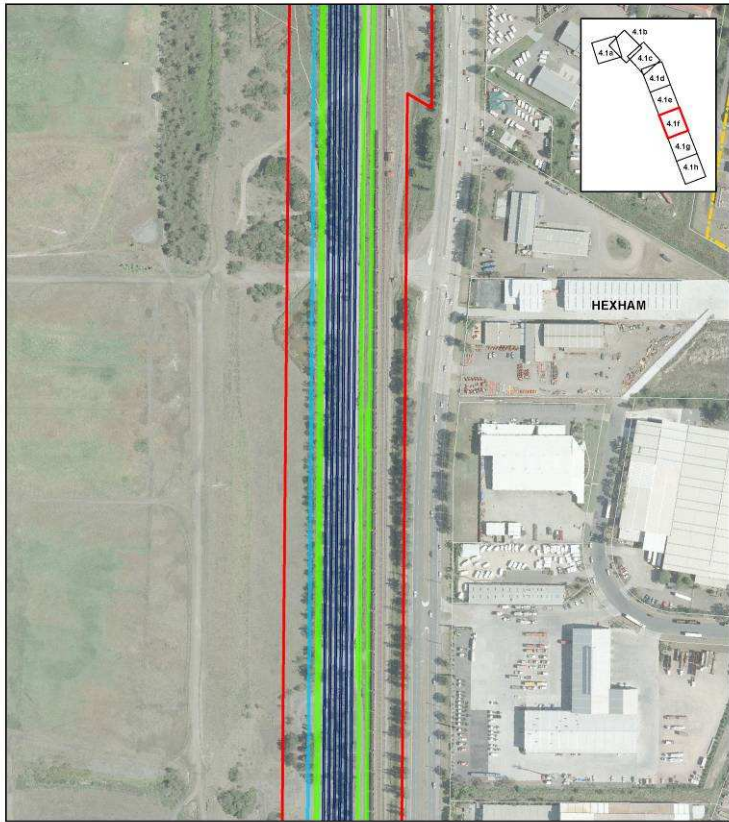


Figure 4g: Project Layout

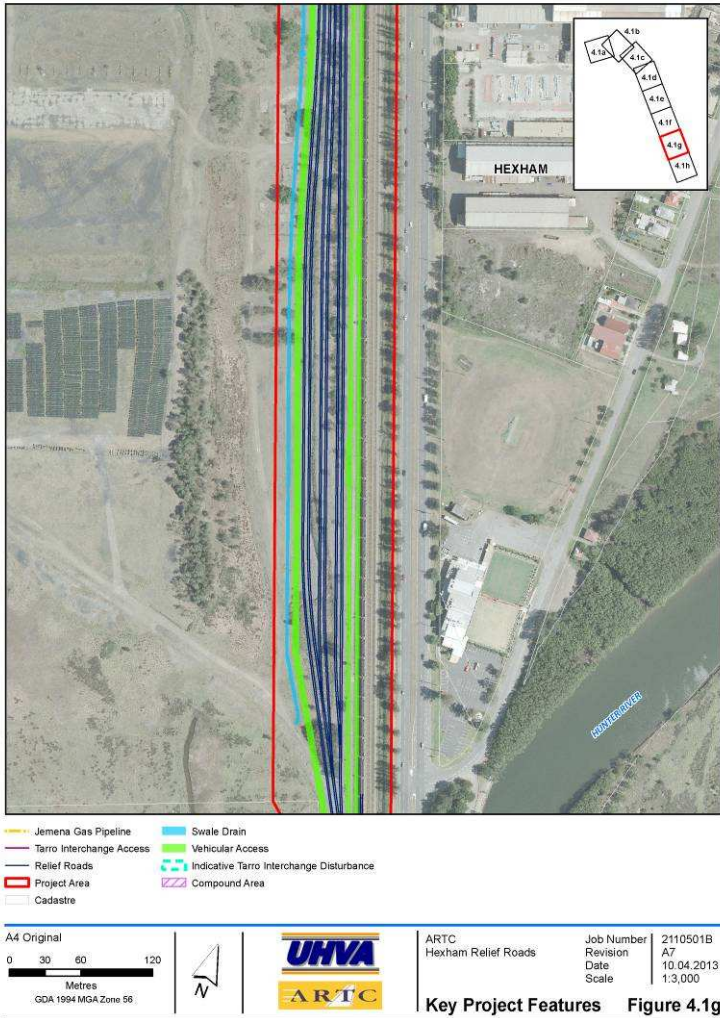
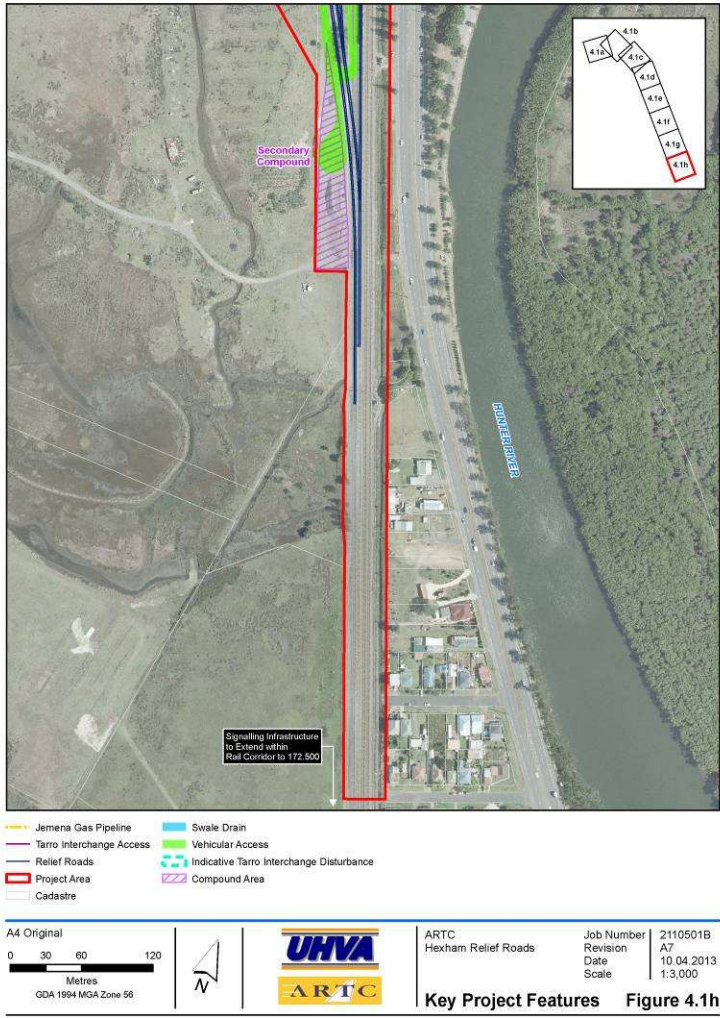


Figure 4h: Project Layout



It is proposed that the site would be accessed via a new T-intersection at the Tarro Interchange and access road connecting the interchange to Woodlands Close, subject to agreement with the asset owner. Alternatively, access would be from Woodlands Close via the New England Highway. Both access routes have been assessed in this report.

The Proponent also proposes to relocate an existing private access track adjacent to the project area to provide more suitable access to adjoining properties to the west and south of the project area, including Lot 31 DP 583724, Lot 270 DP 605404 and the Brancourt's effluent treatment plant (refer **Figure 2**). The access track would be 3.5 metres wide and would utilise and formalise (to the greatest extent practicable) existing track footprints to minimise on-ground disturbance.

Construction of the project would take approximately 18 months. The key construction components associated with the project are listed in **Table 4**.

Table 4: Key Construction Components

Aspect	Description
<i>Mobilisation and site establishment</i>	Preparatory activities, including fencing and vegetation clearing, to delineate the site and identify and establish work areas.
<i>Site compounds</i>	- A primary compound (2.8 hectares) would be established adjacent to Woodlands Close and south of the Tarro Interchange (refer Figure 4c). The compound would be used for construction offices, storage of construction equipment, parking of construction worker vehicles and storing up to 10,000 cubic metres of spoil. There is the potential for this compound to be used by Aurizon for the construction of the proposed TSF which would be constructed on land to the west of the relief roads; - A mid-site compound (0.36 hectares) would be established to the west of the Down Coal line at the southern end of Woodlands Close between chainages 176500 and 176700 metres (Figure 4d), and remain in place for the duration of construction. The area is an existing lay down yard located in the rail corridor and would be used to house office and amenities buildings, plant and equipment, and for stockpiling; and - A secondary compound (0.33 hectares) would be established at the southern end of the site approximately between chainages 174000 and 174200 metres (Figure 4h). The area currently comprises a mix of degraded hardstand and grassland and would be used to store plant and equipment and provide for minor offices, amenities and storage.
<i>Access</i>	- A new T-intersection would be constructed at the Tarro Interchange along with a 10 metre wide temporary construction access road connecting the T-intersection and Woodlands Close (refer Figures 4a and 4b); - Installation of traffic control measures at the T-intersection on the Tarro Interchange to provide site access; - Establishment of an overhead conveyor across the rail corridor to transport materials to the site for the construction of the T-intersection and temporary access road. The conveyor would be located within the rail corridor opposite the intersection of Old Maitland Road and the Pacific Highway (refer Figure 5). The conveyor would also be used upon completion of these works throughout the duration of construction; and - Construction of a temporary pedestrian overpass across the rail corridor near Hexham Railway Station to provide access for construction workers.

<i>Earth and Civil Works</i>	- Bulk earthworks (with spoil from excavations stockpiled on site and either reused for fill operations or removed to approved off-site waste management facilities. The depth of cut would vary from approximately 0.8 to 2.1 metres; - Gabion rock and shot rock would be imported (approximately 134,000 cubic metres) and placed on the cut to fill to form the track foundation. A 600 to 1,200 millimetre rock layer would be placed on the cut to fill; - Ballast would be imported (approximately 40,000 cubic metres) and placed on top of the gabion rock layer; and - An estimated 48,000 cubic metres of fill would be imported.
<i>Track Installation</i>	Installation of rail and sleepers and tamping.
<i>Signalling</i>	Installation of the new signalling cables would be carried out in parallel with the civil works for construction of the relief roads.
<i>Water Management</i>	Construction of an approximate 2.5 kilometre long swale drain to the west of the relief roads to collect water draining from the project site (refer Figures 4a to 4h).
<i>Demobilisation</i>	Following commissioning of the project, external works would be completed including drainage, revegetation of exposed areas, and progressive demobilisation of the site, including removal of site compounds, fencing, signage and temporary facilities.

Figure 5: Location of Proposed Overhead Conveyor



2.2 Project Need and Justification

Coal mining is an important industry in the Hunter Valley and the increase in the worldwide demand for coal has resulted in an expansion of mining in the Hunter Valley. According to the *Hunter Valley Corridor 2013-2022 Capacity Strategy* (ARTC, June 2013) contracted coal exports from the Hunter Valley are in the order of 158 million tonnes per annum in 2013 and may be as high as 197 million tonnes per annum in 2015 where they stabilise until 2018. The coal from the Hunter Valley is taken by train to the Port of Newcastle for export.

The *State Infrastructure Strategy 2012-2032* (Infrastructure NSW, 2012) and draft *NSW Freight and Ports Strategy* (Transport for NSW, 2012) recognise coal as the largest and fastest growing commodity freight task in NSW and identify the Hunter Valley as an important freight movement corridor. The *State Infrastructure Strategy* also indicates that to meet forecast demands for coal

exports, additional rail capacity and network expansion will be required. To cater for the forecast increase in coal demand, the ARTC is undertaking a number of projects to upgrade the rail network in the Hunter Valley, including the construction of five new relief roads at Hexham.

The Hunter Valley Coal Chain is one of the largest coal export operations in the world and involves coordinating delivery of over 80 brands of coal from 35 coal mines to three coal terminals at the Port of Newcastle. Around 40 coal trains service the mines, operating a total of 50-60 trips per day from the valley to the Port. During day-to-day operations of the Coal Chain, problems can occur with unplanned equipment breakdowns at the coal terminal dump stations. When this happens, a train heading for that particular dump station has to be held on the Up Coal Main. This results in all other coal trains heading towards Newcastle also being delayed creating congestion on the rail network.

Similar problems can occur if trains at the mines are loaded early and enter the rail network out of sequence. This then requires rescheduling to their correct place in the queue for the coal terminals. This also results in congestion on the rail network. Modelling has indicated that by the year 2014, five new tracks will be required close to the Port of Newcastle to allow trains to be re-sequenced in the arrival queue for the coal terminals.

The ARTC's proposal to construct five new relief roads would provide more options and capacity for re-sequencing as it would allow trains to be taken off the Up Coal Main and re-sequenced in the arrival queue for the coal terminals, hence alleviating congestion on the main coal rail network. The proposal is consistent with the objectives of the draft *NSW Freight and Ports Strategy 2012* which includes the delivery of a freight network that efficiently supports the projected growth of the NSW economy. It is also consistent with the priorities set out in the *Hunter Regional Action Plan* (December, 2012) which aligns with the NSW Government's 10 year action plan *NSW 2021*. A key priority of the *Hunter Regional Action Plan* is to invest in critical infrastructure so as to improve productivity, efficiency and support continued industry expansion. Goal 19 of *NSW 2021* is to enhance rail freight movement in NSW.

The Proponent has assessed alternative locations close to the Port including Kooragang Island, Sandgate and Beresford. However, these were discounted due to either environmental constraints, constructability or because they would only provide for a single or two parallel lines and consequently limited re-sequencing opportunities. The "do nothing" option is not feasible as it would not relieve congestion and enable the Hunter Valley Coal Chain to meet demand for coal exports into the future.

3. STATUTORY CONTEXT

3.1 State Significant Infrastructure

Pursuant to Part 3, clause 14(1) of *State Environmental Planning Policy (State and Regional Development) 2011* (State and Regional Development SEPP), development is declared to be State significant infrastructure if:

- (a) the development on the land concerned is, by the operation of a State environmental planning policy, permissible without development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (the EP&A Act); and
- (b) the development is specified in Schedule 3 of the State and Regional Development SEPP.

The Hexham Relief Roads is development that:

- is permissible without consent pursuant to Part 3, Division 15, clause 79(1) of *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP) (i.e. development for the purpose of a railway or rail infrastructure facilities may be carried out by or on behalf of a public authority); and
- is development specified in clause 3, Schedule 3 of the State and Regional Development SEPP (i.e. rail infrastructure by or on behalf of the ARTC that has a capital investment value of more than \$50 million).

Consequently, the Hexham Relief Roads project is declared to be State significant infrastructure (SSI) and is subject to assessment under Part 5.1 of the EP&A Act.

The Minister for Planning and Infrastructure is the approval authority for applications made under Part 5.1 of the EP&A Act.

3.2 Permissibility

The Hexham Relief Roads is defined as a rail infrastructure facility under the Infrastructure SEPP. The ARTC is defined as a public authority under the Infrastructure SEPP. As a rail infrastructure facility being carried out by a public authority, it is identified as development that is permissible without consent under clause 79 of the Infrastructure SEPP.

It is noted that part of the site impacts SEPP 14 wetlands and that these works would normally require consent. However, pursuant to section 115ZF(2) of the EP&A Act, environmental planning instruments do not apply to or in respect of State significant infrastructure, except in relation to the declaration of infrastructure as State significant. Consequently, the zoning and land use provisions under the *Newcastle Local Environmental Plan 2012* do not apply.

3.3 Environmental Assessment Requirements

In accordance with section 115Y of the EP&A Act, the Director-General notified the Proponent of environmental assessment requirements for the proposed project, which were issued to the Proponent on 14 December 2011. The Department is satisfied that these requirements have been complied with.

3.4 Environmental Planning Instruments

With the exception of the Infrastructure SEPP and State and Regional Development SEPP, there are no other State environmental planning instruments that apply to the carrying out of the Hexham Relief Roads project. The proposal is considered to be consistent with both the Infrastructure SEPP and State and Regional Development SEPP.

Notwithstanding, the Proponent has undertaken an assessment of the following SEPPs and the requirements of the policies have been taken into account in the Department's consideration of the project as follows:

- SEPP No. 14–Coastal Wetlands – pursuant to the requirements of clause 7 of the SEPP, the Department has considered the characteristics of, and impacts on, native plant communities, wildlife populations and habitat quality in **Section 5.1**, and surface and groundwater resources in **Sections 5.5** and **5.6**, respectively;
- SEPP No. 55–Remediation of Land – the Department's consideration of the site contamination assessment report and suitability of the site for development upon completion of remediation is addressed in Section 5.8; and
- SEPP No. 71–Coastal Protection – pursuant to Part 2, clause 8 of the SEPP, matters for consideration that are relevant to the construction and operation of the project

include Aboriginal and historical heritage (refer **Section 5.7**), management in accordance with the principles of ecologically sustainable development (**Section 3.5**), suitability of the development (**Sections 1.1, 1.2 and 5**), scenic qualities (**Section 5.8**), conservation of flora and fauna (**Section 5.1**), and water quality (**Section 5.5**).

3.5 Objects of the EP&A Act

Decisions made under the EP&A Act must have regard to the objects of the Act, as set out in Section 5 of the Act. The relevant objects are:

- (a) *to encourage:*
 - (i) *the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,*
 - (ii) *the promotion and co-ordination of the orderly and economic use and development of land,*
 - (iii) *the protection, provision and co-ordination of communication and utility services,*
 - (iv) *the provision of land for public purposes,*
 - (v) *the provision and co-ordination of community services and facilities, and*
 - (vi) *the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and*
 - (vii) *ecologically sustainable development, and*
 - (viii) *the provision and maintenance of affordable housing, and*
- (b) *to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and*
- (c) *to provide increased opportunity for public involvement and participation in environmental planning and assessment.*

Of particular relevance to the environmental impact assessment and eventual determination of the project are objects (a)(i), (ii), (iii), (vi) and (vii) (noting that the proposal does not raise significant issues relating to land for public purposes, community services and facilities or affordable housing). The Department's assessment has given due consideration to these in its assessment as follows:

- the proper management, development and conservation of natural and artificial resources for the purpose of promoting the social and economic welfare of the community and a better environment – the Department's assessment of the need for the project (**Section 2.2**) has considered the benefits of the project in promoting the social and economic welfare of the Hunter region, in particular the benefits of increased capacity and efficiencies within the Hunter Valley coal supply chain, including efficiencies in loading/unloading operations at the Port of Newcastle;
- the promotion and co-ordination of the orderly and economic use and development of land – this is considered in the Department's assessment of the need for the project (**Section 2.2**) and potential amenity impacts to surrounding land use and receptors (including acoustic amenity, air quality and visual amenity – **Sections 5.2 and 5.8**);
- the protection, provision and co-ordination of communication and utility services – the Department considers that the project achieves this aim by implementing measures to protect existing utility infrastructure that traverses the project site; and
- the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats – the Department has considered potential impacts to flora and fauna in **Section 5.1** of this report.

With respect to ecologically sustainable development, the Department's consideration of this issue is discussed in **Section 3.5**.

Object 5(b) is relevant as the project involves the sharing of responsibility and information for environmental planning amongst State and local government authorities. The agency consultation undertaken as part of the assessment process is discussed in **Section 4.2**.

Object 5(c) is also relevant to the project as the issues raised by the community during the exhibition period of the Environmental Impact Statement (EIS) form a part of the assessment of the project and the Department's consideration in **Section 5**. **Section 4.3** provides a summary of the key issues raised by the community.

3.6 Ecologically Sustainable Development

The EP&A Act adopts the definition of ecologically sustainable development stated in the *Protection of the Environment Administration Act 1991*. Section 6(2) of the *Protection of the Environment Administration Act 1991* states that ecologically sustainable development requires the effective integration of economic and environmental considerations in decision-making processes and that ecologically sustainable development can be achieved through the implementation of:

- (a) *the precautionary principle;*
- (b) *inter-generational equity;*
- (c) *conservation of biological diversity and ecological integrity; and*
- (d) *improved valuation, pricing and incentive mechanisms.*

The principles of ecologically sustainable development have been addressed in the EIS and Preferred Infrastructure Report (PIR) prepared by the Proponent. The EIS and PIR include detailed studies in the form of Technical Papers, commissioned by the Proponent in the areas of traffic and transport, noise and vibration, European heritage, Aboriginal heritage, ecology, soil contamination, groundwater, surface water management and flooding. The Proponent has identified all relevant impacts and set out a series of mitigation and management measures that would be implemented during the construction and operation of the project to manage residual environmental impacts.

The Department has considered the need to encourage the principles of ecologically sustainable development, in addition to the need for the proper management and conservation of natural resources, the development of land considering land use, and the protection of the environment (including residential communities and industrial and commercial land uses), in **Section 5** of this report. In addition, the Department notes that impacts associated with the construction and operation of the project have been considered on the basis of 'worst-case scenarios', consistent with the precautionary principle.

The Department's assessment of the ecological impacts of the project (**Section 5.1**) is based on a conservative and rigorous assessment of the likely extent of ecological impacts and likely offset requirements to ensure that appropriate and adequate measures are put in place to prevent the threat of serious or irreversible environmental damage, consistent with the precautionary principle and the principle of conservation of biological diversity and ecological integrity. Although the project would result in residual ecological impacts, these would not diminish options regarding land and resource uses and nature conservation available to future generations.

On the basis of the assessed impacts on the environment and their ability to be managed, it is considered that the project would be ecologically sustainable within the context of the above principles.

3.7 Environment Protection and Biodiversity Conservation Act

A referral was made under the *Environment Protection and Biodiversity Act 1999* seeking a determination from the Commonwealth Minister as to whether the proposed project was considered to be a controlled action. On 2 April 2012, the Commonwealth Minister confirmed that the project was not considered a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999*.

4. CONSULTATION AND SUBMISSIONS

4.1 Exhibition

Under section 115Z(3) of the EP&A Act, the Director-General is required to make the EIS for an application publicly available for at least 30 days. After accepting the *Hexham Relief Roads Environmental Impact Statement*, the Department publicly exhibited it from 8 August 2012 until 10 September 2012 (33 days) on the Department's website, and at:

- the Department of Planning and Infrastructure, Information centre, Sydney;
- the Nature Conservation Council of NSW, Newtown;
- Newcastle City Library, Beresfield;
- Hexham Bowling Club, Hexham;
- Hunter Wetlands Centre, Shortland;
- Tarro Post Office, Beresford; and
- Newcastle City Council, Administration Centre.

The Department also advertised the public exhibition in the Newcastle Herald on 8 August 2012 and notified relevant State and local government authorities of the exhibition in writing. Submissions were invited in accordance with section 115Z(4) of the EP&A Act.

The Department received a total of 43 submissions during the exhibition of the EIS. Eight of the submissions were from public authorities and 35 submissions from the general public. A summary of the issues raised in submissions is provided below in **Sections 4.2 and 4.3**.

4.2 Public Authority Submissions

Eight submissions were received from public authorities: NSW Environment Protection Authority (EPA); NSW Office of Environment and Heritage (OEH); NSW Roads and Maritime Services (RMS); Heritage Council of NSW; Department of Primary Industries (DPI); Newcastle Port Corporation; Hunter-Central Rivers Catchment Management Authority (CMA); and Newcastle City Council. None of the agencies objected to the project, however they did raise issues for the Department's consideration including flooding, stormwater management, noise, biodiversity, groundwater, air quality and traffic and access.

The **EPA** did not raise any concerns but did recommend a number of conditions of approval relating to air quality, noise (including recommended hours of construction, construction noise management and operational noise monitoring) and waste management. The EPA also recommended the prohibition of the discharge of water generated during dewatering of the site.

The **OEH** raised concern over the flood impacts associated with the project, surface water management, the assessment and offsetting of impacts on threatened species, and potential exposure of acid sulphate soils.

In regard to flooding, the OEH expressed concern over the potential for the project to exacerbate local flooding and adversely impact on property owners both adjacent to the project site and in Hexham. The OEH also indicated concern that there was no evidence of consultation with potentially impacted land owners. In addition, the OEH criticised the flood modelling methodology noting that it needed to be updated to include all proposed cross drainage structures. In light of the predicted adverse flooding impacts, the OEH recommended that the Proponent undertake a project risk management assessment which encompasses the full range of flood events up to and including the probable maximum flood.

In regard to surface water management, the OEH raised concern that there was insufficient detail on stormwater management infrastructure, including culvert and drainage channel designs and capacities. Further, the OEH questioned the design of the proposed waterway crossing at Purgatory Creek and its ability to withstand construction traffic. The OEH also sought further information on the proposed drainage swale that would be used to collect and transfer stormwater runoff from the project site. The OEH stated that runoff water should be treated prior to discharge and should not be diverted to different receiving water catchments.

In regard to threatened species, the OEH sought clarification on the fauna and flora survey efforts (including sampling methods, timing of surveys, location, climatic conditions, habitats searched, size of stratification units etc). The OEH advised that it was not able to assess the accuracy of the calculated ecosystem credits and whether the Biobanking Assessment Methodology had been correctly applied due to the absence of credit calculator files. The OEH also indicated concern over the lack of details on the proposed offset location, biodiversity values of the offset, and details on how any offsets would be managed in perpetuity.

In regard to acid sulfate soils, the OEH indicated that any associated groundwater drawdown should not desaturate acid sulfate soils.

Although the OEH did not raise any concerns with regard to the Aboriginal cultural heritage assessment, it did recommend a number of conditions of approval relating to preparation of an Aboriginal Heritage Management Plan and Aboriginal Cultural Education Program, recording of Aboriginal sites, and unexpected finds including human remains.

The **RMS** recommended a series of conditions of approval relating to construction access and construction of the proposed Tarro Road interchange. Included in the RMS submission was a response from Transport for NSW which questioned the potential noise impacts associated with idling trains and the need to consider the potential impacts of the Fassifern to Hexham line (Newcastle Rail Bypass).

The **Heritage Council** indicated that the EIS adequately addressed the requirements of the Director-General's requirements.

The **DPI** raised concern over the potential impacts on fish and invertebrate passage and seagrass and saltmarsh habitats arising from the proposed extension of the existing culvert and associated blockage of the underlying waterway for an extended period of time during construction. In order to protect the adjacent waterways and Hexham Swamp Nature Reserve, the DPI recommended that:

- construction works be in accordance with NSW Office of Water's Guidelines for Controlled Activities;
- the design and construction of the relief roads should ensure no permanent interception of and/or connection with groundwater;
- all impacted riparian areas are rehabilitated so as to maintain or improve their hydrologic, geomorphic and ecological integrity; and

- a site water management plan be developed.

The **Newcastle Port Corporation** indicated support for the project, noting the positive impacts of the proposed project on the efficiency and capacity of the Hunter Valley coal supply chain.

The **Hunter-Central Rivers CMA** raised concern over the suitability of the proposed biodiversity offsets, potential impacts on groundwater quality, the potential exposure of acid sulphate soils arising from the drawdown of groundwater, and potential for the project to result in changes in existing hydrology and impact on the water quality of receiving waters, including Hexham Swamp Nature Reserve. In addition, the CMA indicated that the guiding principles in the Hunter-Central Rivers Catchment Action Plan should be taken into consideration in the implementation of the project.

Newcastle City Council raised a number of issues of concern, noting insufficient assessment of and/ or information on the following:

- the permissibility of the project with respect to the Newcastle Local Environmental Plan (2012);
- impacts of the project on flooding, including the cumulative impacts associated with all future developments in the area and the risk to life and property arising from increased flood levels;
- lack of a detailed stormwater design plan;
- in regard to ecology, insufficient information on the percentage loss of the vegetation types within the Newcastle local government area, the impact on aquatic ecology and Hexham Swamp, and the impact of additional lighting from trains on fauna movements;
- the potential for noise to exceed the nominated criteria (in light of discrepancies between the data presented in figures and tables);
- in regard to traffic and access, insufficient details on construction parking, the suitability of the nominated haulage routes, access routes during the construction of the Tarro Interchange, suitability of the Tarro Interchange to accommodate large vehicles;
- insufficient assessment of the impact of the project on views of Mount Sugarloaf and the potential for project to obstruct views from the west of the highway of the open grazing lands and low lying wetlands; and
- lack of detailed designs illustrating the components, grade, scale and layout of the project.

4.3 Public Submissions

Thirty five submissions were received from the public, five of which were from special interest groups including Hunter Bird Observers Club, Newcastle Sport Fishing Club, Hunter Native Fish, Correct Planning & Consultation for Mayfield Group and Save Our Rail NSW Inc. Of the submissions received, 31 objected to the project, three did not object but raised concerns, and one supported the project. **Table 5** outlines the key issues raised in the submissions.

Table 5: Key Issues Raised in Public Submissions

Issue	Concerns/Issues Raised	Number of Submissions
<i>Air Quality</i>	- Concern regarding the potential health effects of diesel fumes and dust emitted from locomotives idling on the relief roads; - Concern regarding potential increases in fugitive dust emissions during construction and operation; - Concern regarding dust generation along gravel access road; and - Air quality modelling is not based on sound assumptions.	26
<i>Noise and Vibration</i>	- Potential for operation to adversely impact on acoustic amenity; - Need to assess noise and vibration at residences in Shamrock St, Hexham if the street is to be used as an access point to the rail corridor; - The assessment does not adequately address all sensitive receivers and operational scenarios; - The assessment indicates decreases in noise levels with the project even though the number of train movements increases; - Request for the construction of a noise barrier along the residential suburb of Hexham; - Request for double glazing and mechanical ventilation to be provided at impacted dwellings; - Failure to adequately address noise impacts on sensitive receivers on the southern side of Hexham Swamp; - The vibration assessment only considers the construction phase; and - Cumulative impacts arising from increased passenger train movements have not been taken into consideration.	25
<i>Safety</i>	There is a need for a deflection wall to be constructed along the residential suburb of Hexham to protect against derailment.	19
<i>General Environmental Concerns</i>	- Long-term contamination risk due to cumulative pollution effects is not assessed; - Cumulative impacts of the project not adequately assessed; - Need to provide alternative accommodation to impacted sensitive receivers during out-of-hours works; and - Need to address remediation at the end of the life of the project.	8
<i>Flooding</i>	- Potential for project to increase flooding; - EIS fails to acknowledge that part of the project lies within an area zoned as "High Flood Hazard" (as per the Newcastle City Council Flood Plain Study); - Underestimation of potential flood impacts; and - Unclear whether increases in flooding due to climate change (and sea level rises) has been assessed.	7
<i>Socio-Economic</i>	- EIS does not adequately address the cost-benefits of the project relating to non-market valuation/user pays; - Project will obstruct access to properties, mail and services;	7

Issue	Concerns/Issues Raised	Number of Submissions
	- Proponent should buy up houses and rezone the adjacent land for non-residential uses; and - Request for an east-west access to be provided across the train lines.	
<i>Traffic and Access</i>	- Potential impact of construction traffic on 1 Woodland Close, including access arrangements is not adequately addressed; - There is the potential for safety issues to arise at the Tarro Interchange as the proposed access will be after a blind corner/bend sweep; - Traffic data is out of date and does not represent existing situation; and - EIS does not assess public transport, including bus and train passenger services.	6
<i>Fauna and Flora</i>	- Concern regarding the clearing of 9.1 ha of endangered ecological communities; - There is the potential for impacts on endangered bird species which habitat the Hexham Swamp consequent to alteration of existing flow regimes; - Failure to address the project's location within the Stockton Bight to Watagans Conservation Green Corridor; - EIS does not address SEPP 14 No.840 wetland and colonies of <i>Zostera Capricornia</i>; - Concern over the addition of extra culverts impacting on fish passage, tidal exchange and aquatic flora and fauna; - Inadequate assessment of the impacts on Hexham Swamp, including biodiversity values; and - Concern regarding the incursion of the project into SEPP 14 wetlands and loss of wetlands.	5
<i>Contamination</i>	EIS does not address potential for project to result in soil contamination from coal dust and oil seepage from trains.	4
<i>Operation of Project</i>	- EIS does not address crew changes and decanting of locomotives; - Insufficient details on the length of stay of trains; and - EIS underestimates freight train movements.	4
<i>Construction</i>	The assessment should consider the use of rail to transport workers to and from the site and delivery of materials rather than on the road network.	3
<i>Surface Water Hydrology</i>	- Does not address Smiths Creek which flows through SEPP 14 No.840 wetland and into Hexham Swamp; - Water quality data referred to is outdated (2004); - There is the potential for the project to adversely impact on water quality of nearby watercourses; - The maintenance of culverts is not addressed; and - There is the potential for siltation of waterways arising from the construction of the project.	3

Issue	Concerns/Issues Raised	Number of Submissions
<i>Property Values</i>	Concern over the potential reduction of local property values due to increased train movements and associated impacts.	2
<i>Visual Impacts</i>	EIS does not address views from the elevated F3 link Road.	1
<i>Greenhouse Gas Generation</i>	The project facilitates an increase in coal exports and consequent use of coal with the flow on effect of creating additional greenhouse gases.	1

The Department has considered the issues raised in submissions in its assessment of the project in **Section 5**.

4.4 Proponent's Response to Submissions

Upon review of the submissions received, the Department directed the Proponent to prepare a Submissions Report to address each of the issues raised. As part of this process, the Proponent reviewed each submission and made specific comment on each of the issues raised. The Submissions Report was made publicly available on the Department's website. In addition, the relevant government agencies were notified and provided with a copy of the report in light of outstanding issues regarding potential impacts on flooding, surface and groundwater hydrology, acoustic amenity, biodiversity, and traffic and access.

The **EPA** re-iterated its previous advice regarding dewatering and the need to manage groundwater intercepted by construction activities, noting that it would not license such discharges unless they were treated to remove contaminants. The EPA also stressed the need for operational noise monitoring to confirm the noise impacts of the project.

The **OEH** re-iterated its previous concerns with regard to flooding, threatened species assessment and the proposed biodiversity strategy and recommended that:

- the Proponent be required to prepare a formal risk management assessment in accordance with AS/NZS ISO 3100:2009 and include consideration of the full range of flood events up to and including the probable mean flood;
- clarification be provided with respect to the targeted flora surveys including the dates of survey, survey methodology and habitats searched;
- details of all clearing be included in the Biobanking Assessment Methodology assessment of impacts;
- the Biobanking Assessment Methodology tool be rerun to account for inconsistencies identified in the assessment process;
- the Proponent liaise with OEH with respect to the possibility of more appropriately located "like-for-like" offsets;
- the Proponent provide further clarification with respect to the type of non-virgin excavated natural materials to be used;
- the Proponent liaise with National Parks and Wildlife Service (NPWS) regarding the need for access to the Hexham Swamp by government authorities and local conservation groups; and
- the results of the additional archaeological sub-surface investigations be included in the report.

The OEH also recommended conditions of approval relating to mitigating flood impacts.

The **Heritage Council** indicated that the measures proposed to mitigate impacts on archaeological resources are adequate and recommended that the measures are incorporated into the conditions of approval.

The **DPI** did not raise any issues of concern but recommended that surface and groundwater management plans be developed and include water quality monitoring.

The **RMS** clarified and recommended a number of requirements relating to access to the site during the construction of the project.

The **Hunter-Central Rivers CMA** raised concern that the proposed biodiversity offset strategy did not provide "like-for-like" offsets. It was also concerned that the Proponent viewed the adjacent Hexham Swamp Nature Reserve as an opportunity to manage contamination events more easily, when the focus should be on preventing contamination of the wetland.

Newcastle City Council re-iterated its concerns regarding the potential for the project to exacerbate flooding impacts, noting that the proposed increases in flood depths were considered unacceptable. Council also criticised the proposed modelling stating that it did not adequately address the upstream and downstream effects of the project nor did not assess events between the 1% and 2% AEP. Council recommended that the Proponent be required to address the principles of the NSW Government *Floodplain Management Manual* (2005).

Council also indicated that the proposed construction access road should be sealed and designed to current AustRoads Standards.

4.4.1 Preferred Infrastructure Report

The Proponent's consideration of submissions received during the exhibition period and on the Submissions Report led to a number of changes to the project. Consequently, a Preferred Infrastructure Report (PIR) was prepared which included the response to submissions. A copy of the PIR is attached as **Appendix C**.

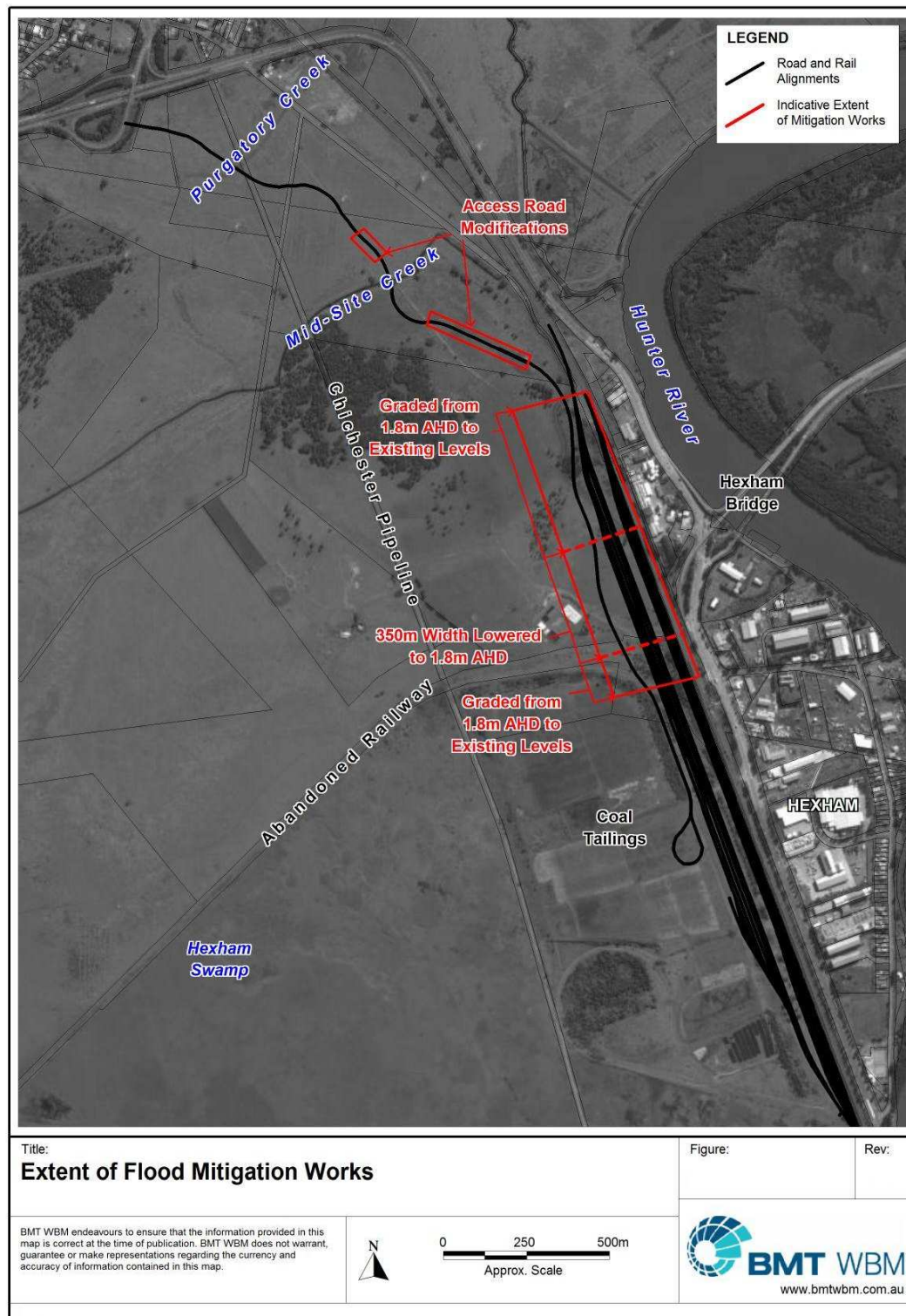
The changes to the project design included:

- lowering of the relief roads by a maximum of 1.2 metres for a distance of 820 metres (primarily to address flooding impacts);
- extension of the relief roads by approximately 160 metres at the northern end;
- lowering (to address flood impacts) and relocation of the proposed temporary construction access road;
- extension of the swale drain at the north end by approximately 1.2 kilometres;
- realignment of the construction access road between the Tarro Interchange and Woodlands Close resulting in an increase in length from 490 metres to 925 metres;
- relocation of the main construction compound;
- relocation of the private access track;
- adjustment to the service road alignment and provision of a third service road; and
- incorporation of an overhead conveyor to transport material to the project site during the construction phase and pedestrian overpass across the existing rail corridor to provide access for construction workers during the construction phase.

Figures 4a to 4b illustrate the modified design. **Figure 2** depicts the location of the relocated private access track and **Figure 5** the location of the overhead conveyor. **Figure 6** illustrates the areas of the construction access road and train tracks that have been lowered.

Consequent to the changes in the design of the project, the Proponent prepared an updated flood study and re-ran the biobanking assessment methodology tool to take into account changes in the total area of native vegetation clearance and included these in the PIR.

Figure 6: Location of the Sections of Lowered Train Tracks and Construction Access Road



5. ASSESSMENT

5.1 Ecology

The project site and surrounding lands have been extensively cleared, with the remaining areas of on-site vegetation predominantly comprising degraded native vegetation, pasture wetlands and exotic grassland. However, approximately one kilometre to the west of the site is the Hexham Swamp Nature Reserve (a SEPP 14 wetland). Kooragang Nature Reserve and Shortland Wetlands are located approximately four and five kilometres to the east and south of the project site, respectively. Together, these wetlands are designated as a RAMSAR wetland – the Hunter Estuary Wetlands (refer **Section 5.1.5**).

To assess the impacts of the project on ecological values, the Proponent undertook an ecological impact assessment which included detailed flora and fauna surveys, targeted threatened species surveys and vegetation mapping. The survey effort included habitat assessments of estuarine and freshwater habitats including intertidal mangrove communities, salt marsh, wetlands and creek systems. An additional survey was undertaken following the exhibition of the EIS due to modifications in the project design.

The Department has considered the Proponent's ecological assessment and the results of the supplementary survey and is satisfied that the level of assessment is sufficient to enable the Department to form a view of the existing biodiversity values within and adjoining the development footprint, and likely extent and significance of impacts associated with the construction and operation of the project. Although the project would have both direct and indirect impacts on biodiversity predominantly during the construction phase, these impacts are primarily the result of vegetation clearing during construction.

5.1.1 Flora Species

A total of 158 plant species were recorded in the study area of which 71 species were native. Although no threatened flora species were identified within the study area during field surveys, based on the results of data base searches and site characteristics, the Proponent indicated that the site provides potential habitat for three threatened flora species:

- *Maundia triglochoides* (Small Water Ribbons) - listed as 'vulnerable' under the *Threatened Species Conservation Act 1995* (TSC Act);
- *Persicaria elatior* (Tall Knotweed) - listed as 'vulnerable' under both the TSC Act and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); and
- *Zannichellia palustris* - listed as 'vulnerable' under the TSC Act.

Assessments of significance were undertaken for the three species in accordance with the *Threatened Species Assessment Guideline – The Assessment of Significance* (Department of Environment and Climate Change, 2007) and concluded that construction and operation of the project would not have a significant impact on any of the species. A significant impact assessment was also undertaken for *Persicaria elatior* pursuant to the requirements of the EPBC Act, in accordance with the *Significant Impact Guidelines 1.1 Matters of National Environmental Significance* (Department of Environment, Water, Heritage and the Arts, 2009). The assessment concluded that the project is not likely to result in a significant impact on this species.

Although clearing will result in the removal of potential habitat of the three threatened flora species, the areas to be cleared represent only a very small portion of the potential habitat within the locality and therefore the project is not expected to adversely affect the propagation of these species. In regard to the Small Water Ribbons, approximately two hectares of potential habitat would be removed. This represents less than 0.07% of the available habitat within the locality and 0.05% of the available habitat within the wider Lower

Hunter Region. With regard to Tall Knotweed, clearing would result in 3.13 hectares of potential habitat being removed which equates to less than 0.06% of available habitat within the locality and 0.04% of the available habitat within the wider Lower Hunter Region.

Approximately two hectares, or less than 0.07% of the available habitat for *Zanichellia palustris* within the locality and 0.05% of the available habitat within the wider Lower Hunter Region, would be removed. Considering the project would not create a barrier to the movement of insect pollinators or seed dispersal due to the mobility of birds in the area, and vegetation clearing would only widen the gap between already fragmented patches of habitat (it would not further fragment or isolate any remaining areas of habitat), the Department is of the opinion that the loss of potential threatened species habitat should not pose a constraint to the construction of the project.

However, due to the potential for threatened species to occur, the Department has recommended a condition of approval requiring the Proponent to develop a procedure for dealing with unexpected finds of threatened species during construction, including stopping works, notification procedures and updating of biodiversity offset requirements.

5.1.2 Ecological Communities

The majority of the vegetation within the project area has been cleared and modified as a result of historic and current grazing, rail construction and former use of part of the site as a coal loader. Seven vegetation communities were recorded on the site (**Figures 7a to 7h**):

- Swamp Oak Swamp Forest Fringing Estuaries – this community is of moderate structural diversity. The majority of the canopy is regrowth with the understorey comprising exotic species due to most of the community having been previously cleared. It occurs as fragmented patches and is subject to ongoing disturbance (grazing);
- Swamp Mahogany Swamp Forest on Coastal Lowlands – this community is also of moderate structural diversity with the majority of the community having been previously cleared and subject to ongoing disturbance from grazing. Consequently, the canopy is generally regrowth native trees with a dense shrub layer of exotic species;
- *Phragmites australis* and *Typha orientalis* Coastal Freshwater Wetlands – this community displays a moderate diversity of native species with invasion by exotics;
- Coastal Saltmarsh in Estuaries – this community is in good condition and is characterised by a high diversity of native species with weed incursions restricted to the edges of saltmarsh areas;
- Exotic Grassland – this is of poor condition with less than 50% native ground cover;
- Exotic Herbfield – this comprises a modified wetland dominated by exotic pasture weeds and is of poor condition; and
- Planted vegetation – this community is the result of rehabilitation works by the RMS and is not consistent with a native vegetation community.

Four of the communities are listed as endangered ecological communities under the TSC Act:

- Swamp Oak Swamp Forest Fringing Estuaries – this is commensurate with the Swamp Oak Floodplain Forest of the NSW Coast, Sydney Basin and South East Corner Bioregions;
- Swamp Mahogany Swamp Forest on Coastal Lowlands – this is commensurate with the Swamp Sclerophyll Forest on Coastal Floodplains of the NSW Coast, Sydney Basin and South East Corner Bioregions;
- *Phragmites australis* and *Typha orientalis* Coastal Freshwater Wetlands – this is commensurate with the Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions; and
- Coastal Saltmarsh in Estuaries – this is commensurate with the Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions.

Figure 7a: Vegetation Communities

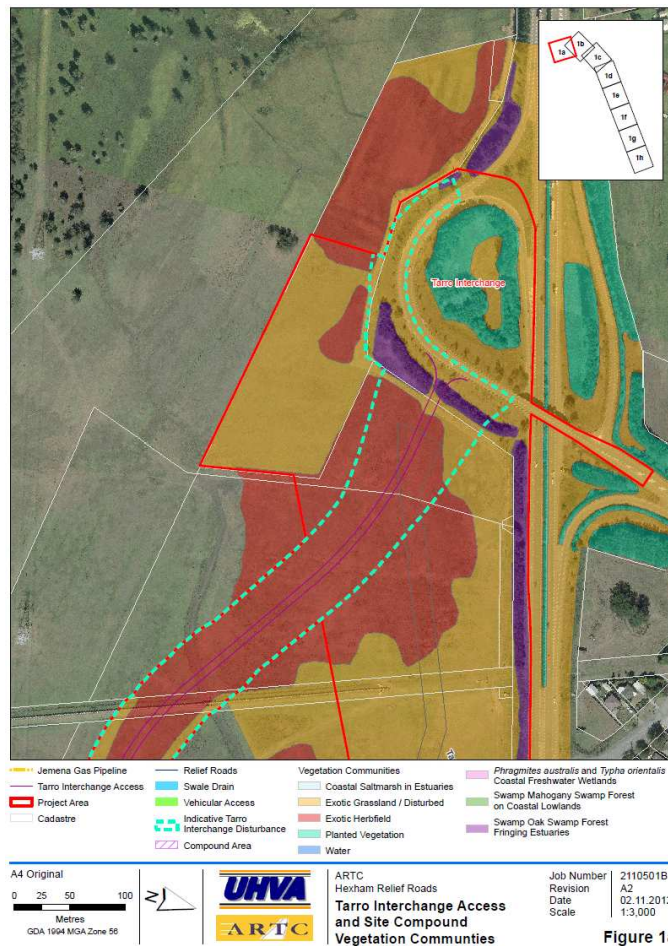


Figure 7b: Vegetation Communities

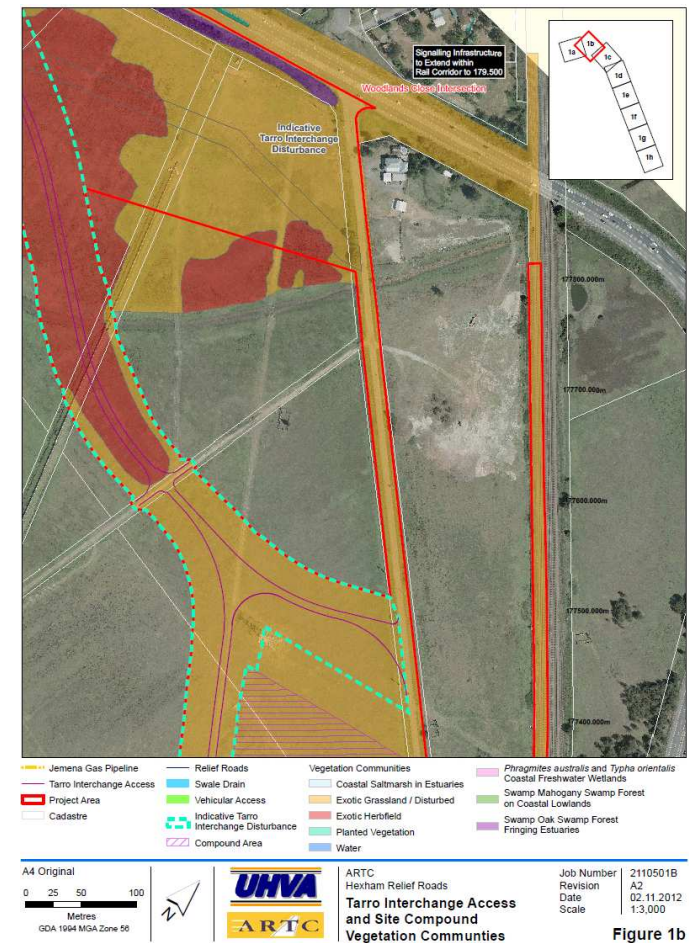


Figure 7c: Vegetation Communities

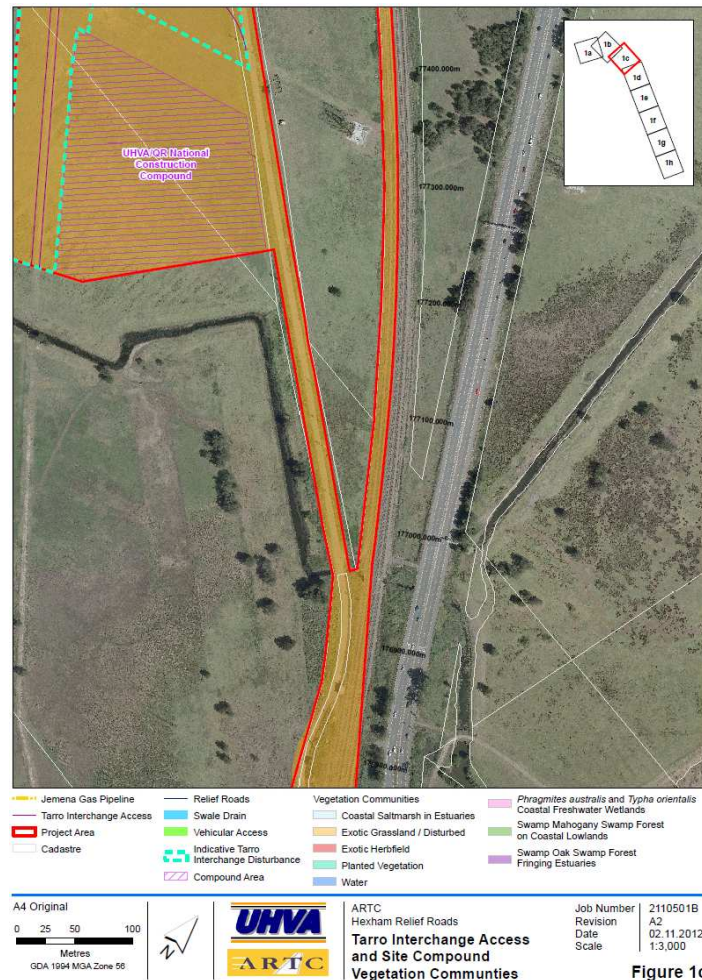


Figure 7d: Vegetation Communities

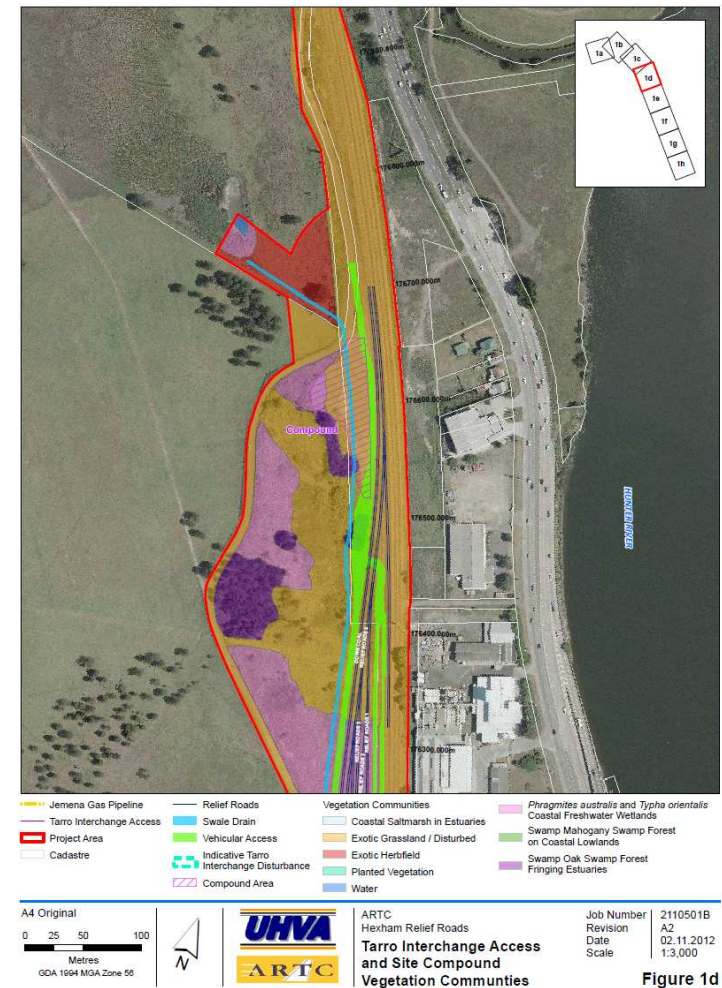


Figure 7e: Vegetation Communities

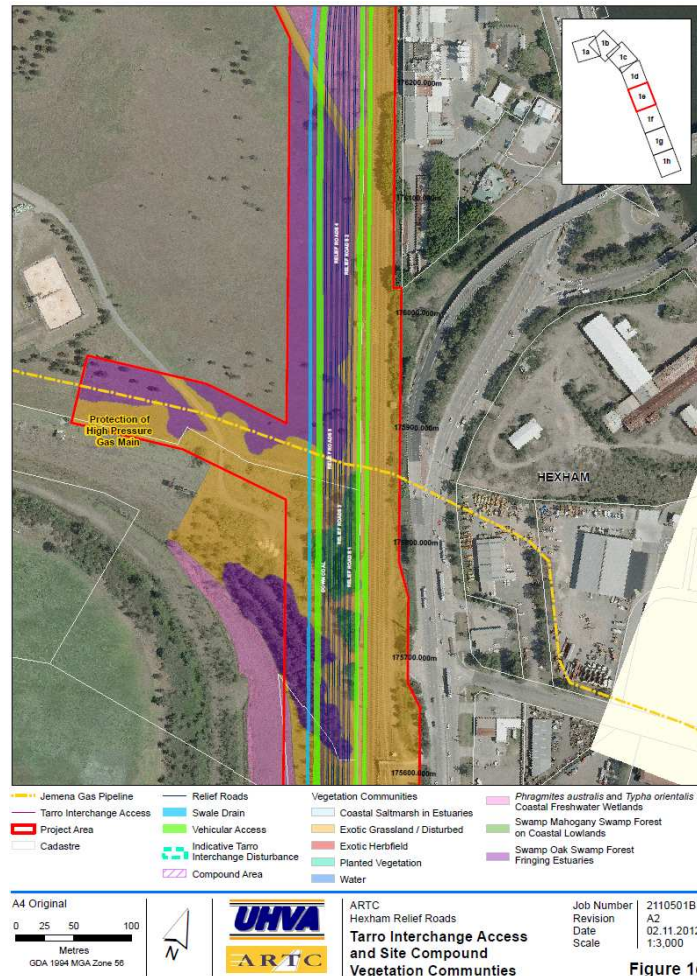


Figure 1e

Figure 7f: Vegetation Communities

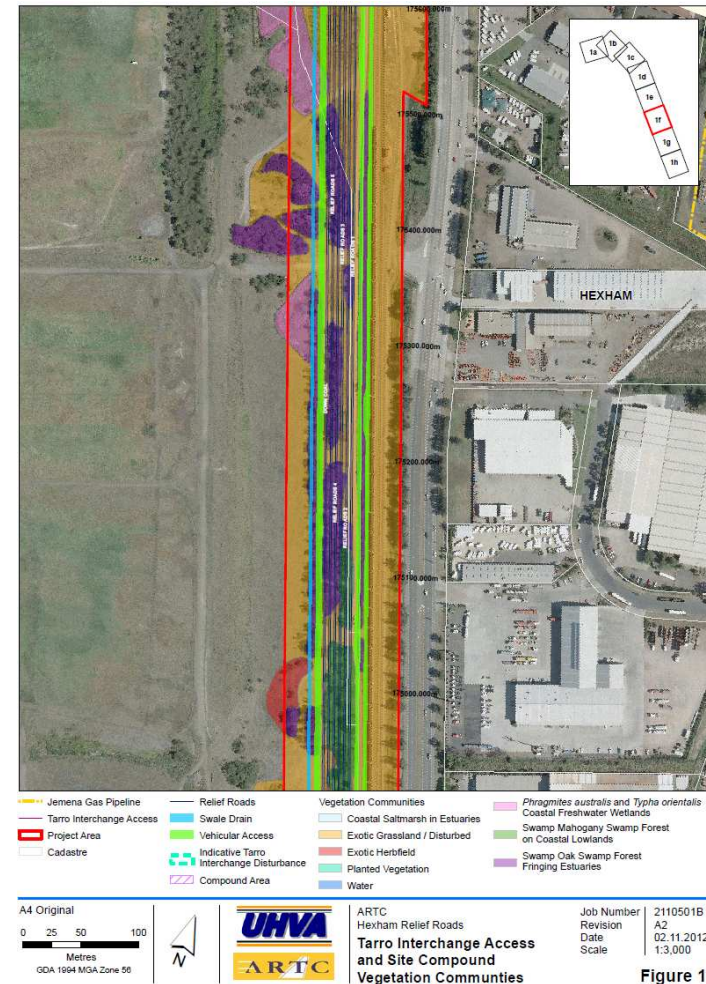


Figure 1f

Figure 7g: Vegetation Communities

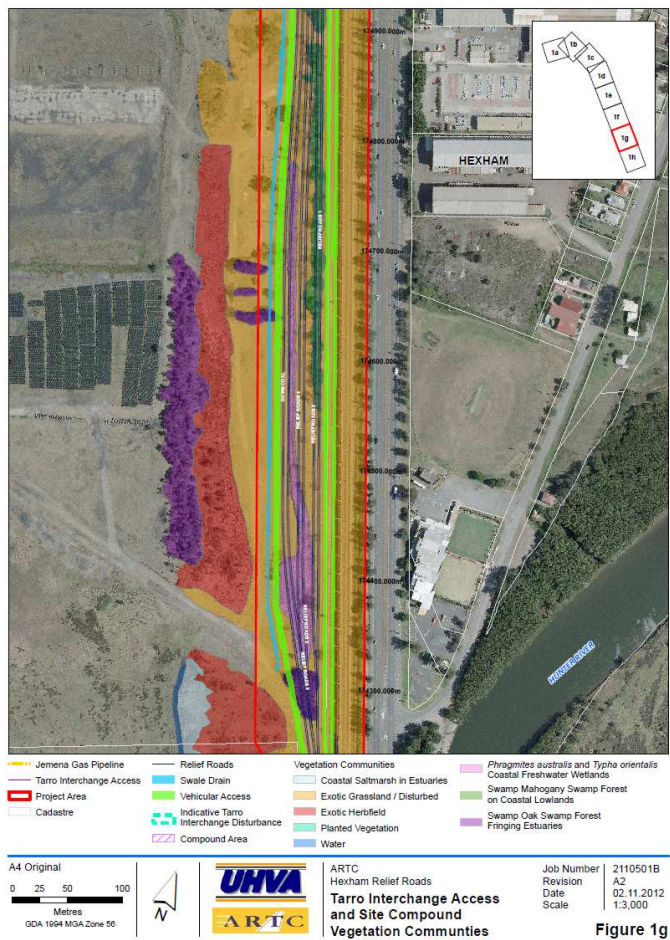


Figure 1g

Figure 7h: Vegetation Communities

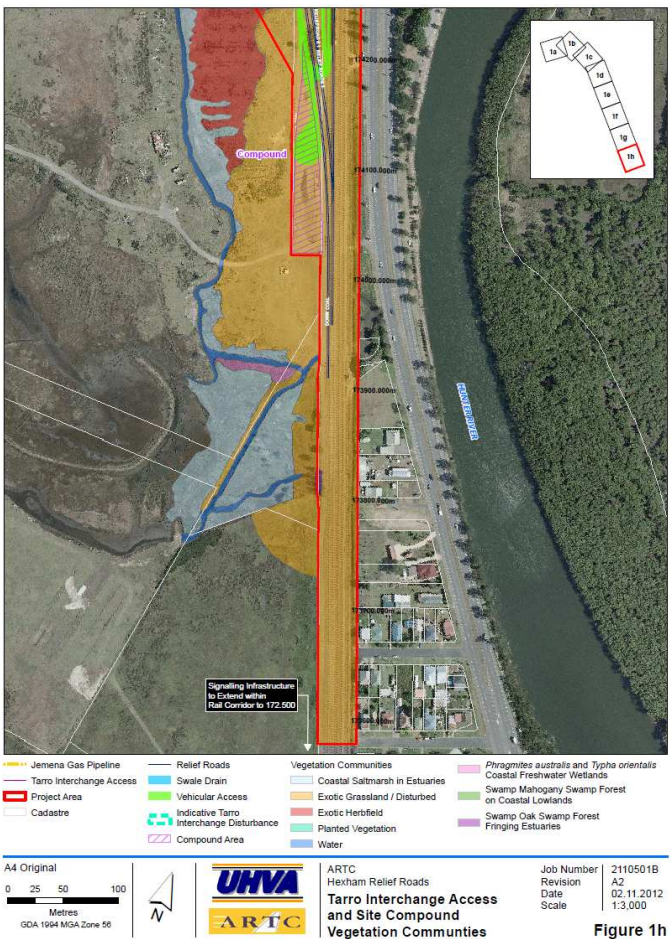


Figure 1h

No threatened ecological communities listed under the *Fisheries Management Act 1994* and EPBC Act occur within the project area.

The Proponent has identified that the construction and operation of the project would require the clearing of approximately 45.25 hectares of vegetation, including an estimated 7.15 hectares of endangered ecological communities. A breakdown of the amount of vegetation clearing required for the project is set out in **Table 6**. The clearing includes 0.5 hectares of SEPP 14 Wetland No. 833 (**Figure 3**) which will be filled to accommodate a part of the proposed rail tracks.

Table 6 – Vegetation Clearing

Vegetation Community	Threatened Species Conservation Act Status	Total Area Within the Project Area (hectares)	Total Area to be Cleared (hectares)
Swamp Oak Swamp Forest Fringing Estuaries	Endangered ecological community	7.21	4.02
Swamp Mahogany Swamp Forest on Coastal Lowlands	Endangered ecological community	1.64	1.11
<i>Phragmites australis</i> and <i>Typha orientalis</i> Coastal Freshwater Wetlands	Endangered ecological community	4.92	2.02
Coastal Saltmarsh in Estuaries	Endangered ecological community	1.63	0
Exotic Grassland	Not listed	57.61	34.19
Exotic Herbfield	Not listed	10.97	3.91
Planted vegetation	Not listed	2.72	0
Total	-	86.70	45.25
Total area of endangered ecological communities		15.40	7.15

The clearing of endangered ecological communities was raised as an issue of concern in public submissions. Although the project would result in clearing of approximately half of the communities within the project footprint, excluding Coastal Saltmarsh which would not be impacted by the project, the Department accepts that the percentage clearance in terms of habitat within the region is relatively minor. For example, in the case of the Freshwater Wetlands, the percentage to be removed represents 0.07% of the available habitat within the Lower Hunter Region. The amounts of Swamp Oak Swamp Forest and Swamp Mahogany Swamp Forest to be removed represent less than 0.2% and 0.6% in the locality, respectively.

The cumulative impact of the project and the proposed adjacent Aurizon TSF is expected to have minimal impact on the region's biodiversity, with less than 4% of the localities total endangered ecological communities expected to be removed cumulatively.

An assessment of significance was undertaken by the Proponent to determine whether the project is likely to significantly affect the Swamp Oak Swamp Forest Fringing Estuaries, Swamp Mahogany Swamp Forest on Coastal Lowlands and *Phragmites australis* and *Typha orientalis* Coastal Freshwater Wetlands. The assessment was undertaken in accordance with the *Threatened Species Assessment Guideline – The Assessment of Significance* (Department of Environment and Climate Change, 2007). An assessment of significance was not undertaken for the Coastal Saltmarsh in Estuaries as this community will not be impacted by the project. All three assessments of significance concluded that the project is not likely to result in a significant impact on the endangered ecological communities.

Although clearing will result in the removal of endangered ecological communities, the Department notes that the vegetation to be impacted is fragmented and is not considered to be important for the long-term survival of the communities in the locality. Due to its linear nature, the project would essentially encroach on vegetation at the interface of existing clearing and easements, and would only add incrementally to existing fragmentation and connectivity processes.

Although the construction of the project has the potential to introduce edge effects into new areas, it is considered that the impacts are unlikely to significantly increase subject to the recommended conditions of approval requiring the implementation of mitigation measures such as weed and sediment control.

The Department accepts that the configuration identified by the Proponent would likely represent the worst-case level of clearing that would be required for the project. To compensate for the loss of biodiversity values associated with the clearing of native vegetation, the Proponent has proposed a biodiversity offset strategy. The strategy is based on the NSW Biobanking Scheme, as modified to reflect the State significant infrastructure assessment process. The Department is of the opinion that the impacts associated with the construction and operation of the project and the credits required to offset impacts have been appropriately assessed and calculated under the Biobanking Assessment Methodology. This position is supported by the OEH.

Through the use of the Biobanking Assessment Methodology, the Proponent has established that 182 ecosystem credits are required to offset the impacts of the project. The preferred biodiversity offset strategy proposed by the Proponent involves the establishment of a proposed Biobank site at Karuah, Port Stephens. The site is 273 hectares and contains 1,768 credits. Approximately 57 Tier 1 credits (improve and maintain) are available within the Karuah site (refer **Table 7**). This equates to 31% of the total offset requirements. The remaining 125 credit requirements would be sourced from the Karuah site from alternative vegetation types of similar conservation significance and would provide Tier 2 (no net loss) and Tier 3 (mitigated net loss) offset outcomes.

Table 7 – Biodiversity Offset Requirements

Vegetation Community	Threatened Ecological Community?	Area to be Impacted (hectares)	Credits Required	Extent of Vegetation Within Offset (hectares)	Credits Retired Within the Offset
Swamp Sclerophyll Forest	Yes (TSC Act*)	1.11	24	7.93	10
Swamp Oak Floodplain Forest	Yes (TSC Act)	4.02	101	5.67	39
Freshwater Wetlands	Yes (TSC Act)	2.02	57	0.89	8
Coastal Saltmarsh	Yes (TSC Act)	-	-	16.30	125
Total		7.15	182	30.79	182

*TSC Act – Threatened Species Conservation Act 1995

Although the nominated biobanking site only provides 31% of the total offset requirements at the Tier 1 level, the provision of Tier 2 and Tier 3 outcomes to offset the residual impacts is in accordance with the permissible variation rules within the *NSW Interim Policy on Assessing and Offsetting Biodiversity Impacts of Part 3A, State Significant Development (SSD) and State Significant Infrastructure (SSI) Projects* (OEH, 2011).

Whilst the application of Tier 2 and 3 outcomes may be in accordance with government policy, in its submission the OEH expressed concern over the lack of evidence to support the application of the Tier 2 and 3 outcomes and questioned whether consideration had been

given to more appropriately located offsets. The Hunter-Central Rivers CMA also raised concern that the biodiversity values represented at the proposed Biobanking site do not match the values that would be impacted by the project.

In considering whether the proposed mitigated net loss standard is appropriate, the OEH indicated that there is a need to demonstrate adequate consideration of:

- (i) whether the credits required by the calculator are available on the market;
- (ii) whether alternative offset sites (other than credits) are available on the market; and
- (iii) the overall cost of offsets and whether these costs are reasonable given the circumstances.

Consequent to this, the Proponent has advised that there are no available sites on the Biobanking Public Register and that it has liaised with the National Parks and Wildlife Service (NPWS) with respect to the possibility of more appropriately located "like-for-like" offsets adjoining the Hunter Wetlands National Park. The NPWS has indicated that it is not aware of any such properties. The Proponent has also advised that potential off-site sites were not discounted on cost.

To ensure that the proposed Biobanking site provides the best biodiversity outcomes and that no other offsets are required, the Department has recommended that the Proponent develop a Biodiversity Offset Package in consultation with the OEH and Hunter-Central Rivers CMA, and that this be submitted for the approval of the Director-General. The Package must provide justification for the application of Tier 2 and 3 outcomes and detail the process for securing the biodiversity values in perpetuity. The Package must also incorporate measures for addressing and incorporating offset measures arising from any changes in biodiversity impacts.

The Department has also recommended that the Proponent develop and implement an Ecological Monitoring Program to assess the effectiveness of the mitigation measures employed to manage and minimise impacts on threatened species, endangered ecological communities and their habitats.

The endangered ecological communities within and on lands adjacent to the project site are groundwater dependent. In response to concerns raised by the Department, OEH and in public submissions regarding potential impacts associated with groundwater drawdown, the Proponent undertook further assessment of the potential impacts of construction on groundwater dependent ecosystems. The Proponent concluded that although construction of the project may result in short-term fluctuations in pre-construction groundwater levels, groundwater drawdown is not expected to extend significantly beyond the railway formation. Although the railway formation is expected to act as a unit of somewhat higher permeability than the surrounding ground, the Proponent states that existing groundwater flow behaviour is not expected to alter significantly as the ground surrounding the formation will remain unchanged. As such, the Proponent concluded that the project is unlikely to result in substantive changes to groundwater dependent ecosystems.

Modifications to existing drainage lines and flooding also have the potential to impact on groundwater dependent ecosystems through changes in water quality and modified flow patterns and water depths. The Proponent argues that the project is unlikely to significantly impact on existing water quality values of the groundwater dependent ecosystems in the locality, including the SEPP 14 wetlands and nearby Hexham Swamp Nature Reserve. Notwithstanding, to minimise the potential for the project to impact on groundwater dependent ecosystems the Department has recommended conditions of approval that require the Proponent to:

- monitor and assess changes to groundwater dependent ecosystems;
- develop and document the contingency measures that would be implemented in the event that changes to groundwater ecosystems are observed; and

- implement a surface and groundwater monitoring program which includes monitoring of surface water quality and groundwater depths and flows, and documentation of the contingency measures that would be employed should adverse impacts on surface or groundwater hydrology arise.

In addition to the recommendations regarding the protection of threatened flora species, endangered ecological communities, biodiversity values and groundwater dependent ecosystems, the Department has recommended the Proponent implement the following measures to minimise impacts on native vegetation:

- develop and implement a Construction Flora and Fauna Management Plan which sets out the mitigation measures for managing impacts to native vegetation (and fauna);
- minimise the clearing of native vegetation, including freshwater wetlands;
- establish “no go” areas at freshwater wetland and coastal saltmarsh sites outside of the construction area;
- undertake pre-clearing surveys; and
- implement measures for the progressive re-vegetation of areas temporarily disturbed during construction.

The Department considers that with the implementation of the measures outlined above, impacts on native vegetation and biodiversity values can be adequately mitigated and/or offset, and should not pose a constraint to approval of the project.

5.1.3 Fauna Species

A total of 77 vertebrate fauna species comprising 57 birds, seven mammals, eight amphibians, three reptiles and two fish were recorded within the study area.

Only two threatened species were recorded within the study area during field surveys – *Pteropus poliocephalus* (Grey-headed Flying Fox) and *Epthianura albifrons* (White-fronted Chat). The Grey-headed Flying Fox is listed as ‘vulnerable’ under both the TSC Act and EPBC Act. The White-fronted Chat is listed as ‘vulnerable’ under the *Threatened Species Conservation Act 1995*.

A further two threatened species, *Ephippiorhynchus asiaticus* (Black-necked Stork) and *Circus assimilis* (Spotted Harrier), were recorded outside of the study area during field surveys. The Black-necked Stork and Spotted Harrier are respectively listed as ‘endangered’ and ‘vulnerable’ under the TSC Act.

Whilst online databases indicate the potential for 64 threatened fauna species to occur within the area, the Proponent has assessed the project site as providing potential habitat for the above mentioned four species and a further 23 threatened fauna species:

- Amphibians – *Litoria aurea* (Green and Golden Bell Frog);
- Birds – *Anseranas semipalmata* (Magpie Goose), *Botaurus poiciloptilus* (Australasian Bittern), *Tyto longimembris* (Eastern Grass Owl), *Daphoenositta chrysoptera* (Varied Sitella), *Ixobrychus flavicollis* (Black Bittern), *Rostratula australis* (Australian Painted Snipe), *Calidris tenuirostris* (Great Knot), *Charadrius leschenaultia* (Greater Sand Plover), *Lemicola falcinellus* (Broad-billed Sandpiper), *Limosa kimosa* (Black-tailed Godwit), *Charadrius mongolus* (Lesser Sand Plover), *Hieraaetus morphnoides* (Little Eagle), *Lathamus discolor* (Swift Parrot), *Glossopsitta pusilla* (Little Lorikeet) and *Turnix maculosa* (Red-backed Button quail); and
- Mammals – *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Mormopterus norfolkensis* (Eastern Free-tail bat), *Saccolaimus flaviventris* (Yellow-bellied Sheath-tail Bat), *Scoteanax rueppellii* (Greater Broad-nosed Bat), *Miniopterus australis* (Little Bent-wing Bat), *Miniopterus schreibersii oceanensis* (Eastern Bent-wing Bat) and *Myotis macropus* (Large-footed Myotis).

All of the above species are listed as vulnerable under the TSC Act with the exception of the Swift Parrot and Australasian Bittern which are listed as 'endangered'. Both of these species are also listed as 'endangered' under the EPBC Act. The Green and Golden Bell Frog is also listed as 'endangered' under the EPBC Act. The Australian Painted Snipe is listed under the EPBC Act as 'vulnerable'.

Assessments of significance conducted by the Proponent concluded that the project would not have a significant impact on any threatened fauna species.

Three migratory species listed under the EPBC Act were recorded in the study area – *Ardea modesta* (Eastern Great Egret), *Haliaeetus leucogaster* (White-bellied Sea Eagle) and *Bubulcus ibis* (Cattle Egret). Assessments of significance concluded that the project is unlikely to have a significant impact on migratory species as it would not substantially modify, destroy or isolate areas of important habitat. This conclusion was supported by the Commonwealth Department of Sustainability, Environment, Water, Populations and Communities.

No endangered populations as listed under the TSC Act, were recorded in the study area or are considered likely to occur.

To minimise the impacts on fauna species, the Department has recommended that the Proponent prepare a Construction Flora and Fauna Management Plan which details the measures for managing fauna impacts including:

- pre-clearing surveys and a two-stage clearing strategy;
- maintaining and re-instating any habitat features following disturbance, where feasible and reasonable; and
- developing and implementing measures to minimise the incidence of fauna being trapped in excavation cells and to deal with trapped or injured fauna.

Although the Green and Golden Bell Frog was not recorded during targeted surveys, there is a likelihood that areas with suitable attributes could provide habitat for this species. The proposal will result in the removal of 2.7 hectares of potential Green and Golden Bell Frog habitat. Consequently, the Department has recommended a condition of approval requiring the Proponent to prepare a management plan outlining the strategies that would be implemented in the event that the species is identified during construction.

5.1.4 Aquatic Fauna

The fauna study included trapping fish in estuarine and freshwater habitats. Only one species of fish, *Mugil cephalus* (Sea Mullet), and one prawn (genus *Acetes*) were identified in the Hunter River Estuary. Both are commonly occurring marine fauna that have been previously recorded throughout the estuary.

Only one species of fish was recorded in the freshwater aquatic environments – *Gambusia holbrooki* (Eastern Mosquitofish). The Mosquitofish is a declared noxious species and predation by Mosquitofish is listed as a key threatening process under the TSC Act.

The DPI and public submissions raised concern regarding the potential blockage of Purgatory Creek during the construction of the culvert as this could stop the free migration of fish into and out of significant nursery habitats that are undergoing rehabilitation on the site and in the SEPP 14 wetland upstream. The DPI and public submissions also raised concern over the increased distance (70 metres) fish will be required to travel to enter upstream habitats once the culvert is constructed.

Although extension of the box culvert would increase the distance fish are required to travel to enter the drainage line, the Proponent has indicated that the impact would not be significant due to tidal movements facilitating fish passage. To limit the potential for adverse impacts on fish passage, the Department has recommended the Proponent:

- construct watercourse crossings in consultation with the NoW (and DPI where the crossing has the potential to impact on fish passage);
- construct the Purgatory Creek culvert in a manner which provides a waterway area and hydraulic capacity equivalent to the existing culvert;
- ensure that connection between the Hunter River and Hexham Swamp Nature Reserve floodplain is retained throughout construction; and
- document the measures for maintaining the extended Purgatory Creek culvert during construction and operation of the project, including the clearing of blockages.

Modifications to existing drainage lines and waterway crossings have the potential to allow the Mosquitofish to extend its range further into the Hexham Swamp Nature Reserve.

Consequently, the Department has recommended that approval of the project be subject to the Proponent implementing drainage controls to prevent the extension of the Mosquitofish.

The Department has also recommended conditions aimed at preventing the flow of polluted discharges offsite and maintaining existing stormwater flows to minimise the potential for changes in surface water quality and flows and consequent impacts on aquatic fauna.

5.1.5 Fauna Habitats

As noted in **Section 5.1.3** a range of birds, mammals and herpetofauna inhabit the project area. The suitability, size and configuration of the fauna habitats within the study area can be broadly correlated with the vegetation communities identified within the project site (refer **Table 8**). The proposed project would result in the loss of approximately 7.15 hectares of habitat as shown in **Table 8**.

Table 8: Fauna Habitats and Potential Losses

Fauna Habitat	Corresponding Vegetation Community	Extent Within Study Area (hectares)	Habitat Area Proposed to be Cleared (hectares)
Swamp Forest	Swamp Oak Swamp Forest, Swamp Mahogany Swamp Forest, Planted Vegetation	11.57	5.13
Estuarine Habitat (saltmarsh and mangroves)	Coastal Saltmarsh in Estuaries	1.63	0
Freshwater Aquatic Habitat	<i>Phragmites australis</i> and <i>Typha orientalis</i> Coastal Freshwater Wetlands	4.92	2.02
Cleared Land	Exotic Grassland, Exotic Herbfield	68.58	38.10
Total		86.70	45.25

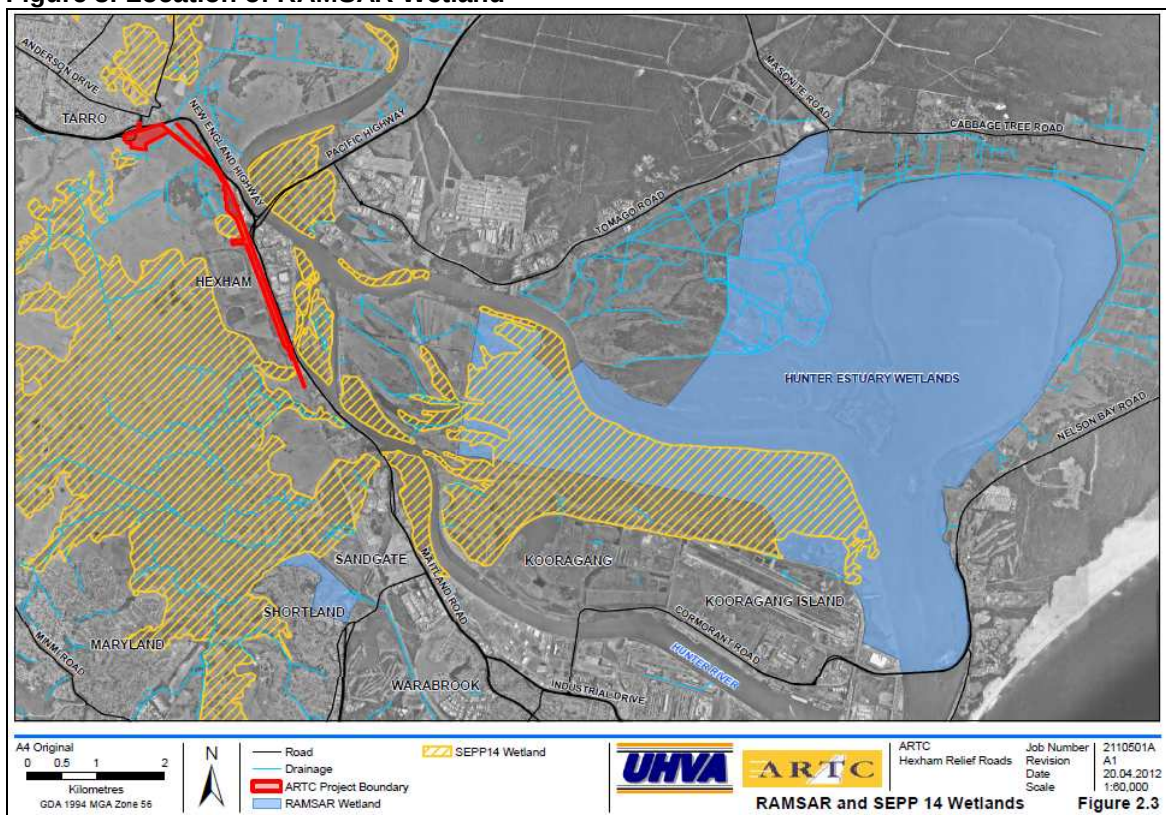
Although the study area provides potential foraging habitat for a number of threatened and migratory species, the Department acknowledges that it lacks important microhabitat elements such as roosting and breeding habitat (i.e. large tree hollows). Further, the habitat to be removed is considered marginal for these species in light of its degraded nature and the abundance of similar or greater quality roosting and breeding habitat in the locality, including the nearby Hexham Swamp Nature Reserve and RAMSAR declared Hunter River Estuary Wetland (refer **Figure 8**).

In addition, the majority of the species that might utilise the area are highly mobile and while the project area potentially forms part of a larger home range, the Proponent's assessment indicates that it does not constitute primary habitat and that species would not utilise the

project area exclusively. In the case of migratory species, construction and operation of the project are unlikely to have an adverse impact on the habitat and life cycle of the species due to their ability to undertake large-scale seasonal movements. Further, migratory species are more likely to inhabit the nearby Hunter River Estuary Wetland which is designated as significant with respect to providing habitat for international migratory birds.

The Department acknowledges that construction of the project is unlikely to result in significant habitat fragmentation or loss of habitat corridors because it will not dissect or isolate any new or substantial areas of native vegetation. Nor is it likely to impact on the movement of native fauna within the region due to existing habitat fragmentation and isolation. The proposed project will effectively add incrementally to the width of an existing rail easement. In addition, the project would not further inhibit movement of ground dwelling fauna than is already occurring from the existing rail corridor, with mobile species easily traversing the railway tracks.

Figure 8: Location of RAMSAR Wetland



Considering the habitat to be removed has been assessed as being of little importance for the survival of fauna species and no fragmentation of habitats will occur, the Department considers that provided the recommended conditions regarding minimising the extent of clearing, implementing a Construction Flora and Fauna Management Plan, and developing and implementing a Biodiversity Offset Package are adopted, impacts on fauna and their habitats can be effectively managed and duly compensated.

5.2 Noise and Vibration

The existing noise receiving environment surrounding the project site comprises a number of commercial, industrial, residential, and agricultural uses. Background noise levels in the area are predominantly influenced by continuous road traffic noise on the Pacific and New England Highways, and intermittent road traffic noise on Old Maitland Road, as well as noise from passenger and freight rail operations.

Construction and operation of the project has the potential to impact on the acoustic amenity of sensitive receivers. To determine the potential noise and vibration impacts associated with the project, the Proponent commissioned a noise impact assessment as part of the EIS, with a supplementary noise study commissioned as part of the PIR to assess the noise impacts arising from the proposed design amendments. Construction noise impacts were assessed against the *NSW Interim Construction Noise Guidelines* (ICNG) (Department of Environment and Climate Change, 2009) with construction traffic noise assessed in accordance with the *NSW Environmental Criteria for Road Traffic Noise* (ECRTN) (EPA, 1999). Operational noise impacts were assessed against the *Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects* (IGANRIP) (Department of Environment and Climate Change, 2007).

The assessment of construction and operational noise involved the prediction of noise impacts at 22 of the most exposed receivers (including residences, places of worship, recreational land uses and commercial premises) in the vicinity of the project (refer **Figure 9**). The resulting predictions were compared against defined criteria/ goals to determine the magnitude of impact and to inform the development of measures to minimise, mitigate and manage the impacts.

The nearest residential properties are located off the Pacific Highway on Clark Street, Merchant Street and Fenwick Street (and represented by Receiver Locations R10-R15) and off Woodlands Close (Receiver Locations R1 and R2). An old church is located at 61 Old Maitland Road (Receiver Location R17). Commercial and light industrial premises are located on the New England Highway/Pacific Highway (and represented by Receiver Locations 18 and 19). Recreational areas include Hexham Park (Receiver Location R21) and Foreshore Reserve (Receiver Location 22), and the Hexham Bowling Club (Receiver Location R20).

During the exhibition, Council and a number of public submissions raised issues regarding the adequacy of the noise and vibration assessment presented in the EIS, which primarily related to background noise levels adopted, the identification of sensitive receivers and the validity of the modelling that was carried out. These issues were addressed in an updated noise and vibration assessment submitted as part of the PIR.

The Department and the EPA are satisfied with the methods used to calculate the relevant noise levels, and that the noise criteria have been developed in accordance with applicable policies and guidelines. Further, both the Department and EPA consider that the modelling is sufficiently conservative, such that the predictions represent a worst-case scenario and it is highly unlikely that the level of noise that would be experienced will reach the predicted levels as modelled.

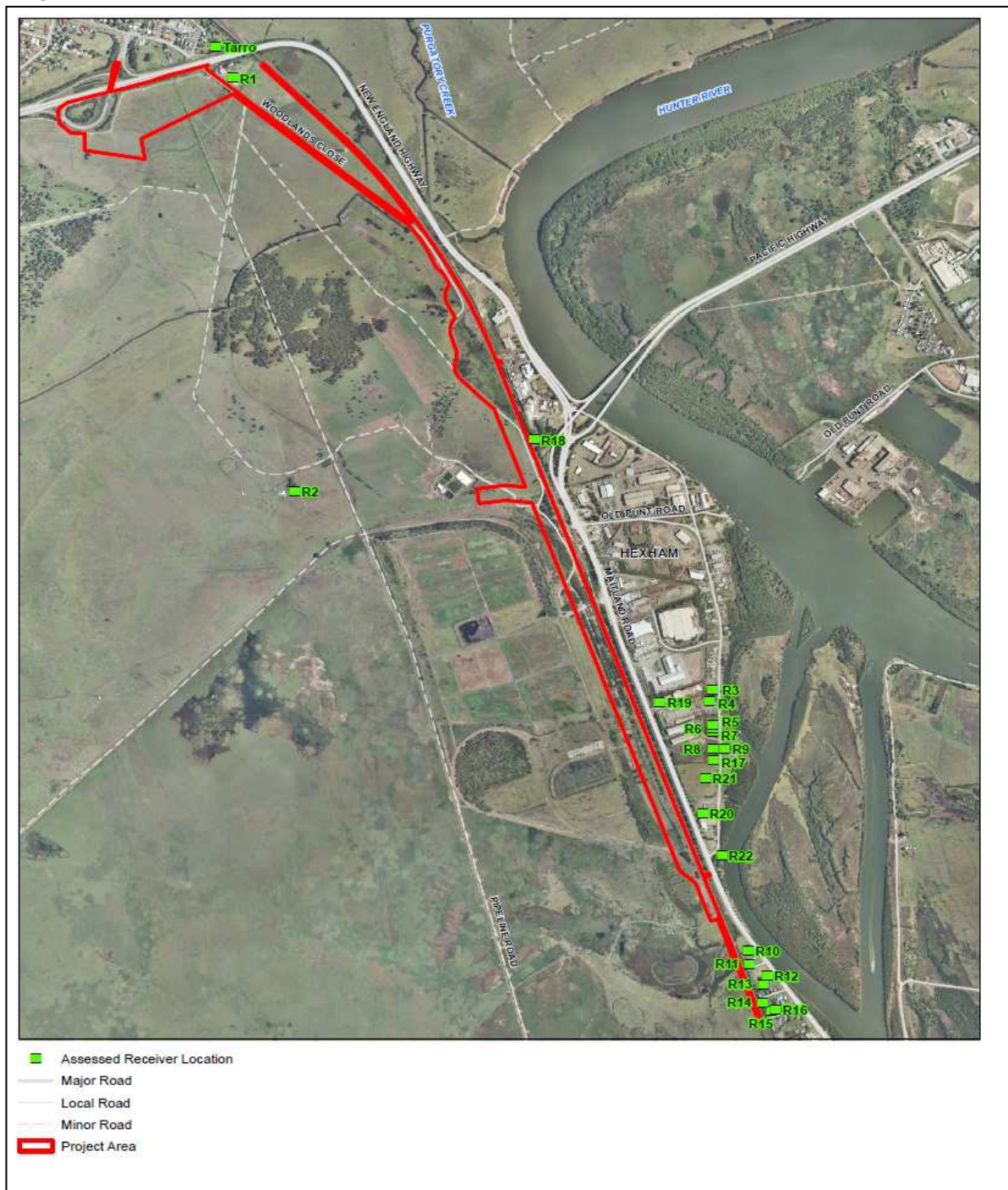
5.2.1 Construction Noise and Vibration

Construction Noise

The main construction activities that would generate noise are:

- site clearing/ removal of vegetation;
- bulk earthworks, including excavation and construction of the track formation;
- track installation;
- conveyance of materials to the site via the overhead conveyor; and
- construction of the temporary access road connecting the Tarro Interchange and Woodlands Close.

Figure 9: Assessed Receiver Locations



The Proponent has advised that although the majority of construction activities would be undertaken during standard construction hours as defined in the ICNG (7:00 am to 6:00 pm Monday to Friday and 8:00 am to 1:00 pm on Saturdays), some out-of-hours works are proposed (for example, during rail possessions). To assess the level of noise impacts on sensitive receivers, the Proponent adopted the ICNG Noise Management Level (NML) of “Rating Background Level + 10 dB (A) LAeq (15 minute)” for standard daytime hours and the more stringent NML of “Rating Background Level +5 dB (A) LAeq (15 minute)” for work outside of the standard hours.

The modelling results predict that during standard daytime hours, compliance with the NMLs is generally predicted at most sensitive receivers except for the following:

- exceedances of 1 dB(A) at the residential receiver locations R10 and R11 (Clark Street) and 6 dB(A) at R8 and R9 (Old Maitland Road) resulting from vegetation clearing;
- an exceedance of 1 dB(A) at the residential receiver location R8 consequent to rail tamping works;
- an exceedance of 1 dB(A) at Foreshore Reserve (R22) resulting from vegetation clearing; and
- exceedances of up to 16 dB(A) at the commercial receiver locations R18 and R19 due to vegetation clearing and by up to 8 dB(A) due to track work installation.

In regard to out-of-hours works, NMLs are predicted to be exceeded by up to 13 dB (A) at R1 (residence on Woodlands Close) consequent to utilities works, and by up to 9 d (BA) at R8 and R9 due to vegetation clearing. At receiver locations R10, R11, R12 and R13 (Clark and Merchant Streets), vegetation clearing is predicted to result in noise levels exceeding the NML by up to 12 dB (A) while rail installation and tamping works are predicted to result in noise levels of up to 11 dB (A) above the NML.

Higher level exceedances (up to 16 dB(A) above the NML) are predicted to occur at commercial receivers as a result of vegetation clearing. However, the Department acknowledges that many of the commercial premises would not be operational during the proposed periods of out-of-hours works and hence the potential for adverse impacts on the acoustic amenity of such receivers would be limited.

The results of the modelling indicated that there is the potential for sleep disturbance to be experienced at the nearest receivers on Woodlands Close, Old Maitland Road, Clark Street, Merchant Street and Fenwick Street where vegetation clearing, utility works, excavation works, track installation and rail tamping occur during the night time.

The supplementary modelling undertaken for the proposed design amendments indicates that noise levels generated by the construction of the temporary construction access road would comply with the construction NMLs at R1 (the nearest residential receiver) during standard hours and out-of-hours works. The operation of the overhead conveyor across the rail corridor to transport construction material could increase noise levels by around 1 dB (A) to 3 dB (A) LAeq (15 minute) when it is used simultaneously during other construction activities. However, this is not considered to be a significant additional impact in the context of the above predictions. Further, the Department notes that whilst it may slightly increase noise levels, it would represent a positive impact in that it would reduce the number of vehicles accessing Woodlands Close, by providing direct access off the Pacific Highway.

It is understood that the predicted noise exceedances represent the worst-case maximum impact scenarios, where in actuality the duration of work and intensities of noise is likely to be shorter and less intense, and the noisiest activities would not occur for the entire construction period.

It should be noted that it is often not possible for linear infrastructure projects to minimise construction noise levels to consistently meet the recommended NMLs at all sensitive receivers. As a result, NMLs are not strictly applied, but rather represent the point at which reasonable and feasible management and mitigation measures are to be implemented to minimise noise impacts. Consequently, in accordance with the approach set out in the ICNG, the Proponent intends to manage rather than completely mitigate unavoidable noise impacts and implement a range of mitigation and management measures based on best management practice and community engagement. This approach is consistent with that

adopted by rail operators on other large-scale infrastructure projects constructed in Sydney and other areas of NSW.

The noise management measures committed to by the Proponent include:

- the implementation of quieter construction methods, where feasible and reasonable (e.g. use of bored piles rather than impact-driven piles);
- locating potentially noisy activities away from sensitive receivers, where possible;
- maximising the separation distance of fixed equipment (e.g. generators and compressors) from sensitive receivers;
- where measured noise levels exceed the NMLs, fitting dominant noise generating mechanical plant with noise mitigation controls such as engine shrouds;
- avoiding simultaneous use of loaders, bobcats, excavators and rail tampers, where possible; and
- shutting down of equipment when not in use.

The Proponent's intent to manage noise impacts has been reinforced in the recommended infrastructure approval which includes a condition requiring the Proponent to implement all reasonable and feasible noise mitigation measures with the aim of achieving the NMLs. Where NMLs are exceeded, the Proponent is to manage noise impacts in accordance with the Construction Noise and Vibration Management Plan for the project. This Plan must detail the proposed noise management and mitigation measures, including scheduling of works to minimise noise impacts and respite periods. The Department also has recommended that the Proponent be required to implement a complaints handling procedure which includes measures for responding to construction noise complaints.

In addition, the recommended conditions of approval require the Proponent to consult with potentially noise-affected community, religious and educational institutions and, where feasible and reasonable, ensure that noise generating construction works are not timetabled during sensitive periods, unless other appropriate arrangements are made.

In order to minimise potential noise impacts on sensitive receivers, the Department has recommended a condition of approval which restricts construction activities to standard construction hours, being 7:00 am to 6:00 pm, Monday to Friday, and 8:00 am to 1:00 pm on Saturdays, unless certain circumstances exist. Such circumstances include, but are not limited to:

- where the works generate noise that is less than 5 dB(A) above the rating background level at a sensitive receiver;
- where a negotiated agreement has been reached with affected receivers; or
- where works are approved through an Environment Protection Licence (including rail possessions).

The Proponent generally proposes construction activities to be carried out during the above standard construction hours but has identified that there would be a need for some works to be undertaken outside of these hours for technical, mandatory or unforeseen reasons, including works by utility providers, structural works, asphalt works and lighting. In particular, as rail-related construction work is required to be carried out in close proximity to an operational rail network the need for work to be undertaken outside of standard hours often arises. In many cases, work that needs to be carried out safely in close proximity to the live rail network can only be undertaken during periods of scheduled track work (i.e. rail possessions) which are typically scheduled during periods of lower rail usage (i.e. overnight, weekends and holiday periods).

The Department recognises that there will be circumstances when flexibility in working hours is warranted, such as the circumstances outlined above. The Department has assessed the Proponent's justification for works to be undertaken outside of standard hours, and the proposed management and mitigation measures. The Department considers the request to be generally justified to ensure the safe and efficient delivery of the project, provided that suitable management measures are implemented and the relevant affected community is properly consulted in accordance with the recommended Construction Noise and Vibration Management Plan. The one exception to this is the undertaking of vegetation clearing outside of standard construction hours. The Department is of the opinion that the Proponent has not provided sufficient justification as to why this activity would need to be undertaken outside of the standard hours unless it is immediately adjacent to the existing rail lines and therefore could only be undertaken during a rail possession. Consequently, the Department has recommended a condition requiring the Proponent to prepare, and submit to the Director-General, a Rail Possession Plan which details the activities to be undertaken during a rail possession, a construction noise and vibration statement, and a consultation and notification process for impacted receivers. The Department has also limited works during rail possessions to those necessary to facilitate critical work on or in the immediate vicinity of the rail line which cannot be undertaken otherwise due to safety issues.

The Proponent has also assessed the potential for cumulative construction noise impacts of the project with the proposed Aurizon TSF at the four closest residential receivers – R1 (Woodlands Close), R2 (off Woodlands Close), R5 (Old Maitland Road) and R12 (Merchant Street). The assessment found that there is the potential for concurrent impacts to occur and for the cumulative noise impacts to exceed NMLs at R5 and R12 during standard construction hours and at all assessed receivers outside of the standard hours of construction. To address this, the Department has recommended a condition that requires the Proponent to develop a protocol with Aurizon to coordinate works to minimise cumulative noise impacts.

In summary, the Department acknowledges that construction noise can create nuisance for the community and that there would be some exceedances of the project NMLs. However, noise impacts associated with large infrastructure projects are unavoidable and need to be managed, rather than completely mitigated. Overall, the measures put forward by the Proponent represent best practice and, along with implementation of the recommended conditions of approval, are likely to prove effective in managing noise.

Construction Vibration

Vibration has the potential to impact surrounding sensitive receivers during construction from the use of large fixed and mobile plant including vibratory rollers, excavators, bulldozers, hydraulic hammers and pile drivers.

The Proponent has derived safe working distances based on applicable criteria in *Assessing Vibration: A Technical Guideline* (Department of Environment and Conservation, 2006), Vibration Dose Value for perceptible human disturbance and Peak Particle Velocity for cosmetic damage. Based on the outcomes of modelling, the Proponent has determined that vibration-generating construction activities would meet the applicable vibration criteria at the majority of surrounding sensitive receivers, except where vibratory roller operations occur within 30 metres from a residence. In such cases, the daytime and night-time peak particle velocity criteria may be exceeded.

The nearest residential receivers are located at a distance greater than 30 metres from the construction works. Notwithstanding, the Proponent has indicated that ground vibration monitoring would be undertaken at the commencement of works to determine the safe working distances for all vibration generating plant. In addition, to minimise the risk of buildings being damaged by the proposed construction activities, the Proponent proposes to

undertake baseline condition surveys of residences on Clark Street, Fenwick Street, Merchant Street and at/off Woodlands Close and Hexham Station prior to commencement of construction to determine current integrity and visible damage and to manage vibration through safe working practices to prevent further or new cosmetic damage.

The Department is satisfied that the Proponent's assessment has demonstrated that vibration generated during the construction period would have minimal impact on human comfort levels, and that through implementation of the proposed management measures, can be adequately mitigated. To ensure any residual impacts are effectively managed, the Department, in consultation with the EPA, has recommended:

- vibration criteria to provide performance standards that must be achieved during construction works;
- vibration monitoring during construction to ensure vibration levels remain below the vibration criteria; and
- implementation of mitigation measures with the aim of achieving the relevant construction vibration criteria.

Construction Traffic Noise and Vibration

Road traffic noise levels from the New England Highway are around 70 dB (A) LAeq (1 hour) and currently exceed the day time noise goal of 60 dB (A) LAeq (1 hour) for a collector road. Pursuant to the ECRTN, construction traffic noise arising from the project should not lead to an increase in existing noise levels by more than 2 dB (A) or 65 dB (A) LAeq (1 hour). Construction-traffic generated noise of the proposed temporary construction access road and Woodlands Close should not exceed the noise goal of 55 dB (A) LAeq (1 hour) at surrounding receivers during standard construction hours and 50 dB (A) outside standard construction hours as the project represents a development with the potential to create additional traffic on local roads.

Predicted construction traffic noise impacts were derived from the total construction hourly road traffic movements for the project predicted at the façade of the residence at 1 Woodlands Close, as this is the closest receiver to the construction traffic route.

The assessment found that construction traffic noise would comply with road traffic noise goals for all arrivals, departures and deliveries at all times although some short-term noise from air braking and tailgates may be intermittently audible above existing ambient noise levels. To address this issue, and to minimise construction road traffic noise overall, the Proponent has indicated that it would ensure that signposted traffic speeds are adhered to and all drivers would implement responsible driving practices to minimise unnecessary acceleration and braking events. The Department supports this commitment and has recommended that measures for managing traffic noise are incorporated into the Construction Noise and Vibration Management Plan.

5.2.3 Operational Noise and Vibration

Potential operational noise and vibration impacts were raised as a key issue by Newcastle City Council and in approximately 7% of the public submissions, including submissions from special interest groups. The submissions raised concern about increased rail noise resulting from increased trains operating on the rail lines as well as noise from idling trains.

As previously noted, operational noise impacts were assessed in accordance with the IGANRIP. The IGANRIP sets rail noise trigger levels for "new rail development" and "redeveloped rail lines" for sensitive land uses. The noise trigger levels are applied to enable an assessment of noise impacts and consideration of reasonable and feasible mitigation and management measures and are not mandatory targets to be strictly adhered to.

In accordance with the IGANRIP, the nearest residential receivers to the project that are currently exposed to rail noise levels greater than the “new rail development” noise trigger levels have been assessed as “redeveloped rail line” (R10 to R15 and R23 to R25). Where existing rail noise is below the “new rail development”, noise impacts at sensitive receivers have been assessed as “new rail line development” (R1 to R9 and R16). Rail noise trigger levels for other non-residential sensitive land uses (R17 to R22) have been applied in the noise catchment area in accordance with the IGANRIP.

Consistent with the IGANRIP, potential noise impacts have been assessed for operations at project opening (in 2014) and for future operations in 2024, based on the projected increase in freight and passenger rail movements on the Hunter Valley network. The outcomes of the assessment indicated that:

- for both the ‘at opening’ (2014) and ‘future’ (2024) operating scenarios, IGANRIP compliance is predicted at all residential, commercial, recreation (passive and active) receivers and land uses, and so no noise mitigation and management measures are required to reduce and control rail noise impacts;
- as the project increases the separation distance between the Up and Down Coal lines to receivers east of the rail corridor, a slight decrease in existing rail noise would be achieved at 7 residential receivers on Clark Street, Merchant Street, Fenwick Street and Woodlands Close; and
- at the church on Old Maitland Road, noise impacts from the ‘at opening’ (2014) and ‘future’ (2024) operating scenarios would trigger the IGANRIP noise goals by up to 3 dB(A).

To allay concerns raised in submissions regarding operational noise impacts, the Department has recommended that the Proponent prepare an Operational Noise and Vibration Review (ONVR) in consultation with the Department and the EPA. The overall purpose of the ONVR will be to verify the predictions made in the operational noise and vibration assessment and to identify noise and vibration control measures (both at source and property treatments) that would be implemented in the detailed design of the project to meet the IGANRIP noise trigger levels, including the church on Old Maitland Road. The Department has also recommended that the Operational Environmental Management Plan for the project detail the proposed measures for ongoing monitoring and management of operational noise impacts. The requirement for an ONVR and ongoing monitoring is consistent with the recommendations of the EPA.

Further, the Department has recommended a condition of approval requiring the Proponent to design and operate the rail line components of the project with the objective of not exceeding airborne noise trigger levels at all existing and approved developments.

A large number of the public submissions called for the construction of a noise barrier and property treatments (double glazing and mechanical ventilation) to minimise noise impacts to residents in Hexham. Consequent to the noise modelling indicating that the operational noise criteria would be complied with at Hexham residences, the Department considers that the request is not justifiable. However, in the event that the ONVR (or operational noise monitoring) indicates exceedances of the IGANRIP noise levels, the recommended conditions of approval require the investigation into and implementation of appropriate noise controls.

The Proponent's noise assessment addressed the potential cumulative operational noise impact of the project and proposed Aurizon TSF. The assessment concluded that the influence of the proposed Aurizon TSF operations would not result in an increase in cumulative noise levels above that of the project alone, except at one receiver in the vicinity of Old Maitland Road, which would experience an increase of 1 dB(A). Considering that this level of change is generally not perceptible, the Department is of the opinion that the

increase in noise arising from the joint operation of the two projects would not adversely impact on the acoustic amenity of sensitive receivers. The proponent for the proposed TSF project will be expected to assess and manage potentially disturbing noise characteristics in accordance with the *NSW Industrial Noise Policy* (Environment Protection Authority, 2000).

In regard to vibration impacts, the Proponent's assessment concluded that ground vibration levels associated with the operation of the project would comply with applicable vibration dose values (perceptible human disturbance) and peak particle velocity (cosmetic damage) criteria.

In regard to operational traffic noise, once operation of the project commences, only one or two light vehicles a day would access the site for maintenance activities. This would have a negligible impact on existing road traffic noise levels.

Overall, the Department is satisfied that the operation of the project would not have a significant adverse impact on the acoustic amenity of sensitive noise receivers. The Department also notes that the level of predicted impact is commensurate with other similar rail projects operating in NSW. Further, it is noted that predicted airborne noise levels in previous rail modelling projects have shown good correlation with the values measured once operations have begun.

5.3 Traffic and Access

5.3.1 Construction Traffic and Access

Construction of the project would involve the mobilisation and demobilisation of construction plant and equipment and delivery of materials to the project site. The project site is bounded by the Pacific Highway and New England Highway. Access to the project site is currently via the New England Highway and Woodlands Close.

Due to potential safety issues arising with turns into and out of Woodlands Close from the New England Highway, the RMS has advised that it would not permit construction access via Woodlands Close. Consequently, the Proponent intends to construct a temporary construction access road to provide a direct link for construction traffic from the New England via a dedicated T-intersection on Anderson Drive at the existing Tarro Interchange. The temporary construction access road would connect to both the primary construction compound and Woodlands Close (refer **Figure 4a and 4b**). The access road would be approximately 925 metres in length and 10 metres wide, and speed limited to 40 kilometres per hour.

The location and length of the access road (as described in the PIR) represents a change to the original EIS design which was only 490 metres in length and connected with Woodlands Close much further north near the New England Highway. The Department considers that the revised design is preferable in that it increases the distance between the access road and the residence located at 1 Woodlands Close with the consequent benefit of reducing the visual and acoustic impacts associated with construction traffic.

The revised T-intersection and construction access road design is supported by the RMS and Newcastle City Council. Consistent with the recommendations of the RMS and Council, the Department has recommended that the T-intersection and construction access road be designed in accordance with current AustRoad Standards and to the satisfaction of the relevant road authorities.

The construction access road has been designed to allow for shared access with the proposed Aurizon TSF and would be sealed with a two-coat seal to minimise dust and erosion. The Department has recommended that in addition to being sealed, that the road be

constructed to provide for all-weather access. The proposed design also allows for exclusive operational access for the proposed Aurizon TSF in the future, although the Department notes that this outcome would be subject to a separate assessment and approval process.

The temporary construction access road is expected to take three months to build. The RMS has specified that during this period, only light and over-sized construction vehicles (i.e. no heavy vehicle materials deliveries) required for the construction of the temporary access road and T-intersection would be permitted to access the work site off the New England Highway via Woodlands Close. Construction materials required for the road works (and other construction activities) would be delivered to the site via an overhead conveyor across the rail corridor and then transported through the project site to the road works area. The conveyor loading area would be located off the Pacific Highway at Hexham (refer **Figure 5**). The proposed access and delivery arrangements are supported by both the RMS and the Department. To ensure that access to the site and delivery of materials are as described, the Department has recommended conditions of approval that:

- restrict access to the project site via the New England Highway/ Woodlands Close to light vehicles only during the construction of the proposed T-intersection and construction access road, unless otherwise approved by the relevant road authorities (who authorise the movement of over-sized vehicles);
- restrict all construction vehicle access to the project site via the New England Highway/ Woodlands Close upon the construction of the proposed T-intersection and construction access road, unless otherwise approved by the relevant road authorities; and
- require the delivery of construction materials to the road works area site via the conveyor loading area, unless otherwise agreed by the RMS.

To ensure that truck movements associated with the delivery of materials to the conveyor area do not adversely impact on traffic on the Pacific Highway, the Department's recommended conditions require the Proponent to detail the internal vehicle movement plans for the conveyor loading area and describe the measures that would be implemented to ensure that there is no queuing of construction heavy vehicles on the Pacific Highway, including intersection arrangements. The Department has also recommended that the haulage routes to and from the conveyor loading area be detailed in the Construction Traffic and Access Management Plan.

The Proponent has indicated an intent to restrict public vehicle access to Woodlands Close during construction. The Department is of the opinion that access must be maintained for existing local residents, utility providers, and local and State government authorities at all times and has recommended a condition of approval to this effect.

It is acknowledged that there is the potential for construction heavy vehicle movements to impact on the integrity of Woodlands Close and the Tarro Interchange (Anderson Road). Consequently, the Department has recommended a condition of approval which requires the Proponent to undertake road dilapidation assessments of these roads prior to and upon completion of construction. In the event that damage has occurred, the Proponent is required to restore or reinstate the roads to the satisfaction of the relevant road authorities. The Department has also recommended that the Proponent be required to repair any road pavement failures arising from construction traffic movements no later than 48 hours following notification by the relevant road authority, to ensure that the safety of other road users is not compromised.

In regard to construction vehicle movements, the Proponent estimates that construction of the project would generate 400 vehicles per day (200 two-way vehicle movements), comprising 160 light vehicle movements and 240 heavy vehicle movements (for both the interim and temporary construction access arrangements). A traffic impact assessment was

undertaken by the Proponent to assess the construction traffic impacts of the proposal on the surrounding road network. The assessment included modelling of the cumulative impact of construction traffic generated by the project and the proposed Aurizon TSF on peak hour traffic volumes, intersection performance and mid-block level of service.

Operational conditions within a traffic stream or mid-block (including for example, speed, travel time, and driver manoeuvrability) and at an intersection (average delay) are defined in terms of "Level of Service". There are six Levels of Service, designated from A to F, with Level of Service A representing the best operating condition and Level of Service F, the worst. The results of the traffic assessment indicated that the T-intersection at the Tarro Interchange would:

- operate at an acceptable Level of Service of "A" during the AM and PM peak hours (i.e. 6:00 am to 7:00 am and 6:00 pm to 7:00 pm) for the project-related construction traffic generation peak; and
- operate at a Level of Service "B" during the background road traffic peak in the morning (7:30 am to 8:30 am) and a Level of Service "A" during the background road traffic peak in the afternoon (3:30 pm to 4:30 pm).

The cumulative impact assessment concluded that the performance of the intersection would remain as above during the overlap in construction with the project and proposed Aurizon TSF.

Further, the right turn lane on Anderson Drive at the T-intersection would be sufficient to accommodate construction traffic waiting to turn right on the temporary construction access road, without interrupting traffic on the adjacent northbound through lane on Anderson Drive, not only during the construction of the project but also during the overlap in construction with the proposed Aurizon TSF. In addition, motorists would have adequate sight lines along Anderson Drive in negotiating the intersection, contrary to concerns raised in public submissions.

The mid-block analysis indicated that Anderson Drive and the temporary construction access road would operate at a Level of Service "B" or better during both the project-related construction traffic generation peak and background road traffic peak during the AM and PM peak periods. However, during the overlap in construction with the proposed Aurizon TSF, the Level of Service would decline to "C" on Anderson Drive north of the construction access road during the peak AM combined construction traffic generation peak and to "B" during the PM peak hour on Anderson Drive south of the construction access road and westbound along the construction access road.

The proposed construction traffic would have a negligible impact on traffic volumes on the New England and Pacific Highways. The number of construction heavy vehicles associated with the project would equate to approximately 0.4% of the total vehicle traffic on the New England Highway and 0.15% of the total vehicle traffic on the Pacific Highway at this location. The existing heavy vehicle traffic accounts for approximately 15% and 10% of the total traffic volumes on the New England and Pacific Highways, respectively.

Overall, the project-specific and cumulative construction traffic impacts are considered manageable and would have minimal impact on the existing regional and local road networks. Notwithstanding, the Department acknowledges the concerns raised in public submissions regarding potential traffic impacts and proposed haulage routes, and has consequently recommended that the Proponent prepare a Construction Traffic and Access Management Plan and that the Plan include:

- details on the construction traffic haulage routes;
- vehicle movement plans and traffic control plans;

- details on the traffic management measures and key warning signage to be installed at the proposed T-intersection at the Tarro Interchange regarding the changed traffic arrangements and warning of construction vehicle movements;
- a driver code of conduct; and
- measures to be implemented to allow access by local residents, utility service providers and local and State government authorities in the event that access to Woodlands Close from the New England Highway is restricted.

The traffic assessment concluded that the presence of construction personnel and haulage trucks are unlikely to impact on existing public transport services, passenger rail services and freight movements along the Hunter Line, and cycling access. However, changes to pedestrian access may be required at Woodlands Close and along the Pacific Highway adjacent to the conveyor loading area. Although the Proponent is yet to finalise the measures required to ensure safe access by pedestrians, the Department is of the opinion that the recommended conditions of approval adequately require for this matter to be addressed and resolved prior to the commencement of construction.

In regard to concerns raised by Newcastle City Council with regard to parking, the Proponent has indicated that parking would be made available for construction staff at the primary construction compound as well as in the overhead conveyor area. Each parking area would accommodate up to 40 light vehicles (i.e. 80 in total). Approximately 40 light vehicle parking spaces would also be provided within the mid-site compound footprint. As such, no on-street parking would be required for construction staff.

In summary, the Department is satisfied that the Proponent has undertaken a rigorous assessment of the traffic and access impacts associated with the construction and operation of the project, and that the concerns raised in the public submissions have been adequately addressed in the Proponent's Preferred Infrastructure Report and through the Department's recommended conditions of approval. Further, implementation of the conditions of approval will minimise the potential for construction traffic to have an unacceptable level of impact on the safety and operation of the road network and other road users.

5.3.2 Operational Traffic Access

Operational traffic would be limited to maintenance vehicles. The Department acknowledges that traffic volumes associated with the maintenance of the project would be minor (currently estimated at two vehicles per day) and easily accommodated within the capacity of the existing local and regional road network.

Once the project is operational, access to the relief roads is proposed to be via the new T-intersection (Tarro Interchange) and construction access road, subject to agreement with the asset owner. Alternatively, the site would be accessed via the New England Highway and Woodlands Close.

5.4 Flooding

5.4.1 Existing Flood Behaviour

The project area is located within the broad floodway of the Hexham Swamp Nature Reserve and is categorised as predominantly "floodway" (with areas of "flood fringe") under the *Newcastle City-Wide Floodplain Risk Management Study and Plan* (BMT BMW, 2012). Flooding within the Hexham area is primarily controlled by the raised embankments of the Pacific and New England Highways, along with areas of land-raising in the commercial and industrial areas of Hexham.

Flood events are commonly described in terms of the Annual Exceedance Probability (AEP) i.e. the likelihood of occurrence of a flood of a given size or larger occurring in any year. The Hexham area is essentially flood free at the 10% AEP event (refer **Figure 10a**), with flooding confined largely within the Hunter River and floodplain to the north and east of the existing rail embankment. There are, however, some flow connections to the Hexham Swamp Nature Reserve (refer **Figure 11** for location of Hexham Swamp) via the Purgatory Creek and Iron Bark Creek culverts during such an event. The main overbank flow path from the Hunter River is at the Hexham Bridge with a second path located north of the bridge.

At the 5% AEP event, overtopping of the Pacific Highway occurs at Hexham Bridge and Purgatory Creek with flows spilling from the Hunter River into the Hexham area (refer **Figure 10c**). Some of this flow is directed south along the Pacific Highway and back towards the river and some of the flow heads west through the Oak Milk site into the drainage channel adjacent to the existing railway. The other major flow out of the river is across the New England Highway and into the Hexham Swamp to the north of the Hexham area. The flood depths in the vicinity of the Oak Milk site are around 0.8 metres and the depths reach a maximum just to the south-east of the Hexham Bridge flyover at one metre.

At the 2% AEP event waters spill over the New England Highway and into Hexham Swamp in the vicinity of Purgatory Creek (refer **Figure 10e**). In addition, the Pacific Highway is also overtopped between the southern end of the Hexham industrial area and Ironbark Creek. Flow paths progress through the local industrial and commercial properties before spilling over the existing railway and into Hexham Swamp.

For the 5% and 2% AEP flood events, flood flows between the Hunter River and the Hexham Swamp are partially impeded by the existing development through the Hexham area.

At the 1% AEP event the Hunter River and Hexham Swamp become a fully connected system and flood levels are governed by the available flood storage across the floodplain and the downstream tidal condition at the time of the flood peak (**Figure 10g**). The 1% AEP design flood event is typically used as the flood-planning event for development control.

Overall, the general flood extent and behaviour is similar for each event, albeit with the severity of flood depths and velocities increasing with event magnitude.

5.4.2 Off-site Flood Impacts and Mitigation

An assessment of the potential flood impacts associated with the project was undertaken by the Proponent as part of the EIS. This assessment indicated that the proposed relief roads and associated temporary construction access road have the potential to increase local flood levels and consequently impact on neighbouring properties as well as businesses in Hexham. Although the project in its entirety would have limited impact on regional flood behaviour, the localised impacts were of sufficient magnitude to require mitigation.

Consequent to concerns raised by the Department, OEH, Newcastle City Council and in public submissions regarding flood impacts, the Proponent undertook an assessment of feasible mitigation measures and based on these determined that the best solution was to revise the design of the project. The revised design includes lowering the tracks over a total distance of approximately 820 metres between chainages 175680 and 176500. The tracks would be lowered by approximately 1.2 metres over a 340 metre section on either side of chainage 176090 and gradually grade back to previous levels (refer **Figure 6**). The tracks would have a maximum elevation of 1.8 metres AHD which is similar to the existing track at approximately 2.0 metres AHD.

Figure 10a: 10% AEP Peak Flood Depths Existing Conditions

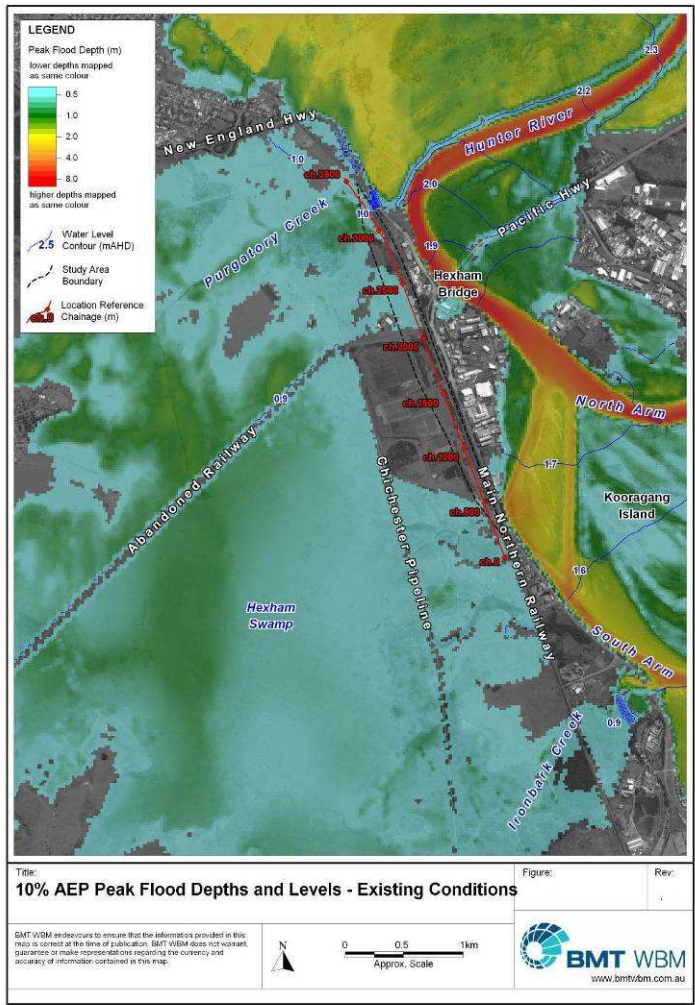


Figure 10b: Impact of Project on 10% AEP

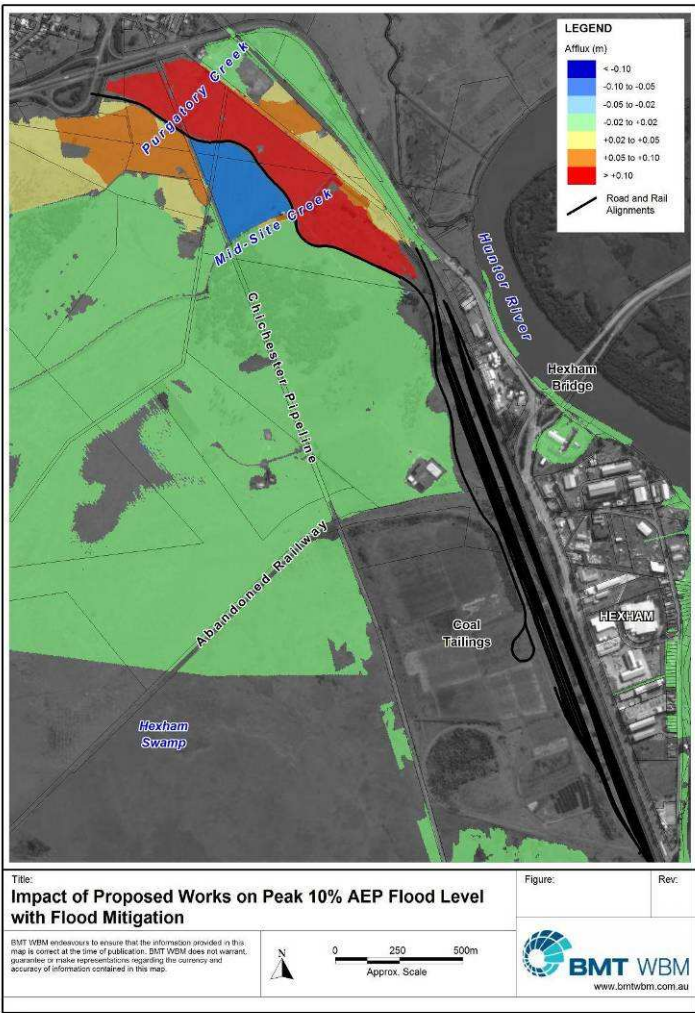


Figure 10c: 5% AEP Peak Flood Depths Existing Conditions

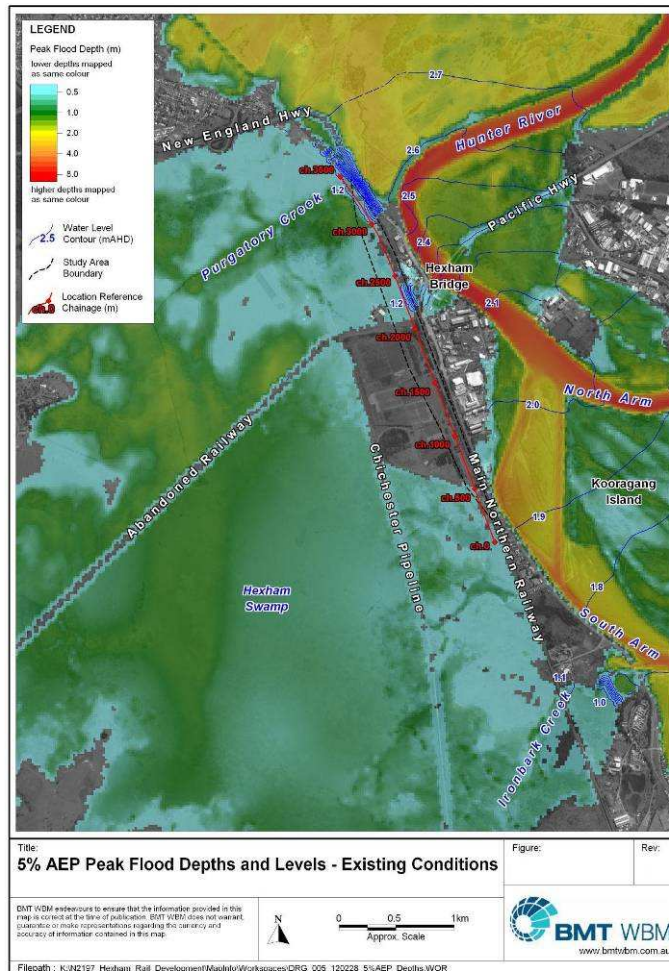


Figure 10d: Impact of Project on 5% AEP

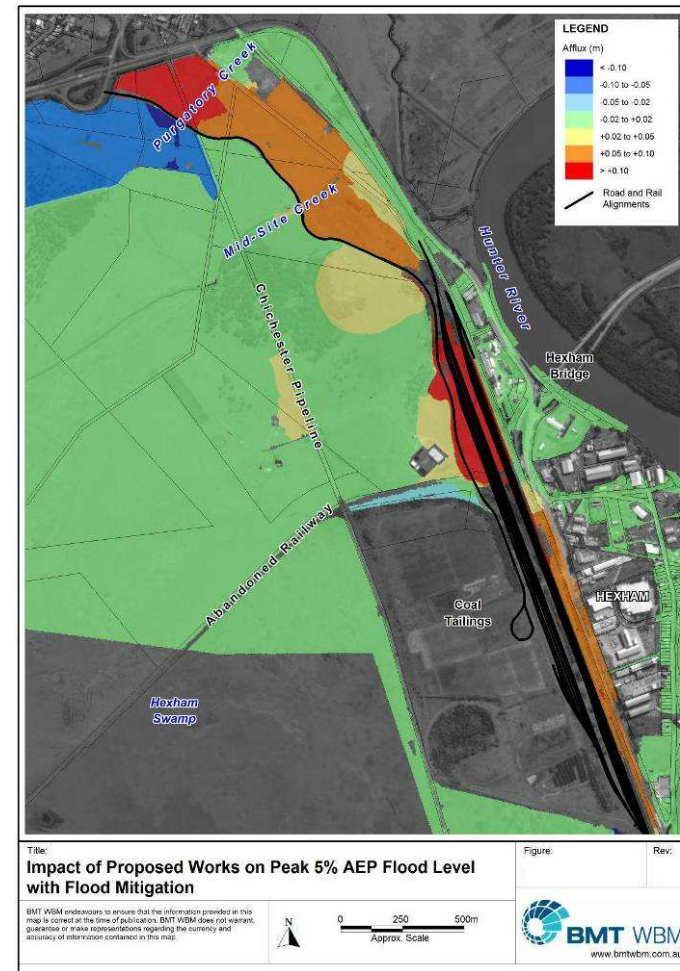


Figure 10e: 2% AEP Peak Flood Depths Existing Conditions

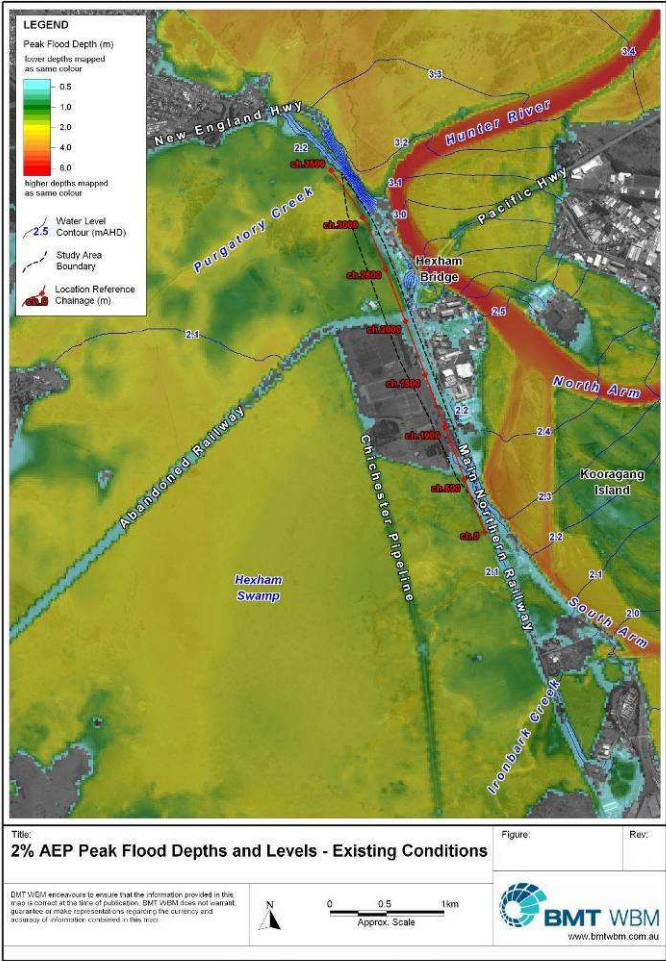


Figure 10f: Impact of Project on 2% AEP

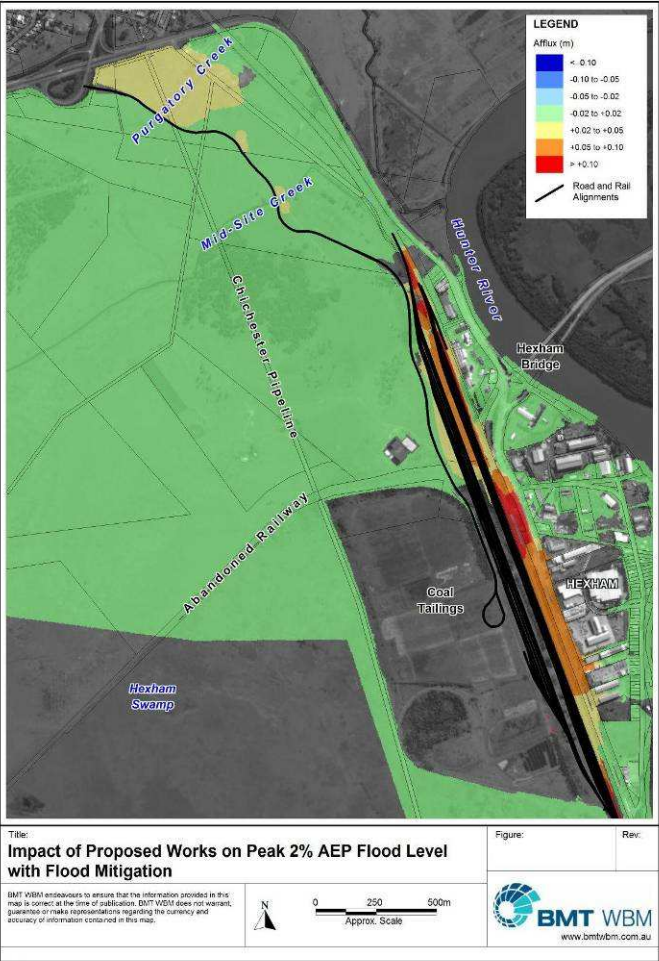


Figure 10g: 1% AEP Peak Flood Depths Existing Conditions

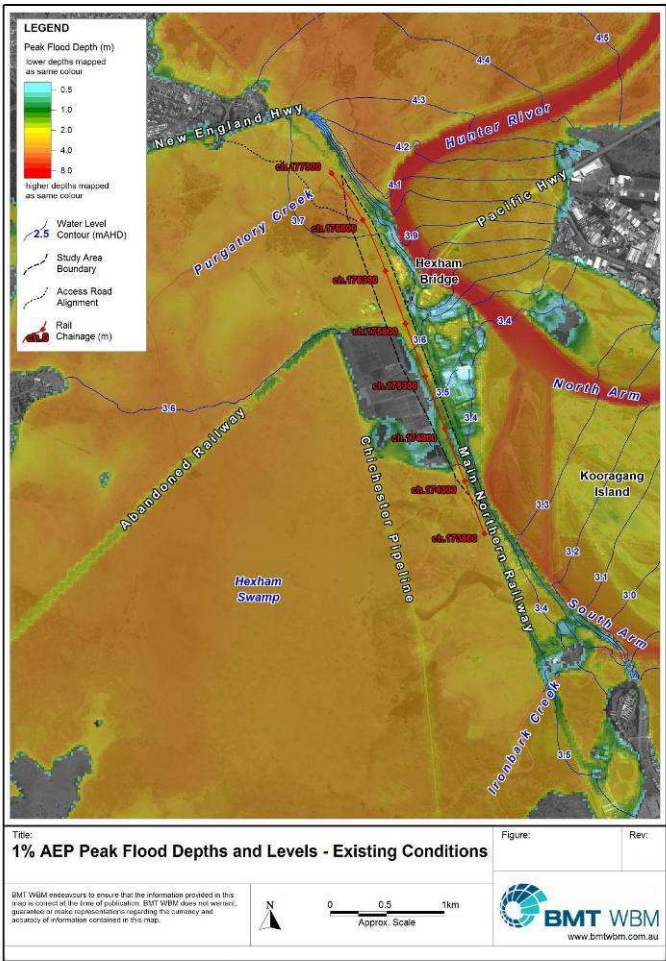


Figure 10h: Impact of Project on 1% AEP

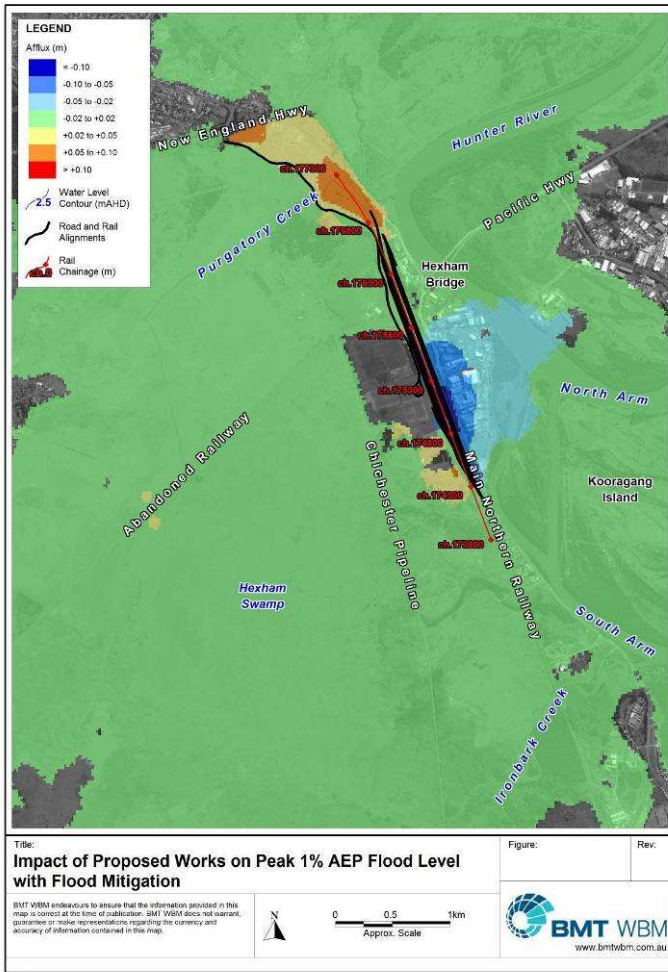
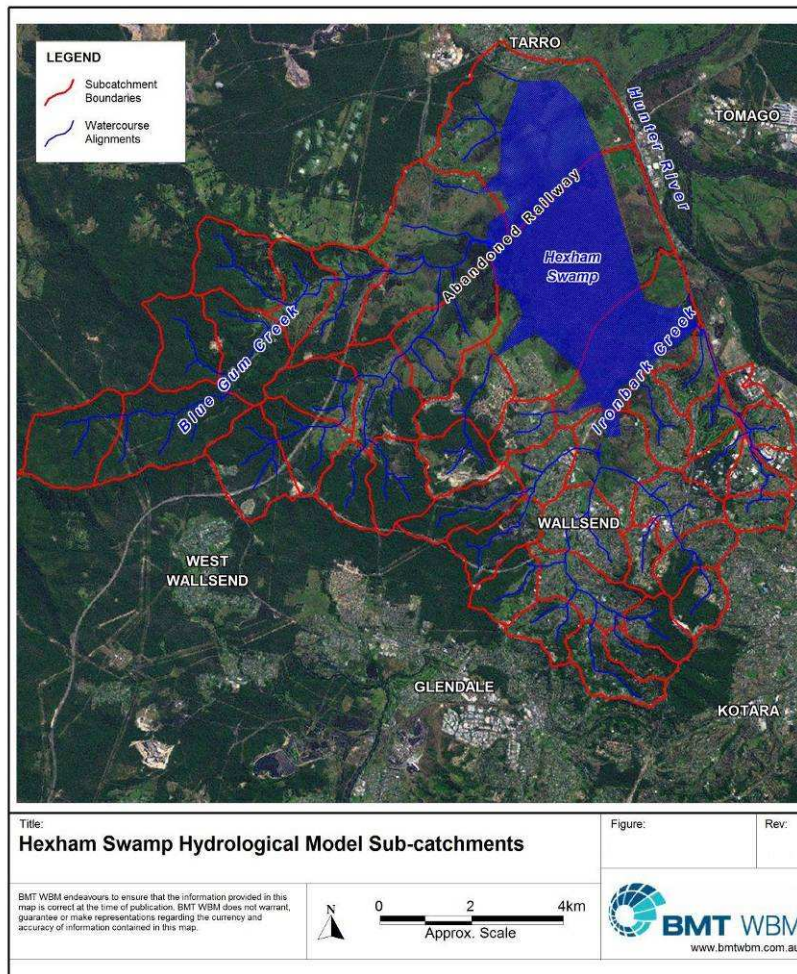


Figure 11: Location of Hexham Swamp

The revised design also included lowering of the elevation of part of the temporary construction access road to around 1.4 metres AHD over a length of 300 metres and lowering a 100 metre length to around 1.6 metres AHD (see **Figure 6**). This is comparable to the levels of Woodlands Close which serves to limit the extent of upstream flood events.

The adequacy of the flood mitigation solution was then tested using a detailed local flood model to determine potential flood impacts on surrounding properties. The assessment considered flood events from the 10% AEP event to 1% AEP event and the probable mean flood (i.e. the largest flood that could occur), as recommended by the *NSW Floodplain Development Manual*. The 20% AEP event was not modelled as the Hunter River remains principally in-bank under such an event. The assessment analysed the cumulative impact of the project and proposed Aurizon TSF and also took into account the F3 Upgrade and climate change considerations.

In regard to the cumulative impacts of the project, the proposed Aurizon TSF and F3 upgrade, modelling was only undertaken for the 1% AEP event as this is the flood-planning event for development control. As the proposed F3 level sits higher than the proposed temporary construction access road level, the F3 embankment becomes the critical control point on peak flood levels upstream. The impact of the proposed access road is effectively drowned out such that increases in the peak flood levels are largely attributed to the F3 embankment. Consequently, the Proponent restricted its assessment of cumulative impacts to the project and proposed Aurizon TSF.

The modelling undertaken by the Proponent indicated that lowering of the train tracks would significantly reduce flood impacts to existing property and businesses and would have negligible impacts for the 10% AEP event (refer to **Figure 10b** for increases in flood levels consequent to the amended design). Based on the modelling predictions, there would be no change in flood categorisation for the Hexham area. In addition, no changes to the flood frequency or duration on adjoining properties were identified to occur, as these characteristics are controlled by flood levels in the Hunter River.

The model also predicted that cumulative impacts on the peak flood levels in Hexham resulting from the construction of the train tracks would be largely restricted to the existing road and rail corridors to the east of the project and the south-east section of the Tarro Interchange. Flood flows through this corridor spill over the existing railway in the vicinity of the coal tailings. For flood events in the order of a 5% AEP to 2% AEP, the peak flood levels along the existing rail and road corridor are predicted to increase by 0.05 metres to 0.1 metres. Increases in flood levels (or afflux) of up to 0.05 metres are predicted to occur on undeveloped land of adjoining properties during the 5% AEP and 2% AEP flood events (refer **Figures 10d and 10f**).

At the 1% AEP event, the peak flood levels in the corridor are predicted to decrease by 0.05 metres to 0.1 metres due to the minor redistribution of flood flows under such events (refer **Figure 10h**).

In terms of impacts to the highway infrastructure, the Department acknowledges that changes in flood frequency and duration are more important than impacts on the peak flood level. The project (and proposed Aurizon TSF) will not have a significant impact on flood frequency or duration for either the Pacific or New England Highways or overtopping of the highways, as these events are controlled by the flood levels in the Hunter River. There are modelled flood level increases of up to 0.1 metres along Woodlands Close arising from the construction of the project and proposed Aurizon TSF. However, the Department notes that the frequency and duration of flooding will not be impacted as this is controlled by flood waters spilling across the New England Highway some one kilometre north of the Hexham Bridge.

Flood impacts to local housing are predicted to be restricted to a single property (1 Woodlands Close, Hexham) where there is a modelled peak flood level increase of under 0.05 metres at the 1% AEP event and up to a 0.02 metre increase at the 2% and 5% AEP events where the residence is located. Consequently, the Department has recommended a condition of approval requiring the Proponent to consult with the affected landowner to develop and agree upon measures for managing and/or mitigating flood impacts to the residence located on the property.

At other residential locations in the vicinity of the project the predicted flood impacts are negligible.

The flood impacts to local businesses (industrial and commercial) and residences in Hexham are also predicted to be negligible. Although there is the potential for increased flood levels along the Pacific Highway (0.05 to 0.1 metres), the businesses along the Highway are elevated on ground raised above the 2% AEP flood level. Flood level changes associated with the project and proposed Aurizon TSF were assessed against known floor level data for many of the properties in the Hexham area. The modelling indicated that there are no newly flooded floor levels for all of the flood events analysed (10 year, 20 year, 50 year, 100 year and probable mean flood). However, in some cases the depth of inundation changes from between 0.01 and 0.03 metres.

At the 1% AEP event when businesses are potentially flooded, there is a reduction in peak flood levels due to the minor flow redistribution.

In light of the Department's, agencies' and public concerns regarding the potential impacts of the project on flooding, the Department commissioned an independent review of the flood assessment. The review was undertaken by the Water Research Laboratory, School of Civil and Environmental Engineering, University of New South Wales. The review concluded that:

- the local (four metre grid) model used in the assessment of flood impacts associated with the revised project design is a reasonable representation of existing design flow behaviour in the Hexham area;
- the 40 and four metre grid models used in the assessment are useful in determining the relative impact and magnitude of the cumulative impacts of the project and proposed Aurizon TSF on flood levels;
- the models have utilised the best available information on flooding and the interpretation and application of the information is sound;
- the numerical flood modelling approach used to assess the likely impacts of the project and proposed Aurizon TSF on flooding is sound;
- the predicted flood impacts are indicative of the likely impacts; and
- the proposed lowering of the train tracks to minimise flood impacts is an acceptable approach.

However, the Review noted that inconsistencies in the flow distributions and flood gradients between the regional scale (40 metre) grid model and local scale (four metre) grid model, along with the lack of suitable historical flood data in the Hexham locality to benchmark the model, suggests that the models are effectively un-validated in the vicinity of the proposed project site. Consequently, the accuracy of the predicted peak flood levels appears to be uncertain in Hexham nearby the proposed project. Given this uncertainty, the predicted extent of inundation and the number of properties affected is also uncertain.

In light of the potential uncertainties relating to peak flood levels, the Department has recommended a condition of approval which requires the Proponent to design and construct the project so that it does not result in increases in flood levels on adjacent lands and on road and rail corridors greater than the levels predicted in the flood assessment. Limiting flood afflux to these levels would minimise the potential for adverse flood impacts to arise. The Department has also recommended that the Proponent compare the actual extent, level and duration of future 1%, 2%, 5% and 10% AEP events against the predicted modelling impacts. Where impacts are found to exceed the predicted outcomes and adversely impact on properties, structures and/or infrastructure, the Proponent is required to develop and implement mitigation measures to reduce future flood impacts in consultation with NoW, Newcastle City Council and affected landholders.

The duration of flooding in the area is dependent on the flood depth and the differential flood levels between the Hunter River and Hexham Swamp. The modelling shows that the duration of flooding for the area is in the order of several days for the 1% AEP event and up to a week for the probable mean flood. The predicted increases in flood depth are therefore unlikely to cause a noticeable difference in the duration of flooding as this is governed by the slow time to drain the area rather than flood depth. Notwithstanding, the Department has recommended a condition of approval which requires the Proponent to design and construct the project so that it does not increase the frequency and duration of flooding events on adjacent land.

Peak flood velocities in the Hexham area are relatively low with the modelling predicting only minor changes in velocities as a result of the construction of the project and proposed Aurizon TFS. The off-site impacts on peak flood velocities for the modelled events were

determined to be insignificant. However increases of up to 0.5 metres per second may be experienced along the existing railway for the 5% AEP event. Flood velocity increases of up to one metre per second are predicted immediately to the west of the project site where the relief roads alignment ties into the existing rail alignment and up to 0.5 metres per second along parts of the temporary construction access road. There are also localised changes of up to 0.5 metres per second associated with localised flow redistribution around the access road. The flood impacts for the probable mean flood event show some localised redistribution of peak flood velocities. Considering the predicted changes in flood velocities are relatively minor, the Department has not recommended any conditions in this regard.

In regard to the temporary construction access road, this introduces an additional topographic control. The modelling indicates that the impact of the access road on flood levels in Hexham Swamp downstream of the access road alignment would be relatively minor and in the order of 0.02 metres. The greatest impact on modelled flood behaviour would be for an event in the order of the 5% AEP event, for which peak flood levels upstream of the road alignment are typically increased by 0.05 to 0.1 metres. The impact is locally as high as 0.4 metres but this is restricted to Aurizon owned land at the western end of the access road. Impacts on private property are expected to be between 0.05 and 0.06 metres along Woodlands Close. These areas are undeveloped and flood impacts are therefore considered to be minor.

For events in the order of a 2% AEP event, flood afflux caused by the temporary construction access road would be reduced to around 0.02 to 0.03 metres, as the floodplain depths increase and the access road becomes drowned. Consequently, any associated impacts are considered negligible. At the 1% AEP event the impacts are typically around 0.05 metres and are locally as high as 0.08 metres. These impacts are driven principally by a minor flow redistribution rather than the influence of the access road.

In regard to climate change, the modelling predicted that the construction of the project and proposed Aurizon TSF would broadly have similar impacts under future flood condition scenarios incorporating climate change. The reason for this is that the design mitigation solutions are such that they effectively maintain the same flow distributions as existing conditions across the full range of design events. Based on the outcomes of the modelling, the Proponent therefore predicts that the broad flood behaviour locally in the Hexham area will be similar under climate change scenarios, although the frequency of particular magnitude events may change.

5.4.3 On-site Impacts and Mitigation

The project involves regrading of site elevations up to a level of over three metres AHD. Rail and other infrastructure situated at or above this level should remain flood free for flood events up to the order of around the 2% AEP event. However, sections of the relief roads that have been lowered for flood mitigation purposes will flood more frequently with flood waters beginning to flow over the lowered section at around the 5% AEP event.

Flood depths across the site are predicted to increase with event magnitude - over 0.5 metres for events in the order of a 2% AEP and almost two metres for an event around the 1% AEP magnitude. Modelled flood velocities across the lowered section of the relief roads are predicted to be around 0.5 metres per second for the 2% AEP event and up to 1.5 metres per second for the 1% AEP. Increased flood depths and velocities across the site have implications for the on-site rail and associated infrastructure and as such the Department has recommended that critical infrastructure such as electrical supply and equipment is elevated above the 1% AEP level and a suitable freeboard (of 500 millimetres) is provided. Extensive damage to infrastructure is likely to occur at the probable mean flood event as flood waters would be over five metres deep.

Within Purgatory Creek, local peak flood velocities are predicted to increase to around three metres per second through the access road cross drainage. To mitigate this impact, the Department has recommended that appropriate scour protection works be installed in the vicinity of the Purgatory Creek crossing.

To reduce the potential impacts of flood events during construction, the Proponent has proposed to locate compounds and stockpiles (where practicable) above the 10% AEP flood level. A large part of the proposed primary compound site is already above the 10% AEP flood level. The Proponent proposes to build up those areas of the site below this level and have buildings and stores elevated above the 10% AEP flood level. The Proponent's commitments in regard to siting of compounds and storage of materials has been reinforced in the conditions of approval.

The infilling of areas to above the 10% AEP flood level is predicted to result in a minor impact on flood levels in the vicinity of Purgatory Creek and to the west of the compound as the filling will remove flood storage from the Purgatory Creek floodplain. For the 5% AEP event, the impact will mainly remain confined to the west of the rail embankment in the vicinity of Purgatory Creek and Hexham Swamp. The predicted flood afflux for such an event is predicted to be below 0.1 metres within the site compound. For the 2% AEP and greater events, floodwaters will completely inundate the construction compound and since the compound levels will be relatively similar to existing ground levels, the resulting afflux will be below 0.02 metres. At the 1% AEP event, the Hunter River and Hexham Swamp become fully connected so the flood storage loss due to the construction compound will be insignificant compared to the total storage across the floodplain.

Although raising the elevation of the proposed compounds and stockpiles is predicted to result in some minor changes to floodplain flows in the form of minor redirections around the compounds and stockpiles, the Department notes that such activities would not block flows. To ensure that there are no long-term impacts associated with raised areas, the Department has recommended that the Construction Environmental Management Plan include measures for reinstating ground elevations to pre-construction conditions.

The Proponent has prepared a provisional Flood Emergency Management Plan for the project. Although the Plan provides procedures for managing flood risk during construction and operation, and outlines actions to be undertaken during recovery from a flood event, the Department is of the opinion that more detailed, site-specific measures are required. To ensure appropriate flood emergency response measures are in place and provide for flood risks to be effectively managed, the Department considers that the Plan should be updated upon completion of the detailed design and has recommended a condition to this effect.

In regard to the safety of on-site personnel during construction and operation, the Proponent has advised that flood warnings issued by the Bureau of Meteorology and the State Emergency Services are given 24 hours in advance for Singleton and Maitland. For large flood events, there is a lag time of around 20 hours or more between the peak flood passing Maitland and arriving at Hexham. This would provide sufficient warning of more than a day in advance of when the Hexham Swamp and project site are likely to be inundated by Hunter River flood waters and consequently provide adequate time to evacuate personnel, and relocate any equipment off site.

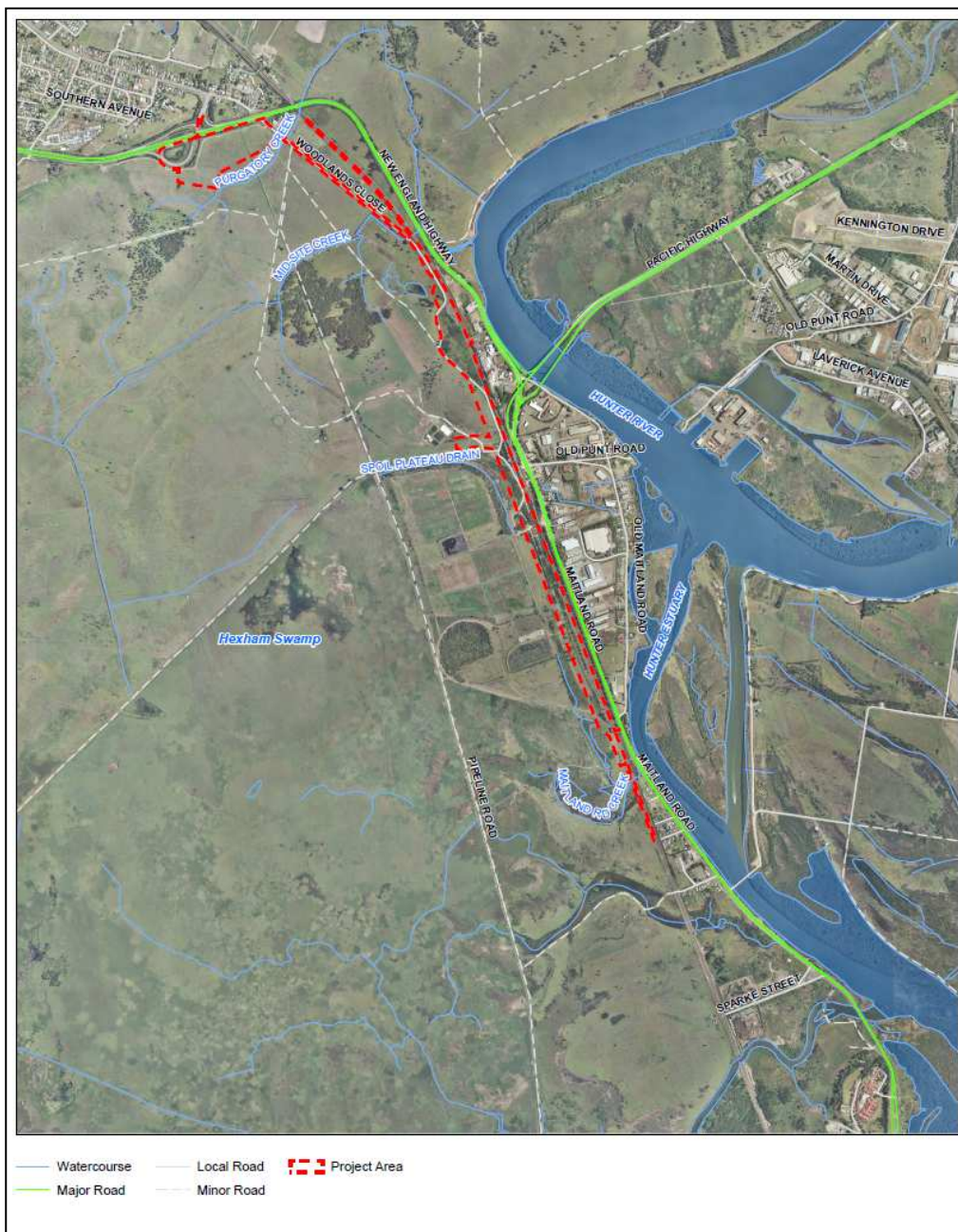
The Department is satisfied that the Proponent has undertaken an adequate assessment of the potential flood impacts and this view is supported by the Peer Review. Although the project would affect local flood behaviour, the Department considers that the degree of impact has been reduced to an acceptable level through the lowering of the train tracks and parts of the temporary construction access road as well as the other mitigation measures committed to by the Proponent and the Department's recommended conditions of approval.

5.5 Surface Water Hydrology

5.5.1 Stormwater Management and Water Quality

The project site is framed to the east by the Hunter River and is separated hydrologically into two major parts by the abandoned Minmi-Hexham railway embankment. The area to the north-west is drained by Purgatory Creek, a tributary of the Hunter River. The area to the south-east of the railway embankment is drained by a number of small intertidal streams. Three creeks drain the site from west to east into the Hunter River – Purgatory Creek and two unmade drainage channels referred to as Mid-site Channel (central region) and Maitland Road Channel (**Figure 12**). Mid-site channel discharges into Purgatory Creek just upstream from Hexham Bridge. Maitland Road Creek flows under the Highway in a culvert to discharge into the south channel arm of the Hunter River, approximately 500 m south of Hexham Park.

Figure 12: Surface Water Hydrology



The potential for construction of the project to impact on the water quality within watercourses traversing and adjacent to the project site was raised in agency and public submissions. Potential pollution sources associated with the construction of the project include spills, vegetation clearing and earthworks (both of which have the potential to result in erosion and sedimentation) and exposed acid sulfate soils. The Proponent has committed to implementing controls consistent with the controls set out in Landcom's *Managing Urban Stormwater: Soils and Construction* (2006) to manage and mitigate erosion and sedimentation. Proposed specific measures include:

- capture of sediment laden runoff and diversion to sediment control structures (such as fences, mulch bunds, rock check dams, shallow sumps and engineered sediment basins);
- provision of durable, all-weather surfaces of unsealed vehicle access tracks;
- diversion and separation of waters that flow onto the site, where practicable;
- storage of fuels, oils and hazardous substances in bunded locations above the 10% AEP flood level;
- installation of rumble gates or other vehicle wash facilities to remove soil from vehicles leaving the project area; and
- spill containment kits suitably located.

The Proponent has also committed to preparing a Soil and Water Quality Management Plan and progressive erosion and sediment control plans for individual stages of construction.

The Department considers the above as appropriate measures and has reinforced them in the recommended conditions of approval to address the concerns raised in public submissions regarding siltation of waterways and water quality impacts. Although the Proponent included additional information in the PIR in response to concerns raised by the OEH and Newcastle City Council regarding the need for additional details on stormwater management, the Department has recommended that the Proponent prepare a Construction Soil and Water Management Plan which details the measures for preventing the discharge of pollutants from the site and managing surface water runoff and leachate from acid sulfate soils, including the handling, treatment and disposal and/or reuse of captured runoff and leachate. This is consistent with the recommendations of the EPA.

As part of the operational stormwater management measures, the Proponent proposes to construct a 2.5 kilometre swale drain along the western side of the relief roads, similar to the existing drain at the site. The swale would typically be 0.5 to 1.3 metres below ground level with isolated areas of 1.6 metres and 1.9 metres depth. The swale would be constructed as a permanent feature replacing the existing network of drains within the project footprint.

Water would drain into the proposed swale through mitre drains which would collect runoff via the gabion rocks under the train tracks. The swale would be designed to accommodate the 1:50 year storm event (or 2% AEP event) and be at a gradient to ensure that there is no permanent ponding of water.

The swale would be divided into two regions – a southern flowing swale and a northern flowing swale - with a bund wall within the swale segregating and controlling the volume and rate of flow to the northern and southern halves. The southern section of the swale would discharge via a reinforced concrete pipe (similar to that of the existing drain at this location) into an existing earth channel which eventually flows into the Hunter River via a concrete lined channel under the rail and a culvert under the Pacific Highway. The northern outlet would discharge into an existing retention pond that overflows into the low-lying wetlands which drains to Mid-site Creek and then into the Hunter River. The proposed northern and southern discharge points are similar to the existing drainage swale, and would not be diverted to different receiving water catchments, hence meeting the recommendations of the

OEH. The Department has also recommended that a permanent berm be constructed along the western side of the swale to physically separate the drainage system from the proposed Aurizon TSF drainage catchments.

To ensure that discharges from the swale would not result in increased scouring or flooding, the Department has recommended a condition of approval that requires discharges from the swale to be released at a controlled rate similar to that of the existing drains. In response to concerns raised by the EPA and OEH in regard to the quality and flow of discharges from the swale, the recommended conditions of approval also stipulate that the stormwater management system shall be designed, and employ surface water management techniques, such that existing runoff volumes, and rates are maintained to pre-construction levels and there are no adverse effects to adjoining lands as a result of runoff. Further, pollutant loads from the site must be minimised and not exceed pre-construction levels. These requirements address the concerns raised by the Hunter-Central Rivers CMA and public submissions in regard to water quality impacts.

Although the design of the swale has been amended to minimise interaction with groundwater, groundwater would be intercepted at some locations due to the presence of a shallow groundwater table. The Proponent has advised that groundwater flows to the swale are expected to be similar to pre-development conditions. To avoid permanent interception of groundwater, the Department has recommended that the swale drain be designed and constructed to ensure there is no permanent interception with groundwater.

The Proponent states that discharges from the swale drain are expected to be of an improved quality (when compared to discharges from the existing drain) due to improved groundwater quality arising from the replacement of existing fill. Notwithstanding, the Department has recommended that the Proponent prepare and implement a Surface Water and Groundwater Monitoring Program, in consultation with the OEH, to monitor the quality of discharges from the swale and water quality within watercourses, and thereby confirm the Proponent's assumptions regarding water quality impacts. The Monitoring Program also requires the Proponent to identify trigger points for further investigation and contingency and ameliorative measures in the event that adverse impacts are identified. The Department has also recommended that water quality monitoring be undertaken for a period of three years following the completion of construction as a means of assessing any water quality impacts.

The Proponent has indicated that the swale drain would only be used as a drainage structure once the construction of the train tracks and internal service is complete. Use of the swale as a means of collecting and discharging runoff prior to this could result in sediment-laden discharges from the site. Consequently, the Department has recommended a condition of approval to reinforce this commitment by the Proponent.

The Department acknowledges that ongoing maintenance of the swale is required to avoid it becoming overgrown with vegetation and full of sediment. Consistent with the recommendations of the OEH, the Department has recommended that the Operational Management Plan for the project includes measures for maintaining the swale once operational.

The Department considers that provided the Proponent's mitigation measures are implemented and the recommended water management and quality conditions are adopted, the project can be managed to minimise potential water quality impacts and stormwater runoff.

5.5.2 Creek Crossings

Only one creek crossing is required for the project and this is associated with establishment of the temporary construction access road across Purgatory Creek. The Proponent has indicated that the proposed crossing would incorporate a new culvert of equivalent hydraulic capacity to the existing crossing (located immediately downstream of the proposed new crossing). Both the DPI and OEH stressed the importance of maintaining the existing hydraulic capacity and waterway area to minimise impacts on aquatic flora and fauna and maintain existing hydraulic conditions which in turn would minimise impacts on creek geomorphology. The Department has recommended a condition of approval in this regard.

Although the DPI initially raised concern regarding potential impacts on fish and invertebrate passage, and seagrass and saltmarsh habitats arising from the proposed extension of the existing culvert, it later confirmed that this was in error. As part of the preparation of the PIR, the Proponent presented the culvert design to the DPI and the DPI advised that it had no objection to the crossing, provided that the structure's invert is at or below the existing bed level. Nevertheless, concern regarding the impact of the Purgatory Creek crossing on fish passage and aquatic habitats was also raised in public submissions. To minimise impacts during construction, the Proponent has indicated that if practicable, culvert works would be scheduled during a dry period. Where it is undertaken during a rainfall event, the workspace would be isolated and the isolation designed such that it is completed within one week.

The Department recognises that there is the potential for blockages to occur during the construction of the proposed culvert. Consequently, the Department has recommended conditions of approval which require the Proponent to clear all waterway blockages arising from the construction of the project.

To minimise potential impacts on Purgatory Creek and other watercourses that traverse the project area, the Department has also recommended that:

- all temporary and permanent watercourse crossings be designed in consultation with the DPI and that Newcastle City Council be consulted on the design of the Purgatory Creek crossing (as requested by Council);
- all crossings are to be consistent with the NoW's *Guidelines for Controlled Activities, Policy for Fish Friendly Waterway Crossings* and *Policy and Guidelines for design and Construction of Bridges, Roads, Causeways, Culverts and Similar Structures*;
- riparian areas are to be restored and rehabilitated in consultation with the DPI; and
- the Construction Soil and Water Management Plan for the project detail the measures to be employed to minimise stream hydrology impacts, including measures to stabilise bank structures and details of buffer zones adjacent to waterways.

The Department considers that implementation of the recommended conditions would minimise the potential for the construction and operation of the project, in particular the crossing of Purgatory Creek, to have an unacceptable level of impact on the hydrology and geomorphology of local watercourses.

5.6 Groundwater Management

An assessment of the existing groundwater characteristics of the area was undertaken by the Proponent as part of the EIS and included drilling ten boreholes over the length of the proposed rail tracks. Following modification to the design of the relief roads, additional groundwater investigations were undertaken to assess the potential impacts associated with lowering of the train tracks and modified swale design. The groundwater investigations included assessment of groundwater quality, standing water levels, seepage velocity, hydraulic conductivity and flow patterns. The assessment also included consideration of

construction and operation of the project on groundwater dependent ecosystems and potential acid sulfate soils (PASS).

5.6.1 Hydraulic Characteristics and Impacts

The Proponent's groundwater assessment indicated that groundwater characteristics such as standing water level flow direction, seepage velocity and hydraulic conductivity have been disrupted by the placement of the rail corridor and fill, and the historical industrialisation of the eastern portion of the Hexham Wetland. Groundwater flow direction is variable and dependent on a number of conditions (including rainfall, flooding, and tidal conditions) and there is likely to be a small component of horizontal flow to the east towards the Hunter River and also west and south towards the Hexham Swamp.

Groundwater investigations indicated that groundwater levels along the project alignment range between 0.5 to 1.7 metres below ground surface (or 0.8 to 3.2 metres AHD). Variations in groundwater depth are attributable to differences in transmissivity of the existing fill, rainfall, tides and surface water flows.

Construction of the relief roads would involve the excavation of existing fill and soil to a maximum depth of approximately 2.1 metres. Excavation is proposed to be undertaken in 10 cells of equal length along the length of the formation. Once the dry cut material has been removed from a cell, a groundwater holding facility would be constructed at the lower end of the cell. Once the holding facility is complete, bulk excavation of the wet material would commence. The area would be dewatered by pumping any seepage to the holding facility. Once the cell is complete, an assessment would be made to determine if the holding facility would be retained for storage of surplus groundwater from the next cell or if the basin would be removed to complete construction of the formation in that cell.

The Proponent has indicated that during construction, groundwater drawdown immediately adjacent to the formation of the tracks may be up to 2.3 metres and 1.8 metres in wet and dry conditions, respectively, (assuming a hydraulic conductivity of one metre/day) reducing to negligible at a distance some 25 metres from the edge of the formation. To reduce the impact to groundwater levels, the Proponent has proposed a groundwater recharge strategy during construction whereby groundwater seepage into the cell under active construction would be pumped out from the holding facility in the cell and injected into the completed cell to the south of the active cell.

Although the Proponent predicts that the recharging of collected groundwater during construction would considerably reduce groundwater drawdown within the vicinity of the excavation, the Department considers that this should be verified by on-site monitoring. Consequently, the recommended Surface and Groundwater Monitoring Program includes monitoring at sites representative of the potential extent of impacts on groundwater depths and flows.

The Proponent's fallback position when groundwater recharge is not suitable is to store, treat and release the groundwater. The storage system would include the holding facilities in the cells along with additional storage tanks which would hold groundwater pre- and post-treatment. The holding basins would be connected to the treatment facility via a polyethylene pipe. It is proposed that once the treatment system is operational, water could be discharged from the site into the surrounding area.

Both the EPA and the OEH expressed concern over the treatment and disposal of groundwater, with the EPA stating that it would not license the discharge of groundwater pollutants and that off-site disposal of groundwater at a licensed facility may be required. In light of this, the Department has recommended a condition which prohibits the discharge and land application of dewatered groundwater unless in accordance with an Environment

Protection Licence. The Department has also recommended that the Construction Soil and Water Management Plan for the project include details on the methods for the treatment and disposal of groundwater.

Excavation and backfilling along the relief road alignment would involve replacing the existing fill with rock fill of coarse composition between layers of geogrid and geofabric. Existing fill borrowed during excavation would be used to form a stabilisation berm on both sides of the rock fill. Material beyond the stabilisation berm would be in-situ unaltered ground. The proposed rock fill is expected to be of higher permeability than the existing ground. Additionally, the permeability of the stabilisation berms is likely to be of somewhat higher permeability than the existing fill material.

Consequently, the proposed railway formation is expected to act as a unit of higher permeability than the surrounding ground and would essentially create a high permeability unit running north-south. However, as the formation would be surrounded by existing ground it is not expected to modify the existing direction of groundwater flow significantly in ground surrounding the formation.

As the formation is likely to act as a hydraulically connected unit with the surrounding ground, there is the potential for groundwater to drain down gradient through the formation and ultimately seep through the finger drains to the swale at locations where the swale invert is below the groundwater level within the formation. The Proponent states that the interception and drainage of groundwater would be similar to that currently evident from existing on-site drains. However, drainage of groundwater within the formation to the swale has the potential to result in groundwater drawdown within the formation, and that drawdown would induce groundwater drawdown within ground immediately adjacent to the formation.

Groundwater modelling indicates that under wet conditions, groundwater between chainages 174400 and 176300 metres may seep to the swale, resulting in groundwater drawdown (relative to pre-construction levels) of up to 0.9 metres immediately adjacent to the formation. Under dry conditions, groundwater drawdown is expected to be limited to between approximately chainages 174450 to 175650 metres and up to 0.4 metres relative to pre-construction levels immediately adjacent to the formation. The greatest extent of drawdown of some 50 metres from the edge of the formation is assessed to occur at approximately chainages 174900 to 175000 metres. The Department notes that this is a conservative assessment of drawdown based on the relatively high hydraulic conductivity value of one metre per day adopted in the modelling.

As noted in **Section 5.1** (Ecology) the vegetation communities within and adjacent to the project area are groundwater dependent. Both the Department and OEH raised the potential impact of groundwater drawdown on groundwater dependent ecosystems as an issue of concern. The outcomes of the groundwater assessment indicate that under the worst-case scenario groundwater drawdown would extend to approximately 50 metres from the edge of the formation. This distance is within the project footprint. As the nearest groundwater dependent ecosystems would be outside this distance, the Proponent concludes that operation of the project would not impact on groundwater dependent ecosystems.

The Department considers that the level and extent of groundwater drawdown would need to be confirmed upon completion of construction and is of the opinion that the recommended conditions relating to operational groundwater monitoring would achieve this. Further, the recommended conditions requiring the development of contingency plans to address changes in groundwater depths and flows and changes in groundwater dependent ecosystems would ensure that appropriate measures would be effectively and efficiently implemented to mitigate potential impacts.

The groundwater assessment indicates that groundwater drawdown during operation of the project (including under dry conditions) is not expected to be great enough to cause groundwater levels to fall below the top of potential acid sulfate soils and expose them to oxygen. The reasoning for this is that potential acid sulfate soils have been identified to occur at depths of greater than one metre below the ground surface, whereas the maximum predicted drawdown during operation is estimated to be 0.9 metres. The Department acknowledges that the Proponent would need to undertake immediate action in the event that acid sulfate soils are exposed and has therefore recommended that the Construction Soil and Water Management Plan include a contingency plan in the event that groundwater levels are observed to fall below the top of areas defined as possessing potential acid sulfate soils. This condition addresses the concerns raised by the OEH and Hunter-Central Rivers CMA in regard to desaturation of acid sulphate soils. The Department has also recommended that the Soil and Water Management Plan includes an Acid Sulfate Soils Management Plan consistent with the *Acid Sulfate Soils Manual* (Acid Sulfate Soils Management Advisory Committee, 1998) and that this plan details the procedures for handling, treating and managing such soils.

The proposed railway tracks would traverse an existing high pressure gas transmission main (owned by Jemena) which runs perpendicular to the project area. Ground improvement works in the vicinity of the gas main would involve the construction of reinforced concrete piles walls and deep soil mixing to support the ground. The in-ground walls are designed to be 900 millimetres wide and spaced at 1.7 metre centres across the full width of the railway formation. A transition zone of reducing wall depth with distance from the gas main is proposed. The walls immediately adjacent to the gas main corridor would be constructed from ground surface to a depth of approximately 24 metres below ground surface, with adjacent walls gradually transitioning to depths of approximately five metres below ground surface at some 20 metre distance on either side of the gas main corridor. With the gas main some 4.5 to six metres wide, the walls would extend a distance of approximately 45 metres along the alignment.

Although the proposed walls would impose a barrier to groundwater flow within the railway formation, the Proponent considers this as beneficial as it would limit the groundwater flow through the formation to the northern portion of the alignment under wet conditions and hence further reduce any potential impacts on groundwater levels. The Department's recommendation to require the Proponent to undertake groundwater monitoring would verify the degree of any impacts, while the recommendation to develop and implement contingency plans would minimise the potential for significant adverse impacts to arise.

5.6.2 Groundwater Quality and Impacts

In regard to groundwater quality, the investigations indicated that local groundwater is of variable salinity ranging from fresh to brackish. In addition, pH levels are also highly variable, ranging from acidic to neutral with values as low as 5.4 recorded. The concentration of heavy metals is variable with detected copper and arsenic levels occasionally above the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment Conservation Council, 2000) guideline trigger levels for the protection of freshwater aquatic ecosystems, and nickel and zinc concentrations generally above guideline trigger levels at all monitored locations. Ammonia and phosphorus were also detected at most monitoring locations along with a range of aromatic and petroleum hydrocarbons, including methane and benzene derivatives.

As noted above, there is the potential for groundwater to be intercepted by and seep into the proposed swale during operation of the relief roads. The Proponent argues that the proposed track formation would cause an improvement in groundwater quality for both existing groundwater in the vicinity of the formation and groundwater seepage to the swale compared to current conditions. The reasoning behind this is that during periods of high rainfall, water

infiltrating the rock fill within the formation would not experience the same water quality influences as water infiltrating the existing soil profile. The rock fill to be used is free of significant heavy metals and leachable salts unlike the existing contaminated fill and soils. Therefore, during rainfall events, infiltration of rainwater to the formation would be expected to dilute existing contaminants and salinity within the groundwater to some degree. The Department is of the opinion that the discernible level of contaminant removal is arguable and that monitoring is required to assess the quality of any groundwater seepage.

The Proponent intends to undertake groundwater monitoring during the operation of the project using the existing monitoring bores located in the project area to form a monitoring network. Where possible, the monitoring network would be aligned with the proposed Aurizon TSF to assist with monitoring cumulative impacts. Monitoring would focus on flow direction, groundwater levels and quality. Given the variable concentration of heavy metals and existence of aromatic and petroleum hydrocarbons in the groundwater, and the potential for groundwater to be intercepted by the swale which in turn would discharge to local waterbodies, the Department has reinforced the Proponent's intention to implement groundwater monitoring in the recommended conditions of approval. The Department has also recommended that the Surface and Groundwater Monitoring Program for the project include contingency and ameliorative measures in the event that adverse impacts to groundwater are identified.

The Proponent has advised that it is aware that groundwater may be aggressive to concrete and steel structures due to its salinity and potential acidity, and has considered this in the design and construction of the project.

As noted above, construction of the relief roads will require dewatering during excavation. Dewatering has the potential to mobilise a range of contaminants in the existing fill. As groundwater seepage is to be immediately collected and managed, the Proponent claims that the quality of that groundwater is unlikely to be affected or mobilise any identified contaminants above existing conditions.

Although the modelling outcomes of the groundwater assessment indicate that construction and operation of the project would not have a significant impact on groundwater quality, levels and flows, or on groundwater dependent ecosystems and potential acid sulfate soils, the Department considers that the modelling outcomes need to be confirmed. The Department is of the opinion that the recommendation requiring the Proponent to undertake groundwater monitoring would achieve this. Further, the recommended conditions relating to the development and implementation of contingency measures and plans would result in the effective response to any potential or observed impacts prior to significant adverse effects on groundwater quality, hydraulics and groundwater dependent ecosystems arising.

5.7 Heritage

5.7.1 Aboriginal Heritage

Previous archaeological investigations have found extensive evidence that the study area and its surrounds have been occupied by Aboriginal people. Although numerous heritage sites have been identified in the region, no Aboriginal sites are listed on the Aboriginal Heritage Information Management System (AHIMS) to occur within the study area. However, an archaeological assessment by McCardle Cultural Heritage in 2011 for the proposed Aurizon TSF defined a Cultural Potential Archaeological Deposit (PAD) within the project area (refer **Figure 13**).

The Proponent undertook an Aboriginal heritage assessment (as part of the EIS) to determine the potential for Aboriginal heritage sites within the project area and assess the likely impact of the project on items of Aboriginal heritage significance. Following changes in

the design of the project, test excavations were undertaken in early 2013 in the vicinity of the proposed temporary construction access road linking the Tarro Interchange to Woodlands Close and the primary construction compound. The assessment and excavations were undertaken in consultation with registered Aboriginal stakeholders, with the consultation process including site surveys/inspections and provision of reports for comment.

Two Aboriginal sites were located within the project area during the 2012 and 2013 archaeological surveys for the project - Site HS1 and HS2. In addition, an area of potential archaeological deposit (PAD) associated with HS1 was identified (refer **Figure 13**).

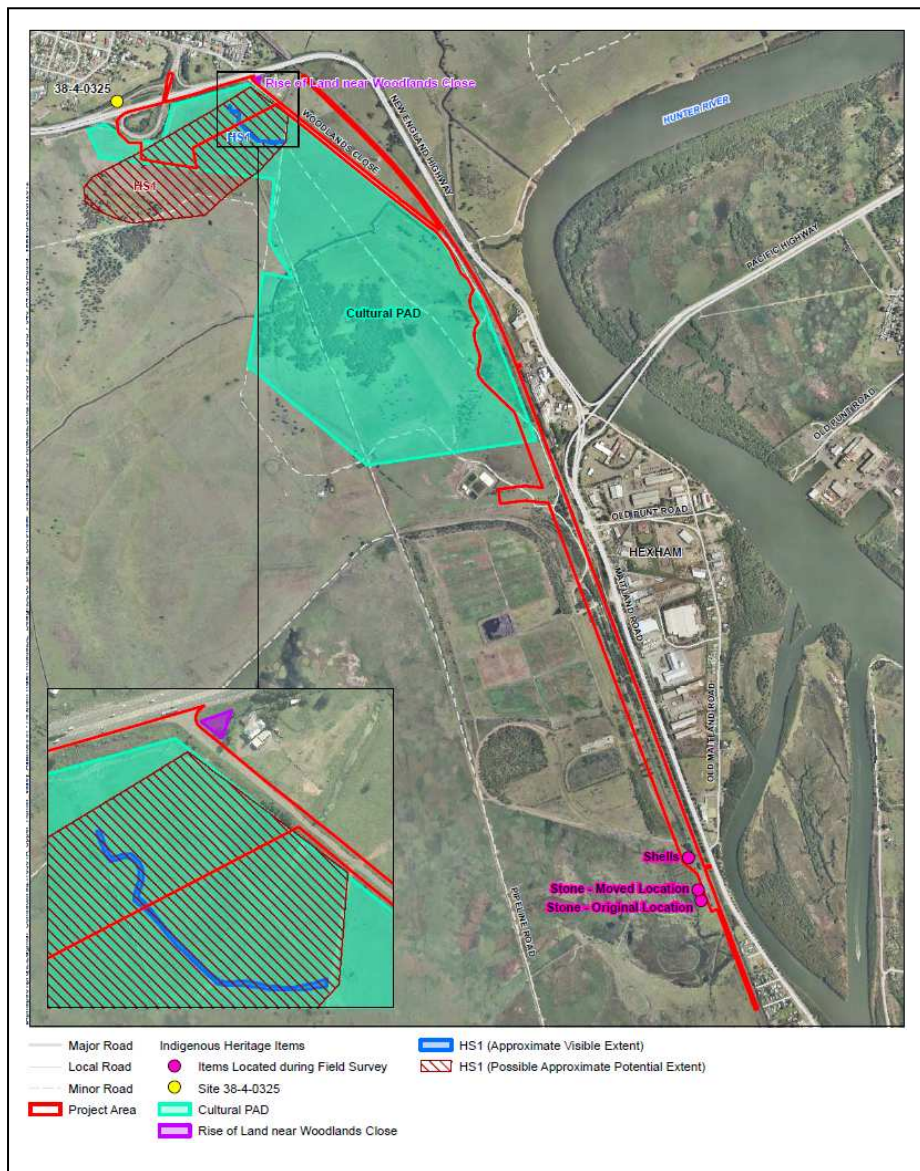
In regard to HS1 (site #38-4-1478 as listed under the AHIMS), this site comprises artefactual stone and shell material. The material was found to extend along a constructed track within a disused Hunter Water easement with the majority of artefacts displaying signs of extensive damage from vehicle use of the track. Archaeological test excavation adjacent to the constructed track confirmed that the material observed was not present within local soils, suggesting that the artefacts have been imported into the area within construction material during the original construction of the track. As such, the materials are not considered as indicative of the local Aboriginal archaeology nor are they considered to have archaeological sensitivity.

Aurizon commissioned an independent archaeological consultant to undertake a review of the 2011 heritage assessment by McCardle Cultural Heritage. The review considered the results of the assessments undertaken in 2012 and 2013 as part of the EIS and PIR for the Hexham Relief Roads project as they relate to Aboriginal heritage within the area. The review supported the conclusion that HS1 is a disturbed deposit with no archaeological significance.

The 2013 assessment recommended that a revised site card be submitted to the OEH AHIMS database detailing the revised site extent and identifying that the material is imported and does not have archaeological sensitivity. Based on this assessment and the outcome of the review commissioned by Aurizon, the Proponent has proposed to undertake this measure and to ensure that it is implemented, a condition to this effect has been included in the recommended approval.

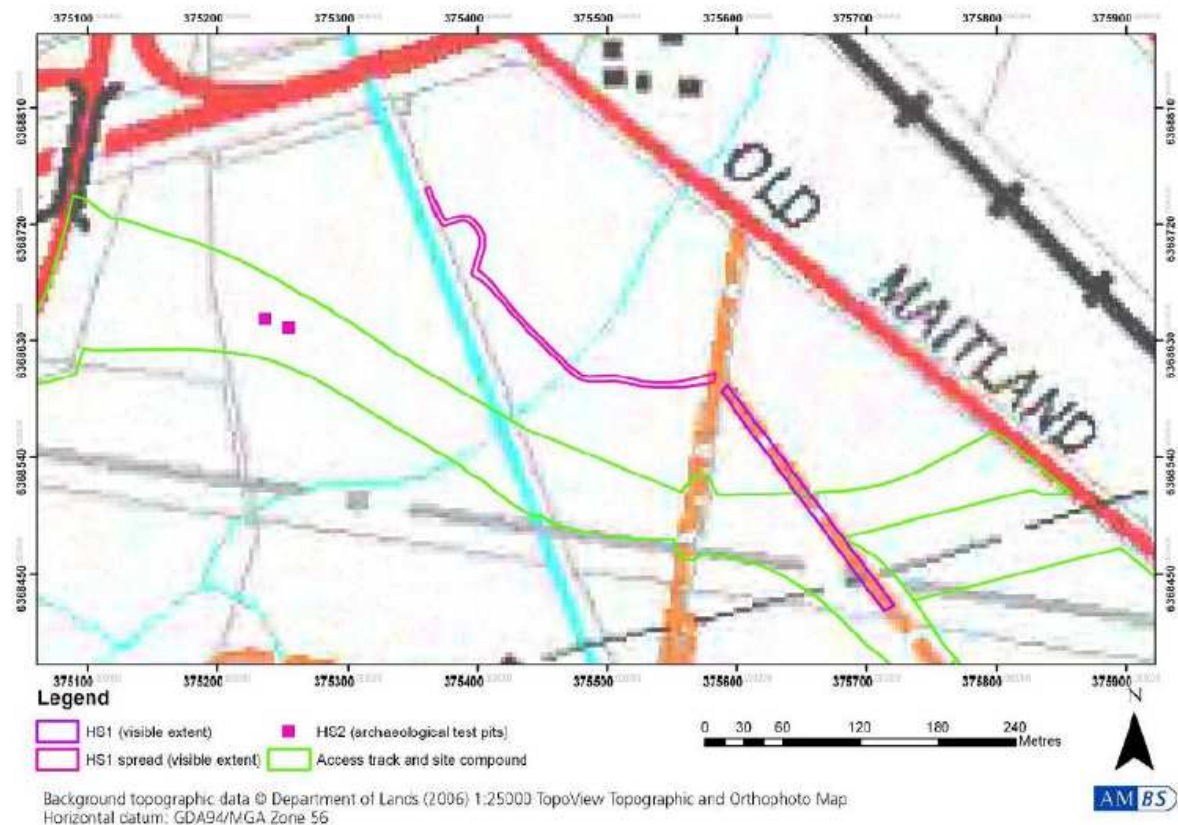
HS1 would be impacted by the construction of the project. Although the artefacts may have been imported to the site, the Department considers that collection and recording of the artefacts should be undertaken (as recommended in the 2013 assessment) and has recommended a condition to this effect. The Department has also recommended that the Proponent be required to establish an appropriate keeping place agreement with registered Aboriginal stakeholders as part of a Construction Heritage Management Plan.

On the basis of the materials observed along the access track, the heritage assessment purported the potential for Aboriginal heritage material below the surface in the vicinity of HS1 and designated the area as a PAD (refer **Figure 13**). This designation was challenged by the independent review which concluded that the PAD was linked to a surface scatter of artefacts contained in imported road fill and consequently there is no scientific data to support the identification of a PAD. The Department concurs with the conclusion of the independent review.

Figure 13: Location of Aboriginal Heritage Sites

In regard to Site HS2, this site comprises three subsurface stone artefacts identified in two adjacent test pits along the access road approximately 160-180 metres from Purgatory Creek (refer **Figure 14**). The materials are not considered to be associated with the material comprising HS1. The artefacts were recovered from disturbed contexts and are likely to represent the background archaeology of the local area, rather than long-term cultural activities that would result in extensive in-situ archaeological sites. Consultation undertaken with the registered Aboriginal stakeholders indicated that the artefacts recovered do not have any specific cultural significance to the local Aboriginal community but they do indicate the importance of the cultural landscape. Consequently, removal of the material from the site is unlikely to have a significant archaeological impact.

Although the site is considered to be of low archaeological significance, the 2013 assessment recommended that a new site card be prepared for HS2 and submitted to the AHIMS and the artefacts recovered lodged in a safe keeping place. The Proponent has indicated that this recommendation will be implemented. Notwithstanding, a condition to this effect has been recommended in the recommended approval.

Figure 14: Location of HS2

The Cultural PAD identified by McCardle Cultural Heritage in 2011 was assessed as being of significance to the registered Aboriginal stakeholders based on its location near the Hexham Swamp and the Hunter River. However, the deposit is disturbed and has low subsurface archaeological sensitivity as:

- it is not considered to be representative of the local landscape;
- comprises a low-moderate diversity of artefact types; and
- is of low research potential.

The independent archaeological review indicated that as the area has no significant archaeological basis and is located in an active fluvial environment, it should be defined as an amorphous cultural area rather than a cultural deposit. The review also recommended that no further Aboriginal heritage assessment is required as the area is a highly disturbed environment influenced by long term, high-energy fluvial processes.

Notwithstanding, based on the previous investigations having been endorsed by Aboriginal stakeholders, the Proponent has opted to undertake test excavations in the vicinity of the signalling area in accordance with the test excavation methodology detailed in *the Hexham Relief Roads Project: Test Excavation Report* (Australian Museum Business Services, 2013). This methodology involves the excavation of six test pits in the central part of the Cultural PAD. The Department endorses the additional test excavation as a means of testing the significance of the Cultural PAD and has recommended a condition requiring the Proponent to undertake the testing.

A number of different species of shells were found in an area of fill near the southern end of the proposed relief roads (**Figure 13**). Hunter Water confirmed that the shells were brought in with bedding sand dredged from the Swansea Channel as fill material during the installation of a pipeline through the area. The registered Aboriginal stakeholder representatives also identified a large, rounded stone in the fill material as likely to be a grindstone even though it did not appear to exhibit any evidence of use, of wear or grinding. As the registered Aboriginal stakeholders have expressed a desire to collect the shell material and stone, the Department has recommended a condition of approval to accommodate collection prior to the commencement of construction in the area.

The EIS identified the rise of land on the north-eastern side of Woodlands Close and the New England Highway as being favourable for camping and therefore potentially comprising archaeological deposits. Although the overall significance of the site was assessed as low, the Department has recommended that a protection zone be established around the rise during pre-construction to prevent incursion into the area as it is not a designated construction zone.

In addition to the management measures recommended above, the Department has recommended that the Proponent prepare a Construction Heritage Management Plan which addresses the measures to be implemented to minimise and manage construction impacts on Aboriginal heritage and includes procedures for:

- dealing with previously unidentified Aboriginal objects, including cessation of works;
- managing the discovery of confirmed or potential human remains;
- ongoing Aboriginal consultation and involvement for the duration of the construction of the project; and
- heritage training and induction.

This recommendation is consistent with the recommendations of the OEH which included the preparation of an Aboriginal Heritage Management Plan, ongoing consultation with Aboriginal stakeholders, and stop work procedures in the event of unidentified Aboriginal objects or discovery of human remains.

Overall, the Department considers that the construction of the project would not have a significant impact on known Aboriginal sites and areas of archaeological potential. In addition, the Department considers that the Proponent's mitigation measures provide an appropriate framework to manage potential impacts during construction. The Department has recommended a number of conditions of approval (as noted above) to further strengthen this framework.

5.7.2 Historic Heritage

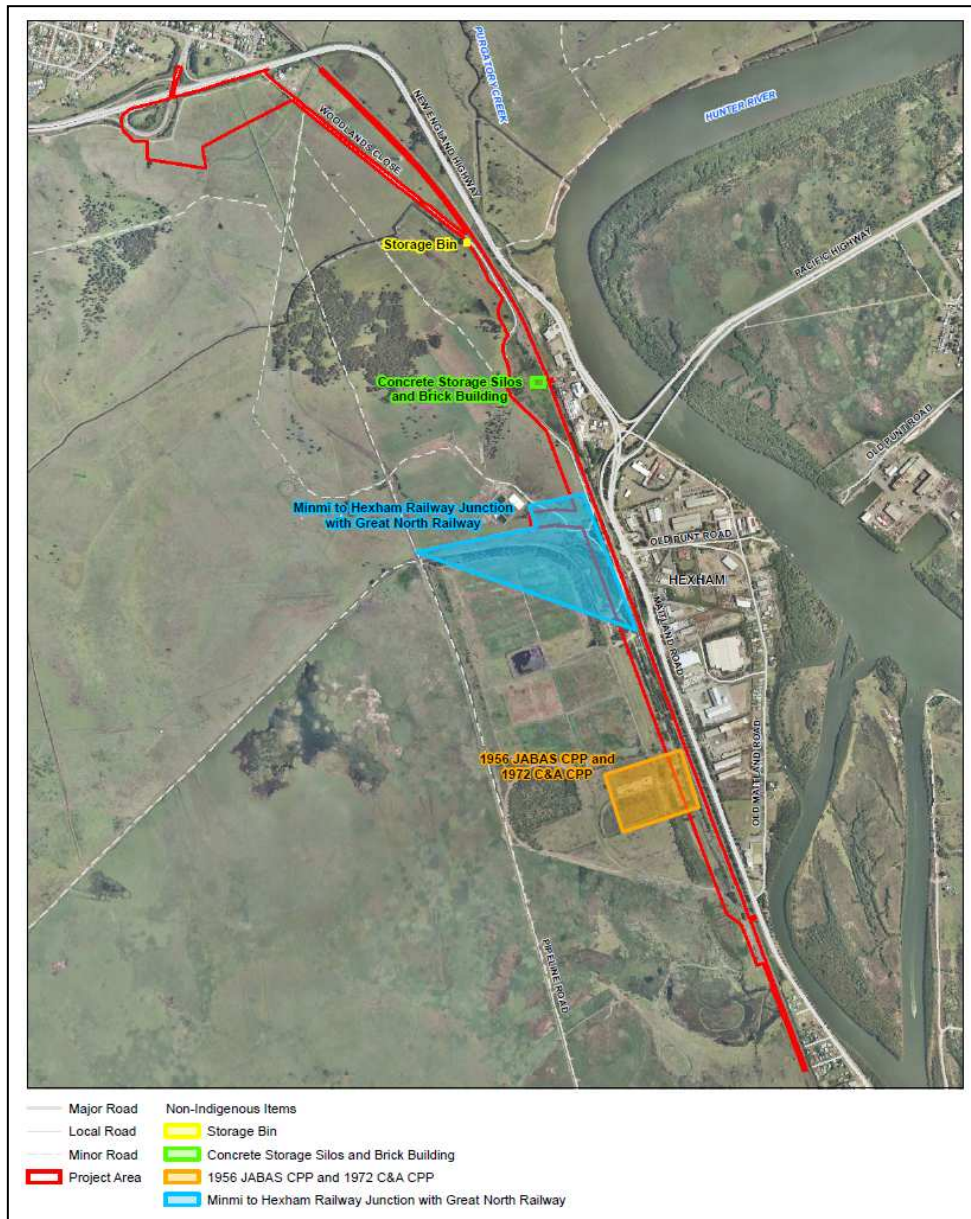
The Proponent undertook a historic heritage assessment to determine the potential impact of the project on items of European heritage significance. Consequent to changes in the location of the proposed private access track, a supplementary heritage assessment was prepared by the Proponent as part of the PIR. Both heritage assessments were prepared in accordance with the *NSW Heritage Manual* (NSW Heritage Office, 1996) and are consistent with the principles of the *The Burra Charter - The Australian ICOMOS Charter for the Conservation of Places of Cultural Significance* (ICOMOS, 1999). Assessments of significance were conducted in accordance with the guideline document *Assessing Heritage Significance* (NSW Heritage Office, 2001).

Three historic heritage items were identified within or immediately adjacent to the project area – the Hexham Railway Station, Oak Factory and the Minmi to Hexham Railway. All three items are listed as having local significance in the Newcastle Local Environmental Plan

(LEP) 2012. Both the Hexham Railway Station and Oak Factory are outside of the project area and will not be impacted by the project.

The junction of the Minmi to Hexham Railway with the Great Northern Railway lies within the project area (refer **Figure 15**). The Great Northern Railway is listed in the Lake Macquarie LEP 2004 as a local heritage item, in the Cessnock LEP 2011 as having State heritage significance, and in the Maitland LEP 2011 as having local significance. However, the section of the railway within the project area is not listed on any heritage registers or the Newcastle LEP 2012.

Figure 15: Items of European Cultural Heritage



Few extant features associated with the Minmi to Hexham Railway were evident within the main construction area. However, remains of the railway were evident in the vicinity of the proposed access track and included railway and sidings covered by low ground cover and grasses. In addition, railway sleepers and associated fittings (baseplates, fishplates, dog spikes and split pins) and a concrete base were found scattered over the railway embankment associated with the railway. Isolated stones, assumed to belong to a larger

structural feature associated with the railway line or colliery infrastructure, were also identified. All of the items have been disturbed and in some instances removed from their original position.

To the west of the project area near the junction of the two railways is a 1940's washhouse and signal box and railway tracks associated with the Minmi to Hexham Railway.

In the area of the junction of the Minmi to Hexham Railway and Great Northern Railway there is the potential for physical evidence of elements associated with the Minmi to Hexham Railway to be uncovered during construction. These elements include the former colliery sidings and workshops, control cabins and signal boxes, junction cottages and a crossing keeper's cottage. As such, the Proponent has proposed to engage an Excavation Director to advise on archaeological issues.

Considering the local heritage significance of the Minmi to Hexham Railway, the Department is of the opinion that an Excavation Director should be present during excavation works, rather than available for advice, to advise on the measures to be implemented (including stopping work) in the event that relics are uncovered. A condition to this effect has been recommended in the conditions of approval.

The Department has also recommended conditions that require the Proponent to:

- develop a procedure for dealing with previously unidentified relics as part of the Construction Heritage Management Plan; and
- document the procedures for monitoring and reporting of impacts on heritage items.

In keeping with the recommendations of the Heritage Council, the Department has also recommended that the Excavation Director's experience complies with the Heritage Council Excavation Director's Criteria.

As the proposed construction works are confined to the west of the Great Northern Railway, the project is unlikely to have a direct impact on the railway. In addition, elements associated with the Great Northern Railway (such as those that may occur at the junction with the Minmi to Hexham Railway) have not been identified as having heritage significance. Consequently, the Department supports the Proponent's position that the historic values of the Great Northern Railway would not be significantly impacted by the construction of the project.

In regard to the relics associated with the Minmi to Hexham Railway in the vicinity of the proposed private access track, the Department concurs with the Proponent's proposal to ensure that the relics are retained in situ where possible and has recommended a condition to this effect. Although the Proponent has committed to consulting with a suitably qualified archaeologist should relics need to be relocated, the Department believes that any relocation of relics should be under the supervision of the Excavation Director. This would ensure appropriate handling, placement and recording of the relocation activities. Consequently, this requirement has been recommended as a condition of approval.

The private access track will cross the railway embankment associated with the Minmi to Hexham Railway. Consequently, the Proponent has proposed to implement the following measures to protect the integrity of any underlying archaeological relics:

- covering that section of the embankment that would be traversed with geotextile, or similar, and laying the road base across this;
- determining the precise location of the track in consultation with an archaeologist; and
- establishing an appropriate buffer zone in the vicinity of the embankment.

The Department concurs with these measures which have been reinforced in the recommended conditions of approval.

To manage and minimise significant adverse impacts on historical heritage, the Department has also recommended that the Proponent detail the processes for heritage training and induction for construction personnel in the Construction Heritage Management Plan required by the infrastructure approval.

During surveys of the project area and surrounds, elements associated with the former JABAS Coal Preparation Plant (CCP) and the Coal & Allied CCP sidings which once occupied the site were identified (refer **Figure 15**) including:

- reinforced concrete foundations of the CCP main building and washery facilities;
- reinforced concrete foundations of the conveyor systems associated with the CCP;
- ephemeral remains of balloon loop sidings associated with the Coal & Allied CPP sidings;
- concrete pads of buildings associated with the Coal & Allied CPP Sidings; and
- miscellaneous structures including two concrete storage silos and associated brick building, a concrete storage bin, and unidentified rectangular features between the bin and silos.

Underground tunnels associated with the JABAS CPP conveyor system are understood to be located between the balloon loop siding and the CPP facility but no evidence of their location was discerned during field surveys.

The project has the potential to impact on part of the JABAS CPP foundations, footprint and sidings, the underground tunnels, and the Coal & Allied CPP foundations and footprint. However, none of the remains of the JABAS CCP and Coal & Allied CPP Sidings are identified on any heritage registers or lists. Further, associated elements, if exposed, are likely to be characteristic of similar facilities associated with NSW coal fields and would not make a contribution to an understanding of the construction or operation of such facilities. Consequently, no mitigation measures are considered necessary in regard to these items. The two concrete silos are substantial structures within the project area and may need to be removed. The silos are characteristic of concrete storage silos within similar contexts and as such are not considered to have heritage value. As the structures have not been assessed as having heritage value at the State or local level, no mitigation of impacts to these elements has been recommended.

Overall, the Department is satisfied that construction and operation of the project would not have a significant adverse impact on historic heritage. Further, provided the Proponent implements the mitigation measures nominated in the EIS and PIR, and the Department's recommended management measures defined in the conditions of approval, residual impacts should be avoided.

5.8 Other Issues

The Proponent has also assessed the potential impacts of the project in relation to soils (contamination, erosion and sedimentation), air quality, visual amenity, solid waste management, socio-economic issues, and greenhouse gas emissions. The Department is of the opinion that the Proponent has undertaken an adequate assessment of these issues. However, conditions are required in regard to some of the issues to ensure that residual impacts are appropriately mitigated and managed. The Department's consideration of these issues is provided in **Table 9**.

Table 9 – Department's Consideration of Other Issues

Issue	Department's Consideration
Soil Contamination	A contamination assessment was undertaken by the Proponent to identify the type and extent of soil, surface and groundwater contamination within the construction footprint, and provide an assessment of the suitability of existing soil and fill for reuse in the construction of the relief roads. This assessment was supplemented by an investigation of the potential for soil contamination within the corridor of the temporary construction access road and primary site compound. Although a large number of the sites along the alignment of the relief roads indicated concentrations of contaminants below the adopted criteria for commercial/industrial land use, a number of sites showed concentrations of total petroleum hydrocarbons (13 sites), benzo (a) pyrene (seven sites), total polyaromatic hydrocarbons (four sites) and lead (one site) in excess of the criteria. The sites containing contamination at levels greater than the adopted criteria were associated with material that was likely imported for the construction of Woodlands Close and ballast and coal reject fill within the ARTC compound area. The results of the supplementary soil contamination investigation of the temporary construction access road and primary compound indicated a low risk of soil contamination with all investigated contaminants either not detected or below the adopted assessment criteria. The Proponent has prepared a Remediation Action Plan which identifies the areas requiring remediation and possible remedial options. Based on an assessment of the available options, the preferred soil remediation option is to excavate the contaminated soil and dispose of it at an appropriately licensed landfill. This method was selected over the more cost-effective options of on-site bioremediation or capping and containing on site for the following reasons: • bioremediation – limited space is available within the project area to successfully undertake this option, a long timeframe may be required to achieve a successful reduction in contaminant levels, the project site is subject to flooding and consequently contaminated material could be washed onto adjacent lands and into waterbodies; and • cap and contain – this is generally not practical where excavations are proposed in other areas of contaminated soil as would be the case of the relief roads. Further, this may be difficult to achieve due to the shallow water table within the project area. In light of the constraints associated with the alternative options, the Department accepts the proposed remediation strategy as the best available option and has recommended a condition of approval requiring the Proponent to undertake remediation in accordance with the Remediation Action Plan. The Department has also recommended that a suitably qualified contaminated land consultant be engaged to prepare a Validation Report upon completion of the remediation of the contaminated areas.

Issue	Department's Consideration
	Further, the Department has recommended that an accredited NSW Site Auditor be engaged to prepare a Site Audit Report to determine the appropriateness of the Validation Report. The site contamination investigation along the length of the proposed relief roads alignment was restricted to testing to the depth of excavation proposed at the time. Consequently, where excavation works are now proposed at greater depths due to the amended design, the Department has recommended that a suitably qualified contaminated land consultant be engaged to undertake further soil testing prior to undertaking excavation. The Proponent has indicated that ballast, chitter and tailings within the existing rail corridor may be reused in the construction of the project. There is the potential for such materials to be contaminated and consequently the Department's recommended conditions of approval include for the testing and classification of such materials prior to reuse. The Department has also recommended that the Proponent prepare a Construction Contamination Plan which sets out the procedures for sampling and testing of the materials that will be excavated at greater depths (due to the amended project design) as well as for ballast, chitter and tailings. The Department has also recommended that the Plan include contingency measures in the event of the discovery of contaminated soils and a procedure for updating the Remediation Action Plan to address the remediation of such soils.
<i>Erosion and Sedimentation</i>	Construction of the project will require excavation and clearing of vegetation, both of which have the potential to result in erosion and sedimentation until such time that exposed surfaces are stabilised. The Proponent has committed to implementing standard erosion and sediment controls consistent with the principles set out in Landcom's <i>Managing Urban Stormwater: Soils and Construction</i> to manage and mitigate this impact. The Department considers this an appropriate measure which has been reinforced in the recommended conditions of approval. In addition, the Department has recommended that the Proponent prepare and implement a Construction Soil and Water Quality Management Plan which details how construction activities would be managed to mitigate and minimise erosion and sedimentation.
<i>Air Quality</i>	Dust generation during construction was raised as an issue of concern in approximately 74% of the public submissions. Potential sources of dust generation include the excavation of fill, vegetation clearing, and vehicle movements along internal unsealed access tracks and materials stockpiles. The Proponent has committed to implementing standard on-site measures to minimise the potential for fugitive dust emissions during construction. Notwithstanding, given the close proximity of residences in the south of the project area and commercial and industrial

Issue	Department's Consideration
	premises to the east, and the concerns raised in public submissions, the Department has recommended conditions of approval requiring the Proponent to: • undertake all works with the objective of minimising visible dust emissions; • implement control measures, including the cessation of works, in the event of visible dust emissions; • seal the temporary construction access road connecting the T-intersection at the Tarro Interchange with Woodlands Close; • detail the measures to manage dust in a Construction Environmental Management Plan; and • implement a Construction Complaints Management System to respond to complaints, including those relating to dust. An air quality assessment was undertaken to assess the operational impact of the project on local air quality in accordance with the <i>Approved Methods and Guidelines for the Modelling and Assessment of Air Pollutants in New South Wales</i> (DEC, 2005). The EPA indicated that the assessment adequately addressed the requirements for air quality modelling and assessment. Four scenarios were modelled, including the worst-case scenario of five trains idling. The modelling predicted the worst-case short term concentrations for nitrogen dioxide, carbon monoxide, dust (PM₁₀ and PM_{2.5}) and sulphur dioxide at sensitive receivers, and annual average concentrations of nitrogen dioxide, sulphur dioxide and PM₁₀. In addition, the modelling assessed the cumulative impact of the project and proposed Aurizon TSF. Coal dust emissions from moving wagons were not assessed. The air quality assessment indicates that the potential for dust nuisance to be generated would be low due to the low speed that the coal trains would be travelling. Further, any surface coal dust generated via train movement would have effectively been removed prior as the trains would have been subjected to the combined effects of travel speed and wind before arriving at the site. A key concern raised in a large number of the public submissions was the potential health effects associated with diesel fumes and dust emitted from locomotives. The modelling indicated that under all scenarios, the predicted concentrations of nitrogen dioxide, carbon monoxide, dust and sulphur dioxide emitted from idling trains would not exceed the impact assessment criteria at sensitive receivers. As such, the Department is satisfied that locomotive emissions are unlikely to adversely affect the local air quality and have flow on effects on human health. Consequently, the Department has not recommended air quality monitoring during the operation of the project.
Visual Amenity	The Proponent has undertaken a visual assessment to establish the visual impact of the project considering both the degree of visual modification resulting from the construction of the project and the visual sensitivity of the surrounding areas.

Issue	Department's Consideration
	Impacts were assessed from viewpoints within 500 metres (foreground), 500 metres to two kilometres (mid-ground), and greater than two kilometres (distant) from the project area. Foreground viewpoints included the residential and industrial/ commercial areas of Hexham, and public viewpoints (Hunter Wetlands National Park, Pacific Highway, New England Highway, Hexham Railway Station and rail line). Mid-ground viewpoints were limited to a single residence some 800 metres west of the project area. The existing scenic amenity of the project area is defined as being of low quality, largely due to the poor visual quality of the nearby industrial area of Hexham, the existing railway, flat landscape, low vegetation levels and degraded nature of the general surrounding area. The main visual changes to the visual landscape arising from the construction of the project would be: • five train tracks and associated infrastructure (e.g. signal boxes and gantries); • new access road from the Tarro Interchange connecting to Woodlands Close; and • removal of vegetation. The visual assessment concluded that the proposed relief roads would only further slightly reduce the overall scenic amenity of the local area. There would be a slight visual impact on views from the Hunter Wetlands National Park due to the removal of vegetation resulting in more obvious views of the railway and less visual screening of the Hexham industrial area. There is only one residence within 500 metres of the project area with views to the site (1 Woodlands Close). Due to the flat nature of the landform, this resident would experience little visual change as a result of the construction of the five train tracks. The visual impact of the proposed temporary construction access road has been assessed as low. The Pacific and New England Highways support a large number of transient viewers who would have views towards the project area while passing alongside. Although viewers from the highways may perceive a visual change consequent to the removal of vegetation, increased width in rail line infrastructure, and temporary construction access road, the level of impact has been assessed as slight. There are limited views of the project area from the Hexham industrial area as the majority of the area is separated by the Pacific Highway, and trees alongside many parts of the Highway effectively screen many potential views from passing motorists. Consequently, the visual assessment concluded that overall there would be a negligible visual impact from this viewpoint.

Issue	Department's Consideration
	In regard to views from Hexham Railway Station, there is a footbridge that provides access to the station which would provide elevated views towards the project area. Although the viewpoint is potentially visually sensitive, the low number of users means that the overall impact is low. The removal of trees within the project corridor would open up views across the rural and wetland area to the west and the increase in the number of rail lines and width of the main rail corridor would be obvious. Consequently, the level of visual impact was assessed as moderate. The Department acknowledges that there are no viewpoints from the Tarro residential area due to the intervening raised highway embankment. The visual impact from the residence 800 metres west of the project area was assessed as low due to distance and existing low quality views of the nearby effluent treatment plant, railway line and Hexham industrial area. At distances over two kilometres, the visual impact is considered to be negligible as there would be difficulty in distinguishing any visual change. The visual assessment also addressed the cumulative impact of the project and proposed Aurizon TSF on visual amenity. The assessment concluded that the construction of both projects would lead to a moderate impact on the landscape character and amplify the impact on surrounding viewpoints. The Proponent has not proposed to implement any mitigation measures to minimise the visual impacts of the project. Instead, the only measure proposed is to "consider" tree planting at a number of locations. Although the existing scenic quality is low, the project would slightly reduce this quality and as such, the Department is of the opinion that landscape planting should be undertaken, where practicable, to partially screen views of the project area and has recommended this as a condition of approval. No other mitigation measures are proposed in light of the overall low visual impact.
<i>Solid Waste Management</i>	The construction and operation (maintenance) of the project would result in the generation of waste. Construction waste streams would include demolition waste, green waste (from clearing) and general construction waste. Waste materials generated during maintenance would vary depending on the activities being undertaken but could include damaged rails, sleepers or other rail equipment. The Proponent has committed to managing all wastes in accordance with the relevant guidelines and the principles of waste avoidance, reduction, reuse and recycling. The Department is satisfied with this approach and has recommended a condition of approval to ensure that this commitment is implemented.

Issue	Department's Consideration
	The Department has also recommended that the measures for managing waste generated during construction and maintenance be addressed in the Construction Environmental Management Plan and the Proponent's existing operational environmental management system.
<i>Socio-economic Issues</i>	The Department acknowledges that the majority of the construction impacts would be limited to localities closest to the project area. The construction of the project has the potential to impact on the acoustic and visual amenity of sensitive receivers as discussed in Sections 5.2 and above. To minimise the degree of impact, the Proponent has committed to implementing a range of mitigation measures. These measures have been reinforced and/or supplemented in the recommended conditions of approval. The Department has also recommended conditions relating to the management of construction access and traffic as a means of minimising potential adverse impacts on local traffic and ensuring access to private properties off Woodlands Close is maintained. The only land to be acquired for the project would be from Aurizon and hence other local landowners would not be impacted by land acquisition. An issue raised in the public submissions was the potential reduction in property values due to increased train movements and associated impacts (e.g. noise). One submission requested acquisition of all properties in close proximity to the project area should the project noise criteria not be complied with. As noted in Section 5.2, noise modeling of the worst-case scenario predicted that operational noise levels would comply with the relevant noise criteria. In addition, the Department has recommended conditions of approval which require the Proponent to undertake an Operational Noise Review and implement mitigation measures in the event that operational noise levels exceed the recommended criteria. Nineteen of the public submissions called for a deflection wall to be constructed along the residential suburb of Hexham to protect against derailment. The proposed project would be located to the west of the existing rail line and not immediately adjacent to any existing residences. Based on this, the Department accepts that a derailment wall is not required.
<i>Greenhouse Gases</i>	The Proponent has undertaken a desktop assessment of greenhouse gas emissions, in accordance with the general principles of: • <i>The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard</i> (World Business Council for Sustainable Development, 2004); • <i>Australian Greenhouse Office Factors and Methods Workbook</i> (AGO, 2006); and • <i>National Greenhouse Accounts Factors</i> (Department of Climate Change, 2011).

Issue	Department's Consideration
	The outcomes of the assessment indicated that a total of 20,671 tonnes of carbon dioxide equivalent gas would be released as a result of construction of the project. This equates to less than 0.01% of the total estimated greenhouse gas emissions for NSW. Greenhouse gas emission sources from the operation of the project would be insignificant and limited to maintenance vehicles and equipment usage during maintenance.

6. CONCLUSION

The Hunter Valley Coal Chain is one of the largest coal export operations in the world and involves the delivery of coal from 35 coal mines to the three coal terminals at the Port of Newcastle for export. The objective of the Hexham Relief Roads is to alleviate congestion on the main coal rail network by providing options for re-sequencing of coal trains in the arrival queue for the coal terminals, hence enabling the Hunter Valley Coal Chain to meet demand for coal exports in the future.

The Department has undertaken a detailed assessment of the proposed Hexham Relief Roads project, having regard to the Proponent's EIS and PIR. In assessing the project, the Department has also considered the views of local and State government authorities and the public, as raised in their submissions during and post exhibition of the EIS.

The Department is satisfied that the Proponent has undertaken a robust and conservative assessment of the impacts of the project and that the impacts can be managed and/or mitigated through design or other management measures to an acceptable level. Based on its assessment, the Department considers the key environmental issues associated with the project to be biodiversity, noise (particularly construction noise), construction traffic and access, flooding, and surface and groundwater hydrology. In order to manage potential impacts that may arise to an acceptable level, the Department has recommended stringent conditions of approval which require not only that mitigation measures be implemented, but that monitoring also be undertaken to confirm compliance and impact predictions as well as provide a trigger for the implementation of contingency measures, as required.

The Department has also recommended conditions of approval for environmental management, including requirements to prepare a Construction Environmental Management Plan and incorporate environmental performance and management measures for the operation of the project into the Proponent's existing environmental management system. The Department believes that these requirements would provide for the implementation of best management practices during both the construction and operation of the project.

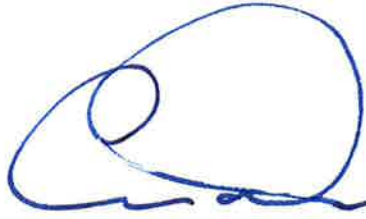
The Department considers that on balance the project is justified on the basis that it is an integral component in the upgrade of the coal freight network and is in the public's interest.

7. RECOMMENDATION

Based on the above assessment, the Department recommends that the Minister for Planning and Infrastructure consider the findings and recommendations of this report and determine to approve the Hexham Relief Roads project subject to the recommended conditions of approval.



A/Director 14/8/13
Infrastructure Projects



14.8.13
Executive Director
Development Assessment Systems and
Approvals

APPENDIX A ENVIRONMENTAL IMPACT STATEMENT

See the Department's website at:

http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=4992

APPENDIX B SUBMISSIONS

See the Department's website at:

http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=4992

APPENDIX C PREFERRED INFRASTRUCTURE REPORT

See the Department's website at:

http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=4992

APPENDIX E RECOMMENDED CONDITIONS OF APPROVAL
