



## PART C Environmental Assessment

## 7. Ecology

### 7.1 Introduction

The Director-General's requirements identified ecology as a key issue for the Environmental Assessment. This section identifies the potential ecological impacts of the Project and the management measures to reduce these impacts. The management measures are further detailed in the draft SoC contained in Appendix B. Table 7-1 outlines the Director-General's requirements and where they have been addressed.

**Table 7-1 Ecology Director - General Requirements**

| Environmental Assessment Requirements                                                                                                                                                                                                                                                                                                                 | Where Addressed                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| Flora, fauna, and habitat, with specific consideration of the Hunter Lowland Red Gum Forest, River-flat Eucalypt Forest and Swamp Oak Floodplain Forest communities, and associated threatened and endangered populations and species, including <i>Eucalyptus glaucina</i> , and <i>Eucalyptus camaldulensis</i> .                                   | Section 7.4.1<br>Section 7.4.2 |
| Habitat fragmentation, foraging, roosting and nesting habitat loss, and rail traffic strikes.                                                                                                                                                                                                                                                         | Section 7.4.4<br>Section 7.4.5 |
| Take into account the <i>Draft Guidelines for Threatened Species Assessment (DECC)</i> ; <i>Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities DECC</i> ; <i>Guidelines for the Assessment of Aquatic Ecology in EIA (DoP)</i> ; and <i>Fish Passage Requirements for Waterway Crossings (NSW Fisheries)</i> . | Section 7.2<br>Appendix E      |

### 7.2 Assessment Approach

A Flora and Fauna Impact Assessment, prepared by Ecotone (2008), was completed in accordance with the *Draft Guidelines for Threatened Species Assessment* (DECC and DPI 2005). Database searches, air photo interpretation, field survey and LHCCREMS vegetation mapping (NPWS 2000) were used to map and quantify the area of vegetation and fauna habitat affected by the Project. The area of remnant vegetation within the study area, and additional areas that may be adversely affected by edge effects, were calculated using geographic information system software. Further details of the assessment approach are provided in Section 2.0 and Section 3.0 of the Flora and Fauna Impact Assessment in Appendix E.





## **7.3 Existing Environment**

### **7.3.1 Overview**

The study area consists predominantly of agricultural and grazing lands, though some areas of native vegetation remain. It includes the urban centres of Singleton, Branxton and Rothbury as well as a number of smaller localities. Native vegetation within the study area occurs in Belford National Park, Singleton Military Area and on private lands. The Hunter River flows through the locality and to the north of the study area.

The subject site consists of a generally flat floodplain of the Hunter River and its tributaries at the western end, with more undulating topography at the eastern end. The site is almost completely cleared and treeless at the western end, with remnant disturbed and partially cleared vegetation (often reduced to the tree layer) and some plantations (olives and vineyards) at the eastern end.

The aquatic habitat is limited to two creeks and a number of unnamed drainage lines, including Jump-Up Creek and Mudies Creek, which run through the Project route and drain into the Hunter River to the north. There is also three artificial wet soak areas created as a result of impeded drainage of natural watercourses.

Surrounding landuse is predominantly rural, with much of the surrounding land cleared for grazing. Some areas of native vegetation occur, in particular within Singleton Military Area and Belford National Park. The subject site includes the localities of Belford and Whittingham.

### **7.3.2 Database Searches**

Records, and potential occurrences, of threatened species, populations and endangered ecological communities were extracted from the following databases for a 10 km buffer around the study area:

- ▶ Department of Environment and Climate Change (DECC) Atlas of NSW Wildlife records for threatened species, endangered populations and endangered ecological communities listed under the TSC Act which have been recorded within the locality; and
- ▶ DEWHA Protected Matters Search Tool for Matters of NES listed under the EPBC Act, which may occur in the locality. Note that Matters of NES are limited to threatened species and migratory species listed under JAMBA, CAMBA and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) only.

The results of these database searches are outlined in Section 2.0 of the Flora and Fauna Impact Assessment (Ecotone 2008) (see Appendix E).

### **7.3.3 Vegetation Communities**

Three broad natural vegetation community types and three artificial, derived or cultivated vegetation community types were found to occupy the study area:

- ▶ Natural Communities:
  - Ironbark - Spotted Gum – Grey Box Woodland / Open Forest;



- Red Gum – Grey Box Woodland / Open Forest; and
- Red Gum – Swamp Oak Riparian Forest.
- Artificial Communities:
  - Plantations;
  - Derived Open Pasture – Grassland / Weedy areas; and
  - Wet Soak Areas.

Descriptions of the above communities are provided in Ecotone (2008).

## 7.4 Potential Impacts

### 7.4.1 Threatened Flora and Endangered Ecological Communities

One threatened flora species was recorded within the study area. Slaty Red Gum (*Eucalyptus glaucina*), listed as vulnerable under both the TSC Act and EPBC Act, was confirmed to occur in several private properties mainly outside, but occasionally within, the existing rail track corridor. The species was generally restricted to the part of the study area east of the Golden Highway overpass, but occurred relatively frequently in this section, occupying several areas.

Two endangered ecological communities (EEC) listed under the TSC Act were confirmed as occurring within the study area, namely *Hunter Lowland Redgum Forest* and *River-flat Eucalypt Forest on Coastal Floodplains*. The potential occurrence of a third EEC, *Lower Hunter Spotted Gum / Ironbark Forest*, within the study area was ruled out as a result of further investigation. Additionally, the community tentatively identified as *Swamp Oak Floodplain Forest EEC* in the Options Evaluation Report (GHD 2007) was found to more accurately constitute *River-flat Eucalypt forest on Coastal Floodplains*, although it does have characteristics of the former EEC. Both the confirmed EECs were in a highly modified condition within the study area, mostly with a simplified or slashed understorey subject to grazing or other disturbances and invaded by weeds.

One flora species that occurs as an Endangered Population in the Hunter catchment, namely River Red Gum (*Eucalyptus camaldulensis*), was tentatively recorded in three locations south of the existing railway corridor during the survey for the Options Evaluation Report (GHD, 2007). However, closer inspection of the relevant trees during the current field surveys confirmed them to be mature Slaty Red Gum (*Eucalyptus glaucina*). It was therefore concluded that the Endangered Population of River Red Gum in the Hunter Catchment does not occur in the study area and would not be impacted by the Project.

One rare plant not listed by legislation but listed as a Rare or Threatened Australian Plant (ROTAP) species by Briggs and Leigh (1996) was recorded in the study area. Mountain Grevillea (*Grevillea montana*) was recorded in several areas at high abundance within the study area, as well as sporadically or as isolated plants. It was restricted to the section of the study area east of the Golden Highway.

#### 7.4.2 Threatened Fauna

Three threatened fauna species, the Brown Treecreeper (*Climacteris picumnus*), Grey-crowned Babbler (*Pomatostomus temporalis*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) were recorded within the study area. Three further species, the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), Speckled Warbler (*Pyrrholaemus sagittatus*) and Squirrel Glider (*Petaurus norfolcensis*), have been recorded nearby and are considered to have a high probability of occurring within the study area. A number of additional threatened species have potential to occur and have been included for consideration in the assessment section of the Flora and Fauna Impact Assessment (Appendix E).

No threatened or migratory fish species listed under the *Fisheries Management Act 1994* are expected to occur given the nature and condition of the aquatic habitats available. It is not expected that the Project would negatively impact any species of threatened or migratory fish.

#### 7.4.3 Aquatic Ecology Assessment

Aquatic habitat was very limited within the study area, being restricted to two creeks that cross the existing railway line (Mudies Creek at the western end and a tributary of Jump-Up Creek at the eastern end of the study area) and three artificial wet soak areas created as a result of impeded drainage of natural watercourses. Most aquatic habitat was in a degraded condition, due to the extensive levels of clearing for agricultural purposes in and surrounding the study area. Given the limited, ephemeral and degraded nature of creeklines and wet areas within the study area and the fact that no threatened aquatic species are expected to occur, the undertaking of a full aquatic survey is not considered warranted under the survey guidelines. The full aquatic ecology assessment included in Appendix E in the Flora and Fauna Impact Assessment (Ecotone 2008).

#### 7.4.4 Impacts on Habitat Connectivity and Barrier Effect

Habitats within the study area are already highly fragmented as a result of past and existing land uses including the existing rail corridor. The additional fragmentation resulting from the Project would be unlikely to have a significant impact on the viability of species that occur within most of the fragments. Native flora species within the remnants generally have a high level of resilience to disturbance and would continue to produce viable seed and germinate in the presence of disturbance factors. Similarly, fauna in most of the remnants are dominated by generalist species that would tolerate a high level of habitat disturbance.

The ephemeral nature of both larger creeks and drainage lines within the study area results in a natural barrier to passage between the more permanent pools outside of periods of water flow. In addition, the length and catchments of these creeks and drainage lines upstream of the rail line are small and also degraded. Any artificial barriers to fish in the form of culverts and other drainage structures are currently in place due to the existing railway infrastructure. The Project would not significantly increase existing artificial barriers to fish.



The existing rail corridor already acts as a barrier for terrestrial fauna such as macropods, reptiles and amphibians. Existing barbed-wire fencing, which occurs along both sides of the existing rail corridor, is unlikely to prevent native fauna from accessing the rail corridor. The Project includes fencing along both sides of the entire length of the route. Depending on the construction material chosen, the proposed fencing has the potential to increase the barrier effect currently operating along the rail corridor, particularly for kangaroos, wallabies and wombats. However, with appropriately designed fencing which 'funnels' animals towards safe crossing points such as under bridges and/or through culverts, it is likely that this barrier effect will be substantially reduced. Local populations of more mobile fauna, including birds and bats, are considered unlikely to be adversely disrupted by increased barrier effects arising from the Project. Existing fauna movement corridors are presented in Figure 9 of the Flora and Fauna Impact Assessment (Ecotone 2008) (see Appendix E).

#### 7.4.5 Rail Traffic Strikes

It is considered unlikely that the frequency of the collision of native fauna with trains would result in a significant potential impact on local populations of threatened species in the study area. Fauna species most likely to collide with trains include terrestrial species such as macropods and wombats. The Project would result in more frequent train movements and, consequently, could result in a higher frequency of collision between trains and native fauna along the length of the Project, particularly in the vicinity of the Golden Highway where kangaroo and wallaby road kills are frequent. Areas where there is a higher potential for collision include those where the route traverses remnants of native vegetation and the riparian corridors associated with creeks and drainage lines.

The only threatened terrestrial mammal, which may occur in the study area, is the Spotted-tailed Quoll (*Dasyurus maculatus*), although it was assessed in the Flora and Fauna Impact Assessment (Ecotone 2008) as having limited potential to occur. Based on the species' large home range, the low number of individuals likely to be using the study area, and the remote chance that a Spotted-tailed Quoll would be crossing the rail corridor at the same time that a train is passing, it is considered that rail traffic strikes do not pose a threat to the long-term viability of a local population of the species.

Rail traffic strikes are unlikely to pose a risk to those threatened species recorded in the study area, namely Brown Treecreeper (*Climacteris picumnus*), Grey-crowned Babbler (*Pomatostomus temporalis*) and Grey-headed Flying-fox (*Pteropus poliocephalus*), as these are all flying species and would be unlikely to be crossing the rail corridor at a height that would result in a collision. This also applies to the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Speckled Warbler (*Pyrrholaemus sagittatus*), which although not recorded in the study area, are known from the study area.



There is a slightly higher risk that a Squirrel Glider (*Petaurus norfolcensis*) may collide with a train as the animal glides across the rail corridor. Depending on the height of the launch tree and the length of the glide, a gliding animal can land at quite a low height, or even on the ground. The nearest records of Squirrel Glider are approximately two kilometres from the study area. The number of Squirrel Gliders likely to be using the study area is low and the chance that a Spotted-tailed Quoll would be crossing the rail corridor at the same time that a train is passing is remote, hence it is considered that rail traffic strikes are unlikely to pose a risk to the long-term viability of the local Squirrel Glider population.

#### **7.4.6 Road Traffic Strikes**

Where the rail corridor passes under a road, such as along the Golden Highway, there is potential for proposed new fencing along the rail corridor to increase the risk of fauna (particularly kangaroos) colliding with vehicles by funneling animals onto the overpasses if it is of inappropriate height or restricts fauna access. Not only is there potential for a wildlife roadkill 'hotspot' to develop at locations such as this, there is also the potential traffic safety issue associated with animal/vehicle collisions.

#### **7.4.7 Assessment of Impact on Threatened Flora and Fauna and Endangered Ecological Communities listed on TSC Act**

An assessment of significance was undertaken for those threatened species and endangered ecological communities listed on the TSC Act that have been recorded, or are considered likely to occur, within the study area. This assessment is included as part of the Flora and Fauna Impact Assessment (Ecotone 2008) (see Appendix E).

The main potential impacts on threatened fauna within the study area are considered to be the loss of roosting/nesting sites associated with the removal of hollow-bearing trees. The results of the assessment indicate that while the Project would result in the loss of some known and potential habitat, such impacts are unlikely to occur to the extent that a local population of any threatened fauna species is likely to be placed at risk of extinction. However if a nest or roost tree for a threatened species is present in the area to be cleared, the loss of that tree could potentially have a significant impact on the local population of that species, particularly if it is removed during the breeding season (to be confirmed/revised).

One threatened flora species, Slaty Red Gum (*Eucalyptus glaucina*), and two EECs (Hunter Lowland Redgum Forest and River-flat Eucalypt Forest on Coastal Floodplains) lie within the proposed impact area and would be affected by the Project. However the potential impacts associated with the Project are unlikely to be so great as to result in either EEC or *Eucalyptus glaucina* being placed at risk of local extinction.

#### **7.4.8 Environment Protection and Biodiversity Conservation Act**

According to the criteria given in the administrative guidelines for the EPBC Act, the Project is unlikely to have a significant impact on any nationally listed threatened or migratory flora or fauna species.



## 7.5 Recommended Mitigation Measures

The Project will involve some clearing of native vegetation and disturbance to flora and fauna habitat, including threatened species and EECs, within the subject site.

A series of recommendations are provided that are designed to minimise the potential impacts. These include management practices during the construction period, ongoing weed management and the setting aside of areas of land as offsets for the loss of habitat for threatened species and endangered ecological communities.

The following recommendations should be considered to mitigate the impacts on flora and fauna:

- ▮ Locating works and machinery compounds and soil stockpiles in cleared areas and not in any areas of natural vegetation;
- ▮ Rehabilitation and replanting of native vegetation on areas of newly created bare soil, such as batters, following construction. A rehabilitation plan should be prepared, including particularly strategies for protection and rehabilitation of occupied or potential habitat for Slaty Red Gum (*Eucalyptus glaucina*), *Grevillea montana* and the Hunter Lowland Redgum Forest and River-flat Eucalypt Forest on Coastal Floodplains EECs;
- ▮ A weed control strategy for newly created areas of bare soil, such as batters. All weeds from areas cleared during construction should be completely removed from the site and not allowed to enter watercourses or moist areas such as drainage lines;
- ▮ Replanting locally-occurring species characteristic of the EECs in appropriate areas, particularly on areas of newly-created bare soil such as batters;
- ▮ Facilitating the expansion of *Eucalyptus glaucina* into additional areas, particularly where saplings were observed to be regenerating around adult trees;
- ▮ Hydro-seeding and hydro-mulching batters with sterile cover crops and native species;
- ▮ Engaging with local Landcare groups and adjoining landowners to identify opportunities for assisting with revegetation works (such as seed-collection);
- ▮ In order to provide offset areas for the loss of *Eucalyptus glaucina* and EEC habitat, agreements could be entered into with adjoining property owners to fence and protect occupied areas of habitat. By fencing off land containing and adjacent to *Eucalyptus glaucina* plants, the population could potentially expand, particularly where saplings were observed to be regenerating around adult trees;
- ▮ Land set aside to ameliorate the loss of *Eucalyptus glaucina* and EEC habitat would also compensate for the loss of threatened fauna habitat;
- ▮ Installation of nest boxes outside of the construction zone, prior to the removal of hollow-bearing trees, to provide temporary shelter habitat for animals displaced by clearing activities;
- ▮ Pre-clearing surveys of all habitat trees (including Grey-crowned Babbler nests and hollow-bearing trees) within the construction zone to determine which trees are occupied by fauna. Any habitat trees are to be clearly marked;

- ▶ Inspection of culverts and drains for roosting bats, by an ecologist, immediately prior to any works;
- ▶ During removal of habitat trees (including Grey-crowned Babbler nests and hollow-bearing trees) and clearing of native vegetation, an experienced and fully equipped wildlife handler should be present to retrieve and manage any displaced wildlife;
- ▶ Prior to vegetation clearance, seed is to be collected from fruiting *Eucalyptus glaucina* for subsequent redistribution within habitat adjoining the construction zone. The species flowers during Spring, with fruit borne on the plant all year;
- ▶ *Eucalyptus glaucina* to be cleared from the construction zone is to be mulched and redistributed in habitat in the vicinity of the location from which it is removed. This will serve to retain seed stock as well as maintain the species within appropriate locations along the rail corridor;
- ▶ Hollow logs, leaf litter and woody debris removed from within the construction areas should be redistributed during re-vegetation works along the route so as to provide ground habitat;
- ▶ Tree hollows should be salvaged from felled hollow-bearing trees and re-attached to mature trees within adjoining habitat;
- ▶ Measures should be incorporated into the Project design to adequately manage runoff, including management of siltation and sedimentation during construction. This is particularly important near watercourses and soaks;
- ▶ Protocols to prevent introduction or spread of *Phytophthora cinnamomi* should be implemented following DECC guidelines;
- ▶ No barbed wire is to be used in any fencing installed as part of the Project due to the known risk to fauna (particularly gliders and microchiropteran bats) of becoming entangled;
- ▶ Fencing should funnel (direct) animals towards culverts and bridges to reduce the barrier effect imposed by the fencing;
- ▶ Opportunities for incorporating 'kangaroo-friendly' fencing which allows animals (such as kangaroos, wallabies and wombats) to traverse the fence (either over or under) should be examined so that animals are not forced to use road overpasses as a means of moving between habitats on either side of the rail corridor. This would not only assist with reducing the potential risk of creating roadkill 'hotspots' at road overpasses, but would also reduce the risk of creating a traffic safety issue through animal / vehicle collisions;
- ▶ Incorporate fauna movement considerations into the fencing configuration at the Golden Highway overpass so that larger animals, such as kangaroos, are not directed onto the highway;

- ▶ Underpasses could also assist in maintaining habitat connectivity for fauna. Various studies (eg AMBS 1997, 2002 and Finegan 1997) have demonstrated that Australian fauna (such as kangaroos, wallabies and wombats) will use appropriately designed culverts and bridges as crossing structures. A number of potential underpasses already exist at culvert and bridge crossings within the study area. It is recommended that consideration of fauna movement (eg providing dry passage and incorporating directional fencing) be incorporated into the design of such structures to maintain / improve their use by fauna, particularly larger species such as kangaroos, wallabies and wombats; and
- ▶ It is recommended that existing fauna movement corridor, as seen in Figure 9 of the Flora and Fauna Impact Assessment (Ecotone 2008), links be retained and that gaps between patches of vegetation are not extended to greater than 30-40m in width. This would assist in maintaining a continuous link for squirrel gliders, as this species is known to be able to negotiate a glide distance of 30-40m (depending on the height of the launch tree).



## 8. Indigenous Heritage

### 8.1 Introduction

The Director-General's requirements identified indigenous heritage as a key issue for the Environmental Assessment. This section identifies the potential ecological impacts of the Project and the management measures to reduce these impacts. A detailed Aboriginal Heritage Impact Assessment is included in Appendix F. The management measures are further detailed in the draft SoC contained in Appendix B. Table 8-1 outlines the Director-General's requirements and where they have been addressed.

**Table 8-1 Indigenous Heritage Director-General Requirements**

| Environmental Assessment Requirements                                                                                                                                                                                                      | Where Addressed         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| Objects, places of significance, natural and landscape values of the corridor and surrounding areas, taking into account the <i>Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation</i> (DECC). | Section 8<br>Appendix A |

### 8.2 Existing Environment

A detailed Aboriginal Heritage Impact Assessment has been prepared for the Project by South East Archaeology. A copy of the Assessment is included in Appendix A. The study area measured 11.3 km in length and 250 m in width for a total area of 283 hectares. Approximately 92.5 hectares of the study area comprises of land that has been extensively impacted by earthmoving works and construction associated with the existing railway line and the New England Highway, such that there is little potential for any Aboriginal heritage evidence to remain in the area. As such, the Aboriginal heritage investigation was focused in the remaining unmodified lands of 190 hectares within the study area.

A total of 30 Aboriginal heritage sites, all isolated stone artefacts or small artefact scatters, were recorded within the overall Project impact area. The study area lies within the boundaries of the Wanaruah Local Aboriginal Land Council (LALC) and within an area of interest to other Aboriginal persons and organisations. Table 8-2 describes the location and features of the Aboriginal heritage sites that occur within the study area. Figure 8-1 shows the location of Aboriginal heritage artefacts recorded during the investigation.



**Table 8-2 Location and Features of Aboriginal Heritage Sites**

| Name            | Lot and DP            | Coordinates    | Chainage | Description                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------|-----------------------|----------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| M5/B            | Lot 32<br>DP 865705   | 332162 6390058 | 232480   | Site M/5B is an artefact scatter comprising of two artefacts, both silcrete flakes. The items are located in a 4x1 metre exposure created by erosion, immediately southwest of the fence bordering the rail corridor.                                                                                                                                                                                                                       |
| M5/A            | Lot 32<br>DP 865705   | 332192 6390029 | 232440   | M5/A is an artefact scatter comprising of five artefacts (three silcrete flake portions, a silcrete flake and a volcanic flake). These items are located in a 3x3 metre portion of a 4x3 metre exposure created by an ants nest and sheet erosion, immediately southwest of the fence bordering the rail corridor.                                                                                                                          |
| M50/A           | Lot 352<br>DP 1058913 | 333611 6387839 | 229600   | M50/A is an artefact scatter comprising of two artefacts including a silcrete and tuff flake portion. They are located in a 5x2 metre area on the wall of a farm dam north of the Golden Highway and west of the rail corridor.                                                                                                                                                                                                             |
| M24/B           | Lot 2<br>DP 86239     | 333772 6387655 | 229420   | M24/B is an isolated artefact comprised of a tuff flake portion. It is located on the eastern margin of a farm dam excavated into the drainage depression, north of the Golden Highway and east of the rail corridor.                                                                                                                                                                                                                       |
| DECC #37-6-1599 | Lot 1<br>DP 806861    | 333808 6387427 | 229180   | DECC #37-6-1599 is an artefact scatter recorded by McCardle (2005) and included six “mudstone” (tuff) flakes, two silcrete flakes a tuff utilized flake, a tuff proximal flake portion and a tuff core. During the present surveys, 12 artefacts were recorded in an 80x30 metre portion of the study area. These included a silcrete flake, two tuff core fragments, four tuff flakes, two tuff flake portions and three lithic fragments. |



| Name  | Lot and DP            | Coordinates |         | Chainage | Description                                                                                                                                                                                                                                                                                             |
|-------|-----------------------|-------------|---------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| M23/A | Lot 1<br>DP 806861    | 333788      | 6387296 | 229040   | M23/A is an isolated artefact comprised of a silcrete core. It is located within a 45x10 metre erosion scour, north of the Golden Highway and east of the rail reserve.                                                                                                                                 |
| M9/A  | Lot 100<br>DP 1033019 | 333548      | 6386955 | 228680   | M9/A is an artefact scatter comprising of two tuff flakes, two tuff lithic fragments and a tuff flake portion. These items are located in an 8x8 metre portion of a 20x10 metre exposure, immediately south of the junction of well-formed gravel roads south of the gate #6 entrance to the Army Base. |
| M9/B  | Lot 100<br>DP 1033019 | 333582      | 6386931 | 228680   | M9/B is an artefact scatter comprising of two tuff flakes located 16 metres apart and situated within the Singleton Army Base, immediately south of the Golden Highway and west of the rail corridor.                                                                                                   |
| M11/A | Lot 100<br>DP 1033019 | 333694      | 6386849 | 228620   | M11/A is an isolated artefact comprising of a silcrete flake portion situated in the Singleton Army Base south of the Golden Highway and west of the rail corridor.                                                                                                                                     |
| M11/B | Lot 100<br>DP 1033019 | 333669      | 6386829 | 228580   | M11/B is an artefact scatter comprising of three artefacts including two silcrete flake portions and one tuff flake portion. These are situated in a 6x3 metre area within the Singleton Army Base south of the Golden Highway and west of the rail corridor.                                           |
| M11/C | Lot 100<br>DP 1033019 | 333641      | 6386739 | 228480   | M11/C is an artefact scatter comprising of three artefacts including two silcrete flakes and one tuff flake. These are situated in a 7x5 metre area within the Singleton Army Base.                                                                                                                     |
| M11/D | Lot 100<br>DP 1033019 | 333678      | 6386743 | 228480   | M11/D is an artefact scatter comprising of three artefacts including a silcrete flake portion, a silcrete lithic fragment and a tuff flake. There are situated in a 20x3 metre area at the junction of several vehicle tracks within the Singleton Army Base, west of the rail corridor.                |



| Name            | Lot and DP            | Coordinates |         | Chainage | Description                                                                                                                                                                                                                                                                                                                  |
|-----------------|-----------------------|-------------|---------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| M11/E           | Lot 100<br>DP 1033019 | 333754      | 6386669 | 228400   | M11/E is an artefact scatter comprising of three artefacts including two silcrete flake portions and one tuff portion. These are situated in a 5x3 metre area on a vehicle track within the Singleton Army Base, west of the rail corridor.                                                                                  |
| DECC #37-6-1605 | Lot 100<br>DP 1033019 | 333818      | 6386611 | 228340   | DECC #37-6-1605 is an isolated artefact recorded by McCardle (2005). This artefact was not relocated during the present survey. It was described as a single “mudstone” (tuff) core between the well-formed gravel road in the Singleton Army Base and the adjacent fence parallel to the western side of the rail corridor. |
| M14/A           | Lot 100<br>DP 1033019 | 333798      | 6386499 | 228240   | M14/A is an isolated artefact comprised of a silcrete flake portion. This is located on a vehicle track, 10 metres north of a track junction and 20 metres north of a low bund wall across the track used for drainage control, within the Singleton Army Base and west of the rail corridor.                                |
| DECC #37-6-1606 | Lot 100<br>DP 1033019 | 333838      | 6386499 | 228240   | DECC #37-6-1606 is an isolated artefact recorded by McCardle (2005). This artefact was not relocated during the present survey. It was described as a single “mudstone” (tuff) core on a vehicle track in the Singleton Army Base.                                                                                           |
| M15/B           | Lot 100<br>DP 1033019 | 333858      | 6386428 | 228140   | M15/B is an isolated artefact comprised of a tuff flake. It is located on an exposure southeast of a junction of two well-formed gravel roads within the Singleton Army Base, west of the rail corridor.                                                                                                                     |
| M15/A           | Lot 100<br>DP 1033019 | 333820      | 6386351 | 228100   | M15/A is an isolated artefact comprised of a silcrete flake. This is located on a drainage culvert south of a gravel road parallel and adjacent to the rail corridor fence within the Singleton Army Base and west of the rail corridor.                                                                                     |



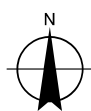
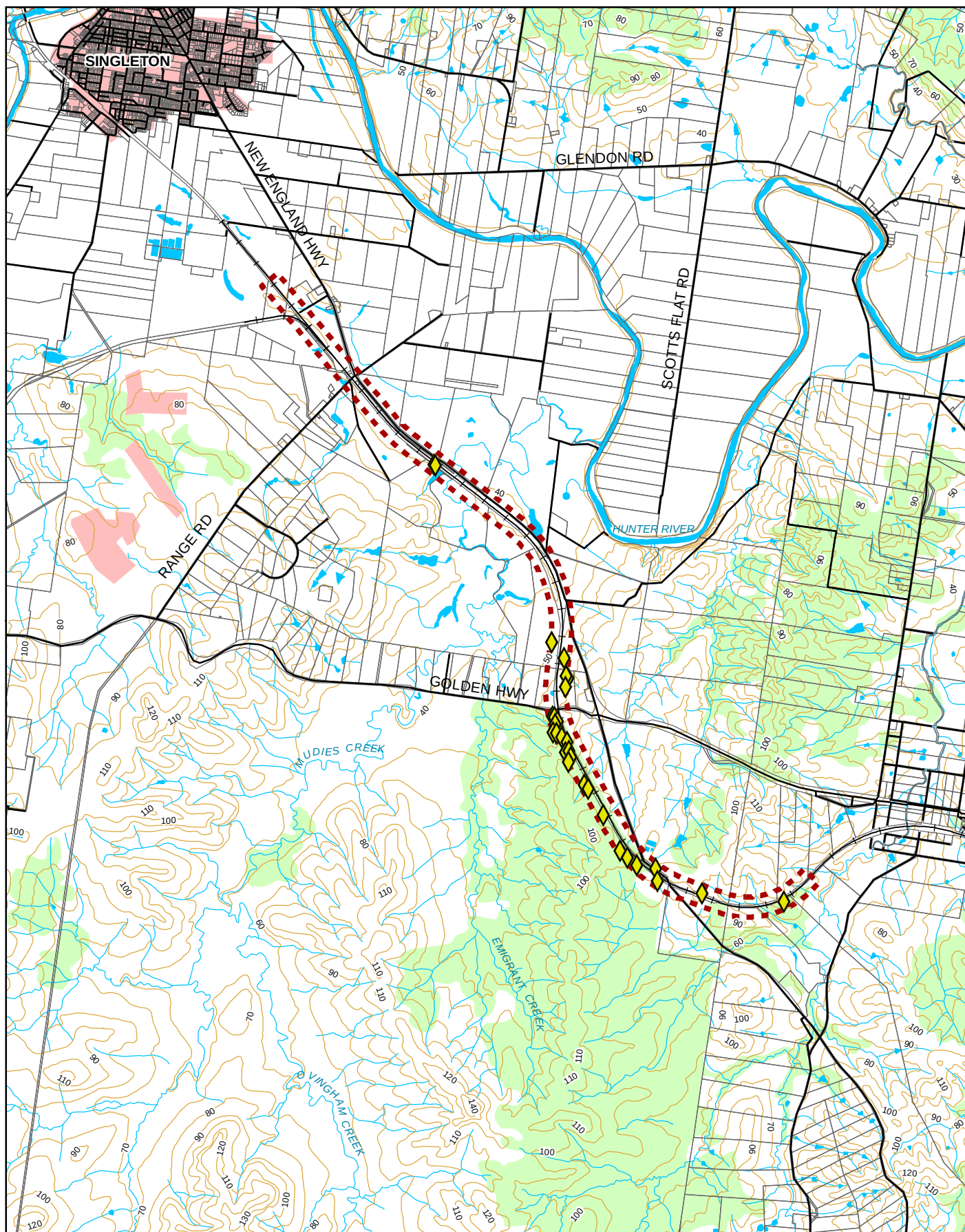
| Name  | Lot and DP            | Coordinates |         | Chainage | Description                                                                                                                                                                                                                                                                                                                              |
|-------|-----------------------|-------------|---------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| M57/B | Lot 100<br>DP 1033019 | 334025      | 6386097 | 227780   | M57/B is an artefact scatter comprising of six artefacts including two silcrete flakes, two tuff flakes, a tuff flake portion and a tuff lithic fragment. These are located within a 2x2 metre portion of a 10x5 metre exposure associated with an ants nest 20 metres south of a well-formed gravel road and west of the rail corridor. |
| M57/A | Lot 100<br>DP 1033019 | 334075      | 6386033 | 227700   | M57/A is an isolated artefact comprised of a tuff core. It is located adjacent to a drainage culvert leading to a well-formed gravel road parallel and west of rail corridor.                                                                                                                                                            |
| M59/A | Lot 100<br>DP 1033019 | 334258      | 6385705 | 227320   | M59/A is an isolated artefact comprised of a tuff flake. It is located adjacent of a spoil mound 30 metres south of a well-formed gravel road adjacent and west of the rail corridor.                                                                                                                                                    |
| BW12  | Lot 89<br>DP 871709   | 334550      | 6385500 | 227000   | BW12 is an artefact scatter recorded by Effenberger and Kitchener (1997) and includes three “mudstone” (tuff) flakes. This artefact was not relocated during the present survey.                                                                                                                                                         |
| M65/A | Lot 100<br>DP 1033019 | 334485      | 6385305 | 226860   | M65/A is an artefact scatter comprised of four artefacts including a tuff core, a tuff core fragment, a tuff utilised flake and a silcrete flake. These are located within a 70x5 metre portion of a vehicle track and adjacent extensive erosion scours. This is within the Singleton Army Base south of the rail corridor.             |
| M65/B | Lot 100<br>DP 1033019 | 334554      | 6385184 | 226760   | M65/B is an isolated artefact comprised of a silcrete flake portion. It is located 40 metres south of a well-formed gravel road parallel and adjacent to the rail corridor fence. This is within the Singleton Army Base and south of the rail corridor.                                                                                 |
| M67/A | Lot 100<br>DP 1033019 | 334672      | 6385089 | 226620   | M67/A is an artefact scatter comprising of a tuff flake and a tuff flake portion. These are located adjacent to a spoil mound 30 metres south of a well-formed gravel road parallel and adjacent to the rail corridor fence. This is within the Singleton Army Base and south of the rail corridor.                                      |



| Name  | Lot and DP            | Coordinates |         | Chainage | Description                                                                                                                                                                                                                                                       |
|-------|-----------------------|-------------|---------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| BW1   | Lot 89<br>DP 871709   | 334830      | 6385160 | 226540   | BW1 is an artefact scatter recorded by Effenberger and Kitchener (1997) and includes six silcrete “indurated mudstone” (tuff) and quartz artefacts. These artefacts were not relocated during the present survey.                                                 |
| M71/A | Lot 89<br>DP 871709   | 334910      | 6385048 | 226400   | M71/A is an isolated artefact comprised of a silcrete flake. It is located one metre south of a fence in the abattoir land and about 40 metres north of the rail corridor.                                                                                        |
| M70/A | Lot 100<br>DP 1033019 | 334938      | 6384894 | 226300   | M70/A is an artefact scatter comprised of two tuff flakes. These are located 20 metres apart on a dam wall and adjacent a spoil mound. This is within the Singleton Army Base and south of the rail corridor.                                                     |
| M39/A | Lot 89<br>DP 871709   | 335508      | 6384717 | 225740   | M39/A is an isolated artefact comprised of a tuff flake. It is located one metre north of a fence bordering the northern side of the rail corridor at the end of a contour bank leading to a dam 15 metres to the north.                                          |
| M32/A | Lot 103<br>DP 882932  | 336488      | 6384640 | 224680   | M32/A is an artefact comprising of six artefacts (four tuff flakes and two tuff flake portions). They are located in a 15x3 metre area on a vehicle track, four metres south of the rail corridor fence at the junction of regrowth forest and a grassy clearing. |



GIS Filename: \\ghdnet\ghd\AU\Newcastle\Projects\22-13755\GIS\Maps\South East Archaeology\Aboriginal Heritage Report (July08)\Heliage\_Report\_Overall\_SA\_July08.mxd



#### LEGEND

— Existing Rail  
— Road

□ Cadastre

— Watercourse

■ Built Up Areas

■ Forest Or Shrub

■ Investigation Area

◆ Aboriginal Heritage Sites

1:64,338 for A4  
0 300 600 1,200 1,800 2,400  
Metres

Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geodetic Datum of Australia 1994  
Grid: Map Grid of Australia, Zone 56



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ARTC - Minimbah Third Track  
Environmental Assessment  
Location of Aboriginal Heritage  
Evidence within Study Area  
8 | August 2008

job no. | 22-13755  
rev no. | A

Figure 8.1



### 8.3 Potential Impacts

The Aboriginal Heritage Impact Assessment (Appendix F) concluded that the impact on the identified and potential Aboriginal heritage resources of the region, in the absence of appropriate management and mitigation measures, would be low. With the high levels of existing impacts within the study area, the low significance of the identified evidence, the limited extent of proposed impacts to the unmodified portion of the study area and the low potential for any sub-surface deposits of artefacts, the impacts associated with the Project would not be significant to the Aboriginal heritage value in the area. Other types of heritage evidence are not anticipated to occur within the study area and other Aboriginal cultural values or associations were not identified during the course of the assessment.

### 8.4 Recommended Mitigation Measures

The following preliminary management and mitigation measures are proposed in consideration of the legal requirements under the *NSW National Parks and Wildlife Act 1974* and *Environmental Planning and Assessment Act 1979*, the results of the survey and consultation with the local Aboriginal community:

- ▶ In order to mitigate the impacts of development and to conserve artefact samples, a program of salvage would be undertaken. This would involve registered Aboriginal stakeholders and qualified archaeologists collecting stone artefacts from any of the identified Aboriginal sites that may be subject to impacts, conducting mechanical surface scrapes within the impact zone in area M5, curating and analysing collected heritage evidence in consultation with Aboriginal stakeholders and preparing a report detailing the results of the mitigation measures implemented;
- ▶ Appropriate precautionary measures, such as informing relevant staff and contractors of the nature and location of the items and the need to avoid impacts, along with temporary protective fencing and signage, would be implemented for those sites within close proximity of the area of works. As a general principle, all relevant contractors and staff engaged on the project will receive heritage awareness training prior to commencing work on site, including but not limited to, the presentation of information about the Aboriginal culture and history of the locality, nature of the identified and potential Aboriginal heritage evidence with the project area, heritage management measures and protocols, and legal obligations;
- ▶ Should any skeletal remains be detected during the course of development, work in that location would cease immediately and the finds would be reported to the appropriate authorities, including the Police, DECC and Aboriginal stakeholders. Subject to the Police requiring no further involvement, any Aboriginal skeletal remains identified would be retrieved by hand excavation and reburied outside of the impact zone at a location agreed to by the Aboriginal stakeholders;



- ▶ Further consultation would be pursued with the registered Aboriginal stakeholders in relation to the Project and the contents and recommendations of this investigation. The continued involvement of the registered Aboriginal stakeholders in the ongoing management of the heritage resource within the Project area would be promoted for the overall Project; and
- ▶ Under the terms of the *National Parks and Wildlife Act 1974* it is an offence to knowingly destroy, damage or deface an Aboriginal object without obtaining the prior written permission of the Director-General of DECC. Therefore, no activities or work should be undertaken within the Aboriginal site areas as described and illustrated in the Aboriginal Heritage Impact Assessment in the absence of a Part 3A approval.

After implementation of these management and mitigation measures, it is concluded that the risk of residual impacts to Aboriginal heritage from the Project would be very low.



## 9. Land Use and Access

### 9.1 Introduction

The Director-General's Requirements identified land use and access as a key issue for the Environmental Assessment. This section identifies the potential land use and access impacts of the Project and the management measures to reduce these impacts. The management measures are further detailed in the draft SoC contained in Appendix B. Table 9-1 outlines the Director-General's requirements and where they have been addressed.

**Table 9-1 Land Use and Access Director-General Requirements**

| Environmental Assessment Requirements                                                                                                                                                                                   | Where Addressed |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Access to, within and across the corridor (road and rail).                                                                                                                                                              | Section 9.2.2   |
| Transport infrastructure (interaction with existing and proposed rail, road and air infrastructure), taking into account the <i>Road Design Guide (RTA)</i> and relevant Austroads guidelines and Australian Standards. | Section 9.2.1   |
| Traffic movement and management (haulage routes, traffic control and safety).                                                                                                                                           | Section 9.3.2   |
| Land use and property (interaction with proposed Whittingham industrial area, acquisition, access, business and infrastructure impacts).                                                                                | Section 9.3.1   |

### 9.2 Existing Environment

#### 9.2.1 Land Use

The Project is wholly located within the Singleton LGA. The area surrounding the Project includes the urban centre of Singleton and the townships of Whittingham and Belford, as well as a number of smaller localities. Section 6.5.2 outlines the land use zonings that the Project passes through. The New England Highway is located to the east of the Main Northern Railway, running parallel or in close proximity to the Project. Public roads and private access ways intersect the Project, including the Golden Highway (via a over bridge), Range Road (via a level crossing) and a private level crossing. Whittingham airstrip adjoins the northern section of the Project. A number of watercourses traverse the Project route and drain into the Hunter River to the north, including Mudies Creek.

The Singleton Land Use Strategy (Planning Workshop Australia, 2008) places the Project primarily within the 'Rural South East', with a small portion in 'Rural West' and 'Army Camp' planning areas. The land use characteristics of these areas that are most applicable to the Project are:

- Pressure for more rural and rural residential development due to accessibility to Maitland, Newcastle, Cessnock and the Greater Sydney metropolitan area;
- Limited water availability;



- Stable population; and
- Commonwealth land outside Council control.

Accordingly, the land uses adjoining the Project are predominantly rural, particularly grazing and associated rural residences. Some commercial undertakings are also present adjacent to the Project. Land uses include:

- Adjoining the northern section of the Project is Whittingham airstrip;
- A nursery and landscaping supply business located between the New England Highway and the Main Northern Railway at Whittingham;
- A small vineyard located to the southwest of the Project;
- Farming, grazing, olive plantations and other vineyards beyond transport easements;
- The Singleton Military Area, including the bombing and firearms range, located adjacent to the west of the Project; and
- An abattoir sited to the west of the southern end of the Project route.

Singleton Council has received a rezoning application for land to the north of the Project route for the Whittingham Industrial Estate.

Some areas of native vegetation occur within or surrounding the Project area, in particular within Singleton Military Area, Belford National Park (located within 1 km from the southern end of the Project route) and on adjoining private land.

### **9.2.2 Access**

As discussed in Section 2.2.2 and shown in Figure 2-1, a number of primary and secondary access points for construction have been identified via the existing road network:

- Primary: Range Road and the Golden Highway; and
- Secondary: existing access points to the rail corridor via the Hermitage Road level crossing, a right of way access across a private property on the Golden Highway, and an access point from the New England Highway.

### **9.2.3 Traffic and Transport**

The Traffic and Transport Assessment in Appendix I (GHD, 2008) assessed the existing traffic conditions at the following key locations:

- The intersection of the private level crossing and New England Highway;
- The intersection of Range Road and New England Highway;
- The intersection of Cemetery Land and New England Highway; and
- The New England Highway in vicinity of the Project.

The assessment estimated the predicted traffic movements at each of the above intersections during construction. It also reported that the Average Annual Daily Traffic (AADT) for 2006 on the New England Highway was 12,906 and had been subject to traffic growth of 2.7% per annum for the five years to 2006.





## 9.3 Potential Impacts

### 9.3.1 Land Use

Localised impacts associated with the Project are primarily associated with property acquisition. Property acquisition would mainly occur in strip form adjacent to the existing rail corridor on both the Up and Down sides of the track. Approximately 30 lots from 26 landowners would need to be partially acquired. Refer to Table 9-2 for details of the acquisition requirements and proposed land use and access impacts. Where applicable during construction, fences and gates would be maintained in accordance with affected property owner's requests.

#### Construction

Construction of the Project would require both acquired lands and leased lands for temporary infrastructure and temporary access. Potential impacts on land use as a result of the construction phase of the Project include amenity impacts such as noise (refer to Section 10.3, air (refer to Section 14.2.2), and visual (Refer to Section 13.3).

#### *Potential Impacts to Whittingham Airstrip*

The Whittingham airstrip is a private airstrip not registered or certified with the Civil Aviation Safety Authority (CASA). The Range Road overbridge has been designed so that the overbridge and vehicles using the overbridge do not impact on the required flight path criteria of a registered aerodrome with similar airstrip dimensions. Consultation with the airstrip management and CASA has been undertaken to assist in the design limits of Range Road so that in the instance that the airstrip operator was to apply to register the airstrip, the proposed Range Road grade separation would not impact on the ability for the airstrip to comply with the relevant aerodrome guidelines.

#### *Potential Impacts to Proposed Whittingham Industrial Estate*

To the east and west of the New England Highway, near the junction with the Golden Highway, a proposed rezoning of Zone 1(a) (Rural Zone) to Zone 4 (Industrial Zone) is currently with the Department of Planning (DoP) for assessment. This is known as the proposed Whittingham Industrial Estate (WIE) and is subject to a draft LEP (Amendment No. 40). Numerous studies have been conducted in this area to determine the feasibility of this rezoning.

The WIE is currently used for low intensity cattle grazing and farmland and comprises a total area of approximately 345 hectares. The rezoning request seeks that approximately 235 hectares be available for industrial subdivision with 88 hectares of site area to be rezoned to Zone 7 (Environment Protection Zone), and the remaining site is for roads and infrastructure (Singleton Council, 2005).

Council resolved to support the proposed WIE in June 2005. However, in September 2005 Council was advised by DoP that the application did “*not adequately address the justification for this type of land use in this location...a more strategic appraisal of the need for and best location of additional industrial/ employment lands within the shire is required...*” (DoP cited in Singleton Council, 2005). This was addressed and an amended draft LEP request was reported to Council on 12 March 2007. Council resolved in this meeting to proceed with the amended draft LEP and request the DoP to issue a Section 65 Certificate under the EP&A Act. The draft LEP is currently with the DoP who is assessing the amended application.



The Project would require strip acquisition of approximately 1.103 hectares of the proposed WIE. The potential impacts of the Project are expected to be minimal as the strip of land being acquired is directly adjacent to the rail line and does not interfere with any access points to the WIE site and is considered unlikely to impact on the lot yield or viability of this rezoning application due to the relatively small area required. Negotiations between the ARTC and the landowner are underway with regard to property acquisition (as discussed below).

### **Operation**

Impacts would occur as a result of permanent physical changes directly associated with the Project. In particular, property acquisition (as outlined in Table 9-2) would create permanent, direct changes to some properties.

### ***Business and Infrastructure Impacts***

The Project has the potential to impact on a number of businesses primarily through land acquisition. These include an abattoir, a nursery, and an airstrip. Table 9-2 indicates the area of land required for the Project. The extent of impact would vary depending on the individual property and how much land is being acquired. However, in the majority of cases the acquisition is in a strip directly adjacent to the existing rail line. The impact of the Project on business activity is addressed in Section 14.1.

### **Property Acquisition**

Construction of the Project and associated infrastructure would require the acquisition of properties in a strip adjacent to the existing rail corridor on both the Up and Down sides of the track. Approximately 30 lots from 26 landowners would need to be partially acquired. The total amount of land proposed for acquisition is approximately 37.71 hectares. All acquisition of land would be undertaken in accordance with the provisions of the *Land Acquisition (Just Terms Compensation) Act 1991*. Refer to Table 9-2 for details of the acquisition requirements and proposed land use and access impacts, mitigation measures and Figure 9-1 to Figure 9-6, which map the extent of acquisition.

ARTC recognises that the negotiated acquisition of the affected areas of the properties is the desired outcome. Efforts are currently underway to pursue this course of action in the first instance. In instances where negotiation with affected landowners is not successful, and in accordance with the statutory timeframes outlined in the *Land Acquisition (Just Terms Compensation) Act 1991*, affected areas would be acquired through compulsory acquisition.

ARTC is not a state authority and in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*, is not authorised to acquire land. ARTC has sought and been granted an agreement for Rail Infrastructure Corporation's (RIC) to use its power as a state authority to acquire property, for the construction of the Project. Once the property is acquired by RIC, it will be incorporated into the ARTC Lease.

If during the acquisition process an affected property becomes listed for sale on the open market, ARTC would consider purchasing the property separate from the acquisition process detailed above.





The acquisition of Commonwealth land is subject to the *Commonwealth Property Disposals Policy*. The policy requires ARTC to make a submission to the Australian Federal Government for consideration and recommendation for sale of the affected property to RIC for the purpose of construction of the Minimbah Bank Third Track. If recommended, the subsequent approval of the Minister for Finance and Administration and Deregulation would be required.



**Table 9-2 Property Impacts**

| Ref No. | Ownership | Total Area (m <sup>2</sup> ) | Area of Acquisition (m <sup>2</sup> ) | % of Property Acquired | Description of Impacts                                                                                                        | Proposed Mitigation Measures <sup>1 2</sup>                                                                              |
|---------|-----------|------------------------------|---------------------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| MD-19.5 | Private   | 404,100                      | 3,656                                 | 0.90%                  | Strip acquisition required on north-western boundary.                                                                         | No specific mitigation measures proposed.                                                                                |
| MD-21   | Private   | 405,100                      | 2,945                                 | 0.73%                  | Strip acquisition required on northern boundary.                                                                              | No specific mitigation measures proposed.                                                                                |
| MD-20   | Private   | 608,800                      | 1,945                                 | 0.32%                  | Strip acquisition required on northern boundary.                                                                              | No specific mitigation measures proposed.                                                                                |
| MD-16   | Private   | 101,100                      | 5,250                                 | 5.19%                  | Strip acquisition required on eastern boundary and new easement to drain water. Existing dam and noise wall will be affected. | Negotiations with landowner to reconstruct or modify the existing dam and noise wall.                                    |
| MD-14   | Private   | 402,900                      | 7,773                                 | 1.93%                  | Strip acquisition required on eastern boundary.                                                                               | No specific mitigation measures proposed.                                                                                |
| MD-13   | Private   | 233,000                      | 6,100                                 | 2.62%                  | Strip acquisition required on northern boundary and subsequent closure of private level crossing.                             | Alternate access to be provided to mitigate the impact of closing of the level crossing.                                 |
| MD-12   | Private   | 2,785,000                    | 7,106                                 | 0.26%                  | Strip acquisition required on northern boundary and access to private level crossing on adjoining property will be lost.      | As the access lost is not the legal property access, ARTC to consider providing secondary property access for landowner. |
| MD-11   | Private   | 392,100                      | 484                                   | 0.12%                  | Strip acquisition required on northern boundary.                                                                              | No specific mitigation measures proposed.                                                                                |
| MD-12A  | Private   | 591,400                      | 11,622                                | 1.97%                  | Strip acquisition required on northern boundary.                                                                              | No specific mitigation measures proposed.                                                                                |



| Ref No. | Ownership | Total Area (m <sup>2</sup> ) | Area of Acquisition (m <sup>2</sup> ) | % of Property Acquired | Description of Impacts                                                                                                       | Proposed Mitigation Measures <sup>1 2</sup>                                    |
|---------|-----------|------------------------------|---------------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| MU-15   | Private   | 212,600                      | 19,362                                | 9.10%                  | Strip acquisition required on western boundary.                                                                              | No specific mitigation measures proposed.                                      |
| MD-05   | Private   | 188,900                      | 9,540                                 | 5.05%                  | Partial acquisition required on northern boundary. Existing dam will be affected.                                            | Negotiations with landowner to reconstruct or modify the existing dam.         |
| MU-17   | Private   | 3,110,190                    | 125,040                               | 4.02%                  | Strip acquisition required on south western boundary and new easement to drain water. Existing noise mound will be affected. | Negotiations with landowner to reconstruct or modify the existing noise mound. |
| MU-18   | Private   | 763,900                      | 8,923                                 | 1.17%                  | Strip acquisition required on southern boundary.                                                                             | No specific mitigation measures proposed.                                      |
| MU-19   | Private   | 352,400                      | 9,306                                 | 2.64%                  | Strip acquisition required on southern boundary.                                                                             | No specific mitigation measures proposed.                                      |
| MU-20   | Private   | 211,300                      | 94                                    | 0.04%                  | Strip acquisition required on southern boundary.                                                                             | No specific mitigation measures proposed.                                      |
| MU-04   | Private   | 206,400                      | 35,300                                | 17.10%                 | Partial acquisition required on southern boundary and strip acquisition along western and eastern boundaries.                | No specific mitigation measures proposed.                                      |
| MU-05   | Private   | 3,902                        | 3,902                                 | 100%                   | Complete acquisition of affected parcel.                                                                                     | No specific mitigation measures proposed.                                      |
| MU-03   | Private   | Unknown <sup>3</sup>         | 628                                   | Unknown <sup>3</sup>   | Strip acquisition required on western boundary.                                                                              | No specific mitigation measures proposed.                                      |
| MU-13   | Private   | 62,420                       | 20,732                                | 33.21%                 | Strip acquisition required at western and eastern property boundaries.                                                       | No specific mitigation measures proposed.                                      |

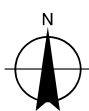
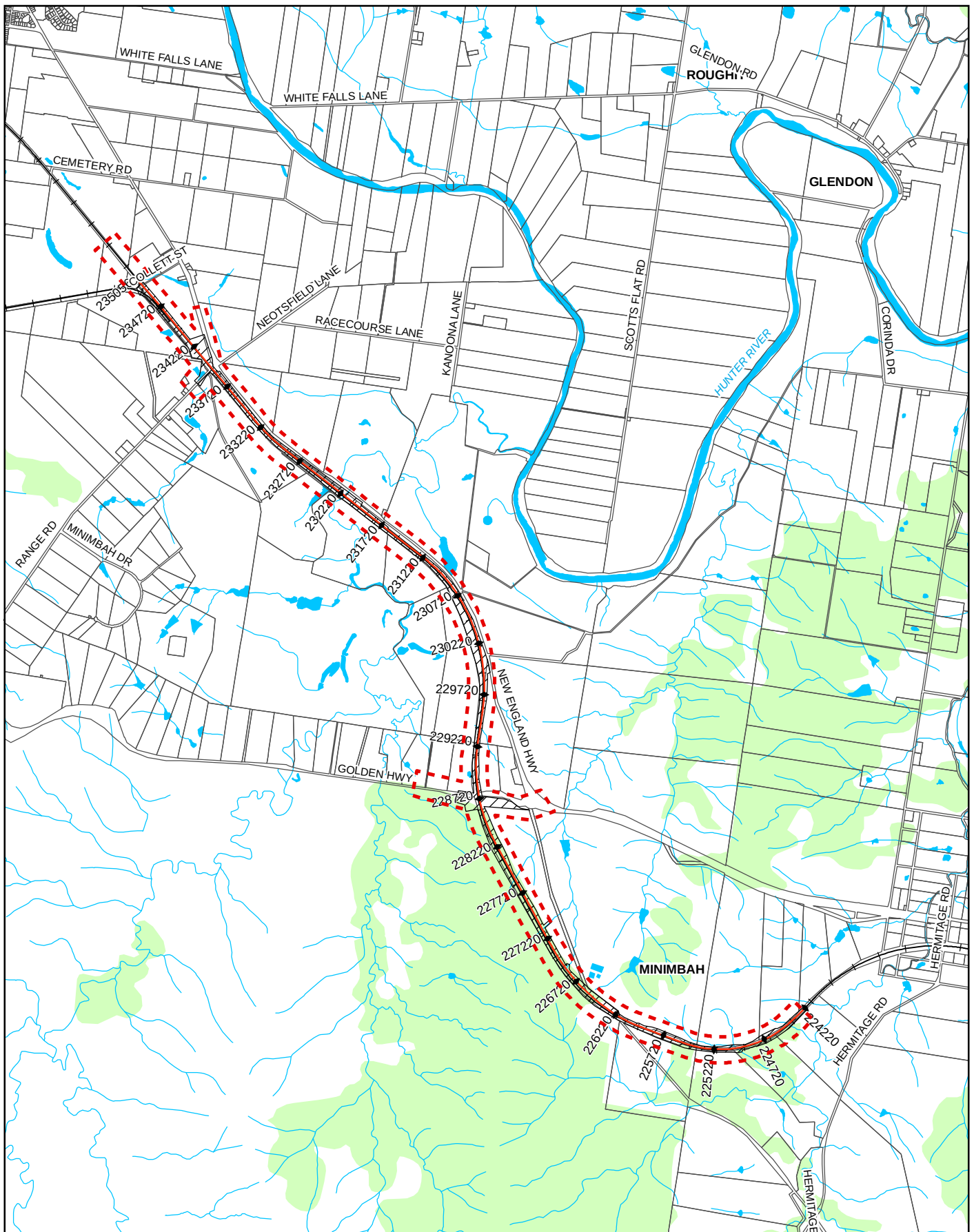


| Ref No. | Ownership    | Total Area (m <sup>2</sup> )                      | Area of Acquisition (m <sup>2</sup> )     | % of Property Acquired | Description of Impacts                                | Proposed Mitigation Measures <sup>1 2</sup> |
|---------|--------------|---------------------------------------------------|-------------------------------------------|------------------------|-------------------------------------------------------|---------------------------------------------|
| MD-04   | Private      | 6,921                                             | 175                                       | 2.53%                  | Strip acquisition required on eastern boundary.       | No specific mitigation measures proposed.   |
| MU-09   | Private      | 15,289                                            | 15,289                                    | 100%                   | Complete acquisition of lot.                          | No specific mitigation measures proposed.   |
| MD-17   | Commonwealth | 132,340,000                                       | 56,260                                    | 0.04%                  | Strip acquisition required on north eastern boundary. | No specific mitigation measures proposed.   |
| MD-19   | Private      | 142,400                                           | 10,150                                    | 7.13%                  | Strip acquisition required on northern boundary.      | No specific mitigation measures proposed.   |
| MD-18   | Private      | 405,400                                           | 42                                        | 0.01%                  | Strip acquisition required on northern boundary.      | No specific mitigation measures proposed.   |
| MD-9.5  | Private      | 11,364                                            | 11,364                                    | 100%                   | Complete acquisition of affected parcel.              | No specific mitigation measures proposed.   |
| MD-11.5 | Private      | 4,046                                             | 4,046                                     | 100%                   | Complete acquisition of affected parcel.              | No specific mitigation measures proposed.   |
| TOTALS  |              | 143,960,991m <sup>2</sup><br>OR<br>14396 hectares | 377,105m <sup>2</sup> OR<br>37.7 hectares | 0.24%                  |                                                       |                                             |

<sup>1</sup> The property specific management measures are in addition to the general management measures listed in Section 9.4.

<sup>2</sup> Fencing would be reinstated to all impacted properties along newly defined boundaries prior to construction.

<sup>3</sup> Surveyor unable to determine lot area as lot is in old systems title.



#### LEGEND

- Existing Rail
- Project Route
- ▨ Property Acquisition Area
- ▭ Cadastre
- Watercourse
- Forest Or Shrub
- ▭ Study Area

1:50,000 for A4  
0 200 400 800 1,200 1,600  
Metres

Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geodetic Datum of Australia 1994  
Grid: Map Grid of Australia, Zone 56

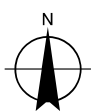
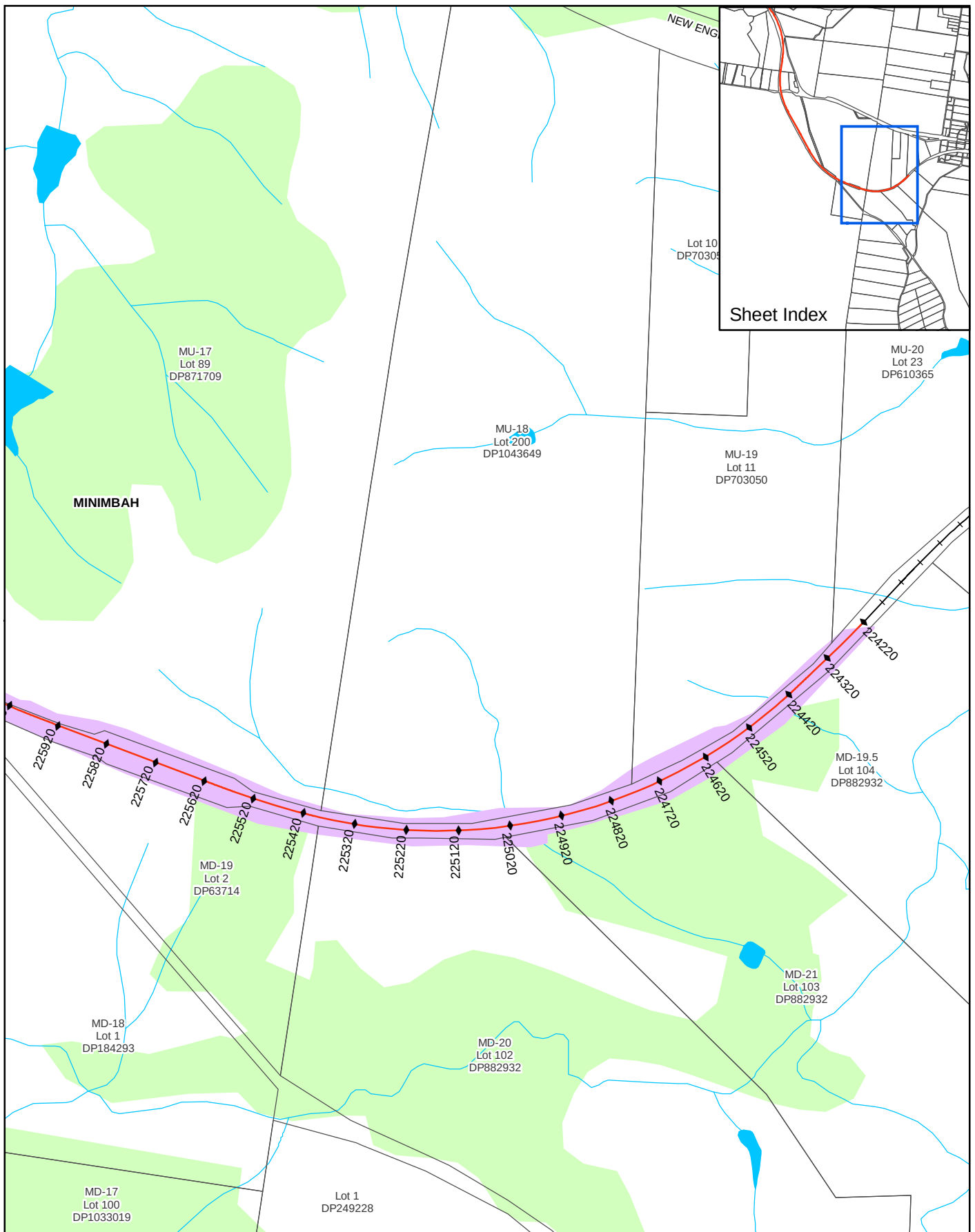


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Environmental Assessment  
Project Extent &  
Property Acquisition Area  
30 June 2008

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Figure 9.1



#### LEGEND

- Existing Rail
- Project Route
- Property Acquisition Area
- Cadastral
- Watercourse
- Forest Or Shrub

1:10,000  
0 30 60 120 180 240  
Metres

for A4



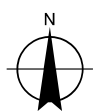
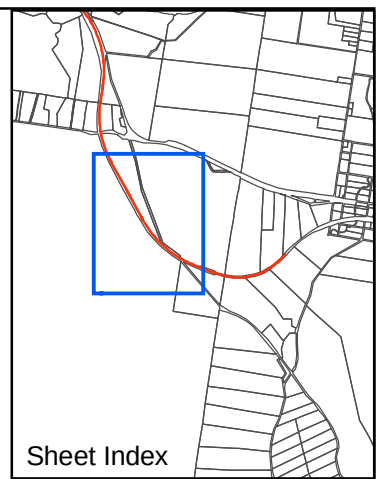
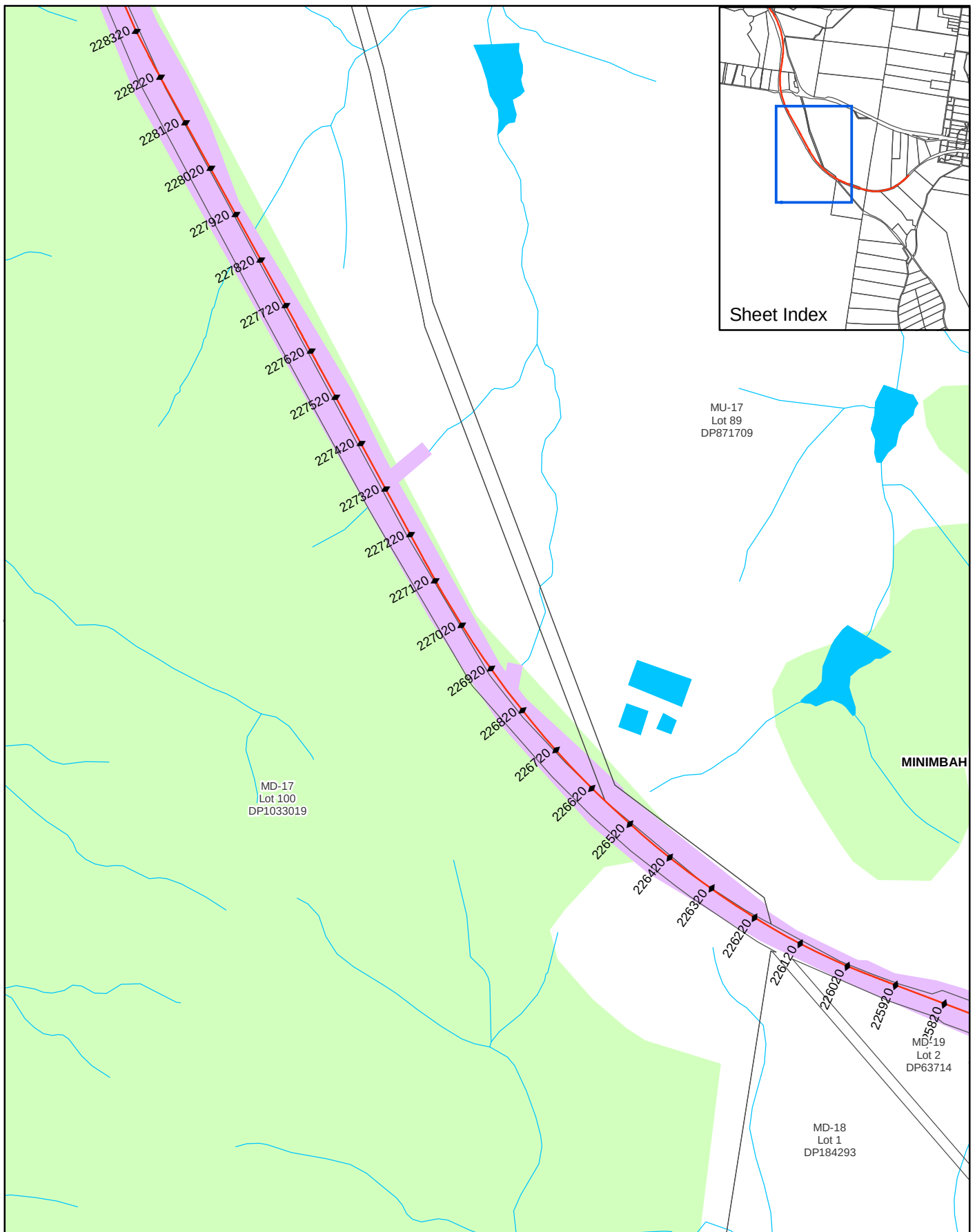
CLIENTS | PEOPLE | PERFORMANCE

ARTC - Minimbah Third Track  
Environmental Assessment  
Property Impacts  
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rev no. A

Figure 9.2





#### LEGEND

- Existing Rail
- Project Route
- Property Acquisition Area
- Cadastre
- Watercourse
- Forest Or Shrub

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Metres

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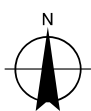
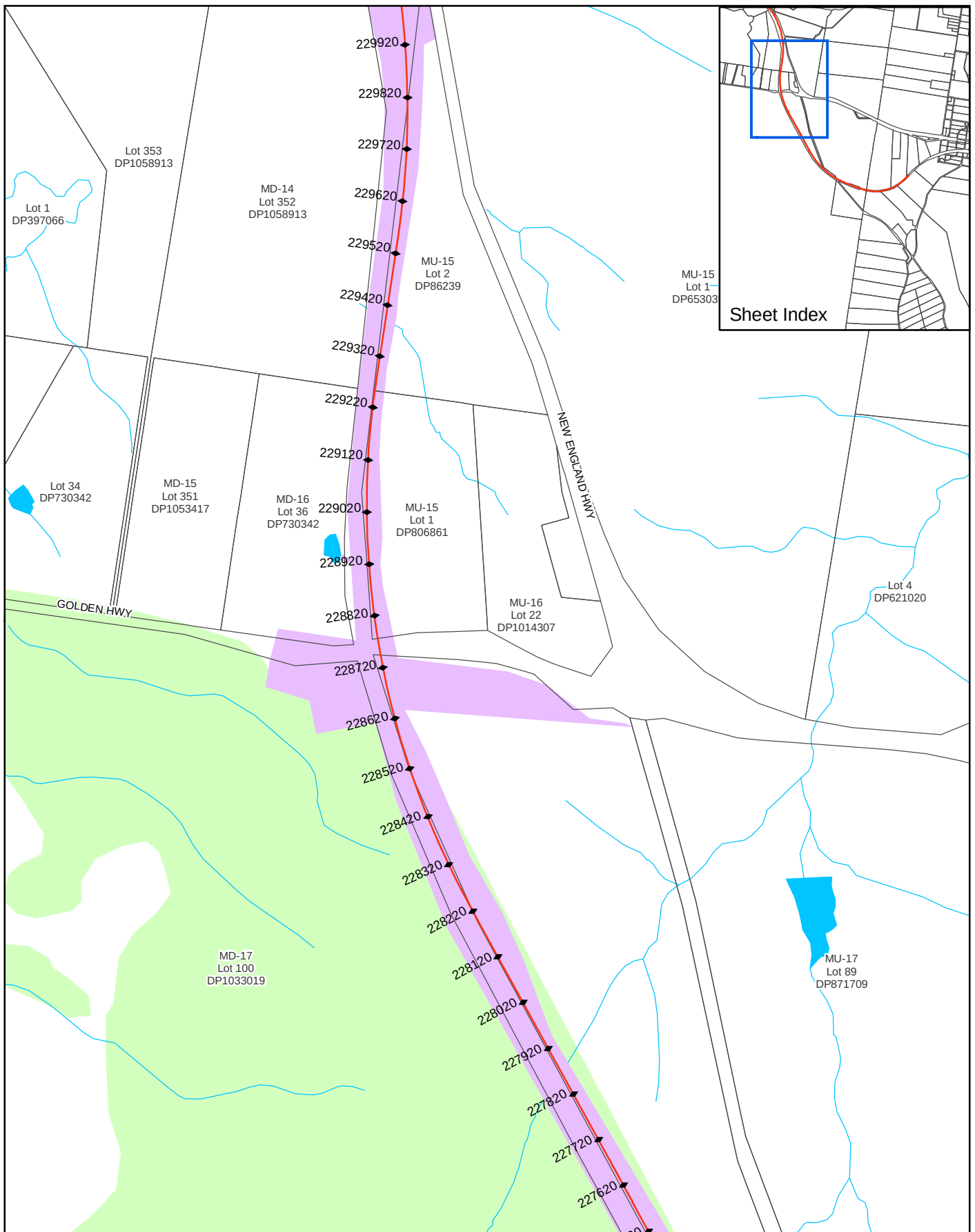


CLIENTS | PEOPLE | PERFORMANCE

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Figure 9.3



#### LEGEND

- Existing Rail
- Project Route
- Property Acquisition Area
- Cadastre
- Watercourse
- Forest Or Shrub

1:10,000  
0 30 60 120 180 240  
Metres

for A4

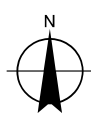
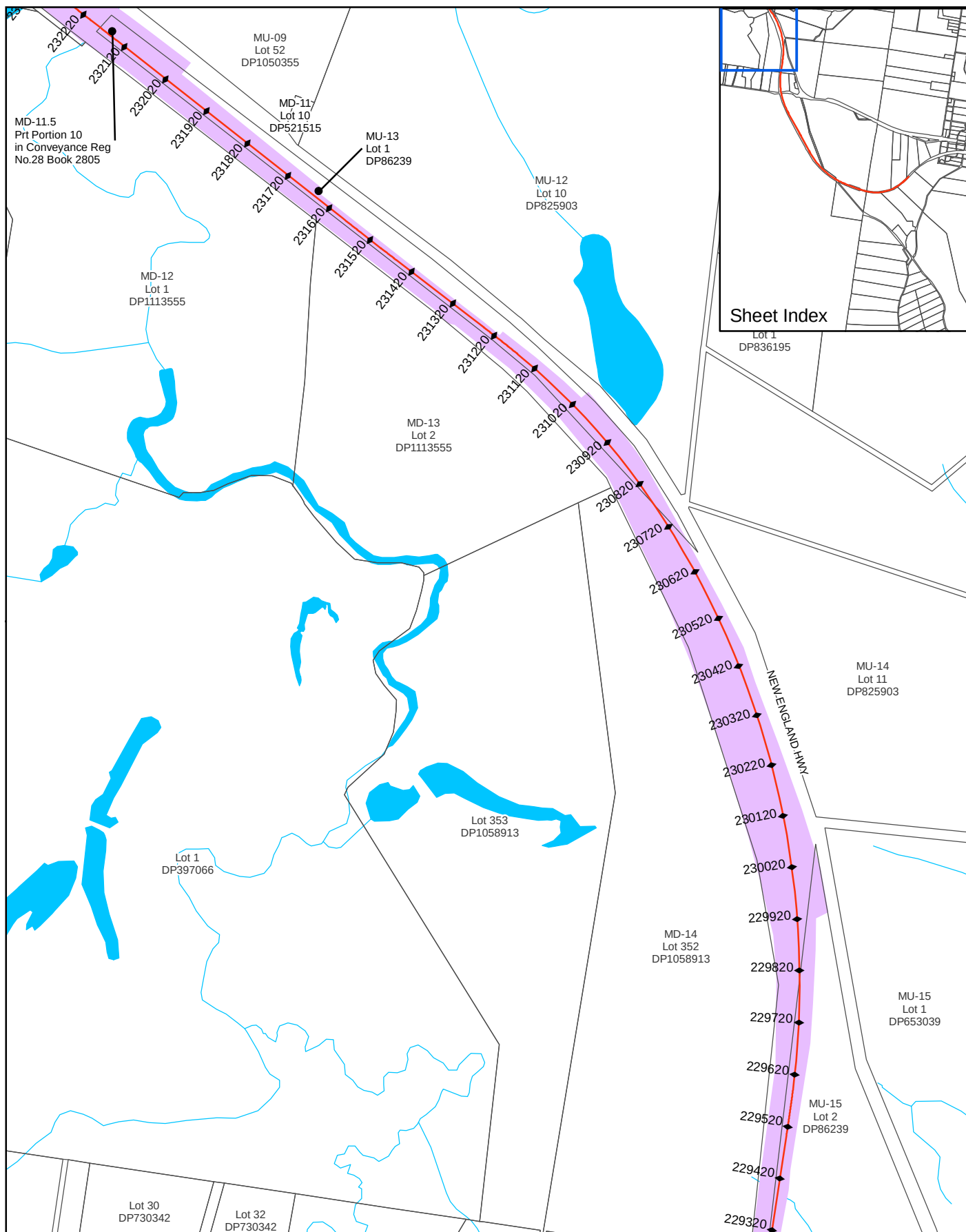


CLIENTS | PEOPLE | PERFORMANCE

ARTC - Minimbah Third Track  
Environmental Assessment  
Property Impacts  
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rev no. A

Figure 9.4



#### LEGEND

- Existing Rail
- Project Route
- Property Acquisition Area
- Cadastre
- Watercourse
- Forest Or Shrub

1:10,000  
0 30 60 120 180 240  
Metres

for A4



CLIENTS | PEOPLE | PERFORMANCE

ARTC - Minimbah Third Track  
Environmental Assessment

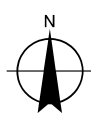
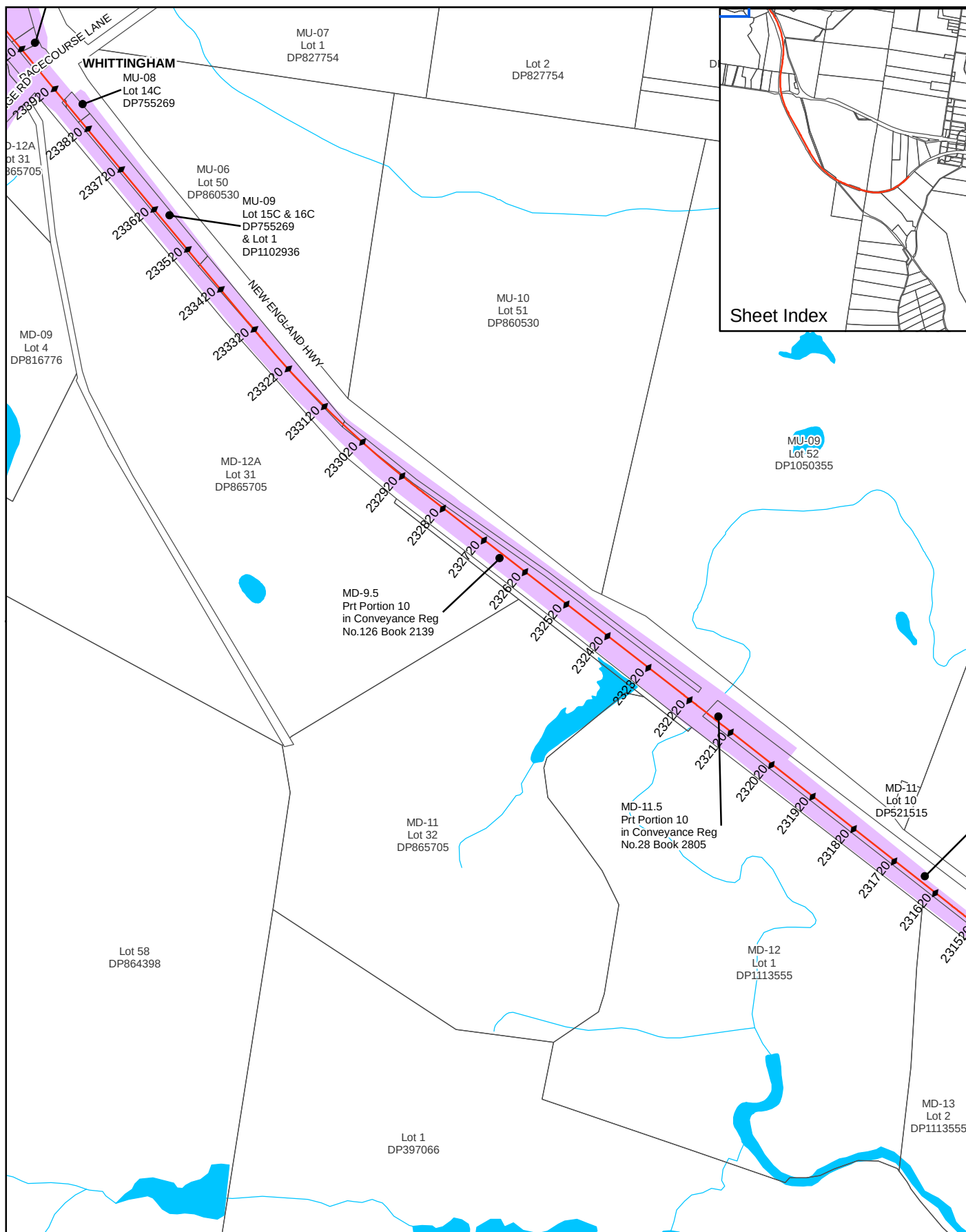
Property Impacts

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rev no. A

Figure 9.5



#### LEGEND

- Existing Rail
- Project Route
- Property Acquisition Area
- Cadastre
- Watercourse
- Forest Or Shrub

1:10,000  
0 30 60 120 180 240  
Metres

for A4



CLIENTS | PEOPLE | PERFORMANCE

ARTC - Minimbah Third Track  
Environmental Assessment

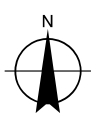
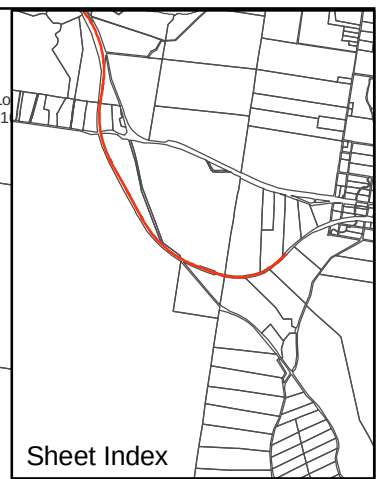
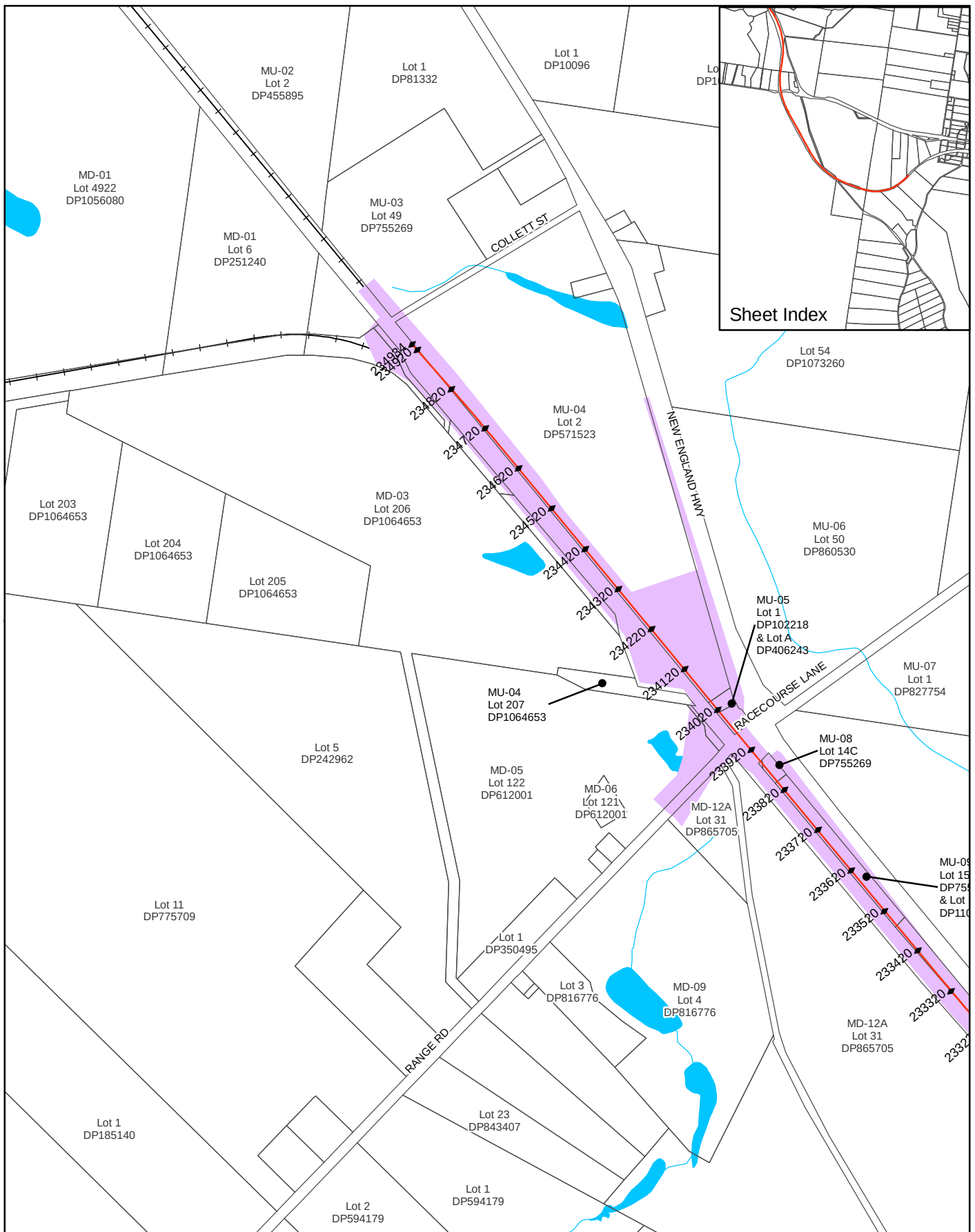
Property Impacts

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Figure 9.6



#### LEGEND

- Existing Rail
- Project Route
- Property Acquisition Area
- Watercourse
- Cadastre
- Forest Or Shrub

1:10,000  
0 30 60 120 180 240  
Metres

for A4



CLIENTS | PEOPLE | PERFORMANCE

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Figure 9.7



### 9.3.2 Access

As discussed in Section 2.2.4, the Project would generate up to 271 truck movements per day. However, the majority of these truck movements (estimated at 250 per day) would be undertaken on haulage roads within the construction site. Some of these truck movements would be required to cross the Golden Highway and Range Road. However, as discussed in Section 2.2.4, the contractor would be required to manage these movements in accordance with a Traffic Management Plan.

As noted in the Traffic and Transport Assessment (GHD, 2008) in Appendix I, between 5 and 21 vehicle movements per day would be generated for delivery of construction materials. These movements would primarily use the primary access points to Range Road and the New England Highway as shown in Figure 2-6.

### 9.3.3 Traffic and Transport

#### Potential Impacts

The primary impacts to the existing transport infrastructure would occur during the construction phase of the Project. These impacts can be divided into general construction impacts and road works construction impacts. The general construction impacts include all works on the rail that would generate traffic and require access points to the road network. The road works construction impacts refer to construction works on or adjacent to the existing road network that would impact traffic flow through either temporary lane closures, detour routes or traffic control measures.

#### *General Construction Impacts*

As discussed in Section 9.2.2, the construction phase of the Project would utilise primary and secondary access points connecting to a number of public roads. The majority of traffic generated by the construction phase would, however, utilise haulage roads within the construction site and require minimal access to public roads.

However, based on a worse case scenario of all these vehicles accessing public roads, it was estimated that the peak traffic generation period (of 271 truck movements per day) would equate to nine movements in and nine movements out of each access point per hour.

The Traffic and Transport Assessment (GHD, 2008) noted that with a peak construction phase workforce of approximately 200 personnel, there is potential for 200 private vehicles to enter and exit the construction site at the start and end of the workday and would utilise parking provided at the construction compounds. However, it is likely that measures such as carpooling would be implemented and therefore reduce vehicle numbers. The majority of the vehicle movements are likely to occur during AM and PM peak periods with 40 vehicle movements per hour in peak hour at each of the Golden Highway and Range Road Primary access points. The Traffic and Transport Assessment (GHD, 2008) concluded that this additional volume of traffic is unlikely to impact on the existing road network, which is expected to have spare capacity above this additional traffic volume. The implementation of appropriate signage and traffic management (as discussed in Section 1.1.1) would reduce the potential safety risks associated with these vehicles entering and exiting the public roads.





### *Road Construction Works Impacts*

The construction impacts include road works on the Golden Highway, Range Road and the New England Highway.

The Golden Highway realignment would involve road works at the connection of the new alignment and the existing alignment west of the existing abattoir access road / rest area intersection with the Golden Highway and approximately 320m west of the Golden Highway over bridge. Through traffic flow would be maintained throughout construction, however speed restrictions and minor detour roads would be required at each of the connection areas. The right turn movement into the abattoir access road would be impacted during construction of the road connection.

The general arrangement of the Golden Highway realignment is represented on drawing ARTCN1080029100 in Appendix C.

The Range Road realignment would impact existing traffic flow on Range Road during construction of the connection. Through traffic would be maintained throughout construction. The existing rail level crossing would remain operational until the proposed Range Road / New England Highway intersection and all associated Range Road alignment works are operational.

The general arrangement of the Range Road realignment is represented on drawing ARTCN1080029200 in Appendix C.

The proposed intersection of New England Highway and Range Road would require New England Highway Road widening on the eastern and western sides of the highway between the existing New England Highway / Range Road intersection and Little Doughboy Hollow Bridge. Traffic flow would be maintained on the New England Highway throughout construction.

Road shoulder construction and formation works at the New England Highway in the vicinity of the rail embankment at chainage 230.020 km to chainage 230.900 km would be required. The works involves a concrete drainage channel between the Minimbah Bank retaining wall, installation of a wire rope safety barriers and shoulder widening from approximately 1m existing shoulders to 3m shoulders. Two-way traffic flow would be maintained on the New England Highway.

### *Operation*

Road traffic generated during the operation phase would be limited to repair and maintenance activities. These would be either short term during normal working hours, or require activities to be undertaken over a 48 hours period during a track possession (as discussed in Section 2.2.11). Traffic generation is likely to be limited and would use existing rail corridor access points that are close to the construction access point (refer to Section 2.2).

The Traffic and Transport Impact Assessment (GHD, 2008) estimated that the realigned intersection of Range Road and the New England Highway would have a Level of Service of "B" (acceptable delays and spare capacity) for the predicted 2018 traffic levels.

The road works required for the project would have the following impacts on the future road network performance:

- Removal of a curved section of the Golden Highway to be replaced by a straight section of road suitable for a signposted speed of 80km/h;





- Provision of 3m shoulders on the Golden Highway would provide more space for cyclists;
- Removal of the Range Road rail level crossing would reduce delay and queuing on Range Road and the New England Highway;
- Provision of right turn lane into Racecourse Lane would reduce delay on the New England Highway or prevent unsafe passing movements on the curve at the existing New England Highway / Range Road intersection;
- Provision of 3m shoulders for the realigned section of Range Road would provide space for pedestrians and cyclists out of the traffic lane; and
- Provision of 3m shoulders on the New England Highway in the vicinity of the proposed retaining wall would provide more travel space for cyclists.

## 9.4 Recommended Mitigation Measures

### 9.4.1 Land Use

As discussed in Section 9.3.1 construction of the Project and associated infrastructure would require the acquisition of properties. All acquisition of land would be undertaken in accordance with the provisions of the *Land Acquisition (Just Terms Compensation) Act 1991*.

Detailed management measures to reduce land use impacts on individual properties and land users would be developed in consultation with the individual landholders concerned during the detailed design and property acquisition negotiations. Access requirements for the construction phase of the Project would be discussed with individual landowners prior to construction.

The Project's design has been undertaken with the aim of incorporating management measures into design elements so as to minimise the amount of land to be acquired.

### 9.4.2 Access

To manage the potential issues associated with the Project construction traffic and Project site access, the following measures would be implemented:

- A Traffic Management Plan would be developed and implemented in consultation with the RTA and Singleton Council;
- Truck movements hauling spoil material would be required to use the haulage roads shown in Figure 2-6;
- A community information and awareness program would be developed prior to and implemented throughout the construction period to inform the local residents of the construction activities and the potential access and traffic issues;
- Appropriate signposting of the access roads and points with appropriate heavy vehicle and construction warning signs;
- Installation of warning signs at the access points to warn existing road users of entering and exiting traffic;
- Distribution of warning notices to advise local road users of scheduled construction activities; and



- ▶ Inducting truck and vehicle operators on the requirements of the Traffic Management Plan.

#### **9.4.3 Transport and Traffic**

Potential measures to reduce transport issues for the Project include:

- ▶ The promotion of car pooling and other shared transport initiatives during the construction phase;
- ▶ Manage the transportation of construction materials to maximise vehicle loads to therefore minimise vehicle movements; and
- ▶ Whenever practical vehicles associated with the construction works would use internal and haulage access roads instead of public roads.



## 10. Noise and Vibration

### 10.1 Introduction

The Director-General's Requirements (DGRs) identified noise and vibration as a key issue requiring assessment in the Environmental Assessment. The DGRs state that an assessment is required for the impacts of noise and vibration as a result of the construction and operation of the Project.

The DGRs for noise and vibration are described in Table 10-1 below.

**Table 10-1 Noise and Vibration Director-General's Requirements**

| DGR                                                                                                                                                                                                                                                                                       | Where Addressed       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| "Noise and Vibration impacts on receivers, taking into account Chapter 171 of the <i>Environmental Noise Control Manual, Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects (DECC/DoP)</i> , and <i>Assessing Vibration: a technical guideline (DECC)</i> ". | Sections 10.2 to 10.4 |

### 10.2 Existing Environment

As discussed in Section 9.1, the land uses adjoining the Project are predominantly rural, particularly grazing land, and associated rural residences. Whittingham airstrip is adjacent to the northern section of the Project, occasional military activities occur at Singleton Military Area, and a nursery and landscaping supplies business is located between the New England Highway and the Main Northern Railway at Whittingham. Road, rail and air traffic associated with the New England Highway, Main Northern Railway and the airstrip respectively would contribute to the existing noise environment.

The Main Northern Railway Up Main carries predominately eastbound laden coal train traffic, and the Down Main carries predominately westbound traffic: unladen coal trains, freight and passenger services.

Coal trains are the predominant traffic upon this section of rail, although goods trains, maintenance rail and both local and regional passengers trains also use the line.

The following studies and monitoring were used to determine the existing noise and vibration levels in the area adjacent to the Project, and to model the predicted impacts resulting from the construction and operation of the Project. Refer to Appendix A – *Noise and Vibration Impact Assessment Report* (GHD, 2008) for full details on the methodology and results of the studies and monitoring.



### 10.2.1 Unattended Noise Monitoring

In order to establish ambient noise levels, unattended noise monitoring was undertaken at the locations listed below (refer to Figure 10-1 to Figure 10-6). Unattended noise monitoring was undertaken using three *Acoustic Research Laboratories (ARL) Pty Ltd EL-215 Type* and two *RION NL-22* continuous environmental noise loggers within calibration. The instruments were programmed to accumulate environmental noise data continuously over sampling periods of 15 minutes for the entire monitoring period.

- **Location 1 (L1):** Range Road, Whittingham (the airstrip). This location is approximately 128 metres southwest of the existing Down line;
- **Location 2 (L2):** Range Road, Whittingham, approximately 35 metres from the existing Down line. The location for Logger 2 was chosen to further calibrate near field noise modelling predictions and assess the potential influence of road traffic noise from the New England Highway;
- **Location 3 (L3):** Mitchell Line Road, Whittingham. This location is approximately 75 metres east of the existing Down line. Note that there is an existing noise wall along a residential boundary coinciding with the rail corridor. It is understood that the acoustic wall is made out of aerated concrete blockwork. Walls dimensions are approximately 57 metres in length, with a width of 0.2 metres, varying in height between 3 and 3.5 metres;
- **Location 4 (L4):** New England Highway, Whittingham. Logger situated 1 metre from the nearest affected residential façade to the rail line. This location is approximately 40 metres northwest of the existing Up line; and
- **Location 5 (L5):** New England Highway, Belford. This location is approximately 675 metres northwest of the existing Up line.

### 10.2.2 Attended Noise Monitoring

Attended noise monitoring was undertaken at receiver locations R1, R7, R8 and R9 to gain a further understanding of the ambient noise environment in the vicinity of the Project (refer to Figure 10-1 to Figure 10-6). Measurements were taken approximately 1.5 metres above ground using a Bruel & Kjaer 2250 Sound Level Meter (SLM). The SLM was programmed to record statistical noise data for the duration of the measurement period.

### 10.2.3 Vibration Monitoring

Continuous background vibration level measurements of the existing site conditions were undertaken to characterise induced ground vibration resulting from the passing of trains in either travel direction past the site by multiple locomotives and coal trains wagons. The measurement location was approximately 26 metres north of the Up line. Vibration monitoring was undertaken using an InstanTel Minimate ground vibration monitor. A selection of summary reports of the ground induced vibration waveforms monitoring results (time and domain) were compared against relevant criteria.

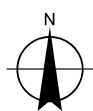


#### 10.2.4 Results

The results of noise monitoring are summarised in Table 10-7 and Table 10-8. The noise monitoring results indicate that the existing ambient daytime and night time noise levels are approximately 58dB(A)  $L_{Aeq}$  at the monitoring locations. Noise monitoring results are presented in detail in Appendix A.

Vibration assessments carried out for typical rail pass-by scenarios from existing operations were undertaken with consideration to the relevant guidelines. The monitored vibration levels fall well below any of the guideline criteria at the monitoring location.





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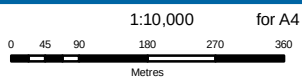
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- Project Route



Noise\_loggers\_20080627.shp

Noise\_receivers\_20080627.shp

- Commercial
- Residential



Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geodetic Datum of Australia 1994  
Grid: Map Grid of Australia, Zone 56



CLIENTS | PEOPLE | PERFORMANCE

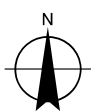
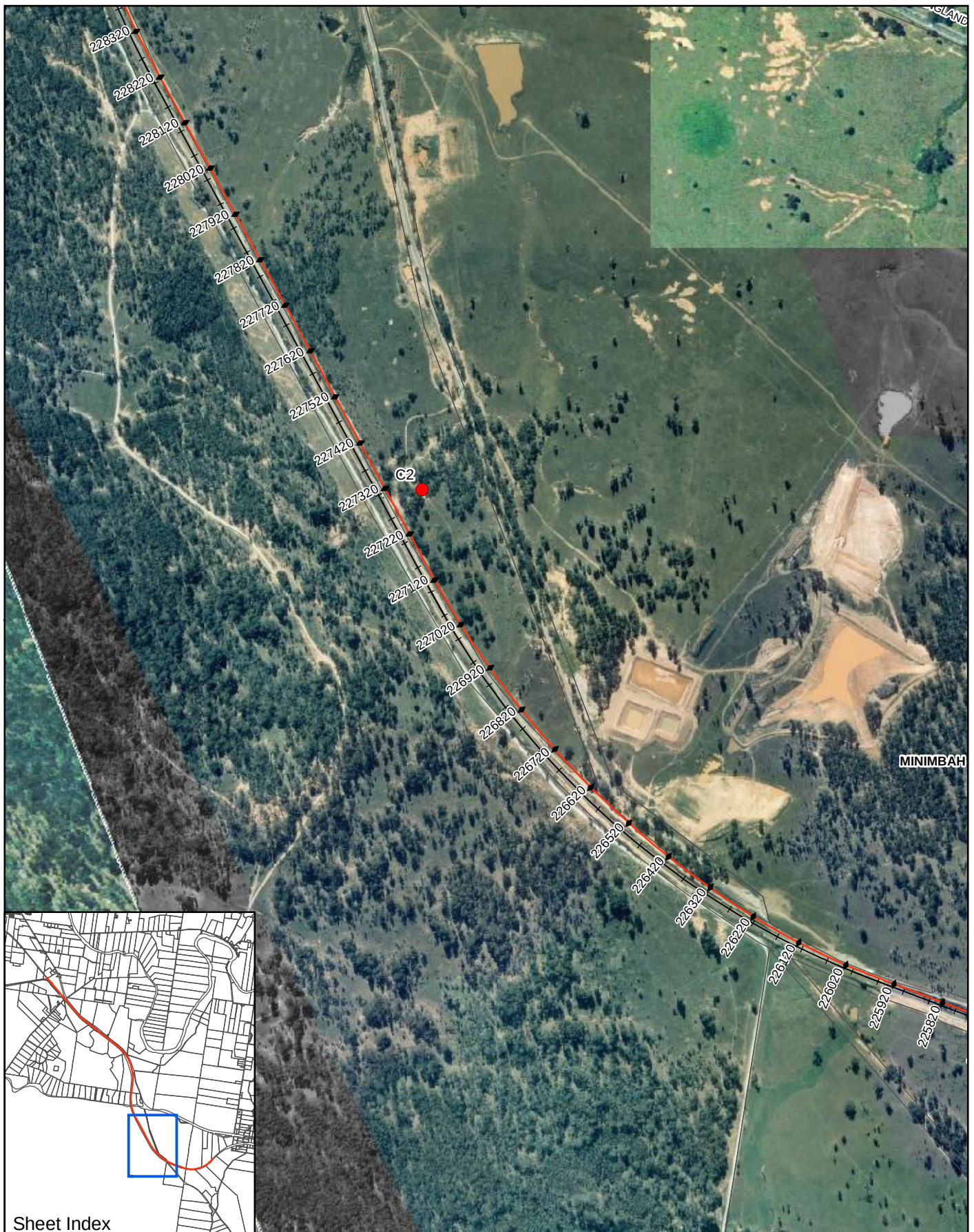
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Sensitive Noise Receivers and  
Unattended Logging Locations **Figure 10.1**

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#### LEGEND

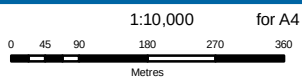
- Existing Rail
- Project Route



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- Commercial
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Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geodetic Datum of Australia 1994  
Grid: Map Grid of Australia, Zone 56



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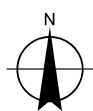
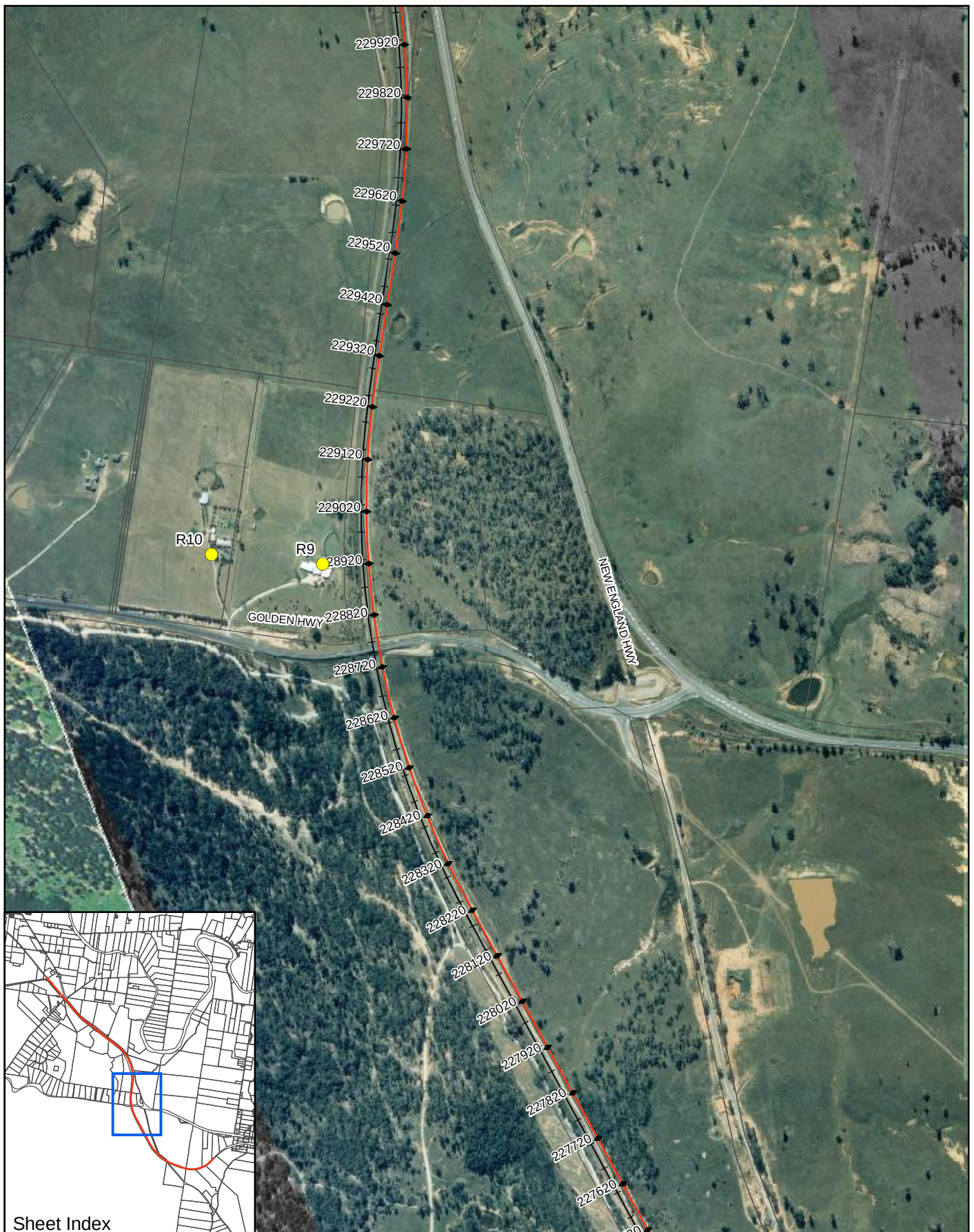
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Sensitive Noise Receivers and  
Unattended Logging Locations **Figure 10.2**

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#### LEGEND

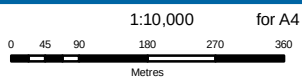
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- Project Route



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Noise\_receivers\_20080627.shp

- Commercial
- Residential



Map Projection: Universal Transverse Mercator  
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Grid: Map Grid of Australia, Zone 56



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Environmental Assessment

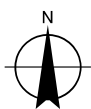
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Sensitive Noise Receivers and  
Unattended Logging Locations **Figure 10.3**  
27 | June 2008 Sheet 3 of 6





Sheet Index



#### LEGEND

- Existing Rail
- Project Route



Noise\_loggers\_20080627.shp

Noise\_receivers\_20080627.shp

- Commercial
- Residential

1:10,000 for A4  
0 45 90 180 270 360  
Metres

Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geodetic Datum of Australia 1994  
Grid: Map Grid of Australia, Zone 56



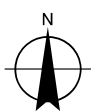
CLIENTS | PEOPLE | PERFORMANCE

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Sensitive Noise Receivers and  
Unattended Logging Locations **Figure 10.4**  
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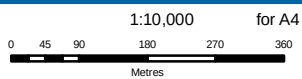
- Existing Rail
- Project Route



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- Commercial
- Residential



Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geodetic Datum of Australia 1994  
Grid: Map Grid of Australia, Zone 56



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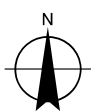
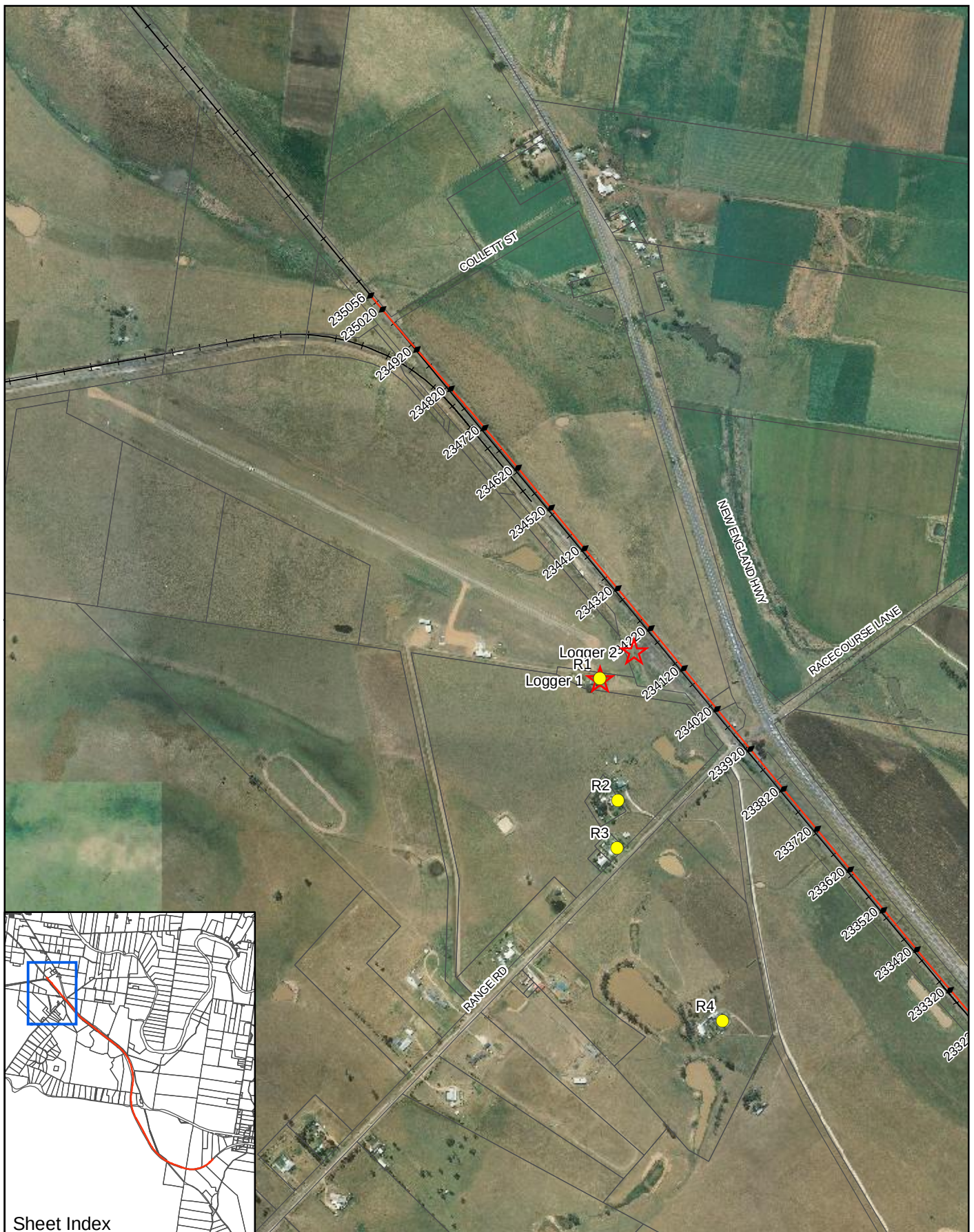
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**Sensitive Noise Receivers and  
Unattended Logging Locations Figure 10.5**

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#### LEGEND

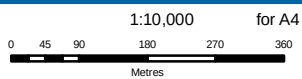
- Existing Rail
- Project Route



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Noise\_receivers\_20080627.shp

- Commercial
- Residential



Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geodetic Datum of Australia 1994  
Grid: Map Grid of Australia, Zone 56



CLIENTS | PEOPLE | PERFORMANCE

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**Sensitive Noise Receivers and  
Unattended Logging Locations** Figure 10.6  
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## 10.3 Potential Issues

### 10.3.1 Construction

Normal construction hours would be between 6.30 am and 6 pm, 7 days per week. The construction activities that would be undertaken during these hours are described in Section 2.2.

However, it is anticipated that throughout the construction program, specific activities would need to be completed outside of these hours. These activities would be undertaken during track possession periods as outlined in Section 2.2.11. It is noted that the proposed construction hours are outside the existing EPL hours (7 am-6 pm Monday to Friday and 8 am-1 pm Saturday).

Construction of the Project would require the construction of haul roads for the transport of construction materials. A large variety of mechanical plant would be used for construction. Examples of mechanical plant would be dozers, excavators, dump trucks, water trucks, low loaders, truck and quad-axle “dog” trailers, rigid table-top trucks, rigid heavy vehicles, semi-trailers, concrete trucks and passenger cars / light commercials.

### 10.3.2 Construction Noise Assessment

Construction noise impacts associated with the Project were conservatively estimated using the well-known distance attenuation relationship described in Equation 1 below.

Equation 1

$$SPL = SWL - 20\text{Log}(d) + 10\text{Log}(Q) - 11$$

Where *SPL* = sound pressure level at the distance *d* from the source;

*SWL* = sound power level of the source;

*d* = distance (m) between source and receiver; and

*Q* = Directivity index (2 for a flat surface).





**Table 10-2 Predicted Plant Item Noise Levels, dB(A)**

| Plant         | Estimated SWL [dB(A)] | Estimated SPL [dB(A)] at Distance (m) |    |     |     |     |     |      |
|---------------|-----------------------|---------------------------------------|----|-----|-----|-----|-----|------|
|               |                       | 50                                    | 75 | 100 | 200 | 400 | 600 | 1200 |
| Crane         | 115                   | 73                                    | 70 | 67  | 61  | 55  | 51  | 45   |
| Bulldozer     | 115                   | 73                                    | 70 | 67  | 61  | 55  | 51  | 45   |
| Excavator     | 118                   | 76                                    | 73 | 70  | 64  | 58  | 54  | 48   |
| Back Hoe      | 108                   | 66                                    | 63 | 60  | 54  | 48  | 44  | 38   |
| Compactor     | 110                   | 68                                    | 65 | 62  | 56  | 50  | 46  | 40   |
| Dump Truck    | 106                   | 64                                    | 61 | 58  | 52  | 46  | 42  | 36   |
| Road Truck    | 110                   | 68                                    | 65 | 62  | 56  | 50  | 46  | 40   |
| Compressor    | 107                   | 65                                    | 62 | 59  | 53  | 47  | 43  | 37   |
| Concrete Pump | 109                   | 67                                    | 64 | 61  | 55  | 49  | 45  | 39   |
| Concrete Saw  | 118                   | 76                                    | 73 | 70  | 64  | 58  | 54  | 48   |
| Paver         | 113                   | 71                                    | 68 | 65  | 59  | 53  | 49  | 43   |
| Breaker       | 120                   | 78                                    | 75 | 72  | 66  | 60  | 56  | 50   |

Other construction noise sources such as sleeper/track laying machines are expected to have similar sound power levels to the noise sources shown in Table 10-2.

Typical noise levels produced by construction plant anticipated to be used on site were sourced from AS 2436 – 1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites*. The power levels of the plant and machinery were distance attenuated from the proposed construction location. Propagation calculations took into account sound intensity losses due to spherical spreading, with additional minor losses such as atmospheric absorption, directivity and ground absorption ignored in the calculations. As a result, predicted received noise levels are expected to slightly overstate actual received levels and thus provide a measure of conservatism. Refer to Table 10-2 for the predicted noise levels from specific items of plant expected to operate in the construction zone.

Pile-driving would only be associated with the construction of the projects major proposed structures (bridges). It is recommended that where possible investigation of the potential use of bored piling in place of pile driving be considered, taking into the consideration the costs associated with bored piling versus obtained noise and vibration reduction benefit.

In principle, bored piling is a soil replacement technique, as opposed to soil displacement techniques (such as pile-driving). As such, there is minimal noise and vibration levels associated with the foundation of bored piles, these being essentially generated by drilling activities.



The magnitude of off-site noise impact associated with construction would be dependent upon a number of factors:

- The intensity of construction activities;
- The location of construction activities;
- The type of equipment used;
- Existing local noise sources;
- Intervening terrain; and
- The prevailing weather conditions.

In addition, construction machinery would likely move about the construction site, variously altering the directivity of the noise source with respect to individual receivers. During any given period, the machinery items to be used in the construction area would operate at maximum sound power levels for only brief stages. At other times, the machinery would likely produce lower sound levels while carrying out activities not requiring full power. It is highly unlikely that all construction equipment would be operating at their maximum sound power levels at any one time. Finally, certain types of construction machinery would be present in the study area for only brief periods during construction. Approximate distances to nearest receivers are provided in Table 10-3 and Figure 10-1 to Figure 10-6.

**Table 10-3 Approximate Distance to Proposed Works Area**

| Name          | Distance to Centreline of Existing Rail Lines (m) |
|---------------|---------------------------------------------------|
| Rec01 (MD_04) | 125                                               |
| Rec02 (MD_06) | 250                                               |
| Rec03 (MD_07) | 310                                               |
| Rec04 (MD_09) | 370                                               |
| Rec05 (MU_09) | 285                                               |
| Rec06 (MD_11) | 535                                               |
| Rec07 (MU_13) | 45                                                |
| Rec08 (MD_13) | 135                                               |
| Rec09 (MD_16) | 75                                                |
| Rec10 (MD_15) | 290                                               |
| Rec11 (MU_20) | 545                                               |

## Construction Noise Impacts

Construction activities along the length of the Project are expected to take place over a period greater than 26 weeks. Table 10-4 and Table 10-5 show the applicable noise criteria for noise monitoring locations L1, L3, L4 and L5 as described in Section 10.2.1 and as shown in Figure 10-1 to Figure 10-6.

Construction noise criteria were sourced from Section 171 of the DECC's *Environmental Noise Control Manual*. As construction activities are expected to occur for more than 26 weeks, The applicable criteria is Background  $L_{A90} + 5\text{dB } L_{A10}$  due to construction noise alone. However the nature of the construction project suggests that works would generally be mobile and would not be concentrated in any location for an extended period of time with the exception of the bridge works. Therefore it may be appropriate for construction noise goals to be adjusted where it is believed to be less than 26 weeks or even 4 weeks in a particular area as in Table 10-4.

**Table 10-4 Construction Noise Criteria for Day Time Works [ $L_{10}$  dB(A) Sound Pressure Level re:20 $\mu$ Pa]**

| Construction Period | Criteria           | L1 | L3 | L4 | L5 |
|---------------------|--------------------|----|----|----|----|
| Less than 4 weeks   | Background + 20 dB | 61 | 56 | 61 | 64 |
| Less than 26 weeks  | Background + 10 dB | 51 | 46 | 51 | 54 |
| More than 26 weeks  | Background + 5 dB  | 46 | 41 | 46 | 49 |

$L_{10}$  dB(A) represents the noise level that is present for a minimum ten per cent of the time.

Sound pressure levels are measured in micro Pascals ( $\mu$ Pa).

**Table 10-5 Construction Noise Criteria for Night Time Works, [ $L_{A10(15\text{min})}$  dB(A) Sound Pressure Level re:20 $\mu$ Pa]**

| Construction Period | Criteria          | L1 | L3 | L4 | L5 |
|---------------------|-------------------|----|----|----|----|
| More than 26 weeks  | Background + 5 dB | 43 | 37 | 41 | 39 |

Night period, [ $L_{A10(15\text{min})}$  dB(A) represents the noise level that is present for a minimum ten per cent of the time measured over a period of at least 15 minutes.

For construction activities within periods of track possession, construction noise impacts may exceed the construction noise goals specified in Table 10-4 and Table 10-5 at a number of locations. The level of noise would depend upon the distance of the construction machinery from the receiver and the type of construction machinery being used. Given the mobile nature of construction activities, it is expected that sensitive receptors would only be exposed to elevated noise levels for relatively short periods.



### 10.3.3 Construction Vibration Impacts

The NSW Department of Environment and Climate Change (DECC) NSW and the Department of Planning (formerly Department of Infrastructure, Planning and Natural Resources) recommended the adoption of the following design criteria for vibration. Floor vibration levels in habitable rooms should comply with the criteria in the British Standard BS 6472: 1992 *Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)* [BS6472]. This Standard is similar to an equivalent Australian Standard but includes additional guidance in relation to intermittent vibration such as that emitted by trains. Intense vibration can cause structural damage to buildings affected by the vibration.

It is likely that local sensitive receivers would perceive construction vibration at times at varying levels depending on the distance from the construction source, the type of construction machinery being used, and individual sensitivity. Vibration generated by pile driving is expected to generate the most significant vibrations levels. Rolling activities, and trucking movements would also generate ground borne vibration.

Table 10-6 shows the comparative vibrations produced by different types of construction equipment.

**Table 10-6 Typical Vibration Levels – Construction Equipment**

| Item                  | Peak Particle Velocity at 10m (mm/s) |
|-----------------------|--------------------------------------|
| Piling                | 12-30                                |
| Loader Breaking Kerbs | 6-8                                  |
| 15 Tonne Compactor    | 7-8                                  |
| 7 Tonne Compactor     | 5-7                                  |
| Roller                | 5-6                                  |
| Pavement Breaker      | 4.5-6                                |
| Dozer                 | 2.5-4                                |
| Backhoe               | 1                                    |
| Jackhammer            | 0.5                                  |

As shown in the above table, pile driving would produce significantly more ground borne vibrations than other types of construction equipment. Pile driving would be associated with the construction of major infrastructure items such as bridges. The configuration of the Project site is such that the minimum distance between the nearest residences and the major roadway overpasses would exceed 125 metres. As a result, vibration impacts from pile driving would not be expected to produce structural damage.



### 10.3.4 Operational Noise and Vibration

#### Guidelines

DECC and the Department of Planning (DoP) jointly issued *Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects* (IGANRIP) in April 2007. The interim guideline was designed to provide a consistent and transparent procedure for the assessment and approval process for rail infrastructure developments within NSW that have potential noise and vibration impacts, and presents non-mandatory noise goals that trigger the need for a project assessment to be conducted. An operational noise and vibration assessment has been undertaken for the Project. Refer to Appendix G.

#### Operational Noise

The predictions for the operational noise from the Project has been based on the year 2020 to account for the completion of all construction activities and modifications to the existing Minimbah Bank, and take into consideration the Project operating at full capacity.

The predicted increase (based on modelling) between the existing operational scenario and the year 2020 scenario with the addition of the third track at the modelled receiver locations R1 to R11 (as shown in Figure 10-1 to Figure 10-6) for daytime and night time is presented in Table 10-7 and Table 10-8 respectively.

**Table 10-7 Daytime Monitoring and Modelling Results**

| Name        | Existing Monitored Day<br>$L_{Aeq(15hr)}$ | Modelled Levels<br>2008 $L_{Aeq(15hr)}$ | Modelled Levels 2020<br>$L_{Aeq(15hr)}$ | Daytime<br>$L_{Aeq(15hr)}$<br>Guideline |
|-------------|-------------------------------------------|-----------------------------------------|-----------------------------------------|-----------------------------------------|
| Rec01_MD_04 | 58.1                                      | 56.0                                    | 57.1                                    | 65                                      |
| Rec07_MU_13 | 57.9                                      | 56.8                                    | 61.1                                    | 65                                      |
| Rec09_MD_16 | 59.4                                      | 53.0                                    | 55.5                                    | 65                                      |

**Table 10-8 Night Time Monitoring and Modelling Results**

| Name        | Existing Monitored Night<br>$L_{Aeq(9hr)}$ | Modelled Levels<br>2008 $L_{Aeq(9hr)}$ | Modelled Levels 2020<br>$L_{Aeq(9hr)}$ | Night Time<br>$L_{Aeq(9hr)}$<br>Guideline |
|-------------|--------------------------------------------|----------------------------------------|----------------------------------------|-------------------------------------------|
| Rec01_MD_04 | 57.6                                       | 56.2                                   | 56.7                                   | 60                                        |
| Rec07_MU_13 | 58.4                                       | 56.9                                   | 61.3                                   | 60                                        |
| Rec09_MD_16 | 56.9                                       | 53.2                                   | 55.7                                   | 60                                        |

It should be noted that monitored noise levels are representative of the acoustic environment at the time of the monitoring, including contributions of rail traffic, road traffic and any other extraneous noise source while the modelled noise levels only refer to rail traffic noise.



Results of the modelling suggest daytime noise criteria can be met at each of the three monitoring locations, while night time criteria are predicted to be exceeded by 1 dB(A) at Rec 07. Generally a difference of 1 dB(A) is imperceptible to the human ear. However it is recommended that mitigation options be investigated for these locations.

### ***Operational Vibration***

Train vibrations are caused at the contact between locomotive and rolling stock wheels and the rail line. The level of vibration is significantly affected by factors such as train speed, axle weight, quality of rolling stock, quality of rail/sleeper superstructure and stiffness and quality of subgrade. Additionally, different transit modes such as commuter, freight and coal trains can generate varying levels of vibration. Due to the large number of variables involved, accurately predicting vibration is difficult.

Assuming the intervening ground types are the same, houses that are to be set back from the Project further than approximately 26 metres should comply with the critical frequency damage criterion for ground vibration set out in the Standard BS6472.

The nearest known residence at R7 is situated approximately 38 metres from the proposed alignment of the third track and would therefore comply with the critical frequency damage criterion for ground vibration as per BS6472.

There is a permanent building structure at the garden nursery premises that is situated approximately 11 metres from the Project. As such it is recommended that vibration controls as outlined in the assessment be implemented for the potentially affected structure within the garden nursery site.

## **10.4 Recommended Mitigation Measures**

### **10.4.1 Construction Noise and Vibration Mitigation Measures**

Construction activities should be conducted consistent with the provisions of Environment Protection Licence 3142 for construction activities, complaint management and reporting conditions. The following construction site noise and vibration mitigation measures are recommended on-site during construction activities:

#### **Noise**

- ▶ Every practical and reasonable measure would be implemented to minimise the noise and vibration impacts of construction activities on local sensitive receivers;
- ▶ The Construction Site Manager would establish contact with the local residents and communicate the construction program and progress on a regular basis, particularly when noisy or vibration-generating activities are planned. Affected receivers should be notified of the intended work, its duration and times of occurrence;
- ▶ The Construction Site Manager should provide a community liaison phone number and permanent site contact so that noise and/or vibration related complaints, if any, can be received and addressed in a timely manner;



- ▶ For any work that would take place outside of normal construction hours, such as track possessions, residents potentially affected by such activities should be notified at least 5 days before hand, as outlined in O3.2 and O3.3 in EPL 3142;
- ▶ All site workers (including subcontractors and temporary workforce) should be informed of the potential for noise and vibration impacts upon local residents and encouraged to take all practical and reasonable measures to minimise noise during the course of their activities;
- ▶ Work methods should be reviewed, with a preference for quieter and non-vibration generating methods wherever possible. This is particularly important for any night-time activities;
- ▶ Where practical, material dumps should be located as far as possible from the nearest residences, and whenever possible, loading and unloading areas should be located as far as possible from the nearest residences;
- ▶ As far as possible, materials dropped from heights into or out of trucks should be minimised;
- ▶ All plant on site should be operated in accordance with the manufacturer's instructions and, where necessary, have current Roads and Traffic Authority (RTA) registration licences;
- ▶ Fixed equipment (such as: pumps, generators, compressors) should be located as far as possible from the nearest residences;
- ▶ All pneumatic tools operated near residences should be fitted with an effective silencer on their air exhaust port;
- ▶ Noise Labels should be affixed to new mobile air compressors and pavement breakers. The unit with the lowest noise rating which meets the requirements of the job should be used where work is conducted in proximity of noise sensitive locations;
- ▶ All mechanical plant should be silenced by best practical means. Noise suppression devices would be maintained to the manufacturer's specifications. Internal combustion engines would be fitted with a suitable muffler in good repair;
- ▶ Where possible, no plant or equipment should be left idling when operating adjacent to residential areas; and
- ▶ All vehicular movements to and from the site should comply with the requirements of the appropriate regulatory authority requirements for such activities.

### **Vibration**

- ▶ Building condition surveys should be undertaken at all potentially impacted structures at the nursery prior to commencement of vibration generating works (such as pile-driving). These would be repeated at works completion; and
- ▶ Pile driving should be subject to a vibration control plan.



#### 10.4.2 Operational Noise Mitigation Measures

At the completion of the environmental assessment process, and prior to construction an Operational Noise Management Plan, including designs, would be formulated. The Operational Noise Management Plan would optimise the site layout and noise control design options to mitigate potential rail traffic noise impacting on the identified affected receivers. The Plan would assess measures such as track design and potential shielding effects from the local topography.

As the operational assessment identifies exceedance of the noise goals, principally at R7, it is recommended that noise control design options be focussed in the vicinity of these specific receiver locations and not along the entire extent of proposed operations.

Property acquisition by ARTC is currently being negotiated for R7 and R9. However, in the event of property purchase not eventuating, the following noise mitigation options are available:

- ▶ **Noise Barriers:** Noise barriers can be constructed from earth, concrete, masonry, wood, metal, and other materials. To effectively reduce sound transmission through the barrier, the material chosen must be rigid and sufficiently dense (at least 15 - 20 kilograms/square metre). All noise barrier types are generally equally effective acoustically provided they have this density;

Noise barriers do not completely block all noise, but they can reduce overall noise levels. To effectively reduce the noise coming around its ends, a barrier should extend past the last affected residence by approximately three times the distance from the residence to the source and by not less than 50 metres where space permits. A noise barrier should also be sealed and extend down to or below the ground level; and

- ▶ **Architectural Treatment:** Where it is found to be more cost effective a noise attenuation measure, the building design of the identified likely affected receiver locations may be modified to incorporate grades of architectural noise mitigation, to ensure that internal noise levels are acceptable.



## 11. Hydrology and Flooding

### 11.1 Introduction

This section identifies the hydrology, flooding and groundwater characteristics and impacts associated with the Project. It includes an assessment of the impacts associated with flooding, water and stormwater characteristics and groundwater resources. The potential impacts of the Project on these characteristics are discussed along with proposed mitigation measures.

**Table 11-1 Hydrology and Flooding Director-General Requirements**

| Environmental Assessment Requirements                                                                                                                                                                                                                      | Where Addressed                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Effects of flooding on the Project, and Project effects on flood characteristics (on surrounding land, property and infrastructure). A range of flood events (including the PMF) shall be assessed in all flood prone areas within the adjoining corridor. | Section 11.2.4 and 11.3.2        |
| Water and stormwater (use, receiving water bodies and creek crossings, water quality and drainage systems), taking into account the <i>Managing Urban Stormwater: Soils and Construction (Landcom)</i> guidelines.                                         | Section 11.4.1                   |
| Groundwater resources (characteristics, users, interception, use and groundwater dependent ecosystems).                                                                                                                                                    | Section 11.2.5<br>Section 11.3.3 |

### 11.2 Existing Environment

#### 11.2.1 Watercourses and Drainage Lines

The Project is located within the catchments of four minor creeks, all of which are tributaries of the Hunter River, located to the northeast of the Project. These catchments are:

- ▶ Jump Up Creek: From the southern end of the Project to approximate chainage 226.500 km the catchment drains from north to south;
- ▶ Unnamed Hunter River tributary, Scotts Flat: From approximate chainage 226.500 km to 228.150 km the catchment drains south to north;
- ▶ Mudies Creek: From approximate chainage 228.150 km to approximate chainage 232.500 km, the catchment drains from south to north; and
- ▶ Doughboy Hollow: From approximate chainage 232.500 km to the northern end of the Project the catchment drains from south to north.

One named creek (Mudies Creek) and ten (10) unnamed drainage lines intersect the Project route and pass under the existing line through existing culverts and bridges. These watercourses are generally ephemeral and are dry for extended periods of time.



In addition to these watercourses, drainage lines and pipelines parallel to the existing rail line (or longitudinal drainage) is also present within the existing rail corridor and discharges to the drainage lines and creeks that cross the existing line.

### 11.2.2 Other Drainage Features

There are several existing farm dams adjacent to the Project route and listed below:

- ▶ Within the existing abattoir, downstream of chainage 226.400 km;
- ▶ Immediately north of the Golden Highway overpass, at approximate chainage 228.900 km;
- ▶ To the east side of the existing line at approximate chainage 229.400 km;
- ▶ To the east and downstream of the existing line and the New England Highway at approximate chainage 231.000 km;
- ▶ To the west and upstream of the existing line at approximate chainage 231.250 km;
- ▶ To the west and upstream of the existing line at approximate chainage 232.350 km;
- ▶ To the west and upstream of the existing line at approximate chainage 232.900 km;
- ▶ To the west and upstream of the existing line adjacent to Range Road at approximate chainage 234.000 km; and
- ▶ To the west of the existing line at approximate chainage 234.500 km.

### 11.2.3 Water Quality

Water quality in the four minor ephemeral creeks is affected by land use in the catchments. The land uses relating to water quality issues in the catchments are:

- ▶ Jump Up Creek, Mudies Creek and Doughboy Hollow: land use in the catchment is primarily pasture with the New England Highway and the existing railway line crossing the catchment and creek. These land uses have the potential to generate nutrients, sediments, oils and greases and metals in any surface runoff. However as discussed in Section 11.2.5, nutrient and metal levels in groundwater are relatively low, indicating that surface waters may also have low levels of these pollutants; and
- ▶ Unnamed Hunter River tributary, Scotts Flat: the abattoir located within this catchment has the potential to result in elevated levels of nutrients, faecal coliforms and sediment entering the stream. Runoff from the existing rail line, New England Highway and Golden Highway has the potential to generate nutrients, sediments, oils and greases and metals in any surface runoff. However as discussed in Section 11.2.5, nutrient and metal levels in groundwater are relatively low, indicating that surface waters may also have low levels of these pollutants.



#### 11.2.4 Flooding

The lower section of the Project lies on the Singleton Floodplain, within the floodplain of the Hunter River. Two of the ephemeral creeks, Mudies Creek and Doughboy Hollow, are affected by large events within the Hunter River including several floods in living memory such as the 1955 and 2007 floods. The 1955 flood is used as the standard flood for planning purposes in accordance with the *Singleton Floodplain Management Plan Development Control Plan* (Singleton Council, 1998). The two-dimensional floodplain model developed by WBM as part of the Singleton Flood Study (WBM, 2006) has been used in this Project to calculate flood levels at Doughboy Hollow and Mudies Creek.

#### 11.2.5 Groundwater

##### Geology

Refer to Section 12.2.2 for information on the geology associated with the Project.

##### Hydrogeology

Two aquifer systems have been encountered during previous geological investigations: a bedrock aquifer and alluvial aquifer. Recent groundwater depth measurements have been taken from 11 piezometers installed by RCA Australia in February 2008. The locations of these piezometers are given in Figure 11-1.

##### **Groundwater Dependent Ecosystems**

Groundwater dependent ecosystems are ecosystems that can depend on groundwater and that may support threatened or endangered species, communities and populations. They include:

- ▶ Terrestrial vegetation communities that show seasonal or episodic reliance on groundwater;
- ▶ River base flow systems which are aquatic and riparian ecosystems in or adjacent to streams/rivers dependent on the input of groundwater to base flows;
- ▶ Aquifers;
- ▶ Wetlands; and
- ▶ Fauna which directly depend on groundwater as a source of drinking water or that live within water which provides a source.

The riparian forest and wet soak vegetation communities (as discussed in Appendix E) in the study area broadly correspond to groundwater dependent ecosystems.

##### **Bedrock Aquifer**

The bedrock aquifer is composed of the Permian siltstones and sandstones of the Maitland Group and outcrops throughout the southern section of the study area. The aquifer is likely to be recharged directly by the infiltration of rainfall. Groundwater was encountered in April and June 2008 at depths of between 5.9 metres to 10.3 metres below the existing ground level. This was a relatively high rainfall period for the area and it is considered that these depths represent high groundwater levels for the aquifer. A search of the NSW Natural Resource Atlas (NSW Government, June 2008) identified one licensed well in the vicinity of the southern section

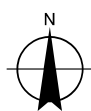
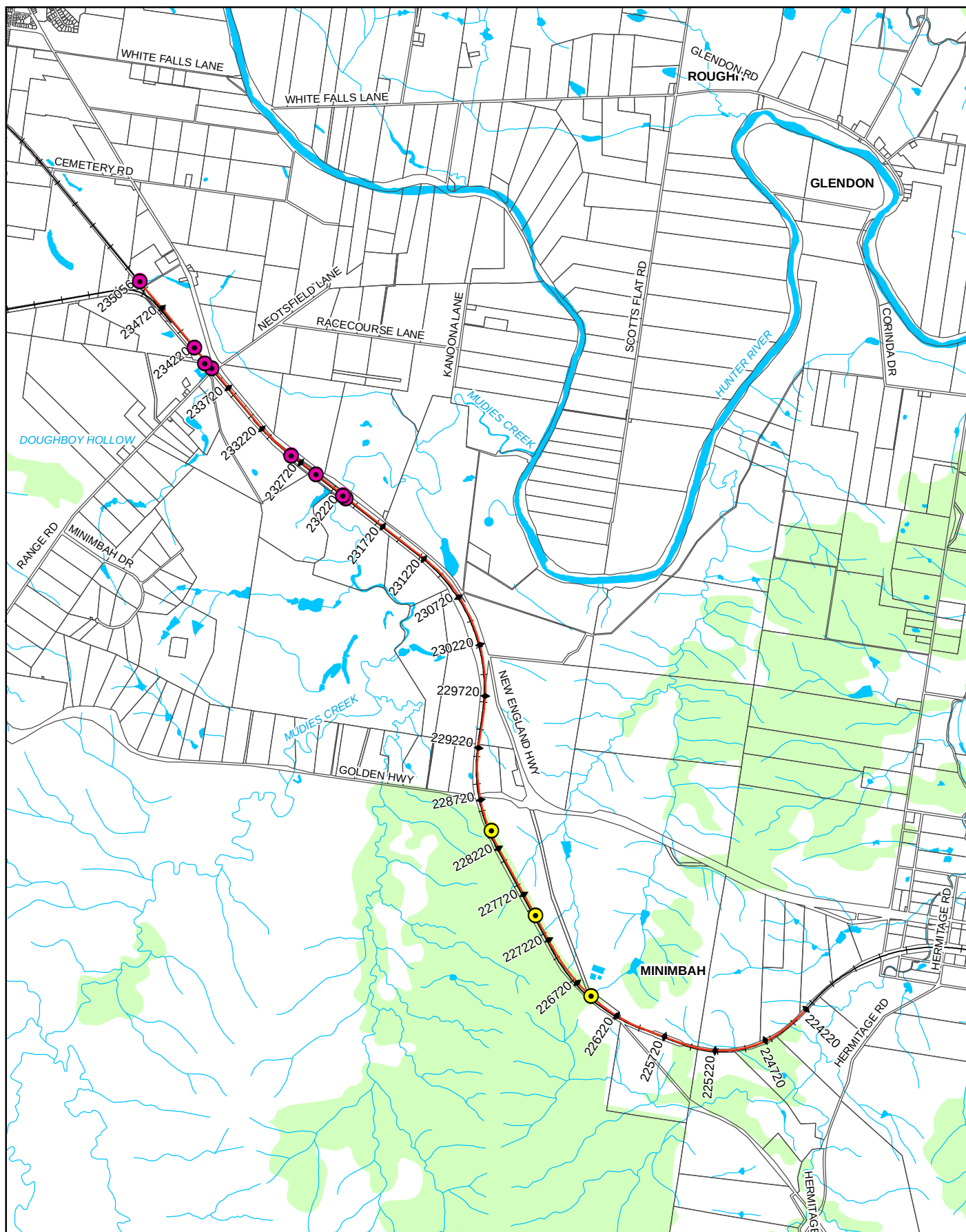


(approximately 1 km to the north). The depth to groundwater in this well was reported to be 7.0 metres below ground level in 1998.

Groundwater flow throughout the southern section of the study area is generally to the north and northwest towards the Hunter River floodplain. The Hunter River is a possible discharge area for this aquifer. A hydraulic gradient (spatial difference in groundwater pressure and elevation) of 0.008 (m/m) to the northwest has been calculated from available data. Groundwater flow and yield are generally low, as indicated by the slow recharging of monitoring piezometers. A relatively low groundwater yield of 0.25 L/s was reported for the licensed well.

The Groundwater Availability of the bedrock aquifer, as recorded in the NSW Natural Resource Atlas (NSW Government, June 2008), is 'saline' which suggests that the aquifer is of a relatively low importance. Groundwater quality data for the aquifer was collected in June 2008. Results are given in Figure 11-2. Since the groundwater in the aquifer is saline its uses are limited to irrigation of some crops, some livestock watering and industrial applications, according to guidelines in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ (2000)). Groundwater from the bedrock aquifer is a sodium-potassium-chloride dominated system. Nutrient and heavy metal concentrations are relatively low in the existing environment.





#### LEGEND

- |                 |                 |                  |                    |
|-----------------|-----------------|------------------|--------------------|
| — Existing Rail | □ Cadastre      | Watercourse      | Peizometer Testing |
| — Project Route | Forest Or Shrub | ● Allurium Wells | ● Bedrock Wells    |

1:50,000 for A4  
0 200 400 800 1,200 1,600  
Metres

Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geodetic Datum of Australia 1994  
Grid: Map Grid of Australia, Zone 56



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ARTC - Minimbah Third Track  
Environmental Assessment

Watercourses and  
Peizometer Testing Locations

job no. 22-13755  
rev no. A

Figure 11.1

25 June 2008



**Table 11-2 Quality Results (mg/L)**

| Parameter                       | Bedrock Aquifer | Alluvial Aquifer |
|---------------------------------|-----------------|------------------|
| pH                              | 7.5             | 7.3 – 7.6        |
| Electrical Conductivity (mS/cm) | 6.9             | 2.7 – 6.2        |
| Redox Potential (mV)            | -51.3 – -78.7   | -47.4            |
| Dissolved Oxygen                | 5.0             | 5.0 – 7.2        |
| <b>Major Cations/Anions</b>     |                 |                  |
| Sodium                          | 1240            | 512 – 1080       |
| Calcium                         | 160             | 66 – 137         |
| Magnesium                       | 161             | 54 – 115         |
| Potassium                       | 22              | 5 – 6            |
| Sulphate                        | 931             | 311 – 484        |
| Chloride                        | 1830            | 578 – 1710       |
| Alkalinity                      | 537             | 341 – 744        |
| <b>Nutrients</b>                |                 |                  |
| NO <sub>x</sub>                 | 0.017           | <0.01 – 0.44     |
| TKN                             | 0.8             | 0.8 – 6.3        |
| Total Nitrogen                  | 0.8             | 0.8 – 6.7        |
| Total Phosphorus                | <0.01           | 0.2 – 2.1        |
| <b>Heavy Metals</b>             |                 |                  |
| Arsenic                         | <0.001          | 0.004 – 0.009    |
| Cadmium                         | <0.0001         | <0.0001 – 0.0001 |
| Chromium                        | <0.001          | <0.001 – <0.005  |
| Copper                          | 0.001           | <0.001 – 0.002   |
| Lead                            | <0.001          | <0.001           |
| Manganese                       | 0.491           | 0.62 – 3.52      |
| Nickel                          | <0.001          | 0.003 – 0.009    |
| Zinc                            | 0.009           | 0.054 – 0.11     |
| Iron                            | 0.6             | 0.4 – 6.48       |
| Parameter                       | Bedrock Aquifer | Alluvial Aquifer |



| Parameter                       | Bedrock Aquifer | Alluvial Aquifer |
|---------------------------------|-----------------|------------------|
| pH                              | 7.5             | 7.3 – 7.6        |
| Electrical Conductivity (mS/cm) | 6.9             | 2.7 – 6.2        |
| Redox Potential (mV)            | -51.3 – -78.7   | -47.4            |
| Dissolved Oxygen                | 5.0             | 5.0 – 7.2        |
| <b>Major Cations/Anions</b>     |                 |                  |
| Sodium                          | 1240            | 512 – 1080       |
| Calcium                         | 160             | 66 – 137         |
| Magnesium                       | 161             | 54 – 115         |
| Potassium                       | 22              | 5 – 6            |
| Sulphate                        | 931             | 311 – 484        |
| Chloride                        | 1830            | 578 – 1710       |
| Alkalinity                      | 537             | 341 – 744        |
| <b>Nutrients</b>                |                 |                  |
| NO <sub>x</sub>                 | 0.017           | <0.01 – 0.44     |
| TKN                             | 0.8             | 0.8 – 6.3        |
| Total Nitrogen                  | 0.8             | 0.8 – 6.7        |
| Total Phosphorus                | <0.01           | 0.2 – 2.1        |
| <b>Heavy Metals</b>             |                 |                  |
| Arsenic                         | <0.001          | 0.004 – 0.009    |
| Cadmium                         | <0.0001         | <0.0001 – 0.0001 |
| Chromium                        | <0.001          | <0.001 – <0.005  |
| Copper                          | 0.001           | <0.001 – 0.002   |
| Lead                            | <0.001          | <0.001           |
| Manganese                       | 0.491           | 0.62 – 3.52      |
| Nickel                          | <0.001          | 0.003 – 0.009    |
| Zinc                            | 0.009           | 0.054 – 0.11     |
| Iron                            | 0.6             | 0.4 – 6.48       |



### *Alluvial Aquifer*

Groundwater has been detected in zones of sands/gravels as well as zones of clay within the alluvial aquifer underlying the Hunter River floodplain. The alluvial aquifer is recharged by direct infiltration of rainfall and by runoff from topographically higher areas. Groundwater was encountered in April to June 2008 at depths of between 4.1 metres to 9.5 metres below the existing ground level. As discussed for the bedrock aquifer, this was a relatively high rainfall period for the area and it is considered that these depths represent high groundwater levels for the aquifer.

Groundwater would generally flow from areas of higher elevation to lower elevation, i.e. generally towards the Hunter River and its tributaries, although groundwater pumping may result in reversal of groundwater flow directions in some areas. The alluvial groundwater table is relatively flat with hydraulic gradients of about 0.0005 – 0.001, although the hydraulic gradient in the vicinity of Muddies Creek was calculated to be about 0.005 (based on recent groundwater level data). Groundwater yield would likely be considerably higher than for the bedrock aquifer due to the higher hydraulic conductivity (ease with which groundwater can move through pores spaces and fractures) of the alluvium. Reported yields of existing wells near the study area are about 4 L/s. Groundwater yields in the alluvium closer to the Hunter River are up to 30 L/s (NSW Government, June 2008).

The Groundwater Availability of the bedrock aquifer, as recorded in the NSW Natural Resource Atlas, is 'marginal' which suggests that the aquifer is of a moderately high importance. Groundwater quality data for the aquifer was collected in June 2008. Results are given in Table 11-2. Based on this data (particularly the electrical conductivity measurements), alluvial groundwater in the vicinity of the study area can be used for livestock watering, some irrigation applications and industrial applications (according to guidelines in ANZECC/ARMCANZ (2000)). Groundwater from the alluvial aquifer is also a sodium-potassium-chloride dominated system. Existing nutrient concentrations are generally higher in the alluvial aquifer than in the bedrock aquifer and generally exceed the relevant ANZECC/ARMCANZ (2000) trigger values for NSW lowland rivers, slightly disturbed ecosystems (Section 8.2.2.1). This is likely attributable to its greater connectivity to current land use activities. Some heavy metal concentrations are elevated, although may be attributable to natural geogenic sources.

It is likely that domestic usage of groundwater extracted closer to the Hunter River would be suitable since it is likely to have a lower salinity. Note that the lowest electrical conductivity (2.7 millisiemens per cm (mS/cm)) was measured from a piezometer located beside Muddies Creek. A search of the NSW Natural Resource Atlas identified six licensed groundwater wells in the alluvial aquifer within 500 metres from the study area.



## 11.3 Potential Impacts

### 11.3.1 Hydrology and Water Quality

#### Construction

During construction of the Project, potential impacts on hydrology and water quality include:

- ▶ Potential erosion from exposed soils and sediments and material stockpiles caused by inadequate management measures, resulting in an increase in sediments in watercourses (as discussed in Section 12.2);
- ▶ Potential spills of fuels, greases and other chemicals from inadequate storage, handling and disposal procedures;
- ▶ Potential blockage of flow paths affecting low flows through construction within creek lines and through erosion and sedimentation control structures; and
- ▶ Potential to alter flows during periods of high flow as a result of larger obstructions within and adjacent to creek and drainage lines.

#### Operation

##### *Minor Drainage Lines*

Existing streambeds generally withstand much higher velocities than a channel that has been newly constructed or disturbed. This is a result of erosion taking place in the natural channel for many years and the material forming the channel lining tends to comprise coarse, stable and well-compacted material. Allowable velocities at culvert outlets that discharge into a natural stream (those that do not result in scour) tend to be higher than the velocities allowed in new or disturbed channels.

The velocity of flow through a culvert is greater than the velocity of flow in a natural channel of the same size and slope. Culverts are generally hydraulically efficient. High velocity flows through existing culverts can result in scour if there is no mechanism to dissipate excess energy at the outlet. These scour holes may undermine the culvert headwall and endanger the structure or damage the surrounding embankment.

The design of the culverts for the drainage lines (as discussed in Section 2) has given consideration to these conditions and been prepared in accordance with the designs and codes set out in Section 5 of the Minimbah Bank Third Track Design Criteria Report (GHD, 2008).

##### *Major Drainage Lines*

The construction of the bridge across Mudies Creek has the potential to impact on existing flood conditions through the following mechanisms:

- ▶ Loss of flood storage area (as assessed in Section 11.2.3);
- ▶ Hydraulic losses associated with extension of existing structures; and
- ▶ Hydraulic losses associated with increased flow length (weir flow) for overtopping of the widened rail embankment for conditions of high flow.





The specific standards and codes referred to in The Minimbah Bank Third Track Design Criteria Report (GHD, 2008), relating to major drainage lines, are the *Floodplain Development Manual* (Department of Natural Resources, 2005) and *Singleton Floodplain Management Plan, Development Control Plan* (Singleton Council, 1998). The requirement specified by the Director-General is to identify changes to existing flood regimes in accordance with the *Floodplain Development Manual* (Department of Natural Resources, 2005). This includes impacts to existing receivers and infrastructure and the potential future development of affected land.

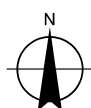
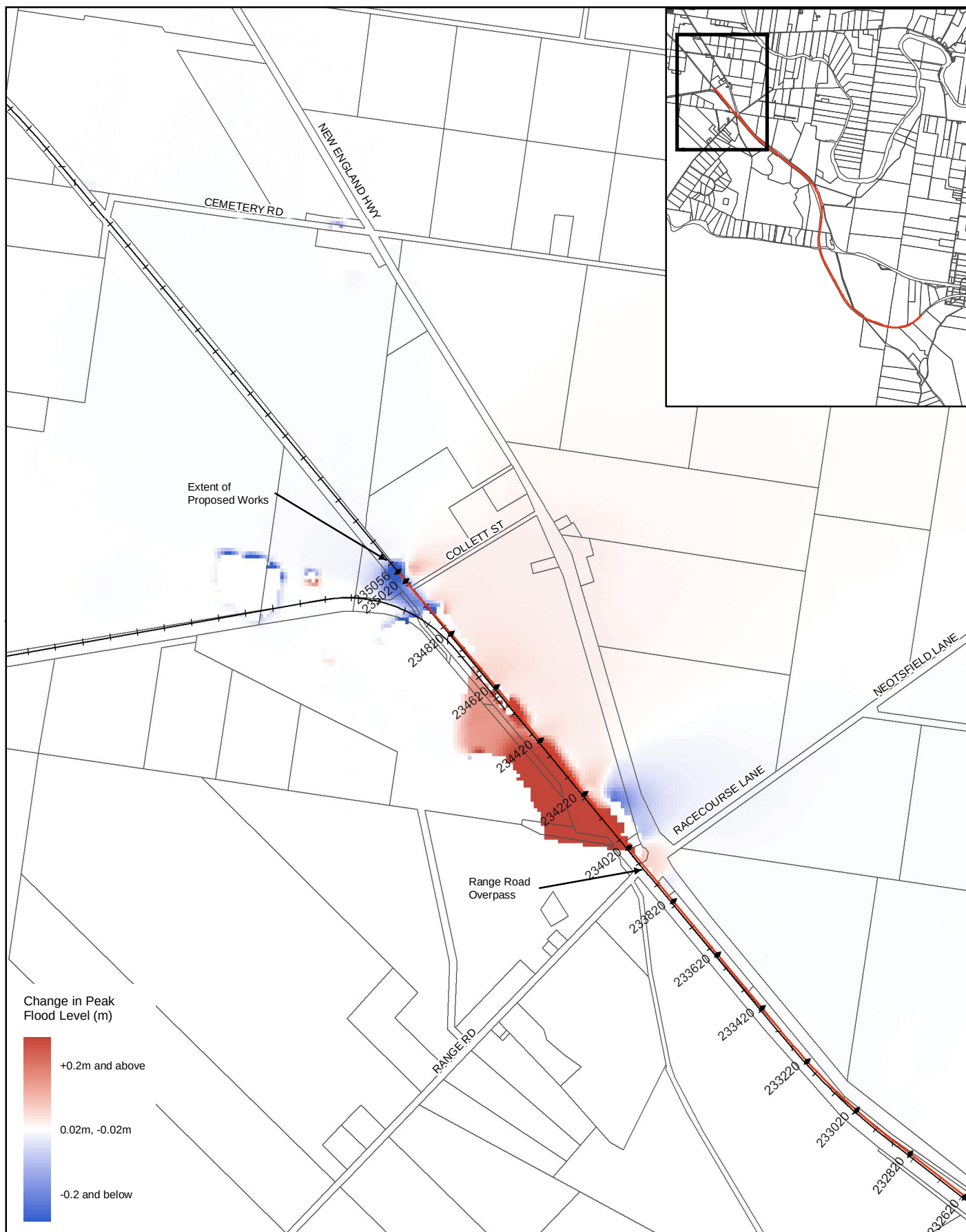
#### ***Other Drainage Features***

Modifications to drainage patterns may result in damage to constructed drainage on farms. This is of particular concern to areas on the Singleton floodplain, part of the floodplain of the Hunter River. Drainage design at the detailed design stage would take into consideration the need to minimise impacts on existing modified drainage patterns and that normal operation of the property is not adversely affected in either large or small flood events.

#### **11.3.2 Flooding**

A TUFLOW two-dimensional hydraulic model of the Singleton Floodplain developed by WBM for the Singleton Flood Study (WBM, 2006) was modified to include survey of the existing track and design information of the Project.

The results presented in Figure 11-2 indicate that the maximum change in peak flood level due to the Project is of the order of 0.15 metres, localised within 150 metres of the rail corridor at the proposed Range Road overbridge. This localised increase in flood level potentially reduces the freeboard of the existing dwelling from approximately one metre to 0.85 metres. This dwelling is located on a raised embankment located approximately 200 metres from the existing rail line on the western side at approximate chainage 234200. No other infrastructure is located in the affected area.



#### LEGEND

Project Route

Cadastre

1:15,000  
for A4  
0 60 120 240 360 480  
Metres

Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geodetic Datum of Australia 1994  
Grid: Map Grid of Australia, Zone 56



CLIENTS | PEOPLE | PERFORMANCE

ARTC - Minimbah Third Track  
Environmental Assessment  
Flood Impacts  
(1955 Magnitude Flood)  
30 June 2008

job no. 22-13755  
rev no. A

Figure 11.2



### **Mudies Creek**

A hydrological assessment of Mudies Creek catchment was undertaken using XP-RAPTS hydrologic software by GHD in May 2008. Peak flow rates throughout the catchment for storm events up to the recurrence interval of 100 year event were calculated. The peak flow rate in Mudies Creek at the proposed bridge for the 100 year recurrence interval storm event was calculated as 185.4 cubic metres per second.

Hydraulic modelling of these flow rates for the existing and new bridge structures was carried out using the HEC-RAS modelling software by GHD in May 2008. Geometric information used in this modelling was taken from rail corridor survey data and bridge design information for the existing and proposed rail bridge and for the New England Highway road bridges. This hydraulic model calculated that the peak flood elevation immediately upstream of the rail bridge is 33.47 metres AHD for the existing bridge and 33.48 metres AHD with the additional bridge proposed as part of the Project. This flood level increase resulting from the Project would not impact on the dwelling located approximately 200 metres from the existing rail line at chainage 234200 and is not considered significant.

### **Probable Maximum Flow**

The Director-General requires the probable maximum flow (PMF) to be included in the range of flood events modelled for assessment of flooding impacts of the Project.

Numerical modelling of the PMF event for the localised catchments of Mudies Creek and Doughboy Hollow is not critical as the flow from these smaller catchments is significantly smaller when compared to the backwater effect from the Hunter River.

Previous studies, including the WBM Singleton Floodplain Study (WBM, 2006), have used a flood level three times the 100 year flood level (the 1955 flood is used in place of the 100 year flood) in lieu of PMF assessments

### **11.3.3 Groundwater**

The main groundwater impacts that may occur include:

- ▶ A reduction in groundwater available to existing users;
- ▶ Long term changes to the groundwater flow regime;
- ▶ Groundwater dependent ecosystems; and
- ▶ Groundwater quality impacts.

### **Reduction in Groundwater Availability**

The availability of groundwater for existing users may be reduced during construction as a result of:

- ▶ Direct removal of existing groundwater wells; and
- ▶ Groundwater drawdown associated with cuttings through hills and dewatering of excavations.



Direct removal of existing groundwater wells would likely be limited to a maximum of two wells located at chainage of approximately 232 km within the alluvial aquifer. These wells are located to the south of the existing rail line but are within the impact boundary.

Groundwater drawdown of the bedrock aquifer is likely to occur to some degree throughout the construction period due to cuttings through areas of higher elevation. The main cuttings that may intercept groundwater and result in groundwater drawdown are Cuts 6a, 6b and 6c, located between chainages 227.94 km and 229.22 km. Localised groundwater drawdown of up to 2 metres is possible. However, there are no existing wells in the vicinity of these cuttings and therefore it is anticipated that impacts to existing users would be minimal.

Works that may reduce the availability of alluvial groundwater to existing users include:

- ▶ Installation of wick drains to accelerate the consolidation of alluvial soils; and
- ▶ Dewatering during bridge pile construction.

It is anticipated that groundwater interception is most likely during construction of the Muddies Creek underbridge (chainage 232.18 km) due to the shallower groundwater levels (generally less than 5 metres below ground level). However, any dewatering of the clay alluvium at this location is likely to be minor and localised due to the low hydraulic conductivity of the clay and the relatively short dewatering times.

### **Changes to the Groundwater Flow Regime**

Long term changes to groundwater flow regimes and groundwater levels may occur, primarily as a result of changes to recharge and discharge characteristics associated with the cuttings (bedrock aquifer) as well as changes in hydraulic conductivities due to soil consolidation (alluvial aquifer).

It is anticipated that recharge to the bedrock aquifer would reduce in the vicinity of Cuts 6a, 6b and 6c (located between chainages 227.94 km and 229.22 km) due to the reduction in the area for rainfall infiltration. However, due to the limited importance of this groundwater resource and the absence of licensed wells in the vicinity of these cuttings, it is anticipated that impacts to existing users would be minimal.

Any changes to groundwater flow regimes in the alluvial aquifer are likely to be minor and not have any major impact on groundwater yields for existing users. Indeed, reductions in the hydraulic conductivity of alluvial soils are likely to be similar to those that resulted from the construction of the existing adjacent track and result in only minor changes to the existing situation.

### **Groundwater Dependent Ecosystems**

The riparian forest, wet soaks, and vegetation communities in the Project area broadly correspond with groundwater dependent ecosystems as defined in Section 11.2.5. These communities correspond with EEC's described in Section 7 and Appendix E. The Ecological Assessment concluded that the Project would not have a significant impact on these EEC's. The groundwater assessment concluded that minimal impacts on groundwater flow regimes would occur as a result of the Project. Therefore there are unlikely to be any significant impacts on groundwater dependent ecosystems as a result of the Project.



## Groundwater Quality Impacts

Groundwater quality may be impacted as a result of:

- Chemical spills during refuelling; and
- Movement of existing contaminated groundwater.

It is likely that impacted groundwater (contaminated or saline) already exists in the vicinity of the study area. Existing land use activities that may have impacted groundwater are outlined in the preliminary contamination assessment. Changes to groundwater flows due to cuttings and dewatering could potentially result in the movement of contaminated or saline groundwater towards existing licensed groundwater wells. The likelihood of impact is limited by the small radius of influence of dewatering activities and the relatively large distance of these wells from the study area.

## 11.4 Recommended Mitigation Measures

### 11.4.1 Hydrology

#### Construction

A Soil and Water Management Plan (SWMP) would be prepared and implemented to minimise potential impacts on hydrology and water quality during construction of the Project. This plan would incorporate the design and installation of erosion controls in accordance with *Managing Urban Stormwater, Soils and Construction Volume 1* (Department of Housing). The SWMP would include the following:

- At the vegetation clearing stage, the vegetation would be stockpiled and then mulched and spread over disturbed areas to provide a natural erosion barrier;
- Prior to commencement of earthworks there would be a range of measures put in place as outlined in *Managing Urban Stormwater, Soils and Construction Volume 1* (Department of Housing) which include but would not be restricted to:
  - Construction of cut-off drains to prevent clean water from upstream of the corridor flowing onto disturbed areas and hence become dirty water;
  - The diversion of those discharge points to the nearest watercourse so that clean water can be kept isolated from dirty water; and
  - The stabilisation of exposed surfaces as soon as practicable stabilised following completion of construction in the vicinity of the works.
- A number of controls outside the specific work area would be put in place and these would include but would not be restricted to:
  - Refuelling of plant and machinery within bunded areas or off-site in appropriate locations wherever possible;
  - Minimisation of disturbed areas for the safe completion of construction activities so that the potential export of sediment is minimised; and
  - The establishment and maintenance of a limited number of construction compounds to reduce the areas of overall disturbance for the Project.





- ▶ As part of the SWMP, a number of temporary sediment basins would be constructed to capture water and remove sediment before it can leave the site or enter watercourses. Conceptual design of the temporary sediment basins has been undertaken and would have the following design features:
  - The sediment basins are to be located where practical at points near where dirty water would discharge into receiving waters; and
  - The minimum depth of the basins would be 0.6 metres, with an average depth of one metre.

A surface water quality monitoring program for the construction period would be developed to monitor water discharged from the construction site, and water quality upstream and downstream of the construction areas. Construction period monitoring would be carried out periodically and after rainfall events, along with assessment of the operation of water quality mitigation measures. Monitoring during the construction phase of the Project would examine the following indicators:

- ▶ PH;
- ▶ Electrical conductivity;
- ▶ Turbidity; and
- ▶ Dissolved oxygen.

### Operation

The design of drainage structures for the Project includes the mitigation measures and guidelines outlined in the Minimbah Bank Third Track Design Criteria Report (GHD, 2008). This report specifies design criteria for management of flow at bridges and major cross drainage structures. As such, no additional operation phase mitigation measures are deemed necessary.

#### 11.4.2 Groundwater

Although potential groundwater impacts are considered to be minor, the following measures to mitigate potential impacts should be adopted:

- ▶ Minimising groundwater drawdown and impacts to existing users by:
  - Minimising the size and depth of excavations (phased construction);
  - Divert runoff away from excavations;
  - Minimise the groundwater pumping rate;
  - Minimising the time that excavations and wells are dewatered, particularly in the alluvial aquifers i.e. if possible, only dewater during the day while construction activities are taking place; and
  - Locating dewatering wells as far away from existing wells as possible.
- ▶ Protecting groundwater quality by implementing the surface water quality mitigation measures for handling, storage and management of fuels and chemicals; and
- ▶ Minimising changes to the groundwater flow regime and previously discussed.



### **Groundwater Monitoring**

Routine groundwater monitoring should be undertaken throughout the construction phase to identify any impacts that may occur. Monitoring should focus on the alluvial aquifer and involve ongoing measurement of groundwater levels and electrical conductivity near the major infrastructure elements of the Project. A decreasing trend in groundwater levels, a change in groundwater flow direction or an increase in electrical conductivity of greater than 10% of the baseline level could be a trigger for further investigations to assess potential impacts on existing groundwater users and the environment if it is determined that the Project could be the source of such changes to the groundwater regime.

## 12. Soils and Geology

### 12.1 Introduction

The Director-General's requirements identified soils and geology as a key issue for the Environmental Assessment. This section identifies the potential noise impacts associated with the Project and the management measures to reduce these impacts. The management measures are further detailed in the draft SoC contained in Appendix B. Table 12-1 outlines the Director-General's requirements and where they have been addressed.

**Table 12-1 Soils and Geology Director-General Requirements**

| Environmental Assessment Requirements                                                                                                                                      | Where Addressed            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| Bulk earthworks (excavations, resource conservation and spoil balance, embankments and retaining structures).                                                              | Section 2.1.8              |
| Soils characteristics and land contamination (including Remedial Action Plan, if required), taking into account the <i>Managing Land Contamination Guidelines (DUAP)</i> . | Section 12.2<br>Appendix H |

### 12.2 Existing Environment

#### 12.2.1 Soils

The Project passes through rolling hills at the southern/ Branxton end and alluvial flood plains at the northern / Singleton end of the Project. The geology of the Project area comprises Permian rock types of the Maitland Group and Quaternary alluvium associated with the Hunter River and tributaries. The Hunter River is located approximately 1 km – 2 km north of the Project route. Muddies Creek, a tributary to the Hunter River, crosses the alignment at about chainage 232.200 km (RCA, 2008).

A review of the Soil Landscapes of the Singleton 1:250,000 Sheet (Kovac and Lawrie, 1991) found that the Project route is characterised by three main soil landscape units:

- ▀ **Hunter** – Hunter soils are associated with the floodplain areas of the Project route. They have a moderate to high erosion hazard, with minor stream bank erosion typical along watercourses and minor sheet and gully erosion on adjacent terraces;
- ▀ **Rothbury** – Rothbury soils cover the undulating and rolling low hills south and southeast of Singleton. They have a very high erosion hazard, and typically minor sheet erosion on slopes with moderate sheet and gully erosion on lower slopes; and
- ▀ **Branxton** – Branxton soils cover the undulating low hills and rises, with many small creek flats, extending over a large area between Singleton and Cessnock. They have a high erosion hazard and are susceptible to tunnel and gully erosion due to their high dispersibility.

Each of the soil landscapes represented in the Project route pose an erosion hazard, which could pose a potential impact during construction.



### 12.2.2 Geology

Reference to the Singleton 1:250,000 Geology Sheet (1969) and the Hunter Coalfield Regional Geology Sheet 9033 (1993) indicates that the southern section of the study area (between chainage 224.200 km and 229.900 km) is underlain by Permian rocks of the Maitland Group, while the northern end (between chainage 229.900 km and 236.500 km) is generally underlain by Quaternary alluvium.

The southern section is characterised by rolling hills with relative levels (RLs) ranging from 66 metres to 96 metres. Nine of the 11 proposed cuttings are within this area. The following formations occur in this area:

- ▶ Branxton Formation (chainage 224.200 km to 225.400 km), comprising conglomerate, siltstone, sandstone and mudstone;
- ▶ Muree Sandstone (chainage 225.400 km to 225.700 km), comprising fine to coarse grained sandstone and conglomerate; and
- ▶ Mulbring Sandstone (chainage 225.700 km to 229.900 km), comprising siltstone, claystone and fine grained sandstone.

These formations have bedding dips of 8° to 11° down to the west and southwest (RCA Australia, May 2008), and therefore the Mulbring Sandstone overlies the Muree Sandstone, while overlies the Branxton Formation.

The northern section of the study area is composed of Quaternary gravel, sand and silt associated with the Hunter River, which lies approximately 1-2 km to the north and northeast. This area is a floodplain landscape with RLs less than 40 metres. The depth of alluvials in this section is up to about 10 metres below ground level. The alluvials are underlain by the Mulbring Sandstone formation. Acid Sulfate Soils (ASS) have not been detected throughout the alluvial soils, which is consistent with the elevation of the area.

### 12.2.3 Contamination

A Preliminary Contamination Assessment of the proposed works area was undertaken. The full report is provided in Appendix H.

The objectives of this assessment were to:

- ▶ Identify potential contaminants of concern; and
- ▶ Identify areas that may require further investigation based on a review of current and historical land uses.

The Phase 1 assessment was conducted through a preliminary desktop review of site history and environmental features such as geology and hydrology, and site inspections, followed by detailed site history reviews and site inspections on sites judged to contain potentially contaminating activities based on the preliminary assessment.



## **12.3 Potential Impacts**

### **12.3.1 Soils and Geology**

The Project would involve bulk earthworks and other construction activities that have the potential to impact on soil stability and erosion, particularly due to the erosion hazard associated with the soils (as described in Section 12.2.1). However, the implementation of suitable environmental management strategies would mitigate the potential impacts of erosion and sedimentation.

Machinery and support vehicles driving off roads may result in the disturbance of surface soils and making these soils susceptible to water and wind erosion. In addition, these vehicles could track dirt and mud onto sealed nearby roads resulting in erosion and sediment loss and the potential sedimentation of nearby watercourses with potentially adverse impacts on water quality.

The main impacts on geology and soils would result from the excavation required in the southern section of the Project route, and filling required at the northern end of the overall Project route. The quantities of material required for excavation and filling is identified and discussed in Section 2.1.8.

It is not considered that construction of the Project would result in major geological impacts as the Project requires limited removal of rock material in the southern section of the Project route.

### **12.3.2 Contamination**

Based on the site history review and site inspection conducted as part of this Preliminary Site Investigation it is considered that the primary concerns with regard to potential contamination in the areas assessed are:

#### **Within the Rail Corridor**

- ▶ Fill and ballast used for the construction of the rail corridor and associated infrastructure;
- ▶ Ballast material impacted with oil and grease;
- ▶ Current railway activities;
- ▶ Spraying for weed and pest control around buildings, tracks and fences;
- ▶ Fuels, oils and greases from operation and maintenance of the rail corridor;
- ▶ The release of grease from automatic grease points on the rails; and
- ▶ Asbestos fibres from train brakes.

#### **Within Properties Proposed for Acquisition**

Based on the assessment conducted it is considered that the following site uses within properties proposed for partial acquisition may pose some concern with regard to potential site contamination;

- ▶ Abattoir;
- ▶ Plant Nursery; and
- ▶ Military Base.





Table 12-2 presents a summary of the potential contaminants of concern within the rail corridor and there associated sources.

**Table 12-4 Potential Sources of Contamination with Rail Corridor**

| Potential Sources                                                      | Contamination Types                                                                                                                                       |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fill and ballast material                                              | Total petroleum hydrocarbons (TPH), Benzene, toluene, ethyl benzene and xylene (BTEX), polyaromatic hydrocarbons (PAHs), Phenols, heavy metals, asbestos. |
| Fuels, oils and greases                                                | TPH, BTEX, PAHs, Phenols and lead.                                                                                                                        |
| Spraying for weed and pest control around buildings, tracks and fences | Organochlorine pesticides (OCP), organophosphate pesticides (OPP), arsenic and PAHs.                                                                      |
| Electrical transformers                                                | Polychlorinated biphenyl (PCB)                                                                                                                            |

Table 12-3 present a summary of the potential contaminants of concern on the sites judged to have potential contaminating activities. A detailed breakdown on the sites together with potential contamination sources and the chemicals of concern is presented in the Preliminary Contamination Assessment.

**Table 12-5 Potential Sources of Contamination on Proposed Acquisition Sites**

| Site ID/Usage     | Contamination Types                                                                  |
|-------------------|--------------------------------------------------------------------------------------|
| Plant Nursery     | TPH, BTEX, PAHs, PCBs, heavy metals, OCPs, OPPs and asbestos.                        |
| Abattoir          | Microbial contamination, nutrients, TPH, BTEX PAHs, heavy metals, OCPs and asbestos. |
| Military Base     | TPH, BTEX, PAHs, heavy metals, OCPs, PCBs and asbestos                               |
| Cropping – olives | OCPs and OPPs                                                                        |

## 12.4 Recommended Mitigation Measures

### 12.4.1 Soils and Geology

An Erosion and Sediment Control Plan (ESCP) would be prepared by the construction contractor based on the mitigation measures identified in this Environmental Assessment and in the SoC. The ESCP should detail structural and non-structural measures to:

- ▶ Prevent erosion;
- ▶ Limit the movement of sediment;
- ▶ Remove sediment from runoff; and
- ▶ Control the discharge of runoff from the work site.



The ESCP should be based on the principle that erosion prevention is more environmentally sound, cost effective and easier than controlling the capture of sediment, especially where soils have a high proportion of fines or clays or are dispersible.

#### **12.4.2 Contamination**

The following mitigation measures are proposed to address potentially contaminated materials during the Project construction works:

- ▶ Further assessment of those sites proposed for acquisition where potential contamination issues due to past or present site usage have been identified. The proposed sampling and analysis plan for this works is outlined in Section 7 of the Preliminary Contamination Investigation included at Appendix H. The results of this would be used as input in preparing the Contaminated Soil Management Plan (see below);
- ▶ Where construction requires disturbance of the fill embankment or other areas of fill, the fill soils would need to be stockpiled onsite to allow assessment of contamination, waste classification if required and would need to be treated and disposed of accordingly;
- ▶ Impacted ballast materials should be stockpiled onsite in areas and in a manner that would not cause impact to nearby waterways and other sensitive receptors;
- ▶ Preparation of a contaminated soil management plan to reduce exposure to contamination soils during construction. The plan would include the following:
  - Requirements for waste classification (including Toxicity Characteristic Leaching Procedure (TCLP) analysis) for surplus soil to be disposed off site;
  - OHS and environmental management requirements for dealing with contaminated soils;
  - Requirements for the management of soil and soil stockpiles, including:
    - Procedure for handling and treatment of expected contaminated soils (such as segregation of soil types, suitable areas for stockpiling, additional sampling); and
    - Contingency plan to deal with unexpected discovery of contaminated soils.



## 13. Visual Amenity

### 13.1 Introduction

Although not listed in the DGRs as a key issue the ERA process as outlined in Section 4, identified visual amenity as a key issue. This section focuses on identifying the potential visual impacts of the Project, and the management measures to reduce these impacts. The management measures are further detailed in the draft SoC contained in Appendix B.

### 13.2 Existing Environment

The key visual characteristics of the existing environment are the following:

- Vegetation that has been heavily disturbed due to vegetation clearance and earthworks within the existing Main Northern Railway corridor and the areas adjoining the rail corridor;
- Vegetation adjacent to the corridor primarily consists of grassed areas and scattered trees;
- Large vegetated areas remain from chainage 224.221 km 229.100 km;
- The nearest building to the Project is a homestead in Whittingham and the abattoir at the southern end of the Project, both which are less than 200 metres of the Project route;
- Aside from the existing signalling hut, there are no buildings within the Project area; and
- There are a number of existing cut and fill locations along the existing line, as shown in Figure 13-1.

Primary observers of the rail lines and surrounding area are considered to be represented by residences within 2 km of the Project. Secondary observers are considered to be represented by residences between 2 km and 4 km of the Project. Depending on the location along the Project being assessed, a primary observer could become a secondary observer, and vice versa. Additional temporary observers are due to travellers on the New England Highway and the Golden Highway, represented in this assessment by locations at 200 m intervals along these highways.

The locations of the primary and secondary observers, and the temporary observers are shown in Figure 13-4. The primary and secondary observer locations have been determined by inspection of aerial photographs only. Due to the age and resolution of the aerial photographs it is possible that not all observer locations have been identified, however the number identified is considered sufficient to be representative for determining the impacts on visual amenity of the Project.



### 13.3 Potential Impacts

Changes to the visual amenity of the area due to the Project would occur due to changes in the visibility of the rail corridor and if the Project would alter the vista for observers. The visibility of the rail corridor is potentially increased by reduction in vegetation surrounding the corridor and changes to the height, length and width of cuttings and fill embankments. The vista for observers is potentially altered as fill embankments are higher or longer than existing fill embankments, resulting in blocking of the view of the landscape beyond.

There would be no adverse reduction in the vegetated areas that conceal the visibility of the rail corridor between chainages 224.221 km and 229.100 km.

The longitudinal profiles of the existing lines and the Project (the difference in the height level between the two lines) are shown in Figure 13-1.

There is a significant length between chainages 226.170 km and 229.275 km where the existing rail lines and the Project are in a cutting. The Project is up to 5m deeper in cut than the existing line resulting in a much wider cut being required than the existing lines, with corresponding potential to have an impact on visual amenity.

The height of the fill embankment for the Project between chainages 229.275 km and 231.200 km is approximately 3 metres higher than the existing fill embankment. This has the potential for several impacts on the existing visual amenity. The increased height could make the Project more visible to observers, and could decrease the view of the landscape beyond the embankment. Additionally, due to its height above natural ground, almost 9 metres at its highest point, and its proximity to the New England Highway, it would provide the dominant view for travellers along a section of the New England Highway.

Figure 13-2, Figure 13-3 and Figure 13-4 show the numbers of primary, secondary and temporary observer locations, respectively, that can see the existing rail lines and the Project.

Due to the presence of the vegetated areas in the area of the major cutting, the topography and the locations of the observer locations, the existing rail lines and the Project in the area have very low visibility, with no significant change due to the Project.

Although the fill embankment between chainages 229.275 km and 231.200 km is made higher by the Project, there is no significant change to its visibility in relation to the primary and secondary observer locations. With regard to the temporary observers on the New England Highway, there is a reduction in the visibility of the fill embankment between chainages 229.275 km and 230.300 km. This is due to the embankment between chainages 230.300 km and 231.200 km, in conjunction with the curve on the highway and embankment, acting to limit the view along that section of the highway. Therefore the height of the embankment in combination with its proximity to the highway on the inside of the curve, results in the embankment becoming a more significant part of the view for observers on the New England Highway in this location, with a significant reduction in longer distance views from the highway.

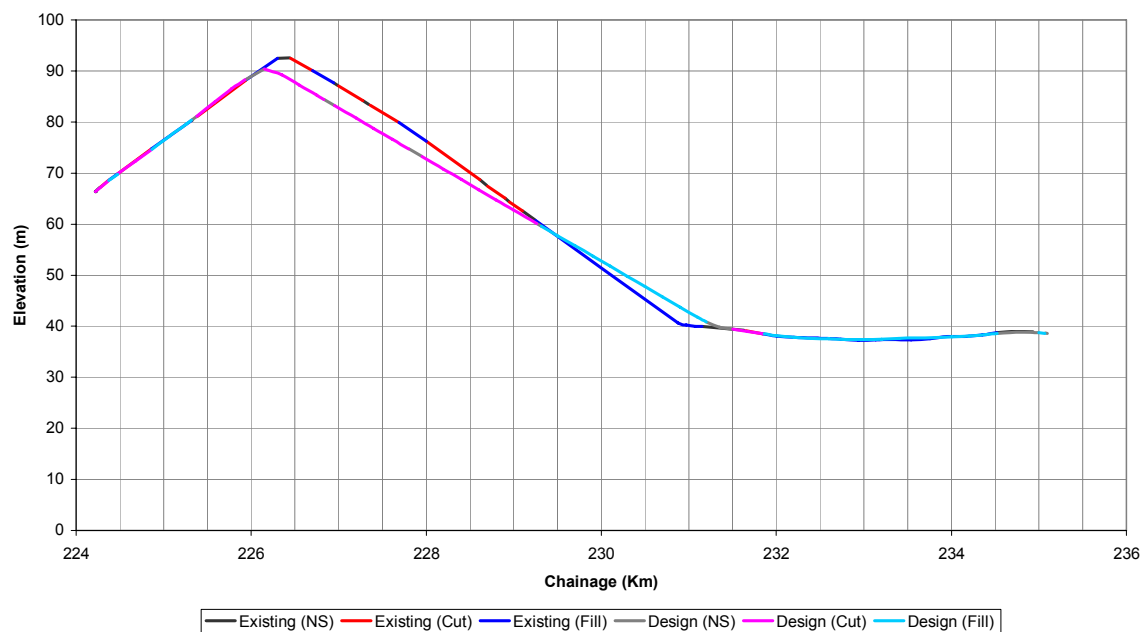
Figure 13-2, Figure 13-3, and Figure 13-4 show the change in visibility of the land around the existing rail lines and the Project from the primary, secondary and temporary observer locations respectively.

The extra height of the fill embankment resulting from the Project would change on the visual amenity of all observer classes by at least partially blocking some views of the rural landscape. The actual number of observer points impacted, however, is generally low, varying from one to four.

The dominant impact on visual amenity is therefore the increase in height of the fill embankment of the Project, combined with its close proximity to the New England Highway, creating a significant visual impact for travellers on the highway. The length of highway impacted is only short, of the order of approximately 2 km. Therefore, at normal highway driving speeds, this impact will persist for a maximum of one minute.

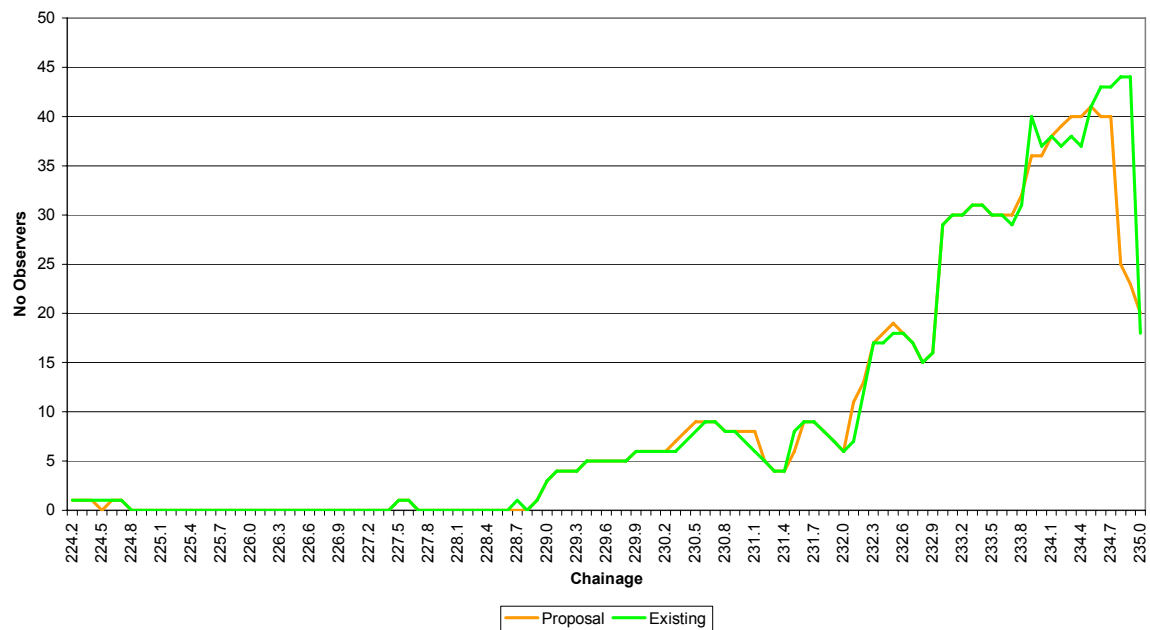
### 13.4 Recommended Mitigation Measures

As discussed in Section 13.3, the Project would not significantly alter the visual amenity of the area. However, to soften the change of the fill embankment on the visual amenity, consideration should be given to landscaping the embankment, and immediately adjacent to it, with appropriate native trees and shrubs (as discussed in Section 7.5).

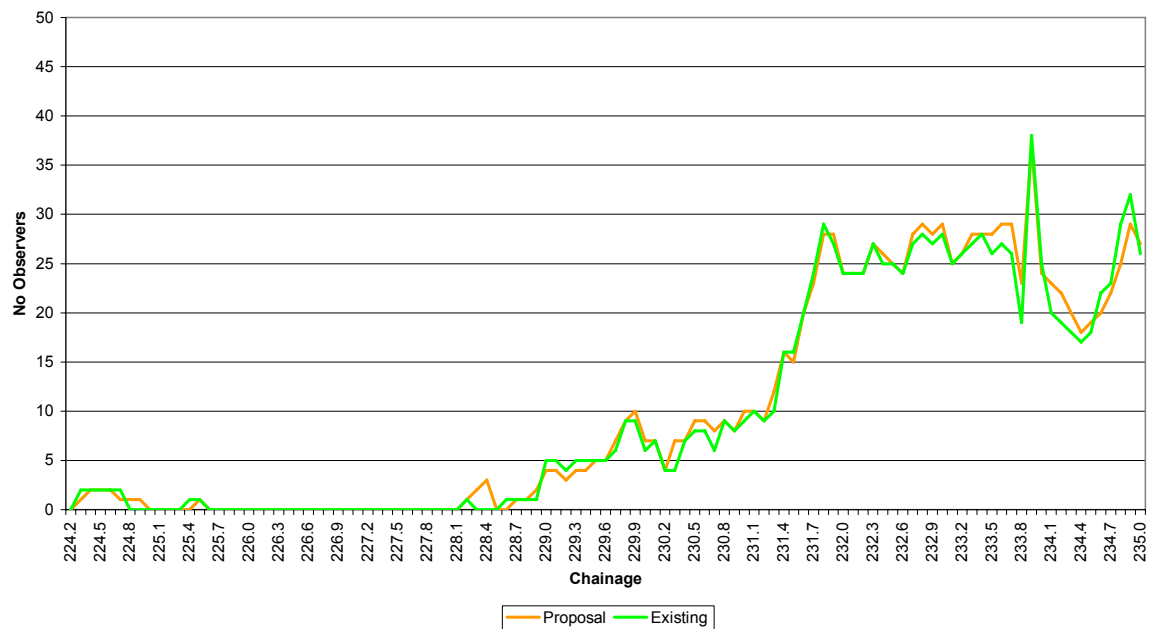


**Figure 13-1 Longitudinal Profiles**

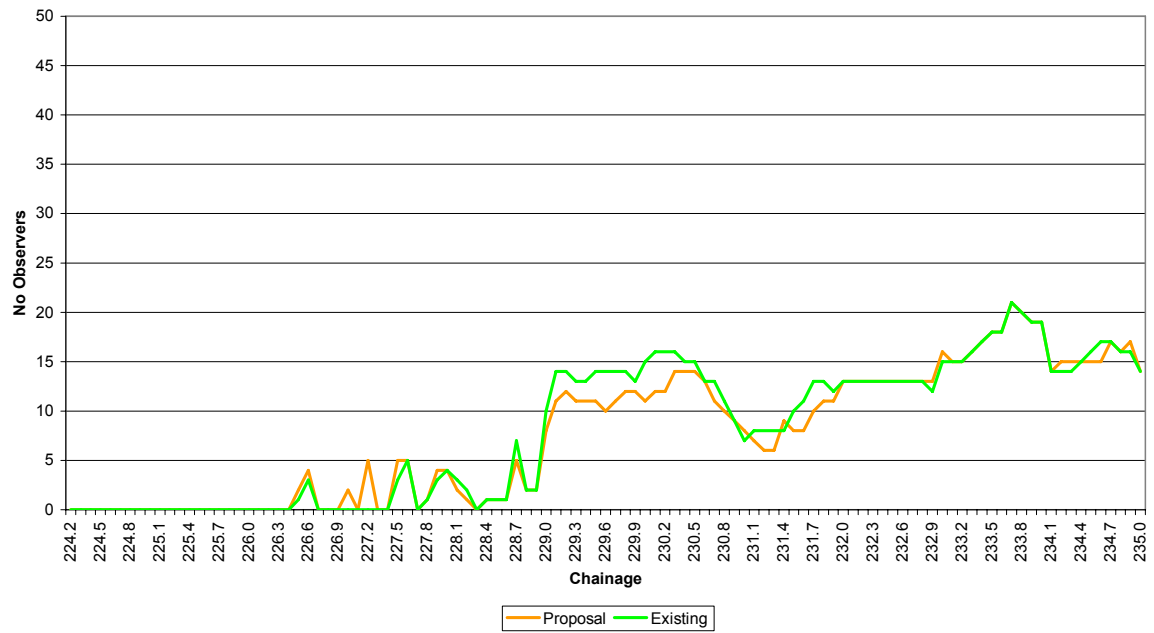




**Figure 13-2 Primary Observers**



**Figure 13-3 Secondary Observers**



**Figure 13-4 Temporary Observers**



## 14. General Environmental Assessment Requirements (Non-key Issues)

### 14.1 Social and Economic

This section describes the socio-economic environment of the Project area, including a demographic profile, notable cultural and social aspects as well as key business characteristics. The potential impacts of the Project on these characteristics are discussed along with proposed mitigation measures.

#### 14.1.1 Existing Environment

##### Population and Settlement

The Project is located in the Singleton Local Government Area (LGA), which forms part of the Upper Hunter Region of NSW. In the 20 years between 1986 and 2006 the Singleton LGA population grew by 28% from 17,126 persons to 21,939 persons. Average annual population growth from 1991 to 2001 was 1.2% per annum (ABS, 2006 and Singleton Council, 2005).

The suburb of Lower Belford within Singleton LGA covers the majority of the Project and has a population of approximately 700 people (ABS, 2006, Basic Community Profile, Lower Belford State Suburb, Sheet T01). Settlement patterns surrounding the Project are characterised by low-density, detached residential and rural dwellings with some commercial and agricultural uses.

Singleton Council forecasts an annual population growth rate for the LGA of 1.5% (Planning Workshop Australia, 2008 and Singleton Council, 2005). This forecast predicts:

- ▶ 24,500 persons in 2010;
- ▶ 26,500 persons in 2015; and
- ▶ 28,500 persons in 2020.

The population in most areas of the Singleton LGA is expected to increase, but some parts of the area would grow more quickly, especially Singleton Heights/North Singleton and the Rural East Planning Area. The Singleton Land Use Strategy (Planning Workshop Australia, 2008) and the Singleton Council have not indicated or advised of any plans for significant population growth within the immediate area surrounding the Project.

##### Business Activity

Within the suburb of Lower Belford the most common industries of employment are coal mining, dairy cattle farming, sheep, beef cattle and grain farming, road freight transport, and school education (ABS, 2006).



## Industry

The commercial centre of Singleton supports an industrial sector, which is based largely on coal mining and electricity generation. Eighteen (18) coal mines produce approximately 70 million tonnes of coal per year and two large power stations approximately 35 km north of Singleton can produce over 4,600 megawatts of power (Singleton Council, 2008). Additionally, the Department of Defence Singleton Military Area provides Defence training and other military services. Well established agricultural operations support a large dairy and beef cattle sector along with a newly emerging mushroom industry, while Singleton's wine and tourism industry is part of Hunter Valley Wine Country (Singleton Council, 2008). Accordingly, Singleton's main industries are:

- Coal Mining;
- Power Generation;
- Defence Training;
- Beef Cattle;
- Dairy;
- Wine Production;
- Tourism; and
- Agricultural.

Although the land uses adjoining the Project are predominantly rural, and associated rural residences, many of Singleton's main industries are present. Adjacent to the northern section of the Project is Whittingham Airstrip, while a nursery and landscaping supply business is located between the New England Highway and the Main Northern Railway at Whittingham. A small vineyard is located to the south of the Project, west of Racecourse Lane. The Singleton Military Area, including the bombing and firearms range, is located adjacent to the Project to the west. An abattoir is located to the west of the southern end of the Project.

## Environmental Amenity

The land uses adjoining the Project route are predominantly rural and as such, the locality experiences a predominantly rural character. However, it is noted that the amenity of the Project route is already affected by existing transport infrastructure, including the existing Main Northern Railway, New England Highway, Golden Highway, and Singleton Military Area including the bombing and firearms, and aircraft activities at Whittingham Airstrip.

### 14.1.2 Potential Issues

Community consultation has been undertaken for the Project, aimed at minimising potential impacts on the community. Additionally, the concept design has sought to minimise potential social and economic issues arising from the Project and as such, it is not considered that the Project would result in significant social and economic issues.



The project has the potential to have both positive and negative impacts on people on a number of levels, including as landowners and residents, rail users and as a community. A qualitative assessment of the range of potential impacts that could arise from the construction and operation of the Project is outlined below.

In particular, the Project would generate social impacts to some local residents, as the Project requires acquisition of private land (as discussed in Section 9), the closure of a private rail crossing, and temporary and permanent alterations to vehicle access. The previously discussed issues could also impact on the local community.

Section 3 outlines the stakeholder consultation process that ARTC and GHD are implementing to identify the potential social issues of the Project.

The existing rail infrastructure already impacts on the connectivity of settlements within the Project area, especially with regard to access and to properties and services. Although the Project would result in some minor changes to existing access requirements, as discussed in Section 9.3.2, the overall Project is not expected to further segregate connectivity of settlements, as it would simply serve as an expansion to the existing rail corridor. In the event that existing access arrangements would be altered by the Project, mitigation measures would be implemented to address any potential impacts relating to changes in access. Accordingly, the Project is not anticipated to impact on the ability of residents to access properties and services. The Project is not anticipated to impact on the provision of community services within the locality.

### **Business Activity**

The Project would affect a number of businesses, primarily through land acquisition and the construction of rail infrastructure at a closer distance than existing infrastructure, which may have noise and vibration impacts as discussed in Section 10.3.

### **Social and Economic Benefits**

The Project would create an overall positive economic impact, as its operation would facilitate increased coal carrying capacity of the Main Northern Railway. This would create a positive economic impact for the coal industry by permitting a higher volume of coal to be transported to the Port of Newcastle, and therefore available for export. Additionally, the construction would result in direct employment opportunities and benefit local and regional goods and services providers.

### **Construction Phase**

The Project would affect businesses along the Project route during the construction stage as a result of noise, vibration and dust from construction sites and compounds. These impacts are addressed in Sections 10, 14.2 and 0. These impacts would be temporary and transient, as construction moves along the Project route.

Economic benefits to businesses in the local area would result from increased demand for accommodation, goods and services. The construction stage would also generate employment opportunities in the local area, especially through subcontractor and material supply.





### ***Operation Phase***

Noise and vibration from existing activities, including current rail activities, traffic from the New England Highway and Golden Highway, the activities of the Singleton Military Area, including bombing and fire arms training, and noise from the adjacent Airstrip, already affect many of the businesses along the Project route. The Project's impact on business activity would be limited to increased rail activity, and in some cases, a reduced separation distance of existing rail activities and business activities. The Project would result in the construction of rail infrastructure in closer proximity to business activity than the existing rail corridor.

In particular, it is expected that the Project would have a minor noise and vibration impact on the abattoir and nursery adjacent to the Project route. Negotiations have been undertaken and property specific management measures would be developed during detailed design as discussed in Section 9.4.1. The Project would have a positive affect on some businesses as the Range Road overbridge would provide unrestricted road access.

### **Primary Industries Impacts**

Property acquisition and modifications to properties could impact on farm profitability through reductions in available land. The surrounding agricultural lands are already largely fragmented and the Project would contribute to further fragmentation of rural lands. This may affect land and stock management on some properties by reducing the land area available for cultivation or pasture.

However it is not considered that the Project would result in any significant impact to the primary industries surrounding the Project route given the strip nature of property acquisition adjacent to the existing railway line, the comparatively small area of land required, the already fragmented nature of much of the agricultural land, and existing land constraints including, but not limited to, flooding and noise and vibration currently experienced on agricultural lands.

### **Amenity Impacts**

#### ***Construction Phase***

The Project would affect the amenity of the surrounding area during the construction stage as a result of noise, vibration, traffic, and dust from construction sites and compounds. These impacts are addressed in Section 2.2. These impacts would be temporary and transient, as construction moves along the route.

#### ***Operation Phase***

The Project would result in minor visual impacts on the existing landscape due to the proposed changes in levels and the proposed use of the rail corridor. The impact of the Project on the visual landscape is discussed in Section 13.3.

### **Property Impacts**

The potential for impacts on property would be mainly associated with property acquisition. The construction of the Project and associated infrastructure would require the strip acquisition of a portion of properties adjacent to the existing rail corridor. Discussion of property acquisition is included in Section 9.



### **14.1.3 Recommended Mitigation Measures**

There would be continuing consultation with the community during the construction phase of the Project. Management measures for the construction and operation phases are identified in Section 2.2 and would be supplemented by the ecology, indigenous heritage, land use and access, noise and vibration, hydrology and flooding, soils and geology and visual amenity measures outlined in Sections 7.5, 8.4, 9.4, 10.4, 11.4, 12.4 and 13.4 respectively, along with those mitigation measures discussed in Chapter 14.

## **14.2 Air Quality and Climate**

### **14.2.1 Introduction**

Air Quality is not listed as a key issue in the DGRs and therefore requires a comparatively reduced level of assessment, with the primary focus on construction and operation dust impacts to local air quality. The ERA process did not result in the level of assessment increasing for air quality.

### **14.2.2 Existing Environment**

#### **Sensitive Receptors**

The potential for air quality impact is greatest at receptors located at the edge of the Project route or construction areas. The level of impact would decrease with distance from the Project route or construction area. In general, sensitive land uses located less than approximately 500 metres should be considered as key sensitive receptors, with particular attention given to receptors located within approximately 300 metres.

Section 9 identifies the land uses surrounding the Project. Sensitive receptors include the following:

- ▶ Residences: Several residences are located within 500 metres of the Project, with the nearest residence within 50 metres of the Project;
- ▶ A nursery located to the eastern side of the Project at Whittingham;
- ▶ An abattoir located at the southern end (within 200 metres of the Project); and
- ▶ A vineyard to the southwest of the Project.

#### **Ambient Air Quality**

The nearest ambient air monitoring station operated by the DECC is at Beresfield, approximately 40 km to the southeast of the Project.

The ambient air quality data for Beresfield, as well as the air quality goals set by the DECC (Environmental Protection Authority) are presented in Table 14-1.



**Table 14-1 Ambient Air Quality Data – Beresfield 2008**

|                         | Ozone                  | Nitrogen Dioxide       | Carbon Monoxide        | Sulfur Dioxide         | Particles PM10              |
|-------------------------|------------------------|------------------------|------------------------|------------------------|-----------------------------|
| Measured concentrations | Maximum 1 hour average | Maximum 1 hour average | Maximum 8 hour average | Maximum 1 hour average | 24 hour average             |
| Standard                | 10 pphm                | 12 pphm                | 9 ppm                  | 20 pphm                | 50 $\mu\text{g}/\text{m}^3$ |
| BERESFIELD              | 2.6                    | 1.7                    | -                      | 1.7                    | 14                          |

*Note: pphm – parts per hundred million, ppm – parts per million,  $\mu\text{g}/\text{m}^3$  – micrograms per cubic metre.*

Air monitoring data for Beresfield suggests that local air quality conditions within the Project area should be within the DECC air quality goals.

#### Local Meteorology

The transport and dispersion of air emissions from the construction and operation of the Project would be influenced by prevailing synoptic flows and vertical temperature profiles that would alter both diurnally and with wind direction, depending on whether flows are coming off the land or water.

Local wind data were sourced (Hyde et al., 1981) from Belford, located approximately 4km east of the Project route. Wind patterns may be slightly different along the Project route but the prevailing wind pattern should be sufficiently representative for the purposes of this qualitative assessment.

Meteorological data at Belford showed the prevailing winds in the upper Hunter Region to be from the north during summer months and from the south during winter months. Typical night time drainage flows occurring from the southwest to northwest in direction, with average surface speeds of around 1.6 m/s. The surface direction of daytime sea breezes at Belford is generally east to southeast and occasionally from the south. Average surface speeds of sea breezes range from 1.6 m/s to 5.5 m/s.

Climatic data was obtained from the Australian Bureau of Meteorology Singleton Army Site from the period 1971-2000. The mean maximum annual temperature at the site for the period is 24.4°C whilst the mean minimum annual temperature at the site for the period is 12°C. The locality has an average annual rainfall of 730.9 mm with the highest mean rainfall occurring in January, and the lowest mean rainfall occurring in July (BOM, 2008).

#### 14.2.3 Potential Impacts

##### Construction

Air quality impacts generated during the construction phase of the proposed Project would primarily arise due to dust emissions.



Environmental effects of airborne particulate matter (dust) are generally related to the size of the particle size range of the dust. Health effects are associated with fine particles less than 10 micrometres in equivalent aerodynamic diameter, whereas coarser particles (10 to approximately 100 micrometres) are associated with effects on amenity (such as visible dust plumes or deposition on surfaces). As a dust plume is transported downwind from a source, the coarser particulates progressively drop-out of the air column to deposit on surfaces such as land, water and cars downwind of the source, while the finer particulate fractions would be retained in the air column longer by turbulent mixing. Wind erosion or dust lift-off can become significant under strong winds (greater than 5 metres per second). As discussed in Section 14.2.2, these stronger prevailing winds predominantly occur from the north during summer and from the south during winter. As such, sensitive receptors nearest to the construction site located to the south and north would be most exposed to dust transport and nuisance.

Air emissions during construction are likely to consist of:

- ▶ Dust emissions from both the mechanical disturbance and wind erosion of dry soils and spoil material; and
- ▶ Exhaust emissions from the range of motor vehicle and mobile plant required for construction of the Project.

The major potential dust sources during construction activity are expected to include:

- ▶ Clearance of vegetation, rock and soil material, potentially including vegetation clearance beyond that required for the construction activities;
- ▶ Areas where protective mulch has not been applied to exposed surfaces;
- ▶ General surface earthworks and excavation works;
- ▶ Pneumatic rock-breaking, where required;
- ▶ Top soil and soil handling (such as stockpiling, loading and dumping);
- ▶ Leveling and grading of disturbed soil surfaces;
- ▶ Passage of construction and administrative vehicles over unsealed sections of road or localised unconsolidated soil surfaces; and
- ▶ Wind erosion of unstable/uncovered surfaces and stockpiles and other unconsolidated surfaces.

It is considered that the dominant sources of dust emissions during the construction works would be during activities that cause large mechanical disturbances during their operations, such as operations of a bulldozer, grader or scraper.

Given the nature of the proposed construction activities, it is expected that application of the mitigation measures to reduce dust generation and vehicle exhaust emissions, as described in Section 14.2.4 would minimise impacts to sensitive receptors.



## Operation

The Project is expected to reduce the current headway time from 13 minutes to 8 minutes, resulting in an increase of train movements along the railway. As well as a reduction in headway time, the Project would reduce the current gradient of 1:80 to 1:100, resulting in faster and more efficient train times. As with existing conditions, no trains are expected to idle within the Project route.

No noticeable dust has been generated from passing trains at the existing Project site. As such, any additional train movements resulting from the Project are not expected to adversely affect the local air quality amenity. Further the reduced time that trains would take to pass through the area would further reduce the opportunity for dust generation.

The Project represents an improvement to the existing rail network, which is likely to improve air quality as a result of improved traffic flow and improved operating efficiency for all trains.

### 14.2.4 Recommended Mitigation Measures

Air quality mitigation and monitoring measures to minimise potential air quality impacts are outlined below, and within the Construction Environmental Management Plan (CEMP) prepared by the construction contractor.

#### Dust Mitigation

The following are the recommended mitigation measures to control dust generation:

- Site managers would be provided with daily weather updates containing warnings of the onset of strong winds. The site manager would then take steps to pre-water construction areas and stockpiles before they were disturbed and continue watering during any activities where fugitive dust may be produced;
- Where practicable, physical barriers would be constructed to act as windbreaks for the construction site or for stockpile areas where practicable and dust screens (such as shade cloth) would be installed on construction site boundaries that are adjacent to sensitive receptors;
- Stockpiles would be a suitable height, width and slope and placed away from public places where possible. Spoil stockpiles would be watered or covered, where practicable;
- Existing vegetation would be retained where possible. Cleared areas would be revegetated as soon as practicable to temporarily or permanently stabilise soil;
- Construction traffic would be controlled by designating specific routes for haulage and access. Vehicle speeds would be limited to limit dust generation and use ballast where possible;
- All trucks hauling dirt, sand, soil or other loose materials to and from the construction site would be covered on public roads and where practicable or required on site;
- Wheel washers/shakers would be installed where vehicles enter and exit unpaved roads onto public paved roads. Material spillage on roads would be cleaned up regularly;
- Earthmoving activities would be reviewed when excessive dust plumes are directed towards sensitive receptors;





- ▶ All construction vehicles, mobile plant and machinery would be maintained and operated in accordance with the manufacturers' specifications to minimise exhaust emissions; and
- ▶ Egress to public roads would be monitored for deposition of any soil material and mechanically swept as required.

### 14.3 Non-Indigenous Heritage

#### 14.3.1 Existing Environment

The Project route and its surrounds have been subject to non-indigenous activity and settlement since the early Nineteenth Century. A search of the Australian Heritage Database and the Singleton LEP was undertaken on 24 June 2008, which identified five historical homesteads and non-indigenous heritage items listed on the local or state heritage registers located within approximately two kilometres of the Project site (Refer to Figure 14-2).

Local Heritage items include:

- ▶ 'The Woodpack Inn'; and
- ▶ 'New Freugh' ruin.

Regional Heritage items include:

- ▶ Gates and Gate Lodge; and
- ▶ Whittington Anglican Cemetery.

State Heritage items include:

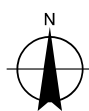
- ▶ Minimbah House;
- ▶ Baroona (Homestead); and
- ▶ Neotsfield (Homestead).

The nearest items are Baroona approximately 600 metres to the southwest (the property containing the Baroona homestead adjoins the Project, however the homestead is approximately 600 metres to the southwest) and Gates/Gate Lodge, approximately 650 metres north-northwest of the Project.

#### 14.3.2 Potential Impacts

Issues that may impact on these heritage items include noise and vibration, visual amenity, and air quality as detailed in Sections 10.3, 13.3, and 14.2.3 respectively. However, these potential impacts are likely to be minimal due to the following:

- ▶ The Project does not involve any direct impacts on any of the listed heritage items (approximately 484 m<sup>2</sup> (0.12%) of the Baroona property requires acquisition, but would not impact on any structure);
- ▶ The nearest heritage item is approximately 600m to the southwest. Due to the distance, any potential impacts from vibration or air emissions are likely to be minimal; and
- ▶ The visual assessment in Section 13 concluded that the Project would not create a significant impact on surrounding residences.



#### LEGEND

- |                 |                   |               |                           |            |
|-----------------|-------------------|---------------|---------------------------|------------|
| — Existing Rail | — Cadastre        | — Watercourse | — Heritage Classification | — Regional |
| — Project Route | — Forest Or Shrub | — Local       | — State                   |            |

1:50,000 for A4  
0 240 480 960 1,440 1,920  
Metres

Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geodetic Datum of Australia 1994  
Grid: Map Grid of Australia, Zone 56



CLIENTS | PEOPLE | PERFORMANCE

ARTC - Minimbah Third Track  
Environmental Assessment  
Non-Indigenous  
Heritage Items  
25 June 2008

job no. 22-13755  
rev no. A

Figure 14.1



### **14.3.3 Recommended Mitigation Measures**

Adoption of the recommended mitigation measures detailed in Sections 10.4, 13.4 and 14.2.4 would further reduce potential impacts on the nearest heritage items (the Barooka homestead and the Gate/Gates Lodge).

Due to the distance of the other identified heritage items from the Project route together with the mitigation measures detailed in Sections 10.4, 13.4, and 14.2.4, it is unlikely that the Project would have any direct or indirect impacts on these items.

## **14.4 Energy and Greenhouse**

### **14.4.1 Introduction**

Climate change refers to the warming temperatures and altered climatic conditions associated with the concentration of gases in the atmosphere known as greenhouse gases (GHG). Greenhouse gases are naturally occurring in the atmosphere, and absorb solar radiation to maintain the temperature of the atmosphere to support life. Greenhouse gases include carbon dioxide (CO<sub>2</sub>), methane, nitrous oxide and water vapour (DECC 2008).

### **14.4.2 Existing Environment**

The main contributors to greenhouse gas emissions in the immediate area are local residences and traffic; motorists travelling along the major roads and highways; and passenger, general freight and coal trains using the existing rail track.

Due to the steeper than normal grade of Minimbah Bank (approximately 1:80), loaded coal trains are currently unable to negotiate the Bank at a constant speed and require greater engine power. The steep grade also results in trains stalling on the Bank creating severe service disruptions, increased rail wear and reduced line capacity. This problem contributes to excess emissions due to higher demands on train and maintenance vehicle fuel use.

### **14.4.3 Potential Impacts**

#### **Construction**

Greenhouse gas emissions and contributions associated with the Project include emissions from construction plant and equipment and vegetation clearance.

The greenhouse gases that would be emitted during the construction of the Project include:

- ▶ Carbon Dioxide (CO<sub>2</sub>);
- ▶ Carbon Monoxide (CO);
- ▶ Oxides of Nitrogen (NO<sub>x</sub>); and
- ▶ Non-methane Volatile organic Compounds (NMVOC).



The greenhouse gas emissions of the construction phase of the Project are primarily associated with the following:

- Clearance of existing vegetation (CO<sub>2</sub> emissions from decomposition of cleared biomass retained on site) and associated activities (such as GHG emissions from vehicles used for land clearing and transportation of green waste to management location);
- Energy (fuel and electricity) consumption, especially fuel consumption of construction machinery and vehicles, while electricity would be used at construction compounds, temporary lighting and other equipment; and
- Construction materials also contain 'latent' greenhouse gas emissions associated with their products and transport. The quantity of GHG emissions is dependent on the form of production and its distance from the production site.

#### ***Traffic Alteration***

Construction of the Project would result in diversion of local traffic around the construction works, and potential restrictions on motorists using the Golden Highway and New England Highway as discussed in the Traffic and Transport Assessment in Appendix I. This could result in traffic delays, and an increase in travel time through the area, and a reduced level of service. However, the level of delay could not be determined until the construction contractor has been commissioned and a Traffic Management Plan developed.

The existing rail line would be out of service for limited periods of the third track construction, mainly during track possession periods, as described in Section 2.2.11.

#### **Operation**

##### ***Vehicle Movements***

Train movements during the operation phase would require fuel and therefore result in greenhouse gas emissions. ARTC has estimated that the Project would reduce fuel consumption by 1,300 litres per 1,000,000 tonnes of coal. This equates to 3.5 tonnes of greenhouse gas savings (based on 2.7 kg CO<sub>2</sub>-e/l from diesel fuel) per 1,000,000 tonnes of coal. Based on the Project's objective of increasing capacity of the line to 165 million tonnes per year (as per Section 5.6.1) this equates to 577 tonnes of greenhouse gases per year.

##### ***Ancillary Infrastructure***

Associated infrastructure such as lighting, signalling would require power that may result in GHG emissions through electricity usage. However, the power demand of such infrastructure, and therefore the GHG emissions, is dependant on the type of lighting and other infrastructure selected, which would not be determined until the detailed design phase. However, the lighting and signalling associated with the Project would be replacing existing similar infrastructure and, therefore, is unlikely to result in significant increases in GHG emissions compared to existing operations.



#### 14.4.4 Recommended Mitigation Measures

##### Construction

Management and mitigation measures to reduce greenhouse gas emissions generated during the construction phase would include the following:

##### *Vegetation Clearance*

- ▮ Minimise the area of vegetation clearance to that required for safe completion of construction;
- ▮ Where vegetation is to be cleared, it should be made available for beneficial reuse (such as mulching and landscaping) either within the Project or for others. On-site burning of vegetation material would not take place;
- ▮ Where practical, make available all timber suitable accumulated during vegetation clearing for milling; and
- ▮ Use large branches (particularly those containing native seed) for brush matting and erosion control in rehabilitation areas where practical.

##### *Energy Consumption*

- ▮ Where feasible, assess the energy efficiency when selecting construction equipment, machinery and infrastructure;
- ▮ Maintain construction machinery in accordance with manufacturer's requirements to maintain operating (and fuel) efficiency;
- ▮ Where feasible, use of biofuels (such as biodiesel, ethanol or blends) to reduce the greenhouse gas emissions associated with fuel use;
- ▮ Use of local material and personnel where possible to reduce transport-related emissions;
- ▮ Where possible, minimise the distance of stockpile areas and other associated facilities from the Project to reduce transport-related emissions;
- ▮ Where possible, use recycled materials, recycled aggregate, and recycled metals (such as recycled content in steel) to minimise the greenhouse gas emissions associated with construction materials; and
- ▮ Use of low greenhouse-intensity materials where possible (such as materials produced with reduced energy inputs and from suppliers using carbon offsets).

#### 14.5 Resource Conservation and Waste Management

##### 14.5.1 Potential Impacts

##### Construction

Major earthworks for the Project are required, with excavation required in the southern section of the Project, and filling required at the northern end of the Project.

Construction of the Project would result in the generation of several waste streams. These would include:





- ▶ Excavated material from bulk earthworks, including soils and rock, as discussed in Section 2;
- ▶ Disturbance or generation of potentially contaminated material as discussed in Section 12.2.3;
- ▶ Vegetative matter (green waste) from clearing and grubbing of vegetation prior to and during construction;
- ▶ Demolition waste, such as asphalt and concrete;
- ▶ Excess construction materials, such as concrete, steel and timber;
- ▶ Packaging materials associated with the delivery of items to site, such as wrapping materials and plastics;
- ▶ Liquid wastes, such as waste fuels, oils and chemicals from plant and machinery maintenance;
- ▶ Wastewater from dewatering activities;
- ▶ Human waste and sewage generated at amenity facilities at the construction compounds; and
- ▶ General garbage and recyclables.

### Operation

Limited amounts of waste would be generated from track maintenance and repair activities. These wastes would include vegetative wastes trimmed from vegetation, trimmed or replaced steel and timber, and oils and greases from maintenance and repair tasks.

#### 14.5.2 Recommended Mitigation Measures

Waste materials generated during construction and operation of the Project would be managed in accordance with the principles of the waste management hierarchy referred to in the *Waste Avoidance and Resource Recovery Act 2001* and the NSW Government's *Waste Reduction and Purchasing Policy 1997*.

A number of other guidelines, Regulations and Acts would be referenced where appropriate, including:

- ▶ *Protection of the Environment Operations Act 1997* outlines the requirements for waste management;
- ▶ *Contaminated Land Management Act 1997* defines the requirements for the management of contaminated materials; and
- ▶ *Waste Classification Guidelines Part 1: Classifying Waste (Department of Environment and Climate Change 2008)* defines the classifications of waste and their management requirements.

Wastes would be classified and managed in accordance with the *Protection of the Environment Operations Act 1997*, and other Acts where applicable.

The following mitigation measures would be implemented to minimise waste generation and to manage those wastes that are generated:



- ▶ Excavated material would, wherever possible, be re-used on site, although some material would require offsite disposal;
- ▶ Contaminated material would be managed and disposed of, as discussed in Section 12.4.2;
- ▶ Topsoil would be reused in revegetation and rehabilitation of cleared areas;
- ▶ Where practical, vegetative matter, not including weeds, would be chipped and reused on-site. Logs and tree limbs suitable for habitat and or fauna refuge would be collected during clearing and placed in a location identified as suitable;
- ▶ Demolition waste materials would be recycled and/or reused on site, or transported to an approved recycling or waste management facility, as appropriate;
- ▶ Construction materials would be sourced and ordered in appropriate quantities to avoid the creation of excess waste, recycled and/or reused on site or on other projects where possible, or transported to an approved recycling facility;
- ▶ Suitable waste bins/receptacles would be provided throughout the work site to capture all waste streams;
- ▶ Separate containers would be provided for recyclable and non-recyclable materials. These materials would be transported to an approved recycling or waste management facility, as appropriate;
- ▶ Waste would be transported from the site when storage facilities are filled. The waste storage area would be kept tidy and well maintained;
- ▶ Liquid waste such as chemicals, fuel and lubricants, and their containers, would be disposed of in accordance with the requirements of the *Waste Classification Guidelines Part 1: Classifying Waste* (Department of Environment and Climate Change 2008); and
- ▶ Portable toilet facilities would be installed on site and emptied periodically by an approved contractor.

## **14.6 Risks and Hazards**

The Project could potentially generate and exacerbate certain existing hazards and risks to human health and the environment. The Project may also generate a number of health and environmental hazards, such as exposure to and contamination by hazardous materials.

### **14.6.1 Existing Environment**

The Project involves both rail and road construction. The Project runs along the existing Main Northern Railway, while it also crosses public and private roads, including a private level crossing, Range Road (level crossing) and the Golden Highway. The New England Highway is in close proximity to the Project site.

A number of services and utilities are present within and adjoining the Project route, including electricity, gas, water (council and private), and rail signalling. The surrounding environment is a cleared rail corridor bordered mainly by grasses and trees.



As discussed in Section 12.3.2, construction may require the disturbance of potentially contaminated materials both within the existing rail corridor and on properties proposed for acquisition, which may pose a risk to those undertaking the works.

Preliminary soil analysis undertaken by RCA Australia in 2008 did not identify the presence of ASS throughout the alluvial floodplain, which is consistent with the elevation of the area.

#### **14.6.2 Potential Impacts**

##### **Construction Hazards and Risks**

###### ***Health and Safety Hazards***

Potential hazards and risks to human health due to construction include the following:

- Possible injury and risk of collision with rail traffic. A large proportion of the construction works are within the Danger Zone, which is defined as everywhere within 3 metres horizontally from the nearest rail and any distance above or below this 3 metres, unless a safe place exists or can be created;
- Possible risk of collision with construction machinery and road traffic. Construction would include activities within the Range Road and Golden Highway Road Reserves, and within close proximity to the New England Highway. This would bring construction machinery in close proximity to road traffic;
- Possible risk of collision with construction machinery and rail traffic;
- Possible injury or health impacts arising from road and rail construction activities;
- Possible exposure to bushfire; and
- Possible contact with contaminated materials (refer Section 12.3.2).

###### ***Environmental Hazards***

Aspects of the Project may introduce potential environmental hazards to the construction area and surrounds. Many of these hazards are inherent to any construction activity. Specific environmental hazards associated with the Project would include:

- Fire hazards that could potentially be ignited by sparks from construction activities;
- Potential for erosion and generation of dust in cleared areas/exposed soil;
- Risk of environmental impacts arising from disturbance of potential areas of contamination; and
- Potential water quality impacts on watercourses as discussed in Section 11.3.

###### ***Health and Safety Hazards***

Operation of the Project has the potential to generate the following health and safety hazards:

- Activities such as transportation of dangerous goods, handling of hazardous waste, refuelling and maintenance of equipment have the potential to spill liquids and dangerous goods (as a result of accidents or unforeseen incidents) and cause potential harm to workers, road and rail users, and the local community in the operation of the Project;



- Movement of maintenance vehicles over exposed soils may contribute to erosion and generate dust, which has the potential to impact on human health; and
- There is potential for collisions or injury for workers whilst undertaking maintenance activities and repairs on the roads and rail lines.

### ***Environmental Hazards***

Operation of the Project has the potential to generate the following environmental hazards:

- Activities such as transportation of dangerous goods, handling of contaminated waste, refuelling and repair of rail maintenance equipment have the potential to spill liquids and dangerous goods (as a result of accidents or unforeseen incidents) resulting in potential harm to the receiving environment via soil and water contamination and resulting impacts; and
- Movement of maintenance vehicles over exposed soils may contribute to erosion and generate dust during the operation of the Project.

### **14.6.3 Recommended Mitigation Measures**

#### ***Human Health and Safety***

Implementation of the following measures would mitigate the potential hazards and risks resulting from construction and operation of the Project:

- Storage areas for oils and hazardous liquids used during construction would be bunded and secured in accordance with the *DECC Waste Guidelines* 2008. Any spillages would be contained and collected for appropriate disposal;
- The management of work in the Danger Zone under operating rail traffic would be undertaken in accordance with the ARTC Safety Policy for work within the Danger Zone; and
- Works within the road corridor consistent with the Traffic Management Plan and in compliance with RTA and Singleton Council standards and guidelines.

A Safety Management Plan (SMP) would be developed prior to the commencement of works on the site. The SMP would be developed to address WorkCover and all other requirements relating to workplace safety and human health.

#### ***Environmental***

Implementation of the following measures would mitigate the potential hazards and risks resulting from construction and operation of the Project:

- Activities with the potential for spillage, including refuelling, maintenance of equipment, mixing of cutting oil and bitumen would be conducted in areas with suitable containment to prevent discharge into watercourses;
- Potentially hazardous and contaminating activities (such as washing construction plant, concrete and handling hazardous materials) would be conducted in contained areas away from watercourses; and
- Minimise, where possible, excess vehicular movements over exposed soils and use of dust suppression as required.