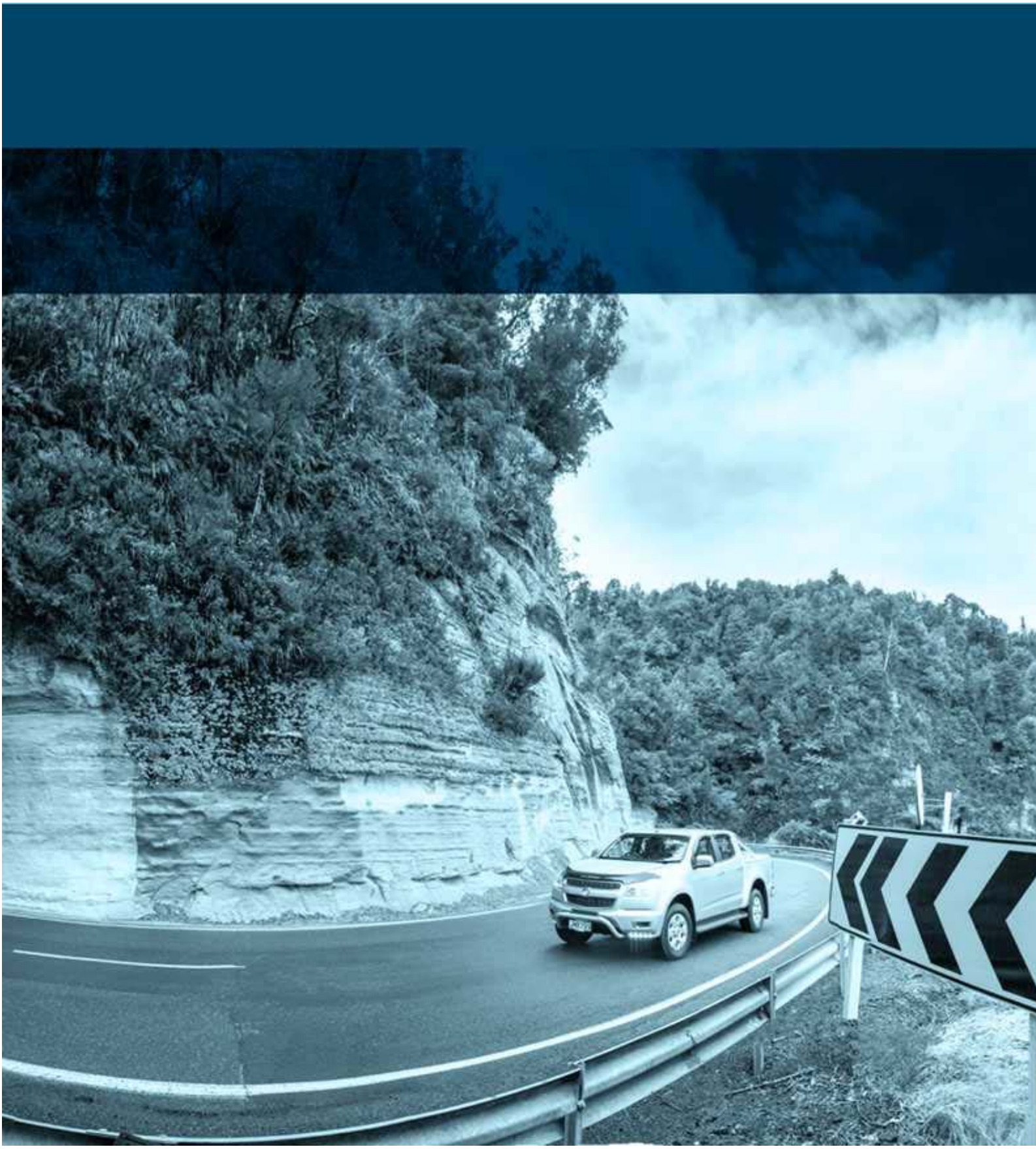
# Section 9 – Assessment of Environmental Effects



# 9 Assessment of Environmental Effects

## 9.1 Summary of environmental effects

### 9.1.1 Overview

SH3 has the key purpose of connecting the Taranaki region through to the Waikato region, and then on to key economic and transportation hubs at Hamilton, Tauranga and Auckland. Although most of the 240km length of SH3 between New Plymouth and Hamilton traverses open country, with average travel speeds between 75 and 85km/h, the Mt Messenger section of SH3 is of a markedly lower standard. The operational characteristics of the existing Mt Messenger section of SH3 include:

- steep grades, a tortuous alignment and restricted forward visibility;
- significant lengths with no or only limited shoulders;
- a narrow tunnel at the summit; and
- a vulnerability to interruption of service by breakdowns, crashes, landslips and rockfalls. When service is interrupted, alternative route options are limited, and require significantly longer travel times (especially for freight).

These constraints translate to problems with safety, route resilience (road closures with no suitable alternatives), poor road geometry and low speeds. These factors combined mean the road, built in 1896, is no longer fit for purpose and will not provide a safe and efficient future roading corridor reflecting the Regional Route classification of SH3. Section 3.3 of this AEE, along with Technical Reports 1 – 4 (refer Volume 3 of the AEE) describes these problems in detail.

The Project will establish a new section of SH3 that will remedy the existing operational problems at Mt Messenger. The Project and its construction are described in detail in Sections 4 and 5, and shown on the drawings in Volume 2.

As described in Section 3.5 and in Technical Reports 1 – 3, the Project will address the known problems along the existing corridor, and will provide a number of transport benefits in relation to safety, resilience, and journey times/reliability. The new road will contribute to a long-term transport solution connecting the Taranaki Region to the north. In particular, the Project alone, and combined with other roading improvements (some nearing completion, others being consented), will significantly improve the connectivity of freight to and from the region, appropriately reflecting the Regional Route classification of SH3.

These positive effects will in turn contribute to positive local and regional economic growth and productivity effects (refer Technical Report 4). The Project will also deliver significant positive social and community effects to Taranaki's way of life, growth and development, and wellbeing (refer Technical Report 5).

The Project traverses an area with high cultural and natural environment values. These values are described in Section 8, in the CIA provided by Ngāti Tama, and in Technical Reports 7 (7a – 7g) – 9. Ngāti Tama have had extensive input into the Project to date, including direct participation in the options assessment process (which avoided the western Parininihi land) and input into design development. The process of identifying methods for

mitigating the cultural effects of the Project will be iterative, involving ongoing consultation and collaboration between Ngāti Tama and the Transport Agency, and will incorporate input and discussions on land acquisition, design development, the mitigation package, construction and operation as set out in the effects assessment below.

The Project will have adverse effects on the existing ecological values within the Project footprint, which is a consequence of the nature of the environment near the Mt Messenger section of SH3. The Transport Agency has proactively addressed these effects, including by engaging a group of expert ecologists to be closely involved in route selection and design processes, assess the effects of the Project on ecological values, and subsequently to design an appropriate and comprehensive mitigation and biodiversity offset package.

This package is a core part of the Project. It is designed to address all residual ecological effects and to ensure that in a 10 – 15 year timeframe, there will be no overall net loss in biodiversity values as a result of the Project. It includes a range of measures to enhance the existing environment over a substantially larger area than the Project footprint, as follows:

- pest management in perpetuity (or until technological advances mean pest management is no longer required) over a 560ha area of native forest;
- 6ha of swamp forest and wetland restoration planting;
- restoration planting and fencing of 8.9km of riparian margin; and
- Restoration planting of some 9ha of vegetation disturbed during construction.

The package will achieve significantly positive biodiversity outcomes that will continue on into the future. These benefits are described in detail in Technical Report 7h.

The mitigation and biodiversity offset package will ultimately deliver significant ecological benefits, and an overall net positive result in terms of biodiversity values. It will also enhance the landscape and natural character values of the Project environment.

During construction there will be temporary adverse effects, including effects on cultural values, ecology, landscape, and on the traffic environment.

Active avoidance of adverse effects has been a key principle adopted during the Project's options assessment and design stages. Where avoidance has not been possible, measures have been proposed to either remedy effects or provide mitigation. These measures are described in more detail in Section 10 and have been reflected in the draft Consent Conditions proposed for the Project (refer Appendix D of Volume 1).

### 9.1.2 Structure of the assessment

The structure of this section of the AEE, and the relevant supporting Technical Reports (contained in Volume 3), is set out in Table 9.1 below.

Table 9.1 – Structure of this section

| Section | Topic | Relevant Technical Report |
|---|---|---|
| 9.2 | Summary of Effects | |
| 9.3 | Transport and Traffic effects | Technical Report 1:Strategic Transport Assessment<br>Technical Report 2:Traffic and Transport Assessment |
| 9.3.3.3 | Resilience effects | Technical Report 3:Resilience Assessment |
| 9.4 | Economic effects | Technical Report 4:Economics Assessment |
| 9.5 | Social effects | Technical Report 5:Social Impact Assessment |
| 9.6 | Recreation effects | Technical Report 6:Recreation Assessment |
| 9.7 | Cultural values | CIA prepared by Ngāti Tama |
| 9.8 | Ecology effects | Technical Report 7a:Vegetation<br>Technical Report 7b:Freshwater Ecology<br>Technical Report 7c:Invertebrates<br>Technical Report 7d:Herpetofauna<br>Technical Report 7e:Avifauna<br>Technical Report 7f:Bats<br>Technical Report 7g:Marine Ecology<br>Technical Report 7h:Ecological Mitigation and Offset |
| 9.9 | Landscape and visual effects | Technical Report 8a:Landscape, Natural Character and Visual Assessment |
| 9.10 | Historic heritage effects | Technical Report 9:Historic Heritage Assessment |
| 9.11 | Operational Stormwater effects | Section 4.16 of AEE |
| 9.12 | Effects of instream structures | Section 4.16 of AEE |
| 9.13 | Operational air quality effects | Technical Report 11:Air Quality Assessment |
| 9.14 | Operational noise effects | Technical Report 10:Environmental Noise & Vibration Assessment |
| 9.15.1 | Construction traffic effects | Technical Report 2:Traffic and Transport Assessment |
| 9.15.2 | Construction air quality effects | Technical Report 11:Air Quality Assessment |
| 9.15.3 | Construction noise & vibration effects | Technical Report 10:Environmental Noise & Vibration Assessment |
| 9.15.4 | Management of contaminated land effects | Technical Report 12:Contaminated Land Assessment |
| 9.15.5 | Construction water effects | Technical Report 13:Construction Water Assessment Report |
| 9.15.6 | Construction effects on groundwater | Technical Report 14:Geotechnical Appraisal |

## 9.2 Summary of effects on the environment

The actual and potential effects of the construction and operation of the Project are summarised in Table 9.2, which includes both positive and adverse effects of the Project, and identifies the level of each effect and whether the effect has been mitigated or offset (for adverse effects).

**Table 9.2 – Summary of Project effects**

| Actual or potential effect | Positive | Adverse | Effect more than minor | Adverse effect mitigated or offset |
|---|---|---|---|---|
| **Permanent effects** | | | | |
| **Traffic and transport** | | | | |
| The Project enhances the security and operational reliability of SH3, a vital strategic link connecting Taranaki to the north. | Yes | | Yes | |
| The Project will result in significant improvement in safety and a reduction in the frequency of crashes. | Yes | | Yes | |
| Travel time reductions and improved journey reliability for vehicles, including freight, between Taranaki and Waikato. | Yes | | Yes | |
| Improved travel time reliability will result in:<br>• Improved certainty around travel times in the corridor for all road users;<br>• More efficient freight movement and associated economic benefits. | Yes | | Yes | |
| Increased average speeds. | Yes | | Yes | |
| Enhanced conditions for cyclists, tourists, and users of local walking tracks. | Yes | | Yes | |
| **Resilience** | | | | |
| The Project will significantly enhance route security and the resilience of the state highway network. | Yes | | Yes | |
| Reduced risk of landslips or rockfall. | Yes | | Yes | |
| Modern stormwater conveyance and reduced risk of carriageway flooding. | Yes | | Yes | |
| Designed to reduce risk of earthquake damage. | Yes | | Yes | |
| Higher safety standards resulting in fewer crashes. | Yes | | Yes | |
| **Economic** | | | | |
| Direct economic benefits from construction activity. | Yes | | Yes | |
| Improvements in travel time and journey time reliability will benefit all road users. | Yes | | Yes | |

| Actual or potential effect | Positive | Adverse | Effect more than minor | Adverse effect mitigated or offset |
|---|---|---|---|---|
| Fewer road closures will facilitate increases in freight along SH3. | Yes | | Yes | |
| Wider economic benefits, including economic growth, generated traffic, travel benefits. | Yes | | Yes | |
| **Social** | | | | |
| Improved accessibility, connectivity, and mobility for people and communities. | Yes | | Yes | |
| Enhanced conditions for economic growth, employment and benefits for people and communities. | Yes | | Yes | |
| Wellbeing benefits for people and communities from improved safety conditions. | Yes | | Yes | |
| **Recreation** | | | | |
| Safer access to local walking tracks. | Yes | | Yes | |
| Enhanced access for tourist travellers. | Yes | | Yes | |
| Local disruption during construction to use of walking tracks. | Yes | | Yes | |
| **Cultural values** | | | | |
| Effects on culturally important Parininihi whenua. | | Yes | Yes | Ongoing consultation with Ngāti Tama |
| Potential effects on mana of Ngāti Tama. | | Yes | Yes | Ongoing consultation with Ngāti Tama |
| Opportunities to enhance mana and kaitiaki responsibilities of Ngāti Tama. | Yes | | Yes | Ongoing consultation with Ngāti Tama |
| **Ecology** | | | | |
| The construction of the Project will result in the removal of approximately 44.4ha of native vegetation. | | Yes | Yes | Yes |
| The construction of the Project will result in disturbance, loss and fragmentation of habitats. | | Yes | Yes | Yes |
| Loss of 15 significant old emergent forest trees. | | Yes | Yes | Yes |

| Actual or potential effect | Positive | Adverse | Effect more than minor | Adverse effect mitigated or offset |
|---|---|---|---|---|
| The construction of the Project will result in direct impacts on fauna associated with lost habitats, including birds, lizards and bats. | | Yes | Yes | Yes |
| Potential effects on threatened species, including kiwi, bats and plants. | | Yes | Yes | Yes |
| Loss of 3.47km of stream habitats. | | Yes | Yes | Yes |
| Works in streams could adversely affect fish species. | | Yes | Yes | Yes |
| Discharges from earthworks and open construction areas could result in increased sediment discharge to streams. | | Yes | No | Yes |
| There is potential for fish passage to be adversely affected. | | Yes | Yes | Yes |
| Significant pest management programme over 560ha, providing benefits to forests and to all associated flora and fauna. | Yes | | Yes | |
| Restoration planting of 6ha of swamp forest. | Yes | | Yes | |
| Plantings of seedlings to replace significant old trees. | Yes | | Yes | |
| Replanting of 9ha of vegetation lost during construction. | Yes | | Yes | |
| Stream bank plantings of 8.9km of riparian margins. | Yes | | Yes | |
| **Landscape and visual** | | | | |
| Physical landscape and character change due to road in remote natural landscape. | | Yes | Yes | Partially |
| Natural character effects on watercourses. | | Yes | Yes | Partially |
| Enhanced amenity values for road-users. | Yes | | Yes | |
| Restoration of swamp forest habitat and streams. | Yes | | Yes | |
| **Operational Stormwater** | | | | |
| Discharge of stormwater from highway. | | Yes | No | |
| Increased quantity of stormwater runoff. | | Yes | No | |
| **Operational air quality** | | | | |
| Vehicle emission discharge effects on 3 residential receptors. | | Yes | No | |
| **Operational noise** | | | | |
| Vehicle noise effects on 3 residential receptors. | | Yes | No | |

| Actual or potential effect | Positive | Adverse | Effect more than minor | Adverse effect mitigated or offset |
|---|---|---|---|---|
| **Temporary construction effects** | | | | |
| **Local social effects** | | | | |
| Localised disruption to small number of properties due to construction activities such changes in access, noise, and dust. | | Yes | No | Yes |
| **Historic heritage** | | | | |
| Potential for discovery of archaeological remains during construction. | | Yes | No | Yes |
| **Temporary construction traffic** | | | | |
| Traffic management at site access locations off SH3. | | Yes | No | Yes |
| Traffic delays on SH3 during tie-in works. | | Yes | No | Yes |
| **Construction air quality** | | | | |
| Nuisance dust effects on 3 residential receptors. | | Yes | No | Yes |
| **Construction noise and vibration** | | | | |
| Construction noise disturbance to 3 residential receptors. | | Yes | No | Yes |
| Construction vibration effects to 3 residential receptors. | | No | No | |
| **Contaminated land** | | | | |
| Discharges from contaminated land during construction. | | Yes | No | Yes |
| **Land disturbance and construction water discharges** | | | | |
| Discharges of sediment from disturbed areas during construction. | | Yes | No | Yes |
| Discharges from concreting activities. | | Yes | No | Yes |
| **Groundwater** | | | | |
| Effects on groundwater levels or land settlement. | | No | No | |

## 9.3 Transport and traffic effects

### 9.3.1 Introduction

This section summarises the findings of assessments undertaken to establish the actual and potential effects of the Project on road safety, route resilience and journey time reliability. Detailed analyses are set out in the Strategic Transport Assessment (Technical Report 1) and the Traffic and Transport Assessment (Technical Report 2).

### 9.3.2 Existing transport environment of SH3 at Mt Messenger

The existing operational environment of SH3 at Mt Messenger is described in Section 3.3. . In simple terms, the road is inadequate for serving its important, inter-regional transport function. The key operational constraints of the Mt Messenger section of SH3 are summarised as follows:

- steep grades, a tortuous alignment, and restricted forward visibility;
- significant lengths with no or only limited shoulders;
- a narrow tunnel at the summit; and
- a vulnerability to interruption of service by breakdowns, crashes, landslips and rockfalls, with very limited and significantly longer (particularly for freight) alternative routes.

These constraints translate to problems with safety, route resilience (road closures with no suitable alternatives), poor road geometry and low speeds.

The current road alignment means that the road environment is unforgiving, with driver mistakes leading to crashes, and subsequently deaths and serious injuries, as well as road closures. Over the five year period from 2012 to 2016, there have been no reported fatal crashes, 6 serious injury crashes, 8 minor crashes and 18 damage only crashes. Extended out to the last 10 years, the record includes 1 fatal crash. While the road through Mt Messenger should achieve a 3 star safety rating on the Transport Agency's SafetyNet system, it only meets the 2 star rating standard.

Road closure records show that, during the period 2011 to 2017, SH3 over Mt Messenger has been closed seven times. Causes include crashes (4 occasions), slips (2 occasions), and a tanker rollover (1 occasion) on a sharp curve. Assessed against the Transport Agency's expected level of performance for the national highway network, closures of the Mt Messenger section of SH3 are of an unacceptable frequency and duration for a Regional Arterial road. Under normal conditions, travel via SH3 between Hamilton and New Plymouth takes approximately 3 hours 10 minutes. If the road is closed along any portion of this route, there are few alternative routes that can be used, and all add significant time to the overall journey (at least 1 hours 45 minutes for SH43 which is the shortest detour, and 3 hours 9 minutes for heavy vehicles which cannot use SH43 and must instead use SH4 via Whanganui).

The geometric deficiencies in the existing alignment over Mt Messenger restrict the speed of vehicles using the route, with both light and heavy vehicles being significantly affected. The existing average speed for the route is 56km/h, which is well below the average travel speeds on SH3 between New Plymouth and Hamilton of between 75 and 85 km/h.

### 9.3.3 Operational transport and traffic effects

#### 9.3.3.1 Effects of Project on SH3 transportation outcomes

SH3 serves the key strategic purpose of connecting the Taranaki region through to the Waikato region and on to key economic and transportation hubs at Hamilton, Tauranga and Auckland. The route connects Taranaki's oil and gas, agricultural, forestry and engineering sectors to suppliers and markets in the north, and provides vital tourism linkages and access to health, cultural and other services. This connectivity is essential for the people and communities of Taranaki to provide for their social, economic, and cultural well-being.

The Project is recognised as a key regional and inter-regional priority in the Regional Land Transport Plan (RLTP) 2015/16 – 2020/21 and supports the strategic vision for the future outlined in the RLTP. As the only direct arterial highway connection to and from the north, enhancing the safety, resilience and journey time reliability of travel on SH3 will benefit the whole of Taranaki, and in particular the growing proportion of heavy traffic carrying freight to and from key economic and transportation hubs. The Project will match the form of the road to its modern-day function and ensure that SH3 can accommodate future growth.

Overall, the strategic benefits that the Project provides to the future security and operational capacity of SH3 represent significant and positive transportation effects.

#### 9.3.3.2 Effects on road safety

The Project will provide a significantly higher standard of road alignment relative to the existing corridor, and will result in significantly enhances safety conditions. This is reflected in the 3 star safety rating the Project is designed to achieve, which is in line with the Transport Agency's national standard for a road of this type.

SH3 across much of Mt Messenger is currently very steep, with grades of up to 12% in some locations. In addition, there are numerous tight bends which need to be negotiated. By comparison, the new road will have a much more forgiving geometry, with gentler curves and maximum grades of 7.5% southbound and 7.0% northbound. There is a combined two way length of 1600m at grades of greater than 6%, which is very much reduced over the existing configuration. Overall, the improved grades will result in improves opportunity for safer passing.

1.5m shoulders will be provided throughout the alignment (narrowed through the tunnel to 1.2m). This will enhance opportunity for safer vehicle pull-over / stopping, and also for passing of slower or stationary vehicles.

The significantly improved forward visibility to a 100km/hr design standard will improve the opportunities for safer passing across the full length of the Mt Messenger crossing.

The Project will also provide safer conditions for users of the Mt Messenger and Kiwi Road walking tracks to pull over and park. A new stopping area will be established for this purpose at a suitable location adjacent to the existing SH3 carriageway, which will have very low traffic volumes when the new bypass is operational.

The positive effects of the Project on road safety are summarised in Table 9.3 below.

Table 9.3 – Summary of Project effects

| Positive safety effects | Measure |
|---|---|
| Improved Geometry | • Eased curves with no curves requiring reduced speed advisory signs.<br>• Flatter grades:<br>o Existing max 12%, Average 8% (4.8km above 6%)<br>o Future: max 7.5% (1.6km above 6% for new route)<br>• Wider shoulders (current 0.5–1.5m, new 1.5m throughout (1.2m in tunnel))<br>• Wider lanes from 3.4m (in localised places narrower) currently, to 3.5m throughout for the new road<br>• Side barriers provided throughout for the new road |
| Improved Safety Star rating | • Increase in safety Star Rating from 2 to 3 |
| Improved forward visibility | • New road design provides visibility suitable for 100km/hr operating speed throughout |
| Passing opportunities | • Improved forward visibility, increased passing opportunities throughout full length of Project |
| Reduced exposure | • Reduced length (7.4km to 6km) |
| Reduce Driver Frustration | • Safer geometry, which is in context with adjoining sections of SH3, with increased passing opportunities |
| Safer connections to recreational walking tracks | • Improvements to existing unsafe accesses to the walking tracks (they currently provide insufficient limited deceleration/acceleration opportunities) |

Overall, the effects of the Project on road safety will be significant and positive.

#### 9.3.3.3 Effects on resilience

The effects of the Project on route resilience is considered in Technical Report 3 (Resilience Assessment) and in Technical Reports 1 and 2 (Strategic Transport Assessment and Traffic and Transport Assessment). As described in Section 3.5.2 of the AEE, resilience is a measure of the ability of systems to resist, absorb, and recover from disruption within a tolerable timeframe.

As noted above in Section 9.3.2, SH3 at Mt Messenger is subject to regular road closures and does not currently meet the reliability standards expected for a Regional Road.[49] The reliability expectations for SH3 at Mt Messenger are such that a 2 to 4 hour closure would be acceptable no more than once in every two years, a 5–12 hour closure no more than once in 20 years, and a 13 hour to five day closure no more than once in forty years.

The closure rates being experienced in the 5 – 12 hours and 13 hours – 2 day categories of performance within this Mt Messenger length of SH3 have been up to twelve times greater than should be delivered by way of the dependability performance expected for a national

[49] NZTA, Customer Levels of Service Assessment, June 2017

route classed as a Regional Arterial. This poor level of reliability experienced over recent years is unacceptable for SH3.

The Project will deliver a new road alignment that is more resistant to disruption:

- **Safety: gradients, wider shoulders, and safety barriers**: all making for an easier, safer driving environment. The safety star rating will increase to 3. As a consequence of the improved safety environment the likelihood of disruption due to crashes will decrease, crashes are less likely to result in a prolonged closure of the road and traffic is likely to be able to continue to flow around such an accident.
- **Reduce the risk of landslips**: Earthworks designs, including cuts and embankments, will be to modern standards, with the risk of failure being significantly reduced (refer Geotechnical Appraisal, Technical Report 14). For steep cuts, the design provides for any slip material to be captured in the verge and not fall onto the road carriageway, should failures occur. As a consequence, the likelihood of disruption due to land slips will decrease.
- **Flooding/storms**: The carriageway has been designed to a level above the design storm flood level. All drainage features have been designed to convey stormwater runoff to reduce the potential for localised flooding, with conveyance capacity designed to the required modern highway design standards (refer Section 4.16). This analysis includes an allowance for future climate change and will mean a decrease in the likelihood of disruption due to flooding.
- **Earthquake**: Technical Report 3 notes there is a low to moderate risk of earthquakes affecting the North Taranaki region. The Project will benefit from modern design, and lessons learned from recent experiences in Canterbury and Kaikoura. The design will limit the exposure of the alignment to liquefaction and lateral spreading in the alluvial valleys (lower Mihi and lower Mangapepeke).
- **Landslip / landslide**: There are no mapped large scale landslide features on the Project alignment, by contrast to the existing route, which crosses a large landslide feature. Small to moderate failures, such as rockfall and overslips following significant earthquake shaking, will likely be able to be cleaned up quickly to restore service. As a consequence, the likelihood of disruption due to earthquakes will decrease.
- **Weather**: Weather related conditions such as fog and frost occur seasonally and snowfall is infrequent. The Project alignment has a lower elevation than the existing route so is considered less susceptible to snow (although there are no reports of road closures due to snow on Mt Messenger in any event). Fog conditions on the existing SH3 alignment are reported to occur from time to time to the north of the site where the highway follows the Tongaporutu River flats. Fog conditions may occur infrequently along the Project alignment but as this risk already exists there is little change expected to the likely effects and risks. Analysis of risk due to frost / icing has been undertaken considering sun angles and shading. The Project alignment generally follows a north – south arrangement and so receives sun through the day, regardless of season. Records from the Transport Agency's maintenance contractor report that grit use for ice conditions has not been necessary at Mt Messenger in

recent times. As the Project alignment will receive good levels of sun through the day, there is little change expected to the existing ice risks on SH3.

In addition to improved resilience to natural hazards (set out in Technical Report 3), the Project will have a number of benefits in relation to operational resilience which are summarised in Table 9.4 below. These benefits relate to the ability to avoid road closures or disruptions as a result of crashes, break downs and maintenance, and to recover to full service following any such closures or disruptions.

**Table 9.4 – Operational resilience benefits**

| Benefit | Measure |
|---|---|
| **Fewer closures** | Current SH3 has suffered 6 closures >2hrs in the last 5 years at a level more frequent than acceptable by the ONRC guidelines. The new road, with its wider lanes and shoulders and better design, will avoid these closures.<br>The new road will require less maintenance requirements due to its modern design. When works are required provision for offline maintenance areas and measures will reduce closures and traffic restrictions. |
| **Faster recovery** | The current road has poor geometry, narrow shoulders and carriageway. The new road will enable vehicles to greater opportunity to pass a vehicle which has crashed/broken down.<br>Shorter/faster route will enable emergency services to attend events more quickly. |
| **Improved journey time reliability** | As a result of fewer planned (maintenance) and unplanned (crashes) closures.<br>Improved drainage/stormwater will reduce the amount of closures.<br>For Freight (in connection with wider programme of work), there will be an improved network from Taranaki through to Ports of Auckland and Tauranga |
| **Reduced driver frustration** | Greater certainty over the road remaining open. |

The Project will provide a robust road corridor which is designed to withstand disruptive events and improve the resilience of SH3. Overall, the effects of the Project on route resilience will be significant and positive.

#### 9.3.3.4 Effects on journey time reliability

Section 9.3.2 and Technical Reports 1 and 2 identify that road closures and the lack of alternative routes results in poor journey time reliability for users of SH3. Alternative routes add significant time to an overall journey (at least 1 hour 45 minutes for SH43 which is the shortest detour, and 3 hours 9 minutes for heavy vehicles which cannot use SH43 and must instead use SH4 via Whanganui).

Transport benefits relating to journey times are detailed in the Transport and Traffic Assessment (Technical Report 2) and summarised in Table 9.5 below.

Table 9.5 – Journey time reliability

| Benefit | Measure |
|---|---|
| **Reduced journey times (Local)** | • Reduced length: 7.4km to 6km;<br>• Increasing travel time for Do Minimum (Existing route 8.45 minutes, Year 20 = 9.14 minutes for all vehicles);<br>• Option reduces travel times: (average all vehicles); Opening year = 4.21 minutes; Year 20 = 4.16 minutes;<br>• Option reduces free-flow travel times: (Light Vehicles @ 100km/hr); Opening year = 3 hours 36 minutes (saving 4.5minutes);<br>Option reduces free-flow travel times: (Heavy Vehicles); 6:28min (saving 6:40 minutes). |
| **Reduced Journey Times (Closures)** | If SH3 is closed:<br>• Alternative New Plymouth to Hamilton routes are significantly longer;<br>• Alternative route via SH43 4 hour 30 minutes: 1 hour 45 minutes longer (95km), not suitable for HPMV (unsealed in places and narrow, winding route alignment)<br>• Alternative route SH4 6 hours 20 minutes: 3 hours 9 minutes longer (243km)<br>• Alternative route SH1 6hr 55min: 3hr 45min longer (286km)<br>Improved road reduced risk/number of closures (see resilience outcomes above)<br>Alternative routes add significant time to journeys: HV drivers have 5 hours 30 minutes max drive time (before a break) and 13 hours total/day. One way journey cannot be completed on detour routes without a break. It is difficult to complete a return journey in a day with one driver.<br>The nature of the existing road means that the Mount Messenger section requires regular maintenance, ie on curves where tyres rut the pavement. |
| **Reduced Journey Times (Over Dimension loads)** | SH3 is not currently suitable for Over Dimension loads due to constraints (including the Mt Messenger and Awakino tunnels). The new road, associated with other planned SH3 upgrades, will enable the route to accommodate Over Dimension loads.<br>The current Over Dimension route using SH1 adds 6 hours 55 minutes to the journey from Hamilton to New Plymouth (3 hours 45 minutes longer). |
| **Reduced driver frustration** | Improved travel times and average speed.<br>• Existing average: 56kph;<br>• Year 1: Average speed 77.6kph, light vehicle free flow speed 100kph, heavy vehicle operating speed 45km/hr; |

| Benefit | Measure |
|---|---|
| | Year 20: Average speed 63kph, light vehicle free flow speed 100kph, heavy vehicle operating speed 45km/hr.[50] |

The technical assessments conclude that enhanced resilience of the route over Mt Messenger will lead to significant improvements in journey time reliability for road users of SH3. The reliability of the transport network is an important factor underpinning economic performance.

Overall, the effects of the Project on journey time reliability will be significant and positive.

#### 9.3.3.5 Effects on travel times

The existing average travel time on SH3 over Mt Messenger is 8 minutes 45 seconds (point to point in either direction) [51].

The Project has been designed to a 100km/hr operating speed (for light vehicles). Heavy vehicles are expected to travel at slower speeds on steeper sections of the route.

Allowing for the improved geometric design and grades of the new alignment, as well as the expected vehicle composition and volumes, average operating speeds will improve as indicated in Table 9.6.

**Table 9.6 – Operating Speeds (averaged for all vehicles)**

| Operating Speeds (km/hr) | Existing road (7.4km length) | New road (6km length) |
|---|---|---|
| SH3 at Mt Messenger | 56km/h | 77.6km/h |

The predicted travel time savings on the new alignment are significant, amounting to a saving of more than half the current travel time for the current Mt Messenger section, as follows:

- **Light vehicles** – light vehicles travelling at 100km/hr on the new alignment will average a travel time of 3:36 minutes point to point. This represents a travel time saving of approximately 4:05 minutes (i.e. the local travel time point to point is more than halved).
- **Heavy vehicles** – heavy vehicles travelling on the new alignment will average a travel time of 6:05 minutes point to point. Heavy vehicles currently take over 13 minutes point to point to travel over Mt Messenger. Overall, travel times for heavy vehicles will be more than halved.

These predictions assume that there are no passing opportunities along the length of the new road, and as such all light vehicles on the route will be slowed by the presence of slower moving heavy vehicles (up and down grade). In practice, however, the improved geometry and greater forward visibility on the new alignment will provide increased safe passing opportunities for drivers. Allowing for day to day variability, and the presence of

[50] Assumes conservatively no increase to HV performance

[51] Obtained from google traffic application API platform, where travel times across the Project area were observed for a week-long period.

heavy vehicles (or not), the typical vehicle journey on this route can be expected to save on average four to five minutes' travel time when compared to the existing route.

Travel times for over-dimension loads will also be significantly improved by the Project. Currently, the Mt Messenger tunnel is not passable by over dimension loads, which need to travel to and from New Plymouth via SH1. This adds adds 3 hours 45 minutes to the journey from Hamilton to New Plymouth. The tunnel on the new alignment will be designed for over dimension vehicles. Once the Project and the bypass work at Awakino Tunnel are completed, over dimension loads will be able to travel safely along SH3 between Hamilton and New Plymouth.

Overall, the effects of the Project on travel times for all road users will be significant and positive.

#### 9.3.3.6 Effects of Project on other transportation modes

The current route along SH3 at Mt Messenger is not commonly used by cyclists due to the distance between major townships. As such, the majority of cyclists along SH3 are multi-day touring groups, familiar with a range of road conditions. The Project will result in significantly improved characteristics for cyclists (and any pedestrians), including improved lane and shoulder width, and improved grades. Safe passage through the tunnel will be possible either cycling in the shoulder or via walking through the safety egress passage.

As noted above, the Project will also provide safer conditions for users of the Mt Messenger and Kiwi Road walking tracks to pull over and park. This access will represent an improvement on the existing configuration where informal parking areas on the side of the road lack any safe connection to the start of the track and lack safe entry and exits.

Overall, the effects of the Project on alternative modes of transport, including for tourist vehicles, cyclists and pedestrians, will be positive.

## 9.4 Economic effects

### 9.4.1 Introduction

This section presents the findings of investigations undertaken to determine the actual and potential economic effects from the construction and operation of the Project.

As described in Section 3.2.3 of the AEE and in Technical Reports 1 and 4, SH3 is critical for supporting the Taranaki economy and its ongoing growth and development. SH3 serves the key strategic purpose of connecting Taranaki's oil and gas, agricultural, forestry and engineering sectors to suppliers and markets in the north, and provides vital tourism linkages and access to health, cultural and other services.

### 9.4.2 Direct economic effects during construction

The Economics Assessment (Technical Report 4) concludes that during the three year construction programme, the Project will bring direct economic benefits, including construction related expenditure, employment and income for Taranaki businesses and residents.

Construction is expected to provide 74 additional jobs, $5.5 million per annum in additional wages and salaries and $33.1 million per annum in additional expenditure on goods and services purchased from local Taranaki businesses.

The direct benefits to the Taranaki Region during construction are expected to be $115.8 million. Local firms will be engaged to provide goods and services to the Project, local residents will be engaged to work on the Project, and local firms will in turn provide goods and services to these employees.

Overall, the direct economic effects to the Taranaki Region of the construction of the Project will be significant and positive.

### 9.4.3 Road user economic effects of the Project

The Economics Assessment concludes the Project will lead to reduced vehicle operating costs, travel time and road accident costs and to improvements in route resilience, benefitting local residents and businesses and visitors to the Taranaki Region. The Project is estimated to lead to:

- travel time savings of $44.8 million;
- vehicle operating cost savings of $19.9 million;
- accident cost savings of $11.3 million;
- road resilience benefits of $13.7 million;
- carbon dioxide emission reduction benefits of $1.0 million; and
- a reduction in road maintenance costs of $1.4 million.

It is expected that nearly all of these road user benefits will accrue to the Taranaki Region, as most traffic using SH3 north of New Plymouth will have an origin or destination within Taranaki.

For businesses, road user benefits result in increased productivity and improvements in business competitiveness. For residents, these benefits will produce cost savings, improve personal safety and enable the freeing up of time for other productive or leisure activities.

Overall, the road user economic effects of the Project will be significant and positive.

### 9.4.4 Wider economic effects of the Project

The wider economic effects of the Project are described in Technical Report 4 and include:

- *Additional journey time reliability benefits* – increased travel time reliability translates into economic benefits as reliability allows motorists to utilise otherwise wasted time on productive activities.
- *Increased economic growth potential* – the Project will increase the attractiveness of the New Plymouth District and the wider Taranaki Region for business and residential development, as well as improve accessibility for visitors, resulting in increased levels of economic activity.
- *Generated traffic* – greater route resilience and journey time reliability in particular will improve the competitiveness of Taranaki based businesses, enhance tourist related travel and generate additional traffic. This will increase the Project's road user benefits

and additional economic benefits from higher levels of economic growth and economic activity within the region.

- *Potential Travel Benefits* – economic benefits arise when road users know a trip can be reliably made. This reduces isolation from facilities in other regions, such as travel to Waikato Hospital or to Auckland Airport, and through more reliable road access to goods and services from other centres.

Overall, the wider economic effects of the Project will be positive.

### 9.4.5 Potential economic costs of the Project

There are a number of potential economic costs of the Project, outside the financial cost, such as:

- *Loss of productive land* – there will be some very limited loss of productive land from within the Project designation. This economic cost will be borne by the Transport Agency through the land acquisition process.
- *Property value effects* – Given the remoteness of the Project and separation from existing landowners, any resulting effect is likely to be small and for most local properties, already taken into account through the presence of the existing SH3 highway. For the very small number of landowners where this effect is more significant (i.e. Pascoe and Ngāti Tama Trustee Ltd), this effect will be taken into account through the Public Works Act process.

Overall, any potential economic costs of the Project are expected to be no more than minor.

## 9.5 Social effects

### 9.5.1 Introduction

A Social Impact Assessment (SIA) for the Project has been undertaken (refer Technical Report 5, Volume 3 of the AEE). The SIA assesses the responses of people and communities to changes that will arise from the Project, both positive and negative, on a local and regional scale. The assessment has taken into account the Transport Agency's *Social Impact Guide* (2016) and considers effects on:

- **Way of life** – Effects on accessibility, connectivity, patterns of living and mobility – the benefits of an improved route and connectivity including the difference the Project would make to daily life (regional and local effects).
- **Economic growth and development** – the benefits that may be realised as part of the Project and the ability to lever off changes in access (regional and local effects).
- **Wellbeing** – changes to wellbeing and safety (regional and local effects).
- **Quality of the environment** – the effects on people from construction and operation of the Project eg noise (local effects).
- **Community –** Impacts on people's property and 'neighbourhoods'; educational facilities; community areas and sites; community plans and aspirations; and on accessibility to services (local effects).

The existing social environment is described in Section 8 of the AEE and in detail in the SIA.

### 9.5.2 Regional social effects

The SIA identifies that the Project will have significant regional social benefits on

- **Way of life and wellbeing**: Interviews conducted for the SIA found that people feel vulnerable and uncomfortable using the existing SH3 route over Mt Messenger. Improved road safety, resilience and journey time reliability resulting from the Project will improve the accessibility, connectivity, patterns of living and mobility of people, communities and businesses.
- **Growth and development**: As described in Section 9.4, the Project will enhance local and regional economic growth and productivity. Social benefits can be expected from the economic benefits of the Project, such as enhanced employment opportunities, retention of regional populations leading to further maintenance and upgrades of social infrastructure, and increased liveability in the region. The 'multiplier' expenditure during construction will benefit local businesses through increased demand for goods and services.

On a regional scale, the overall social effects of the Project will be significant and positive.

### 9.5.3 Local social effects

The SIA identifies that the Project could result in negative social effects on a local scale during construction, encompassing properties in the immediate vicinity of the Project and the small settlements to the north and south of the Project:

- **Way of life and wellbeing**: During the construction phase, disruption to local land owners and local road users may result due to construction traffic and associated traffic management measures. The existing road will remain open during construction, and a construction TMP is proposed, so any such disruptions will be minimal.
- **Quality of the environment**: Localised effects during construction due to dust and construction noise and vibration could reduce environmental quality for local residents. These effects will appropriately managed by a DMP and CNMP.
- **Community**: There are no community facilities in the vicinity of the Project which will be adversely affected by the Project.

The SIA concludes that these local social effects during construction are minor and can be mitigated by appropriate management measures. The CEMP (in Volume 5 of this AEE) provides measures to avoid, remedy or mitigate these potential social effects, including:

- Traffic management measures in the TMP;
- Dust management measures in the DMP;
- Noise and vibration management measures in the CNMP;
- Limiting working hours near residential dwellings; and
- Communication protocols to ensure the local community is kept informed of construction activities.

On a local scale, the social effects of the Project during construction will be negative, but no more than minor. Over the longer term, the local effects are expected to be positive and mirror the regional effects.

## 9.6 Recreation effects

### 9.6.1 Introduction

This section presents a summary of the recreation effects associated with the construction and operation of the Project, based on the Recreation Effects Assessment (Technical Report 6, Volume 3 of the AEE).

Recreational values of the local area are described in Section 0, and include tramping in the Whitecliffs area, tramping and hunting in the Parininihi and Mt Messenger Conservation Area forests, and whitebaiting in the local streams.

### 9.6.2 Recreation effects of the Project

The Project will provide safer conditions for users of the Mt Messenger and Kiwi Road walking tracks to pull over and park. This will be an improvement on the existing configuration, where informal parking areas on the side of SH3 lack any safe connection to the start of the track and lack safe entry and exits for vehicles. The Kiwi Road track will also be re-routed under the new bridge to enable safe passage across the new road.

During construction, some access restrictions to the Kiwi Road track may be necessary to address public safety during bridge construction. However, these restrictions would be short term and well signposted.

Once completed, the Project will support enhanced access to and from Taranaki for tourists and the new road will better cater for campervans, tourist buses and motorhomes. Similarly, improved shoulders, lane widths and grades will provide safer and easier conditions for cyclists.

The Recreation Assessment concludes the overall recreation effects of the Project are positive.

## 9.7 Effects on cultural values

### 9.7.1 Introduction

In developing the Project, the Transport Agency has engaged in detailed consultation with Ngāti Tama. In doing so, the Transport Agency recognises that Ngāti Tama exercises mana whenua for this part of Taranaki, and that the Project is located in Ngāti Tama's rohe.

The Transport Agency recognises Ngāti Tama's cultural values and concerns in respect of the Project. A key aim of discussions with Ngāti Tama has been to seek to minimise effects on Ngāti Tama's cultural values. A description of Ngāti Tama cultural values is presented in Section 8.4.1, which is based on a CIA provided to the Transport Agency by Ngāti Tama.

The Transport Agency has also consulted with iwi to the north and south of Ngāti Tama, including Ngāti Maniapoto and Ngāti Mutunga. Consultation with iwi will continue as the Project progresses.

### 9.7.2 Consideration of cultural effects of the Project

Ngāti Tama's CIA identifies that the area affected by the Project includes Treaty Settlement land and areas of major importance to Ngāti Tama. The Parininihi land was returned to Ngāti Tama through the Treaty Settlement process, and Ngāti Tama consider this process

would be undermined by the Transport Agency acquiring the land for the purpose of the Project. Further, Ngāti Tama consider acquisition of the land would undermine their mana and kaitiaki responsibilities. They highlight that the Project would therefore have major and ongoing cultural effects.

Parininihi has been referred to as 'Te Matua Kanohi o Ngāti Tama Whanui' (The parent face of Ngāti Tama).

The CIA notes the Parininihi lands provide the base for restoring Ngāti Tama's sustenance and connection to the whenua, awa and moana. They provide the opportunity for customary practices and modern activities to reconnect Ngāti Tama to this whenua. The Project would sever the land and have major impacts on the land's potential for Ngāti Tama.

Ngāti Tama have also highlighted the importance of the Parininihi Protection Project and their role as kaitiaki over the land.

The Tiaki Te Mauri o Parininihi Trust has responsibility for the Protection Project. The name 'Tiaki Te Mauri o Parininihi' itself is poignant, meaning 'to care for the mauri of Parininihi'. An important part of that project has been the re-introduction of kōkako to the west of the existing SH3 alignment, which occurred during the winter of 2017.

In developing the Project, the Transport Agency recognises the special relationship of Ngāti Tama with their lands, culture and traditions. Furthermore, the Transport Agency recognises the Treaty Settlement process provides important context to the Project. The Ngāti Tama settlement acknowledged the importance of the relationship of Ngāti Tama to Parininihi.

The Transport Agency has consulted directly and worked constructively with Ngāti Tama through the process of developing the Project. This has included through the options evaluation process and in developing the designs. Ongoing consultation with Ngāti Tama will occur as the Project progresses to ensure Ngāti Tama's aspirations are incorporated into the development of designs, and through construction and operation. As described in Section 9.7.3.4 to 9.7.3.7 below, a series of measures have been developed that seek to acknowledge Ngāti Tama's mana and enable them to act as kaitiaki for their land and in relation to the development, construction and operation of the Project.

While Ngāti Tama highlight in the CIA the significance of the Parininihi land and the ongoing cultural effects that the Project will have, Ngāti Tama also highlight that they have no complaint about the consultation undertaken by the Transport Agency and the ability this has provided for Ngāti Tama to provide input and cultural views on the Project. Ngāti Tama have agreed to continue dialogue with the Transport Agency to explore proposals that might address cultural impacts. As the Project progresses it is expected the CIA will be updated to reflect the outcomes of ongoing consultation.

### 9.7.3 Mitigation of cultural effects

The Transport Agency acknowledges that Ngāti Tama's cultural and spiritual values will be affected both during construction and in the operation of the Project. The process of identifying methods for mitigating the cultural effects of the Project will be iterative, involving ongoing consultation and collaboration between Ngāti Tama and the Transport Agency.

Protocols will be developed with Ngāti Tama to reflect and provide a basis for implementing the mitigation described below.

#### 9.7.3.1 Consultation with Ngāti Tama

Section 7.7 of the AEE outlines the extensive consultation that has occurred with Ngāti Tama. This consultation has been undertaken in a positive, constructive and meaningful fashion, providing opportunity for the Transport Agency to hear from Ngāti Tama and develop an understanding of their values, and also for Ngāti Tama to develop an understanding of the Project and participate in its development. A Memorandum of Understanding (MOU) has been established, which acknowledges the basis and spirit of consultation and reflects the positive relationship between Ngāti Tama and the Transport Agency.

#### 9.7.3.2 Options assessment process

As discussed in Section 6.3.3, Ngāti Tama were central to the MCA process to understand and provide their cultural input into the options assessment process. Representatives from Te Runanga o Ngāti Tama attended the MCA workshops and provided the cultural heritage scores (with explanations) for the options. Their input to the workshops was invaluable more generally, particularly in terms of ecology, given Ngāti Tama's intimate knowledge of the natural environment of the area and leading role in pest management and kokako reintroduction.

In the shortlist MCA process, Ngāti Tama assigned all options a -4 score, reflecting their position that all shortlisted options would have had very significant cultural effects, particularly as all options would require Ngāti Tama land to be acquired.

The CIA confirms the option preferred by Ngāti Tama through the MCA process was the "online" option, which remained largely within the existing SH3 land corridor.[52] It involved the smallest amount of Ngāti Tama land and avoided areas of higher value bush and streams. The CIA records that the option for which consent is being sought (the Project described in this AEE) was considered by Ngāti Tama to have less cultural concern (putting aside the issue of the land take) than options that impacted the area being actively managed by Ngāti Tama to reduce pests, being the Parininihi land to the west of SH3. The other three shortlisted options (other than the online option and the selected option) would all impact land to the west of SH3. Avoiding that actively managed land was factor in the selection of the Project route, to the east of the existing SH3.

#### 9.7.3.3 Land acquisition

The Transport Agency is consulting with Ngāti Tama on its requirements for land to facilitate construction of the Project. At the time of lodging the NoR and resource consent applications, an agreement for land acquisition has not been reached with Ngāti Tama.

The Transport Agency recognises the important status of the land as Treaty Settlement land and the potential for the acquisition of the land to undermine Ngāti Tama's mana and kaitiaki responsibilities. While the Transport Agency relies on the Public Works Act to acquire land, it also recognises the potential effects of the acquisition process on Ngāti

[52]There were online options considered at both the longlist and shortlist stage of the MCA process.

Tama and it will not use the compulsory acquisition provisions of the Public Works Act to acquire Ngāti Tama's land. Mitigation for loss of control over land will be achieved through mutual agreement with Ngāti Tama on the land acquisition process.

#### 9.7.3.4 Design development

Detailed construction level designs will be required to facilitate Project construction and the design development process will go on for some time and continue as construction is progressed. A process has been established for Ngāti Tama to provide input to the detailed Project designs. Design workshops have occurred and will continue through design development.

Areas of interest to date have focussed on the bridge and tunnel and on incorporating cultural themes into landscape designs. Broadly speaking, this process is identified in the LEDF (refer Technical Report 8b in Volume 3) and will involve the Alliance team working together with Ngāti Tama to:

- Agree objectives for cultural design inputs;
- Agree those elements of the design that can be informed by cultural inputs;
- Provide Ngāti Tama and their advisors with engineering design information and with a base of understanding on engineering design principles, standards and constraints;
- Provide the design team with information on cultural values and cultural inputs for incorporating into the Project design;
- Develop designs that reflect cultural aspirations; and
- Review design development to confirm that cultural aspirations have been incorporated into the Project.

This process of working together will provide Ngāti Tama with a voice in the design development process and enable them to exercise their mana and kaitiakitanga in relation to the development of the Project. While already in action, this process will be confirmed by way of consent conditions and will continue through the design development process

#### 9.7.3.5 Mitigation package development

As described in Section 9.8, the Project will remove a corridor of native vegetation, and will affect the streams and watercourses that drain the Mimi and Mangapepeke Valleys. The CIA notes that the awa (streams and rivers), ngahere (bush) and the flora and fauna of Parininihi are taonga. To address the ecological effects of the Project on these taonga, a fundamental part of the Project is a package of mitigation and biodiversity offsets. This mitigation and biodiversity offset package will involve:

- Pest management over an area of 560ha in perpetuity (or until such time as pest management in the form we know of it today is no longer necessary to sustain the levels of biodiversity created);
- Restoration planting of 6ha of swamp forest;
- Planting of 200 seedlings of the same species for every significant tree that has to be felled;
- Riparian planting and exclusion of livestock from approximately 9km of stream banks; and

- Restoration planting of 9ha of disturbed areas.

The package is expected to significantly expand the area of pest management being undertaken on the Parininihi land. The resulting benefits for the taonga of the Parininihi bush, its habitats, its flora and fauna and its biodiversity values will be significant and positive.

#### 9.7.3.6 Construction

As the Project moves into the construction phase, the Transport Agency will continue to enable Ngāti Tama to express their mana whenua and kaitiakitanga responsibilities. It is intended that protocols will be developed with Ngāti Tama to recognise their cultural values and significant sites and provide for appropriate cultural inputs during construction. These protocols are expected to be broad ranging and cover aspects such as:

- Kaitiakitanga responsibilities, including cultural monitoring requirements for activities occurring at sensitive sites, such as vegetation clearance, earthworks, salvaging and translocation of protected fauna;
- Cultural protocols (tikanga) around tree felling and vegetation clearance, cultural harvest and use of vegetation to be removed during construction;
- Monitoring of cultural indicators of environmental health, and review and input to the wider programme of environmental monitoring, including development of any contingency or action plans prepared in response to monitoring outcomes.
- Accidental Discovery Protocol[53].

#### 9.7.3.7 Operation

Road users will pass through Ngāti Tama's lands on the Mt Messenger Bypass as they come and go from Taranaki on an ongoing basis. In this regard, the Transport Agency acknowledges that Ngāti Tama's kaitiaki relationship with the Project and its interaction with the taonga and mauri of Parininihi continues into the future. The principles of partnership and collaboration with Ngāti Tama will extend through the operational life of the Project.

The Transport Agency will develop a protocol with Ngāti Tama that acknowledges this ongoing partnership. The content of the protocol will be developed following discussions with Ngāti Tama.

## 9.8 Ecological effects

### 9.8.1 Introduction

This section summarises the actual and potential ecological effects of constructing and operating the Project and is based on the assessments presented in Technical Reports 7a to 7h (Volume 3 of the AEE).

As described in Section 8.3.4 of the AEE and in Technical Reports 7a–7h, the Project traverses an area forested with indigenous native vegetation, which is part of a wider vegetation sequence running from the coastal margins inland to the lowland mountains. It straddles an ecological boundary between two broad forest classes with podocarp,

[53] An example Accidental Discovery Protocol has been provided with the management plans, but has not been specifically tailored to this Project through consultation with Ngāti Tama.

broadleaved forest largely in the Mimi catchment and the upper Mangapepeke Valley, and podocarp, broadleaved, beech forest within the lower Mangapepeke Catchment and northwards.

Unlike the Parininihi land to the west, the area which the Project alignment traverses has not had consistent pest control and as a result, the ecological condition of this area is diminished. The quality of the habitat varies along the alignment. Within the Mangapepeke Stream catchment, vegetation communities have been affected by long-term stock grazing, fire and logging, with the result being a transition to large open and grazed rushlands and poor quality pastureland further down the valley.

Despite this, the habitats which the Project traverses are of high ecological value. In particular, the Mimi swamp forest is of ecological value. This sequence within the northern tributary of the Mimi River represents a full range of swamp forest, scrub and non-forest wetland communities that would once have been more common throughout this area.

Avoidance of ecological effects, as far as practicable for a lineal road, has been inherent in the design process. As described in Section 6, the route selection process has avoided the high ecological values of the Parininihi land to the west of SH3. Along the Project alignment all vegetation types and significant trees have been mapped and delineated to identify the affected vegetation types and their values. Where it has been possible the Project alignment has been designed to avoid significant trees.

Construction of the Project will result in the removal of a corridor of vegetation and will affect the associated habitats and flora and fauna. A core element of the Project is a mitigation and biodiversity offset package. It includes pest management in perpetuity (or until technology has changed) over 560ha, 6ha of swamp forest and wetland, restoration of 8.9km of riparian margin, replacement mitigation planting of 9ha and revegetation of as much of the construction footprint that will not be road as is practicable.

The outcomes of the mitigation and biodiversity offset package are described in Technical Report 7h. In summary, a broad range of the indigenous flora and fauna present within the mitigation and offset area will benefit from the management of pest animals to permanently low densities and the establishment of new areas of swamp forest, shrubland and riparian habitat. The proposed mitigation will not only increase the area of healthy indigenous vegetation but will improve the connectedness of the forested areas. The net result will be a significant increase in healthy available habitat, enhanced recruitment rates amongst a wide range of indigenous animals, improved condition of the remaining significant forest trees, especially totara and rata, and increased regeneration of many of the more palatable plant species.

Over time further ecological benefits will accrue as a result of the offset programme. For example, the conditions created in the offset area will increase the likelihood of the survival and successful nesting of those kōkako that choose to move east from the release sites in the western Parininihi land.

The following sections summarise the assessments of ecological effects described in detail in Technical Reports 7a-7g. These include assessments of effects on vegetation, terrestrial fauna (including invertebrates, herpetofauna, avifauna and bats) freshwater ecology and marine ecology. The assessments consider the effects of the Project without and with the

mitigation and biodiversity offset package. Section 9.8.9 presents a summary of the mitigation and biodiversity offset package, which is described in detailed in Technical Report 7h.

The assessments are based on investigations completed within the Project footprint and at locations on the Parininihi land to the west of SH3. As has been noted, the Parininihi land to the west of SH3 has higher biodiversity values than the area to the east of SH3 through which the Project traverses. Accordingly, the investigations completed to date provide a conservative benchmark for assessing the potential ecological effects of the Project. Additional ecological investigations along the Project alignment are being completed over the 2017 / 2018 summer period to supplement the existing information base. This additional information will be used to update assessments, mitigation and management measures and will add to the baseline information.

### 9.8.2 Effects on vegetation

A detailed description of vegetation along the alignment, its values, the potential effects of the Project and the benefits of the mitigation and biodiversity offset package is contained in Technical Report 7a.

The vegetation/habitats that will be affected by construction of the Project include:

- the permanent road footprint (i.e. the road and its anticipated batters and cuts, spoil disposal sites, haul roads and stormwater ponds).
- areas associated with construction access, laydown areas and temporary stormwater drains.

The removal of vegetation will also establish an 'edge effect' along the forested corridor, where habitats will be impaired due to the loss of the adjacent vegetation.

In total, vegetation loss due to these factors (including the edge effect allowance) is 44.4ha. This comprises:

- 19.5ha of primary indigenous forest;
- 13.8ha of secondary indigenous forest; and
- 11.1ha of rushland and sedgeland vegetation, which is a mixture of indigenous and exotic vegetation in the rough pastureland in the valley floors.

This vegetation removal includes up to 15 large emergent old podocarp trees which have been specifically identified because of their significance. Affected trees are identified on the drawings in Volume 2 of the AEE. In addition to being old significant trees, these trees also provide habitat for epiphytes, and habitat and food for a range of potential bird, lizard and invertebrate species. The mitigation and offset package will see each of these trees replaced with 200 seedlings of the same species. The pest management programme will significantly benefit all vegetation within the 560ha area, including the old emergent trees which are currently in decline due to browser pressures.

Vegetation removal may also result in the removal of species which are recorded as being threatened or regionally distinctive. Where recovery and replanting or recovery of seed from these plants is feasible this will be undertaken in accordance with procedures set out in the ELMP. Further, the pest management programme will benefit all vegetation within the

560ha area, including threatened plants which are currently in decline, or no longer present, due to browser pressures.

Importantly, the Project mitigates adverse effects on the Mimi swamp forest, which includes a stand of the regionally distinctive plant, swamp maire. The road will cross a tributary to this swamp forest on a bridge, which has been specifically incorporated into the Project and designed to mitigate effects on the wetland habitat. This wetland habitat is also sensitive to sedimentation. The CWMP and CWAR described in Section 9.15.5 address erosion and sediment controls for the Project, including specific provisions to manage and treat construction water discharges that drain to this wetland area. These provisions will mitigate potential adverse effects on the wetland.

The mitigation and biodiversity offset package (described in detail in Technical Report 7h) has been developed to address all ecological effects of the Project, including on vegetation. Over 10 -15 years it will create a net ecological benefit and provide for significant ongoing benefits. The pest management component of the package will not only increase the area of healthy indigenous vegetation but will improve the connectedness of the forested areas (in particular with Parininihi). The net result will be a significant increase in healthy available habitat, improved condition of the remaining significant forest trees, especially totara and rata, and increased regeneration of many of the more palatable plant species. Details of the pest management will be described in the Pest Management Plan.

The restoration plantings component of the package includes restoration planting of 6ha of swamp forest and wetland. The intended area of planting proposed includes the valley flats of the Mangapepeke Valley, which will be transformed from rush / sedge dominated rough pasture areas into swamp forest of kahikatea, pukatea and swamp maire. While transition to a diverse mature swamp forest will take many decades, the ecological value will begin to improve immediately because of the removal of livestock and the management of pests. Ultimately, it is intended that the valley will transform into a diverse, high value swamp/wetland ecosystem.

9ha of restoration planting will also occur along the construction footprint to revegetate areas of temporary access tracks and storage areas that retain soil, hydrology and growing conditions suitable for reinstatement.

The areas of intended swamp forest plantings and restoration plantings are shown on the drawings in the LEDF (and in the drawing set in Volume 2). Restoration methods will be described in the ELMP.

Overall, the Project will result in vegetation loss. The overarching ecological aim, however, is to ensure no net loss of biodiversity values within the medium term, and to achieve overall a net benefit to biodiversity values. The proposed mitigation and biodiversity offset package will achieve net ecological benefit over 10 - 15 years and thereafter, ongoing ecological benefits. This appropriately mitigates and offsets the vegetation effects of the Project and provides significant vegetation benefits over time.

### 9.8.3 Effects on terrestrial invertebrates.

This section summarises the potential effects on terrestrial invertebrates resulting from the Project. A description of the terrestrial invertebrates expected near the Project alignment,

their values, the potential unmitigated effects of the Project and the benefits of the mitigation and offset package is contained in Technical Report 7c[54].

The invertebrate fauna in the wider Project area is typical of communities inhabiting native forests of southern North Island and northern South Island.

While there are local records from the wider Mt Messenger area, nationally 'At Risk' or 'Threatened' species have not been recorded from the Project footprint. This absence may be due, at least in part, to limited studies and it is possible that invertebrate species that are of conservation value would be present within the Project footprint. However, the likelihood of encountering these species is low.

The ecological condition of the forest in the Project area generally has been adversely affected by browsing of pest species, the presence of grazing stock, past logging and fires, particularly in the Mangapepeke Valley. This has reduced habitat quality for terrestrial invertebrates (especially compared to the Parininihi land west of SH3).

The potential effects of the Project on terrestrial invertebrates relate primarily to the effects of habitat loss and fragmentation resulting from vegetation removal, and the direct effects on the invertebrate communities associated with this habitat (current and future).

The mitigation and biodiversity offset package (described in detail in Technical Report 7h) has been developed to address the ecological effects of the Project, including on terrestrial invertebrates. The comprehensive pest management programme will likely be beneficial for terrestrial invertebrates, as predation of New Zealand's native invertebrate fauna by introduced mammals has been widely recognised as a major conservation concern. The precise level of benefit likely to accrue is difficult to quantify (especially as invertebrate predation may switch to increased native species), however, there is a clear link between the health of vegetation communities, and the health of invertebrate communities.

The proposed restoration planting and habitat enhancement programme will also in time, improve ecological connectivity, which will benefit the terrestrial invertebrate community affected by the Project.

Taking these measures into consideration, it is expected that within a 10 – 15 year timeframe there will be no net loss (and likely a net benefit) for terrestrial invertebrates affected by the Project. Overall, the mitigation and offset measures proposed will appropriately and adequately address the potential effects of the proposal on terrestrial invertebrates.

### 9.8.4 Effects on herpetofauna

The following section summarises the potential effects on herpetofauna resulting from the Project. A detailed description of the herpetofauna expected in the vicinity of the Project

[54] The report is based on desktop information and habitat assessments of sites located on the western Parininihi land and on parts of the Project area. The assessment is conservative and will be updated with additional surveys being undertaken over summer 2017/18.

alignment, their values, the potential effects of the Project and the benefits of the mitigation and biodiversity offset package is contained in Technical Report 7d[55].

Several herpetofauna species, including At Risk and Threatened species, could be present within the area affected by Project construction. Based on the assessments completed it has been assumed that up to 13 species (including the 'Threatened' Archey's frog *Leiopelma archeyi* and a number of 'At Risk' species) may be present within the Project footprint. This includes:

- a high likelihood that the following species will be present:
    - Copper skink (Not Threatened)
    - Forest gecko (At Risk – Declining)
- a moderate likelihood that the following species will be present:
    - Ornate skink (At Risk – Declining)
    - Pacific gecko (At Risk – Relict)
    - Striped skink (At Risk – Declining)
    - Elegant gecko (At Risk – Declining)
- a marginal likelihood that the following species will be present:
    - Archey's frog (Threatened – Nationally Vulnerable)
    - Brown skink (At Risk – Declining)
    - Common gecko (Not Threatened)
    - Duvaucel's gecko (At Risk – Relict)
    - Goldstripe gecko (At Risk – Relict)
    - Hochstetter's frog (At Risk – Declining)
    - Northern Grass skink (Not Threatened)

Overall, the ecological value of the area affected by Project construction for herpetofauna is considered to be 'Moderate–High'.

The potential effects of the Project on herpetofauna relate primarily to the effects of habitat loss and fragmentation resulting from vegetation removal, and the direct effects on the communities associated with this habitat (current and future). Vehicle strike is also possible during the operational stage of the Project, although this risk will not change significantly as it already exists on the existing SH3.

The mitigation and biodiversity offset package (described in detail in Technical Report 7h) has been developed to address the ecological effects of the Project, including on herpetofauna, and will over time create benefits for herpetopfauna.

In particular, the comprehensive pest management programme is expected to be beneficial for herpetofauna. There is currently a lack of published evidence that native herpetofauna populations in mainland forest habitats benefit from large-scale pest management

[55] The report is based on desktop information and habitat assessments of sites located on the western Parininihi land and on parts of the Project area. The assessment is conservative and will be updated with additional surveys being undertaken over summer 2017/18.

programmes. Also, like for invertebrates, benefits will be difficult to quantify (especially as predation may switch from introduced to native species). However, it is reasonable to assume that the proposed long-term pest management programme (which will reduce introduced predators and improve vegetation and habitat quality), along with the removal of grazing stock, will benefit herpetofauna.

Restoration planting and habitat enhancement will create habitat, improve ecological connectivity and reduce edge effects on existing vegetation, all of which are likely to benefit the herpetofauna community affected by the Project.

Targeted herpetofauna management measures will be undertaken during the construction stage to reduce the potential for effects, including capture and relocation. These measures will be set out in the ELMP.

Overall, taking into account these measures, effects of the Project on herpetofauna are likely to be negligible over the initial 10 – 15 year time period, but become more positive, with a net benefit, over the medium to longer term.

### 9.8.5 Effects on avifauna

The following section summarises the potential effects on avifauna resulting from the Project. A detailed description of the avifauna expected in the vicinity of the Project alignment, their values, the potential effects of the Project and the benefits of the mitigation and biodiversity offset package is contained in Technical Report 7e.

Based on the investigations completed, the bird community in the wider Project area is comparable with that of large patches of forest elsewhere in the Taranaki region and in the lower North Island. It is considered to be moderately rich by regional and national standards, in terms of the number of threatened and non-threatened species known to be present.

A total of 36 diurnal and two nocturnal bird species were recorded during the surveys in the wider Project area. Twenty-three of these species are indigenous, nine of which are currently listed as 'At Risk', including fernbird (*Bowdleria punctata*), spotless crake (*Porzana tabuensis)*, New Zealand falcon (*Falco novaeseelandiae)*, North Island brown kiwi (*Apteryx mantelli)*, North Island robin (*Petroica longipes*), long-tailed cuckoo (*Eudynamys taitensis*), whitehead (*Mohoua albicilla*), pipit (*Anthus novaeseelandiae*) and black shag (*Phalacrocorax carbo*). Additionally, three nationally 'Threatened' or 'At Risk' species (Australasian bittern (*Botaurus poiciloptilus*), kākā (*Nestor meridionalis*), and rifleman (*Acanthisitta chloris*) were not detected in surveys but are known to be present in the Taranaki region and possibly the wider Project area.

North Island kōkako (*Callaeas wilsoni*; Threat Status: 'At Risk – Recovering') were released into the western part of the Parininihi area in winter 2017. The release site was approximately 4km to the west of Mt Messenger and approximately 4.5km from the Project footprint. Kōkako are yet to disperse near the Project alignment and the chances of this happening in the near future are small, given the extent of available habitat both in and near the release location on the western Parininihi land. Kōkako typically live as bonded pairs in territories ranging in size from 4 – 25ha; the birds released so far are therefore unlikely to

currently occupy much more than 250ha of forest (20% of the western Parininihi land) even if they have all taken up very large territories.

The potential effects of the Project on avifauna relate primarily to the effects of habitat loss and fragmentation resulting from vegetation removal and the direct effects on the communities associated with this habitat (current and future). Vehicle strike is also possible during the operational stage of the Project, although this risk will not change significantly, as it already exists on the existing SH3.

The unmitigated effect of the Project on each bird species is examined in detail in Technical Report 7e. The level of the potential unmitigated effect on kiwi is high due to habitat loss and severance, and potential effects associated with road construction and ongoing operation, noting that kiwi dispersal is limited by their flightlessness. Given their conservation status, the level of potential unmitigated effect on North Island robin and whitehead is moderate. For all other forest birds the level of unmitigated potential effects is moderate or low.

For kōkako, the level of effect resulting from the Project is expected to be low and continue to remain low for some years. The birds released into the Parininihi land are some distance from the Project. Kōkako have relatively low reproductive rates, and relatively long population doubling times (about eight years on average based on the national population). On this basis, natural dispersal into the vicinity of the Project alignment is expected to take some years.

Avoidance of effects has occurred through route selection (on the high value western Parininihi area) and also through the use of a tunnel and bridge. A number of measures are proposed to mitigate potential effects on avifauna.

For kiwi, an intensive kiwi management and monitoring programme is proposed. This will involve locating, relocating and protecting individuals living near or alongside the footprint area during construction. Temporary fences may be used in selected places along the Project footprint to prevent kiwi entering the construction zone. On the completed highway alignment, permanent kiwi exclusion fences will be constructed in selected locations along the new road in areas where kiwi could enter the road corridor and find it difficult to escape (e.g. In large sections of cut). Appropriate signage will also be erected alerting motorists to the possible presence of kiwi along the road. These measures will be addressed in the ELMP.

The mitigation and biodiversity offset package (described in detail in Technical Report 7h) has been developed to address the ecological effects of the Project, including on avifauna, and will over time create significant ecological benefits.

Most forest birds are known to respond positively to pest control, as indicated by increases in relative abundance/conspicuousness and/or increase in breeding success. The pest management programme will increase the populations of most native birds in the offset area, by increasing survival rates and/or breeding success. This programme will also expand the available protected habitat for kōkako. The programme is expected to fully offset the effects of the Project on avifauna. Restoration plantings and habitat enhancement will also, in time, create habitat, improve ecological connectivity and reduce edge effects, benefiting most forest and wetland bird species affected by the Project.

Overall, taking into account the proposed management measures and the mitigation and biodiversity offsetting, it is considered that the overall effects of the Project on avifauna will be beneficial and positive.

### 9.8.6 Effects on bats

This section summarises the potential effects on bats resulting from the Project. A detailed description of the recorded bat activity in the vicinity of the Project alignment, the value of the affected habitat, the potential effects of the Project and the benefits of the mitigation and biodiversity offset package is contained in Technical Report 7f.

As noted in Section 8.3.4 of the AEE, New Zealand has two native bat species, the long-tailed bat (*Chalinolobus tuberculatus*) and the lesser short-tailed bat (*Mystacina tuberculata*). The available recent records (since 2012) of both of long-tailed and short-tailed bats within 15km of the Project footprint, in combination with the occurrence of suitable habitat (primarily old growth native forest), indicates that these species may be present within the wider Project area.

Ongoing bat surveys are being undertaken across the Project site. To date, automatic bat monitor (ABM) records are available for 84 sites across the wider Project area and confirm the presence of long-tailed bats at 79 (94%) of the survey locations. The distribution and levels of long-tailed bat activity indicates a significant population is present in the wider Project area. No short-tailed bats have been detected. While it is unlikely that short-tailed bats will be encountered within the Project construction area, the assessment assumes that it is possible.

The effects of the Project on bats relate primarily to the effects of habitat loss and fragmentation resulting from vegetation removal and the direct effects on any populations associated with this habitat (current and future). Vehicle strike and other possible effects such as disturbance due to people or vehicle lights are possible during the operational stage of the Project, although these risks will not change as they already exist on the existing SH3.

Both species of bats use trees for roosting, particularly large old trees which often have suitable roost cavities. Removal of roost trees can have adverse effects on bat populations, particularly if roosts are being actively used at the time of tree removal.

Overall, the level of effects on both long-tailed bats and short-tailed bats (if present) is considered to be moderate. It is noted however, that the loss of an occupied roost tree, if this occurred, would represent a higher level of effect.

A number of measures are proposed to avoid or mitigate potential effects on bats during the construction work.

The risk of removing trees with bat roosts will be addressed in the tree removal protocol to be included in the ELMP. This will involve application of a number of monitoring methods (e.g. ABM monitoring and visual inspections) to ensure that any trees that represent potential bat roosting habitat are only removed after it is confirmed that they are not occupied by bats. This is a commonly applied and effective protocol. A programme of radio tracking of bats will be carried out during late 2017 to establish the location of bat roosts in the vicinity of the Project construction area. Information from that monitoring will aid with the development of the tree removal protocol.

The mitigation and biodiversity offset package (described in detail in Technical Report 7h) has been developed to address the ecological effects of the Project, including on bats, and will over time create ecological benefits that extend on into the future. Research demonstrates that managing mammalian predators such as mustelids and rats, enhances the long-term survival of long-tailed bats. The assessment of Project effects on bats (Technical Report 7f) identifies that the mitigation and biodiversity offset package will benefit bats.

Overall, taking into account these measures, effects of the Project on bats are likely to be negligible over the initial 10 – 15 year time period, but become more positive, with a net benefit, over the medium to longer term.

### 9.8.7 Effects on freshwater ecology

The following section summarises the potential effects on freshwater ecosystems resulting from the Project. A detailed description of the streams associated with the Project alignment, the value of the affected habitat, the potential effects of the Project and the benefits of the mitigation and biodiversity offset package is contained in Technical Report 7b.

As in Section 8.3.4, the Project alignment is located within two catchments, the Mangapepeke and Mimi. The geology of these catchments is dominated by papa mudstone; which has a considerable influence on stream substrate and sediment load as the gravels are soft and there is a relatively high amount of fine sediment carried through the stream systems. Both streams support aquatic habitats of a moderate to high quality value in their upper reaches and a good diversity of fish species are present. Aquatic habitats in the lower, flatter sections of the streams are affected by cattle grazing and support lower habitat values.

The potential effects of the Project on freshwater ecosystems relate principally to the effects of culverting and diverting streams and to discharges from the construction works and from the operational roadway. These effects are described in detail in Technical Report 7b, and the location of the affected watercourses are shown on the drawing set (Volume 2 – Drawing MMA-DES-DNG-E1-DRG-1000 to 1010). The works are described in Section 4.16 and 5.14.

The potential effects will include both long-term effects over the operational life of the Project and short-term effects during construction. These potential unmitigated effects, along with the mitigation measures that will be implemented to address effects, are summarised in Table 9.7 below.

*Photo 9.1 Typical fish in Mangapepeke Stream and Mimi River. (adult inanga, redfin bully, giant kōkopu)*

Table 9.7 – Actual and potential effects on freshwater ecology

| Type of effect | Commentary |
|---|---|
| **Long-term effects (operational phase)** | |
| Long-term effects on fish passage | The Project involves installing 21 culverts along the Project alignment (refer Section 4.16.3). Most of the culverts are 25 to 40m long, except at the larger fill sites where the culverts range from 55m up to 210m long. Fish passage will be provided through these culverts to match the climbing / swimming passage abilities of the fish communities in the habitat upstream of the culverts. |
| Loss of stream habitat and functions | The Project will require installing or extending culverts on 21 waterways, plus a series of stream diversions as described in Section 4.16.3. This will result in the permanent loss of some 3.47km of stream length. About two thirds of the affected stream length is in the Mangapepeke catchment and one third in the Mimi catchment. About half the affected stream length is in a natural condition, and most of the affected streams are permanently flowing, perennial streams.<br><br>Overall, the effect of stream loss is considered to be high. It will be offset through both the creation of new naturalised stream diversions (as described in Section 4.16.2) and riparian planting along some 8.9km of stream banks. |
| Potential effects of stormwater runoff | Stormwater discharge effects from the operational highway are described in Section 9.11. The combination of the Project having a relatively small impervious footprint relative to the catchment and using a stormwater treatment system developed in accordance with Transport Agency guidelines means any effect on receiving environments will be no more than minor. |
| **Short-term (construction phase)** | |
| Direct effects on fish during construction | Direct effects on fish are possible during works associated with installing culverts and stream diversions, including the risk of direct removal, stranding or injury. To avoid or minimise this effect specific stream diversion methodologies will be developed and a fish recovery protocol will be implemented to capture and relocate fish prior to draining, diverting or excavating streams. |
| Potential sedimentation and water quality changes from vegetation | The associated stream systems carry naturally high sediment loads from the papa catchment. The CWMP sets out methods to manage and control erosion and sediment discharges during construction. An assessment of temporary construction discharges is set out in Section 9.15.5. Best practice management methods will ensure sediment discharges do not significantly increase sediment yield and losses relative to the natural yield from the wider catchment. |

| Type of effect | Commentary |
|---|---|
| clearance, earthworks and construction related discharges | Concreting activities will occur at sites along the alignment and could result in elevated pH levels in discharges. These activities will managed so that contaminated water is treated before discharge or will be removed from site.<br><br>The CWMP and any site specific measures will ensure that any effects on aquatic ecosystems are temporary and no more than minor. |
| Short term limitations on fish passage | Upstream fish passage could potentially be restricted for a short period during construction when culverts are installed and water is flowing through any temporary diversion pipes. These restrictions for most culverts will be for a relatively short duration (a few days to weeks) and adverse effects will be negligible. For the longer culverts at the large fill sites (either side of the tunnel) the process of filling and creating a clean water diversion may take several months. A temporary culvert will be installed to carry water under the fill until the clean water diversion is created on top of the fill and permanent culverts installed. Spat ropes would be installed in these culverts to enable fish passage. |
| Short term loss of stream habitat | Streams will need to be diverted or culverted at multiple locations for the period of construction, but will be removed and the stream restored on completion of works. As a consequence, there will be a loss of stream function and habitat during the construction period. This loss of stream habitat will be offset as part of the mitigation and biodiversity offset package and is described in more detail below. |
| Water take for dust suppression | The Project is seeking two water takes for the purpose of dust suppression. These are:<br>• up to 150m$^3$/day from the Mimi River near the southern extent of the Project area; and<br>• up to 300m$^3$/day from the Mangapepeke Stream. The location will be near the northern extent of the designation either about 50m upstream of the confluence with the west branch (catchment area of about 330ha) or just downstream of this confluence (catchment area to 683ha).<br><br>Water takes will be restricted to no more than 20% of the water depth at the time of the take. This approach is conservative and would offer a high level of protection to the downstream aquatic ecosystems considering expected stream flow conditions and short term nature of the abstraction.<br><br>The water intakes will need to be appropriately designed to exclude fish. In particular the screen mesh size will need to be less than 3mm (side of square) and the surface area sufficiently large so that water velocities through the intake are less than 0.12 m/s. |

As noted in Table 9.7 above, the permanent loss of stream habitat will result in modification to the aquatic ecosystems at those locations. The mitigation and biodiversity offset package (described in detail in Technical Report 7h) has been developed to address the ecological effects of the Project, including on aquatic ecosystems, and will over time create ecological benefits that extend on into the future.

The amount of stream restoration required to achieve sufficient biodiversity offset has been calculated using the Stream Ecological Valuation (SEV) method. The SEV is a standard method for assessing stream values and quantifying loss and any requirements for offset compensation. Based on current designs and SEV calculations the offset restoration will require restoration of 8.9km of stream habitat by planting and fencing riparian margins along streams to achieve a 10m wide strip either side of the stream. The details of how this riparian margin restoration will be achieved will be outlined in the ELMP. Potential locations for much of this restoration plantings are shown on the landscape drawings in the LEDF and in the drawing set (Volume 2, drawings MMM-DES-UDL-CO-DRG-1000 to 1010).

Overall, the effects of the Project on freshwater ecology can be appropriately managed and mitigated, and the residual loss of habitat can be adequately offset to result in 'no net loss' of stream ecological values. Allowing for the implementation of the mitigation and biodiversity offset mitigation, the short-medium term effects of the Project on freshwater ecosystems will be no more than minor and long term there will be an overall benefit.

### 9.8.8 Effects on marine ecology

A detailed description of the coastal environment between Urenui and Tongaporutu estuary and the associated ecological values is contained in Technical Report 7h. This local coastline supports high value marine ecosystems, including within the Parininihi Marine Reserve.

The Project alignment and all construction works are well removed from the coastal environment. However, the Project site is effectively connected to the marine environment via the Tongaporutu and Mimi Rivers. Construction or operational related discharges from the Project could be conveyed to the marine environment.

The erosion and sedimentation controls proposed during construction as part of the CWMP, along with the stormwater treatment measures developed for the operational highway, are designed to protect the downstream freshwater receiving environments and as a consequence, also provide protection to the marine environment. The assessments of construction and operational discharges presented in Sections 9.8.7 and in Sections 9.11 and 9.15.5 conclude that provide the measures described are in place, the effects on freshwater receiving environments are expected to be no more than minor. Accordingly, effects further downstream in the marine environment are not anticipated.

Overall, the Project is expected to have no measurable effect on marine ecosystems.

### 9.8.9 Ecological mitigation and biodiversity offset package

The mitigation and biodiversity offset package is a core part of the overall Project and is described in Section 4.2.3 and based on the analysis presented in Technical Report 7h.

As described in the ecology Technical Reports (Technical Reports 7a to 7) the mitigation and biodiversity offset package mitigates and offsets all of the residual ecological effects of the

Project. The package and its outcomes have been summarised in the sections above. The elements of the mitigation and biodiversity offset package are described in more detail below.

#### 9.8.9.1 Pest Management

The objective of this part of the package is to reduce all major introduced mammalian predators and herbivores (including livestock) from a management area of 560ha. This is a key component of the mitigation and biodiversity offset package, and has been proven from other locations in New Zealand to have wide ranging ecological benefits. It is proposed that this programme of pest management will be continued in perpetuity (or until such time as pest management in the form we know of it today is no longer necessary to sustain the levels of biodiversity created), delivering beneficial outcomes from its implementation into the future.

Intensive, effective and enduring pest management, with a focus on all animal pests down to the size of rats, has been shown to generate biodiversity benefits across a wide range of plants and animals. Bats, kiwi, many forest bird species, most wetland bird species, reptiles and many invertebrate species will increase in number as predatory pressures are greatly reduced and habitat recovery increases local carrying capacities. Plant biomass and diversity will increase as grazing and browsing pressure is reduced, the diversity and abundance of the browse sensitive species will increase as seedling survival improves, and the health of the old emergent forest trees, especially rata and totara, rebounds in the absence of possums in particular.

As forest and vegetation health improves in the low-pest environment, the carrying capacity within the pest management area for many indigenous animal species will increase substantially. When the carrying capacity of each species is met, "surplus" juveniles of mobile species (birds and bats) will move out into the wider Mt Messenger area and increase populations in those areas. This is sometimes referred to as the "halo effect". Because the pest management is proposed in perpetuity (or until such time as pest management in the form we know of it today is no longer necessary to sustain the levels of biodiversity created) the ecological benefits throughout the region will be permanent.

The amount / area of restoration planting and pest management to be undertaken has been determined through utilisation of a biodiversity offset calculation model (which is described in Appendix A to Technical Report 7h). The model was developed as part of the New Zealand Government's 'Guidance on Good Practice Biodiversity Offsetting in New Zealand' (August 2014), is consistent with international guidelines on biodiversity offsetting and was selected in consultation with DOC experts.

The location proposed for the pest management is described in Technical Report 7h, and will focus on the Ngāti Tama land to the east of SH3 and surrounding land areas. The details of this pest management will be developed as part of the Pest Management Plan (PMP).

#### 9.8.9.2 Swamp forest and wetland plantings

Six hectares of swamp forest restoration planting is proposed to fully offset the loss of the kahikatea and swamp maire forest affected by the Project. Restoration planting, in addition to pest management, is proposed because there is only a small amount of this vegetation

type (especially swamp maire) remaining in the wider Project area as a result of land clearance and drainage and the impact of pests. Increasing the area of this forest type by planting, and with the support of pest management in perpetuity (or until technology negates the need) will improve the likelihood of swamp forest species expanding naturally back into suitable habitat in the wider Project area.

The intention of the swamp forest restoration planting will be to transform pasture / rush / sedge dominated areas that are suitable for planting into swamp forest into stands of kahikatea, pukatea and swamp maire, with small areas of rimu and matai where ground conditions are not as saturated. The process will require the establishment first of a hardy, successional vegetation (manuka, hukihuki, ramarama, houhere, putaputaweta and others), and then the interplanting of the swamp forest species into this 'nursery' habitat. This approach is well understood and proven as successful from other restoration projects.

Locations for swamp forest and wetland plantings have been evaluated and are described in Technical Report 7h and is proposed to include parts of the Mangapekeke Valley. The details of this restoration planting will be developed as part of the ELMP.

While transition to a diverse mature swamp forest will take many decades, the ecological value will begin to improve immediately because of the removal of livestock and the management of pests. Ultimately the proposed mitigation planting will transform into a diverse, high value swamp/wetland ecosystem.

#### 9.8.9.3 Seedling planting to replace significant trees

It is proposed that 200 seedlings of the same species should be planted for every significant tree that has to be felled along the Project footprint. Technical Report 7a identifies these trees, noting that some 15 significant trees may have to be removed during road construction. While efforts will be made to reduce the number of these trees that do have to be removed, if all 15 are lost then 3000 seedlings will be planted in their place.

Locations for these seedling plantings have been considered in Technical Report 7h and will likely focus on the deforested tributaries of the Mangapekeke Valley and in other suitable locations. The details of this planting will be developed as part of the ELMP.

#### 9.8.9.4 Habitat replacement plantings

Nine hectares of predominantly indigenous vegetation that will be removed or disturbed during construction will not be offset by pest management or swamp forest restoration planting. The loss of this vegetation will be mitigated for by one-for-one replacement planting of the same or similar indigenous species.

The main areas where this restoration planting will occur are those sites disturbed by construction where the original soil cover and hydrology is retained or can be restored and it is appropriate to re-establish the original vegetation type to that site. Locations for this plantings have been considered in Technical Report 7h and will likely focus on the middle and lower sections of the Mangapepeke Valley and other suitable areas.

Details of the site preparation, species planting mixes, planting methods and post-planting maintenance will be included the ELMP.

#### 9.8.9.5 Stream restoration

The waterways affected by the Project have been assessed in Technical Report 7b using the SEV calculator to establish the requirements for offsetting the effects of stream loss. Some 3.47km of stream length will be lost and offset by stream restoration along 8.9ha of stream margin.

Stream restoration work will consist mostly of planting a 10m wide riparian margin on each side of the channel and fencing of the stream to exclude livestock. Riparian plantings will consist of a mix of indigenous riparian margin sedges, shrubs and trees. The primary objective will be to provide shade and organic matter to the stream channel to improve the quality of habitat for native fish and invertebrates. A reduction of sediment and nutrient loads entering the streams will also be achieved by fencing and planting, especially along the stream sections that pass unfenced through farmland.

Locations for this stream restorations have been considered in Technical Report 7h and will likely focus on the Mangapepeke and Mimi Streams and local tributaries. Details of the site preparation, species planting mixes, planting methods, post-planting maintenance and fencing will be included the ELMP.

#### 9.8.9.6 Roadside rehabilitation plantings

After the completion of construction the disturbed land area not covered by road surface and not mitigated by replacement planting (refer Section 9.8.9.4 above) will consist of:

- Steep cut faces;
- Constructed fill embankment slopes;
- Newly constructed stream channels (stream diversions).

All fill areas and road margins and construction zones that cannot be returned reasonably quickly to the vegetation types present before construction will be revegetated with appropriate early successional plant species. A variety of restoration and revegetation techniques are proposed to accelerate successional processes.

On the steep cuts, natural regeneration of faces will occur over time, as has been observed in locations along SH3 at Mt Messenger (refer Section 9.9.3.1 below). To facilitate and speed up this process, planting of species that can inhabit steep faces along the upper edge of the face will occur where safe and feasible to serve as a supply of seed to the cut face surface.

On the fill embankments, the mudstone fill materials are not suitable for the establishment of seedlings and it will be necessary to establish a conditions where favourable planting outcomes can occur. This will involve re-applying back onto the fill, the soil, duff, and woody debris collected when the surface for the new road is cleared. This material provides a suitable growing substrate for several colonising and early successional species. Also, cut manuka vegetation and fern trunks will be placed over the ground surface to provide a constant trickle of seed and create weather-protected, moisture retaining microhabitat that will enhance seedling germination and survival. The retrieval, stockpile and re-use of topsoil and organic material will occur wherever possible for this roadside restoration work.

The design of the roadside restoration areas is described in the LEDF. Detailed restoration planting methods and post-treatment maintenance requirements will be detailed in the ELMP.

### 9.8.10 Ecology outcomes resulting from the Project

All aspects of the indigenous flora and fauna present in the wider Project area will benefit from the management of pest animals to permanently low densities and the establishment of substantial new areas of swamp forest, shrubland and riparian habitat. The proposed mitigation will not only increase the area of healthy indigenous vegetation but will greatly improve the connectedness of the forested areas. The net result will be:

- a significant increase in healthy available habitat;
- enhanced recruitment rates amongst a wide range of indigenous animals;
- improved condition of the remaining significant forest trees, especially totara and rata; and
- increased regeneration of the browse sensitive plant species.

Over time, further ecological benefits will accrue as a result of the offset programme. The conditions created in the pest management area will increase the likelihood of the survival and successful nesting of those kōkako that choose to move east from the release sites in the western Parininihi block. Other species, especially more mobile long-tailed bats and forest birds, will begin to move into adjacent forest areas as carrying capacity limits are met.

A range of other mitigation and management measures are proposed to avoid or reduce construction effects on flora and fauna (eg collection and relocation of cuttings / seed from threatened or regionally distinctive plants; kiwi, bat and lizard relocations; kiwi exclusion fencing; fish recovery).

Additional ecological investigations along the Project alignment are being completed over the 2017 / 2018 summer period to supplement databases. This additional information will be used to update mitigation and management measures and will add to baseline information and records.

Overall, the assessment of ecological effects of the Project, as described in Technical Reports 7a to 7h, concludes that the management measures and the mitigation and biodiversity offset package will appropriately address all of the ecological effects of the Project and over time, deliver significant ecological benefits.

## 9.9 Landscape, natural character and visual effects

### 9.9.1 Introduction

This section outlines the Project's landscape, natural character and visual effects and is based on the assessments presented in Technical Report 8a (Volume 3 of the AEE).

The existing landscape and natural character values of the area are described in Section 8.3.5. The Project alignment is contained within two valley systems, being the well-defined Mangapepeke Valley in the north, and the broader upper Mimi Valley in the south. At the northern and southern ends of the Project alignment, the landscape comprises pastoral flats contained by these two valleys, with a gentle topography, and modified landscape character. As the Project alignment progresses from the flats up each valley, either travelling in a southerly direction up the Mangapepeke, or a northerly direction up the Mimi, the slopes become steeper and covered in indigenous forest, and the environment takes on higher naturalness characteristics.

### 9.9.2 Landscape and environmental design approach

The approach to developing the landscape and environmental design measures that will be incorporated into the Project is described in the LEDF (Technical Report 8b, Volume 3 of the AEE). The LEDF informs the assessment of landscape, natural character and visual effects as it describes the design outcomes that the Project seeks to achieve that avoid, remedy and mitigate adverse landscape effects.

The LEDF articulates four overarching landscape design principles, all aimed at avoiding, remedying and mitigating adverse landscape, natural character and visual effects:

- "Keeping low in the landscape" – minimising the physical landscape effects.
- "Letting the landscape speak" – emphasising the surrounding landscape and its scenic amenity.
- "Integrating the Landscape and Ecological" outcomes of the Project – responding to and reflecting the natural character of the area, the natural ecological, patterns and processes, and integrating with the biodiversity outcomes that will come from the ecological mitigation package.
- Recognising culture – enabling a design development process where Ngāti Tama continue to express their mana whenua and kaitiakitanga over the Parininihi land.

The Project design described in Section 4 and the drawing set (Volume 2, particularly on the preliminary landscape concept drawings, MMA-DES-UDL-DRG-1000 to MMA-DES-UDL-DRG-1010) gives effect to these design principles through a design that:

- Retains the key ridgelines defining the landscape by using a tunnel, and minimising effects on landform and bush;
- Includes a bridge across a tributary to the Mimi swamp forest;
- Minimises stream and valley crossings by keeping to the sides of the valleys;
- Develops cut faces that echo natural slope angles;
- Promotes natural succession re-vegetation;
- Integrates landscape and ecological rehabilitation;

- Provides an opportunity for cultural expression and recognition; and
- Promotes a scenic journey experience.

*Figure 9.1 – Landscape perspective of alignment viewed from above the eastern ridge of the Mimi Valley*

### 9.9.3 Assessment of landscape, natural character and visual effects

The assessment of landscape, natural character and visual effects uses the definition of 'landscape' contained in the New Zealand Institute of Landscape Architects Best Practice Note 1070:

> "*the cumulative expression of natural and cultural features, patterns and processes in a geographical area, including human perceptions and associations*".

In assessing the effects of the Project, consideration has been given to the overlapping matters of:

- Physical Landscape Change;
- Landscape Character;
- Natural Character of the streams and wetlands;
- Effects in relation to associative landscape values; and
- Amenity including visual amenity to and from the Project for identified viewing audiences including rural residents, and the travelling public.

These effects are described below for:

- The Mangapepeke Valley; and
- The Mimi Valley.

Visual effects are described for five indicative view points along the alignment.

#### 9.9.3.1 Effects on Mangapepeke Valley

*Physical landscape change effects*

From the north the Project alignment sits on the eastern flank of the valley and gently works southwards up the Mangapepeke, cutting through minor toe slopes (refer Figure 9.2). The result is a sinuous, relatively open alignment that affords scenic views, and reflects the meandering natural valley landform. As the alignment progresses up the valley (towards the

south) the scale of landform modification becomes higher, as the alignment becomes more dominant in the tighter valley and surrounding valley landform.

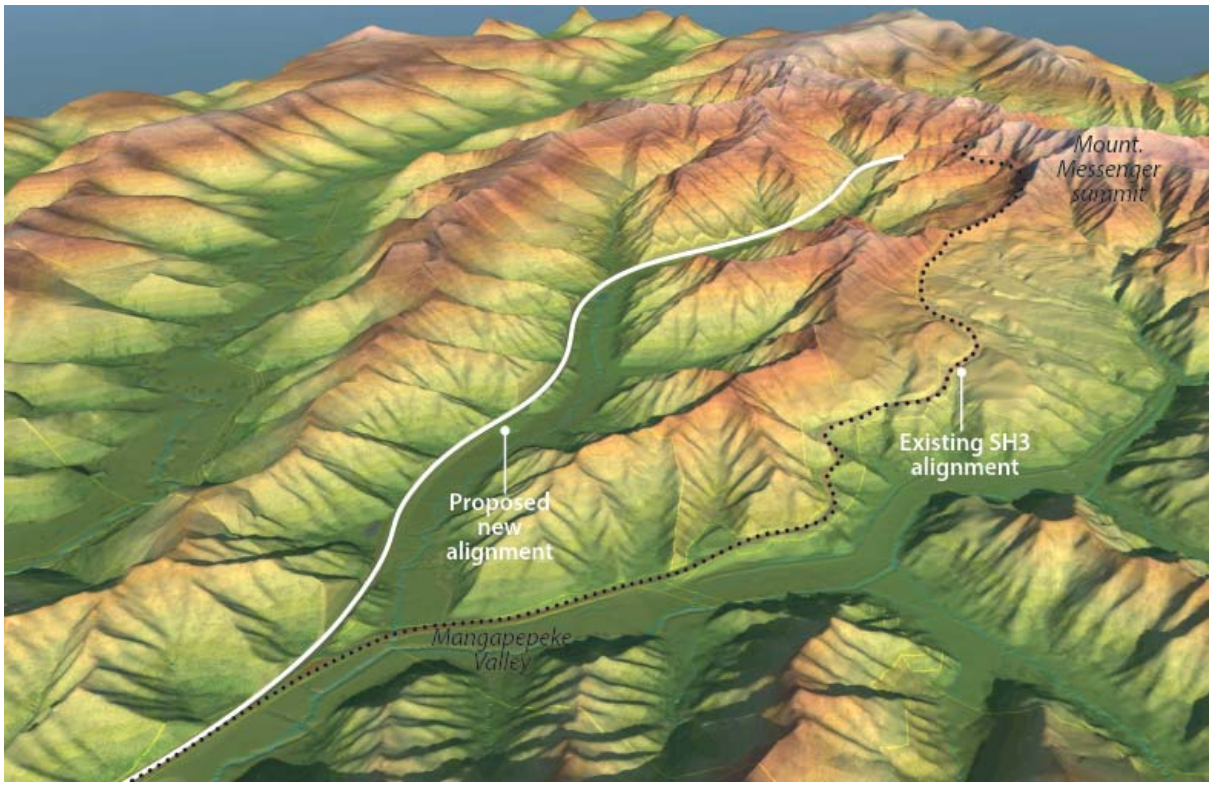



*Figure 9.2 – Topography of alignment viewed looking south up the Mangapepeke Valley*

The cut and fill transitions along the Project alignment (refer drawings) are sensitive locations, which will be integrated with the surrounding terrain to minimise effects. Where cuts and steep faces occur on the existing SH3 (refer Photo 9.2 and Photo 9.3 below) they re-vegetate and take on a natural appearance and blend with the immediate bush roadside. In the context of the surrounding papa landscape, slip / cliff faces are a common natural feature (refer Photo 9.2). Cuts on the new alignment will also be colonised naturally by vegetation. This process is estimated to take up to 5 to 10 years and will be assisted by top seeding of the upper soil slopes above the cuts, textured finishing of cut faces and the use of successional hydro-seeding.

*Photo 9.2 – A Natural exposed rock (slip) face and bush as seen from SH3*

*Photo 9.3 – Naturalised cuts along the existing SH3 corridor.*

Excess fill will be placed into disposal areas. These disposal areas are currently grazed side gully areas along the west of the lower Mangapepeke Valley. These disposal areas will be designed to integrate with the immediately adjoining landform, avoiding the appearance of

artificial or engineered landforms that would be more obvious and contrasting in proximity to the valley flats.

The large engineered fill near the head of the Mangapepeke Valley represents a moderate-high degree of landform modification within a very discreet and visually contained steep bush upper catchment landscape. While modified, the fill generally works "with the grain" and follows the natural alignment of the primary valley landform and spurs, which moderates the overall effect.

*Landscape character effects*

The Project will introduce a highway into what is current a relatively remote, generally undeveloped landscape setting. This represents a change in landscape character.

As noted earlier, in the lower Mangapepeke, the Project alignment sits on the eastern flank of the valley and gently works southwards up the Mangapepeke, cutting through minor toe slopes. The Project design minimises major landform modification and disturbance and preserves the integrity of the key characteristics of the existing hill county bush character. In this regard, the highway will be a relatively recessive element in the context of the dominant qualities of the surrounding natural hill country. It preserves the large undisturbed areas of bush, as well as the dominant and strong landforms with bush cover forming backdrops of the lowland and more modified valley flats.

In the more contained upper Mangapepeke Valley, the change in character will be more pronounced, particularly at the areas of the large embankment starting at Chainage 2850. This fill occupies and alters the valley floor and natural stream corridor. The change in character will be moderated through design which seeks to integrate the fill into the existing pattern of steep surrounding hill slopes and natural drainage patterns, restoration plantings which integrate the highway with the bush character of the immediately surrounding landscape, and by reinstatement of the streams along the fill margins.

Significant vegetation removal will be required in forming the alignment, particularly where the alignment is higher up in the Mangapepeke Valley. This includes the removal of around 15 significant old emergent forest trees.

The mitigation and biodiversity offset package described in Section 4.2.3 (and in the ELMP) outlines how vegetation losses will be mitigated. Significant ecological mitigation planting is also proposed, including:

- 6ha of swamp forest planting, all or predominantly in the lower Mangapepeke valley;
- Riparian planting (10m each side of the stream edge) along 8.9km of stream; and
- 9ha of replacement mitigation planting consisting of manuka and early successional planting.

The majority of the planting is intended to be within the lower Mangapepeke valley and to integrates landscape and ecology outcomes. This planting will have significant long term positive landscape effects on the enhancement of the natural landscape characteristics of the lower Mangapekeke Valley in particular, and will greatly assist the integration of the highway within a natural bush setting.

*Natural character of streams and wetlands*

The Project has been specifically designed to minimise impacts on natural streams and wetlands through the Mangapepeke Valley. In hugging the eastern flank of the valley the alignment avoids the main stem of the Mangapepeke Stream for much of its length, with modification being limited to the streams draining the side gullies to the east.

The large embankment starting at Chainage 2850 will have a greater effect on the natural character values of the upper Mangapepeke Stream system. Through this section the stream channel will be filled and diverted into new naturalised stream channels and under the embankment via a culvert. These works will modify the higher natural character values in this upper part of the Mangapepeke Valley.

As noted above, the mitigation and biodiversity offset package described in Section 4.2.3 outlines how riparian restoration will be undertaken on some 8.9km of local streams. A significant portion of this riparian restoration is intended to occur within the Mangapepeke Valley. This restoration planting will enhance the natural character values of these watercourses and mitigate for the effects of construction works. When also taking into account the swamp forest plantings proposed in the lower Mangapepeke Valley, the mitigation and biodiversity offset package will enhance the natural character of the entire Mangapepeke Stream corridor and valley.

*Associative values*

Cultural associations are a recognised factor in the wider appreciation of landscape values. The LEDF promotes a process for working with Ngāti Tama to ensure that cultural aspirations are expressed within the Project designs. This is likely to be an iterative process, where the exchange of ideas is required to fully explore opportunities and to enable Ngāti Tama to express their mana and kaitiaki responsibilities.

*Amenity values*

By selecting an alignment that works with the underlying landform, the wider scenic amenity qualities of the Mangapepeke Valley are maintained, and the natural scenic landscape qualities of the valley and wider landscape dominate. It is expected that these scenic amenity qualities will be further enhanced over time. As natural successional processes begin to colonise cut slopes and as the restoration plantings described above establish and return areas of the rural valley flats to swamp forest, the Mangapepeke Valley will become a highly naturalised and unique bush highway that will be appreciated by future road users for its remoteness and scenic qualities.

#### 9.9.3.2 Effects in Mimi Valley (including inter-valley ridge)

*Physical landscape change effects*

On the southern side of Mt Messenger, progressing from south to north, the alignment sits on the existing SH3 alignment to the point where the existing highway starts to climb. From here it progresses up the western flank of the Mimi Valley, sitting to the east and below SH3 (refer Figure 9.3). It cuts through the lower spurs of the ridge as it gains height to the bridge over the adjoining Mimi swamp forest, and then into another deeper cut and fill before reaching the southern tunnel portal and tunnel through the inter-valley ridge between the Mangapepeke and Mimi catchments.

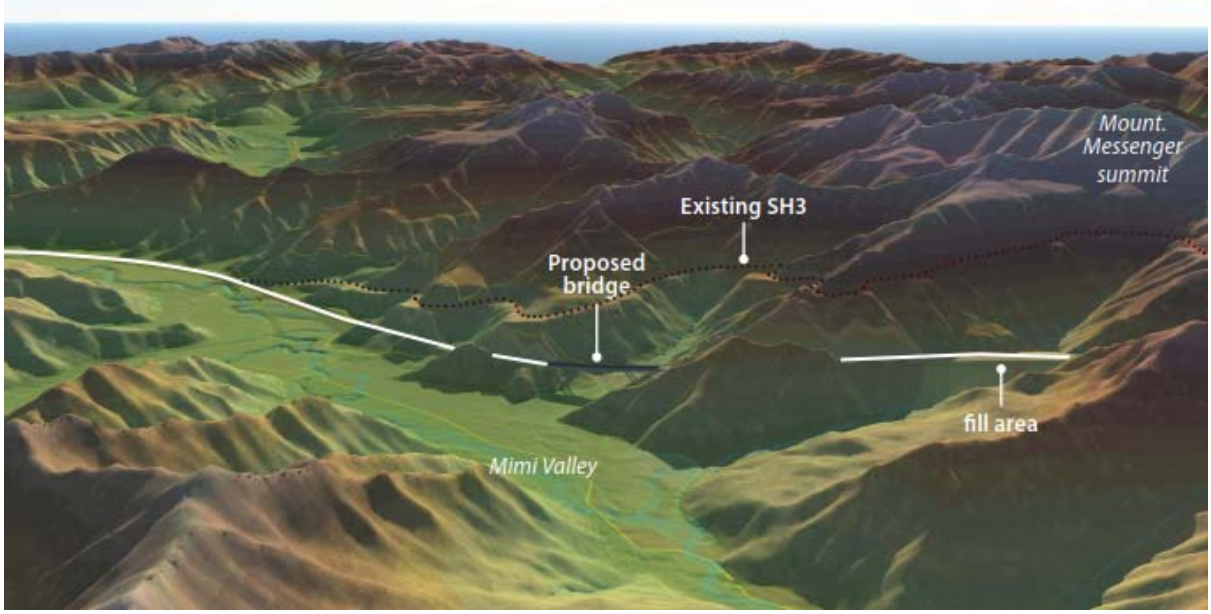



*Figure 9.3 – Landscape model of alignment viewed from above the eastern ridge of the Mimi Valley*

The inter-valley ridge between the Mangapepeke and Mimi catchments is a defining landform in the local context. This feature has been preserved by the tunnel that conveys the alignment between the two catchments and remains intact as a connected ridgeline spur as part of the wider Mt Messenger topographical pattern. The tunnel is one of the principal positive landscape features of the Project, which not only maintains the integrity of natural landform but also echoes the character and heritage associations of the existing SH3 Mt Messenger tunnel as a transitional 'journey feature' or waypoint reference for road users.

The fill south of the tunnel portal infills the steep gully at this point. It will be integrated into the surrounding steep terrain forming a minor basin west (upslope) of the proposed alignment and will then tie into the surrounding gully to the east (downslope).

The cut immediately to the south of this fill passes through one of the minor spurs that run southwards below the existing SH3 alignment, and runs obliquely through the underlying papa geology. Cuts through these southern spurs will be designed in a similar fashion to those described in the Mangapepeke Valley, and similarly colonised naturally by vegetation.

### *Landscape character effects*

In addition to the physical change described above, the bridge structure (refer Figure 9.4) over the head of the Mimi swamp forest will bring additional landscape change. This structure has been specifically included to protect the wetland habitat and avoid landform modification (fill) within the steep bush gully that immediately adjoins the wetland. The form and proportion of this bridge has been considered as part of the integrated design development process. The underbridge form of this structure has been specially designed to minimise land disturbance and minimise vegetation and land disturbance at the pier footings.

*Figure 9.4 – Bridge over Mimi swamp forest*

The bridge is considered an appropriate design response to this section of the Project, preserving as far as practically possible the natural landform context and also preserving the adjoining swamp forest. The bridge affords road users a strong visual connection with this landscape feature and the wider Mimi Valley beyond.

The hydrant tanks to be located on SH3 at the existing rest area, and tunnel control building to be located alongside the alignment south of the tunnel, represent additional new built structures. Screening will be provided to screen the structures from view.

### *Natural character effects*

The Project specifically avoids directly impacting the natural character values of the Mimi swamp forest. Road drainage will be diverted away from the swamp forest system to storm water treatment areas downstream.

The bridge offers unique scenic views of the wetland for southbound road users. This is a positive outcome for the appreciation of the wild and scenic values of this landscape feature. The Project does however shift SH3 closer to the wetland, and this will alter the perceptual and experiential qualities of visitors to the wetland.

### *Associative values*

The processes outlined above for the Mangapepeke Valley will enable Ngāti Tama to fully explore opportunities and express their mana and kaitiaki responsibilities across the full Project area.

### *Amenity values*

The alignment selected for the southern approach to Mt Messenger retains the natural scenic qualities of the landform, preserving the important inter-valley ridgeline and wetland features. The two key structural design elements of the Project (the tunnel and the bridge) have been designed to fit with the surrounding landscape and not appear as discordant or obtrusive built elements in an otherwise natural landscape setting.

Road users will be very much aware of the wider dominance of the natural landscape. Approaching the tunnel the roadway will be "swallowed" by the landscape only to emerge in an equally scenic environment. This represents a dynamic journey experience for road users

with the tunnel a key 'waypoint'. Views from this bridge will be of scenic amenity value providing a strong visual connection and journey experience with the wider landscape.

### 9.9.4 Assessment of visual effects

Technical Report 8a presents an assessment of the visual effects of the Project for the expected viewing audience, and is informed by five indicative viewpoints.[56] The viewpoints comprise both public and private viewing locations. Given the remote setting, the private viewing audience is very small, comprising three rural dwellings[57].

Views are typically dominated by the wider character of the surrounding hill county, which is reinforced by the naturalised vegetation patterns. These successional vegetation patterns bring a bush character down to the immediate roadside. Similar vegetation patterns will be reinforced adjacent to the highway by the mitigation plantings described in Section 9.9.3 above. In the lower Mimi Valley, views are moderated by the influence of the existing SH3 corridor and generally modified character of the working rural landscape.

Three rural dwellings will be affected as follows:

- 3072 Mokau Road is in relatively close proximity to the alignment and currently has views of the existing SH3 highway. The existing landform and proposed screen plantings help visually integrate the highway and screen northbound views from this dwelling. The northern cut slope (western face) and adjacent landform will also screen headlight glare and daytime visibility of southbound traffic.
- Northerly views from the private dwelling at 2750 Mokau Road will include a short section of the new alignment. At this location, the natural landscape character of the surrounding hill country predominates, including views across to Mt Messenger and expansive northerly hill country views with uninterrupted ridgelines extending northwards into the distance. Low visual effects of highway mitigated by the visual exposure of a limited roadway section and the recessive location of the Project in the wider context of the upland hill county. It may also be possible to screen the particular line of sight to this section of the Project by foreground planting on 2750 Mokau Road should this be appropriate and acceptable to the property owners.
- Northerly views from 2528 Mokau Road will include the road corridor itself as a relatively recessive element, generally taking a lower alignment than the current SH3 corridor. The proposed alignment will be visible in the context of a working rural landscape that includes the influence of existing farm buildings and structures as well as the mixed vegetation patterns of the Mimi Valley. The most visible elements of the Project in this view will be the south facing cuts (right of frame). However these cuts are expected to take on a naturalised appearance similar to existing south facing cuts on SH3 where successional re-vegetation has occurred. Over the construction period,

[56] Photosimulations have been prepared for each of these locations and are contained in Technical Report 8a)

[57] 3072 Mokau Road in the north, 2750 Mokau Road on the inter-valley ridge and 2528 Mokau Road in the south. The assessment assumes all three dwellings will remain in place and occupied.

views from this property will include construction activities, reducing the immediate rural amenity for periods.

The visual assessment concludes that any visual effects on the viewing audience are typically low or moderate to low.

A low level of temporary visual effects are expected over the duration of construction. Much of the work occurs out of public view and in remote areas not visible from the SH3 corridor.

### 9.9.5 Overall conclusion on landscape, natural character and visual effects

Technical Report 8a concludes that overall, the Project represents an appropriate and well considered design response to the wider hill country setting within which it is located, such that the prosed highway will be a recessive human influence within a predominantly natural landscape setting.

The route selection process (see Section 6 above) avoided potential adverse effects on the following significant landscape areas and features:

- The intact wilderness area of the Waipingao Valley;
- The area west of Mt Messenger that is of particular significance to Ngāti Tama and the wider community reflected in the Parininihi Protection Project;
- The 'Regionally Significant Landscape' that has been identified west of SH3;
- The high quality Mimi swamp forest; and
- The landmark peak of Mt Messenger – including the picturesque tunnel and other features of the existing Mt Messenger section of SH3.

In summary, the key landscape effects that have been identified include:

- The introduction of a highway into two valleys that currently have a quiet, remote rural character – albeit exposed in places to the existing highway on the western flanking hills;
- The clearance of 44ha of vegetation, of which 33ha is indigenous vegetation;
- Earthworks including batters cut into the side slopes of the valley and fills placed into gully areas;
- The creation of permanent disposal areas; and
- The crossing, filling and diversions of 3.47km of streams.

The key natural character effects relate principally to the effects on watercourses.

Overall, landscape effects are considered to be moderate, while natural character effects are moderate – high in the upper Mangapepeke, moderate in the lower Mangapepeke, and moderate – low in the Mimi.

A number of measures that mitigate landscape, natural character and visual effects have been introduced through the design process. Future design development through the LEDF process, including collaboration with Ngāti Tama, will mitigate effects further. Key mitigation measures proposed as a core part of the Project include:

- Treatment of cut and fill batters to integrate with natural landforms;
- Integrating earthworks into the immediate landform context;

- Mitigation plantings that reinforce existing vegetation sequences;
- Constructing stream diversions with naturalised elements reflecting the characteristics of the existing streams; and
- Ecological restoration, particularly of swamp forest plantings through the Mangapepeke Valley and riparian planting along 8.9km of streams.

Taking into account the proposed mitigation measures, the Landscape, Natural Character and Visual Assessment concludes that landscape and visual effects will be reduced to moderate-low, while natural character effects will be reduced to moderate.

As natural successional processes begin to colonise cut slopes and as the restoration plantings establish the alignment will become a highly naturalised and present a unique bush highway. This will enable a scenic user experience that not only integrates the highway into the landscape but also connects landscape and ecology, addressing wider landscape fragmentation particularly in relation to the restoration of patches of lowland pasture back into the surrounding indigenous landscape. Overall, the Project will have positive visual amenity effects.

## 9.10 Effects on historic heritage values

### 9.10.1 Introduction

This section presents a summary of the historic heritage effects of the Project, and is based on the Historic Heritage Assessment report (Technical Report 9, Volume 3 of the AEE).

A description of the historic heritage values of the area is set out in Section 8.4.2 of this Report. In summary, while the coastal areas and river valleys near the coast were areas of historic Māori occupation, the steep hill country associated with the Project area was less widely utilised. There is unlikely to have been any significant occupation of the Mangapepeke Valley because of its frequent flooding and steep inaccessible valley sides, although the valley may have been used by Māori to access inland areas.

No archaeological or other historic heritage features were identified within the Project footprint. Near to the southern end of the Project alignment in the Mimi River valley there is a recorded pā site, Maukuku Pā (archaeological site Q18/74) and related cultivations on a relatively flat spur overlooking the Mimi River valley. A site recorded as 'old clearing' ('Nga oko oko') was also identified from early survey plans adjacent to Maukuku Pā.

### 9.10.2 Project effects on historic heritage

The Historic Heritage Assessment concludes that no known archaeological or other historic heritage sites will be affected by the proposed construction of the Project.

The likelihood of encountering heritage sites is considered to be low, given the steep rugged terrain covering much of the Project route and the fact that the remainder of the route is within low-lying valley floors prone to flooding. However, the large scale nature of earthworks required for the Project means there is some potential to encounter settlement remains within the Project footprint, although these are unlikely to be significant.

Conditions are proposed to address any accidental discovery of heritage remains, and also any accidental discovery of koiwi tangata, in accordance with the Transport Agency's Accidental Archaeological Discovery Specification (P45). Additionally, the Transport Agency

intends to seek a Project-wide Authority under Section 44(a) of the Heritage New Zealand Pouhere Taonga Act 2014 (HNZPTA).

Overall, any potential effects of the Project on historic heritage values are expected to be no more than minor.

## 9.11 Operational stormwater management effects

This section assesses the actual and potential effects of the Project on stormwater quantity and quality. It deals with stormwater generated by impermeable surfaces associated with the Project that require treatment. Stormwater management provisions for the Project are described in Section 4.16 of this AEE Report and are based on Austroads standards and the Transport Agency's Stormwater Treatment Standard for State Highway Infrastructure.

In summary, the stormwater drainage network and treatment system for the Project comprises:

- Open roadside channels (swales) constructed along the alignment to convey flows (up to the design storm) from the road surface downstream to constructed wetlands for treatment.
- Stormwater will then be detained and treated in constructed wetlands, prior to discharging to the receiving environment. Two wetlands will be located adjacent to the road alignment in the Mangapepeke Valley and one wetland in the Mimi Valley.
- Clean water flows from the natural valleys and associated streams and watercourses will be conveyed from one side of the road corridor to the other to enable the continuation of streams and overland flowpaths.
- Runoff from the bridge and drainage from the tunnel (which is expected to be minimal) will be collected and conveyed for treatment in the constructed wetlands.

### 9.11.1 Stormwater quantity effects

The Project will increase the area of impervious surface in both the Mangapepeke Stream and Mimi River catchments. However, these increases are small in the context of the overall catchments. The impervious surface represented by the new alignment equates to about 2.4% of the Mangapepeke catchment and 0.7% of the Mimi catchment. Any change in the quantity of storm flow discharge from these catchments following completion of the Project works will be small.

### 9.11.2 Stormwater quality effects

The drainage network will convey all road runoff to the constructed wetlands for treatment. Pre-treatment will occur in the conveyance swales, where solids will be filtered. The wetlands will provided extended detention of flows and treatment to reduce total suspended solids (TSS), metals, nutrients, oil, grease and bacteria and also to remove gross litter and floatables, such as oil and volatile hydrocarbons. Stormwater will be treated in accordance with the water quality standards identified in the Freshwater Plan to comply with Permitted Activity Rule 23. Stormwater discharge effects on water quality and freshwater ecology are also addressed in Section 9.8.7 and in Technical Report 7b.

The two northern constructed wetlands will discharge to the Mangapepeke Stream and the southern wetland will discharge to the Mimi River. Outlets from the wetlands will be designed to avoid scour and erosion at the point of discharge to the receiving environment.

Overall, stormwater discharge from the Project will comply with the Permitted Activity standards in Rule 23 of the Freshwater Plan. Any effects of stormwater discharge are expected to be no more than minor.

## 9.12 Effects of structures on streams and watercourses

Where the alignment crosses natural valleys and watercourses, culverts will be installed to provide for the conveyance of natural flows from one side of the embankment to the other and enable the continuation of streams and overland flowpaths. Where fill embankments are located parallel to watercourses, the watercourses will be diverted along the toes of the embankments. Permanent stream diversions will be required where it is necessary to realign a natural stream channel. The design approach for culverts and stream diversions is described in Section 4.16 and shown also on the drainage drawings in Volume 2 (Drawings MAA-DES-DNG-DRG-1000-1010 and on MAA-DES-DNG-00-DRG-40022, 4005, 4006, 40088).

The effects of the Project on the ecological values of streams and watercourses, and the measures proposed to mitigate and offset those effects, are addressed in Section 9.8.7 above and in Technical Report 7b.

### 9.12.1 Stream diversions

Stream diversions will:

- seek to replicate the gradient, sinuosity and hydraulic characteristics of the natural channel being diverted;
- seek to replicate the natural materials and characteristics of the original watercourse to ensure similar ecological functions are maintained; and
- be designed to enable fish-passage for species encountered in the upstream habitats.

Details on the individual diversions, their location, length of stream affected and the reinstated stream channel designs are proved in Section 4.16.2. Details are also presented in the assessment of ecological effects in Section 9.8.7 and in Technical Report 7b. Diversion channels will be sized to convey design storm flows and overland flow provided where channel capacity is exceeded.

### 9.12.2 Culverts

The Project will require the installation of culverts on both permanent and intermittent watercourses, as outlined in Section 4.16.3. Culverts will be sized to convey the design storm and to enable fish passage, provide erosion control and debris management, and energy dissipation. Fish passage provisions through the culverts are described in more detail in Section 4.16.3 and in Technical Report 7b, but in summary, will enable fish-passage for the species encountered in the upstream habitats.

### 9.12.3 Effects of structures on streams and watercourses

As described in Section 9.8.7 and in Technical Report 7b, the Project will result in the modification of some 3.47km of watercourses. Effects of modification will be mitigated by way of riparian plantings for some 8.9km of stream length. Based on the design provisions incorporated into stream diversions and culverts outlined above, and on the proposed mitigation, any effects of the proposed stream structures will be no more than minor.

## 9.13 Operational air quality effects

This section summarises the actual and potential effects of the Project on air quality during the operational phase of the Project. A detailed assessment of the effects of the Project on Air Quality is presented in Technical Report 11.

There are only three sensitive residential air quality receptors in the vicinity of the Project[58].

Existing air quality in the Project area is expected to be very good. The Project is located in a relatively undeveloped rural area, with only localised source of air emissions (eg motor vehicles using the existing SH3; domestic heating emissions, and intermittent discharges from farming activities).

Once the new alignment has been opened, there will be emissions to air comprising exhaust emissions and brake and tyre wear from vehicles. There are a variety of air contaminants from motor vehicle emissions, including carbon monoxide (CO), sulphur dioxide ($SO_2$), fine particulates ($PM_{10}$ and $PM_{2.5}$) and nitrogen dioxide ($NO_2$).

Operational air quality effects have been assessed using the Transport Agency Guide[59], which addresses air quality impacts associated with state highway improvement projects. The Guide recommends use of the Transport Agency's air quality screening model, which considers the effect of $PM_{10}$ and $NO_2$. The screening model has been used to assess the operational air quality effects of vehicle emissions on the sensitive receptors and consider effects now and in 10 years' time (i.e. 2017 and 2027), both with and without the Project.

The screening model results show that the concentrations of $NO_2$ and $PM_{10}$ during the operational phase are well within air quality criteria and therefore the risk of adverse air quality effects, including on the three sensitive residential air quality receptors, is low.

An assessment of vehicle emission effects on ecological air quality has also been completed using the screening model results. The results indicate that predicted levels of $NO_2$ during the operational phase will remain well within ecological air quality criteria and therefore any effects on ecosystems will be negligible.

Overall, the effects of the Project on air quality are expected to be no more than minor.

[58] 3072 Mokau Road at the northern end of the alignment, and 2528 Mokau Road and 2397 Mokau Road at the southern end.

[59] NZ Transport Agency, Guide to Assessing Air Quality Impacts from State Highway Projects, Version 2.0, December 2014. Note that this guide is more current than the MfE Good Practice Guide for Assessing Discharges to Air from Land Transport

## 9.14 Operational noise effects

This section summarises the effects of noise generated by vehicles on the new alignment during the operational phase of the Project. A detailed assessment of noise and vibration effects is presented in Technical Report 10.

Road traffic noise in New Zealand is generally assessed and controlled through NZS 6806:2010 Acoustics – Road-traffic noise – New and altered roads (NZS 6806 or the Standard). The Standard assesses noise effects at noise sensitive locations only, and in rural areas this includes all residential dwellings (and other sensitive receivers defined in the standard) within 200m of the road. There are only 3 sensitive receivers located in relation to the Project alignment: 3072 Mokau Road in the north, 2750 Mokau Road on the inter-valley ridge and 2528 Mokau Road in the south[60].
Noise level predictions have been made for these receivers following the methodology set out in NZS6806, and are presented in Table 9.8. Noise levels arising from the operation of the highway once the Project is complete is predicted to comply with the relevant noise criteria from NZS 6806.

**Table 9.8 – Predicted Traffic Noise Levels**

| Receiver | Predicted Traffic Noise Level, dB $L_{Aeq(24h)}$ | | NZS 6806 Noise Criteria (dB $L_{Aeq(24h)}$) |
|---|---|---|---|
| | Without Project | With Project | |
| 3072 Mokau Road | 51 | 54 | ≤64 |
| 2750 Mokau Road | 48 | 44 | |
| 2528 Mokau Road | 57 | 56 | |

The change in noise effects at 3072 Mokau Road will be noticeable, but is considered acceptable due to the low overall traffic noise level received. The level of noise at all facades of the dwelling will be substantially lower than the NZS6806 noise limit. The dwellings at 2750 Mokau Road and 2528 Mokau Road are predicted to receive slightly lower traffic noise levels than they currently receive from traffic on SH3. For these dwellings the Project will result in a slight noise level improvement.

Traffic vibration does not generally cause adverse effects in situations where roads are well-maintained. The Mt Messenger Bypass will be subject to a comprehensive road maintenance policy as part of the wider SH3 maintenance programme which will ensure the road surface remain smooth and any defects are fixed within short timeframes. Even if the road was to degrade, effects are only an issue for residential receivers within 25 metres of the road surface;[61] there are no houses within this distance of the Project alignment.

Overall, any operational noise and vibration effects from the Project are expected to be acceptable and no more than minor.

[60] It is noted that the dwelling at 2750 Mokau Road is outside the 200m distance and not technically a sensitive receiver in accordance with NZS 6806, but has been included for completeness.
[61] As per Class C of the Norwegian Standard NS 8176.E:2005.

# 9.15 Temporary construction effects

## 9.15.1 Temporary traffic effects during construction

### 9.15.1.1 Construction traffic effects

Technical Report 2 includes an assessment of temporary traffic and transport effects during construction. The key temporary effects will be from construction traffic, such as trucks and other vehicles travelling or delivering materials to the site.

Construction traffic movements are summarised as follows:

- At peak, some 500 light vehicle movements per day for a workforce of 200-250 staff coming to and from site.
- Approximately 80 truck movements per day over a six month period to shift in the order of 87,000m$^3$ of bulk fill.
- On average, 20 truck movements per day delivering aggregates throughout the duration of works, with an expected peak of 120 movements per day.
- On average, 16 concrete truck movements per day, peaking during the 12 month period of lining the tunnel.
- On average, 120 pavement materials truck movements per day, occurring over about a 120 days.
- A small number of deliveries of plant and equipment to and from site, and transport to different locations across the site. Some of the plant will require over dimension permits to travel along the existing route.
- Occasional deliveries of materials such as culverts, geotextile, steel, barriers, fencing materials and other such bulky construction items. These will generally arrive on single unit trucks or semi-trailers.
- Daily site servicing by delivery of fuel to site by mini tanker, along with potable water tankers and trucks to remove sewage from on-site toilets, which will visit the site as required.

Allowing for the sequencing and staging of construction activities, the amount of truck traffic can be expected to fluctuate between 60 and 160 movements per day, with an overall average of around 80 movements per day.

The traffic assessment presented in Technical Report 2 notes that as existing daily traffic volumes on SH3 are relatively low, additional construction traffic generated by the Project will be accommodated within the capacity of the existing SH3 corridor. Temporary traffic management measures will be in place over the duration of the construction to manage any temporary traffic related effects. These measures are described in the CEMP and CTMP, and are summarised in Section 10 of the AEE.

Overall, and allowing for the implementation of appropriate traffic management measures, any temporary effects of construction traffic on the existing SH3 alignment are expected to be no more than minor.

#### 9.15.1.2 Site accesses and stopping bay

A number of temporary site accesses will be required from SH3 into the Project construction area. These access locations are described in Section 5.7.2 and considered in Technical Report 2 and in the CTMP.

The site accesses will be controlled, so that access will only be possible for those authorised to access the site. The accesses will be developed so as to ensure good visibility to and from the accesses, in line with the approach design speeds, and where necessary LED warning signs will be used to warn road users. Where appropriate, the access points will be sealed for the first 10m onto the site to prevent detritus spreading onto SH3. In addition, a stopping bay at the southern approach to the site provides trucks with an area to pull over while drivers check that relevant accesses are clear.

The traffic assessment presented in Technical Report 2 concludes that the site accesses can be appropriately managed to ensure the safety of SH3 users. Overall, any temporary effects associated with site access to the Project construction site are expected to be no more than minor.

#### 9.15.1.3 SH3 tie-in works

As noted in Section 5.7.4, works will be required at the northern and southern ends of the new alignment to connect the new alignment to SH3 at the completion of the Project. The works will require appropriate traffic management, with stop/go control of traffic required to enable parts of the work to be completed safely. Given the relatively low volume of traffic on SH3, a stop/go operation will be able to clear waiting traffic without significant delays or build-up of traffic queues. Any effects are expected to be temporary and no more than minor.

#### 9.15.1.4 Temporary traffic management during construction

All construction works involving temporary traffic management will be undertaken in accordance with the CTMP (refer Volume 5 of the AEE). The CTMP addresses:

- Traffic controls required at SAPs and during tie-in works;
- Temporary speed restrictions during construction;
- Delineation devices, such as cones;
- Signage;
- Maximum delays permitted during traffic management control; and
- Notification methods to road users of potential disruptions on the State Highway network as a result of the Project.

Overall, and allowing for construction traffic management in accordance with the CTMP, the temporary effects of construction related traffic are considered to be no more than minor.

### 9.15.2 Construction effects on air quality

This section summarises the temporary effects on air quality during construction. A detailed assessment of air quality effects is presented in Technical Report 11.

Potential effects on air quality from road construction activities relate principally to dust generated by earthworks. Other potential air discharge sources include odour, if

contaminated soils are disturbed, or from exhaust emissions from construction vehicles and plant.

Technical Report 11 details the qualitative assessment methodology that has been adopted for assessing potential construction related air quality effects. The approach takes into account the likely frequency, intensity, duration, offensiveness/character and location of the effects and reaches a conclusion as to whether emissions are likely to have an objectionable or offensive effect on receptors (referred to as a 'FIDOL assessment').

As noted in Section 9.13 on operational air quality effects, the Project is located in a relatively undeveloped rural area, with only three residential dwellings (sensitive air quality receptors) in the vicinity (refer Section 9.13).

#### 9.15.2.1 Effects of construction dust

There are two main potential effects from dust (particulate matter):

- nuisance/amenity effects; and
- health effects.

Nuisance/amenity effects are generally associated with coarser fraction dust. Health effects are generally associated with fine dust (referred to as $PM_{10}$ and $PM_{2.5}$) as these fine fractions of dust are able to penetrate the nose and mouth if breathed in, and can enter the lungs.

The dust emitted during road construction activities is generally in the coarser dust range (referred to as deposited dust – greater than 30µm in diameter), which falls out of the air and is deposited on exposed surfaces. As the proportion of fine particles in the emissions is likely to be low, the potential adverse effects are mainly associated with nuisance / aesthetic effects.

Possible nuisance / aesthetic effects include the visible soiling of surfaces such as houses, furniture, cars and the visible deposition of dust on flowers and vegetable gardens. The three sensitive residential dwellings near the Project are also likely to collect rainwater from their roofs as a drinking water source.

Deposited dust (where there is high dust loading) also has the potential to impact on vegetation and ecosystems.

Potential dust sources during construction activities include:

- Construction yards, site and haul road establishment;
- Topsoil removal and distribution;
- Excavations;
- Cut and fill operations;
- Soil stabilisation and base course construction;
- Loading and unloading of bulk materials;
- Stockpiling of materials, including unloading and placement;
- Vehicle movements on unsealed roads; and
- Wind erosion from exposed areas and stockpiles.

The most significant sources of dust generation during the Project construction works are likely to be:

- stockpiles;
- exposed areas during earthworks; and
- vehicle movements on unsealed haul roads.

The risk of exposure of sensitive receptors to dust emissions depends on the following factors:

- The proximity of the receptors to construction activities that could give rise to dust emissions. In this regard, deposited dust will generally deposit out of the air within about 100m of the source (except under very high wind speed conditions); and
- The frequency and duration of meteorological conditions that are likely to transport dust towards the sensitive receptors (e.g. dry conditions and strong winds (greater than 5m/s) in the direction of receptors).

In summary, the FIDOL assessment presented in Technical Report 11 shows that there is the potential for significant amounts of dust to be generated from the proposed construction activities during dry, windy weather conditions unless appropriate dust controls are implemented. Most of the area surrounding the Project is not sensitive to amenity effects of dust.

However, the proximity of the three residential receptors means that good practice dust control methods will be required in proximity to these locations to minimise the risk of nuisance / aesthetic effects. A draft DMP has been developed (refer Volume 5) to address good practice at these locations. With the DMP in place any residual effects of dust are unlikely to be offensive or objectionable or be of concern for roof drinking water supply.

Overall, with good practice dust management measures in place as per the DMP, any temporary construction related dust effects at the three sensitive residential dwellings are expected to be no more than minor.[62]

Potential dust effects on native vegetation adjacent to the construction works have also been considered. While dust deposition could occur on fringing vegetation immediately adjacent to the construction foot print (within 10m of dust generating construction activities), the associated vegetation is unlikely to be particularly sensitive to dust and the frequent rain events are expected to reduce levels. Accordingly, any dust effects on vegetation are expected to be no more than minor.

#### 9.15.2.2 Other potential construction air quality effects

The air quality assessment in Technical Report 11 concludes that separation distances between residential dwellings, earthworks areas and possible contaminated soil locations (refer Section 9.15.4 below) are such that any potential for odour effects is very low. Similarly, the separation distances between construction vehicle operating areas and dwellings are such that they would not be impacted by exhaust emissions. Overall, any effects of other construction related emissions are considered to be no more than minor.

[62] At the time of lodging the applications, it has been assumed that the land owners at 3072 Mokau Road, Debbie and Tony Pascoe will relocate from this site during construction. Regardless, the assessment concludes that effects at this dwelling will be no more than minor.

## 9.15.3 Construction noise and vibration effects

### 9.15.3.1 Introduction

This section summarises the temporary effects on air quality during construction. A detailed assessment of air quality effects is presented in Technical Report 11.Environmental Noise and Vibration Assessment (Technical Report 10, Volume 3 of the AEE).

Construction noise effects are considered in relation to the construction noise standard NZS 6803:1999[63]. The "long-term duration" criteria from NZS 6803:1999 are most appropriate for this Project given the long duration of works. The Standard does not anticipate that full compliance with the construction noise criteria will necessarily be achieved at all times and at all receivers. Where compliance is not possible, it focusses on the implementation of the best practicable option (BPO) for construction noise management and mitigation.

Construction vibration effects are considered in relation to the Transport Agency's "State highway construction and maintenance noise and vibration guide (August 2013)". The Guide adopts the German (DIN 4150) and British standards (BS 5228-2) noted in Section 2.0, and applies them in a progressive manner that addresses both annoyance and building damage effects.

As noted in Section 9.14, given the relatively remote location of the site, there are few sensitive receptors in the vicinity of the alignment. The dwelling at 3072 Mokau Road will be vacant during construction and no assessment of construction noise and vibration has been made for that property. All other dwellings in the vicinity of works have been included in the assessment. This includes 2750 Mokau Road and 2528 Mokau Road (which are in the order of 300m and 100m from the edge of the designation boundary), along with 2397 Mokau Road which is the closest dwelling to the spoil disposal area located at the southern end of the Project (at approximately 35m from the edge of the designation boundary).

### 9.15.3.2 Effects of construction noise

Estimates of construction noise and the separation distance (day time and night time) at which compliance with the construction noise standard is achieved (without noise mitigation) is presented in Table 9.9 for the plant and equipment expected to be utilised in the Project construction activities.

[63] Which is the standard referenced in the Transport Agency's 'State Highway Construction and Maintenance Noise and Vibration Guide'.

Table 9.9 – Construction noise levels and compliance distance

| Activity | Activity Sound Power Level | Compliance distance to day-time limit (70 dB LAeq) without noise barriers (direct line of sight) | Compliance distance to night-time limit (45 dB LAeq) without noise barriers (direct line of sight) |
|---|---|---|---|
| | dB LWA | metres | metres |
| Earthworks | 118 | 65 | 700 |
| Vibropiling or hammer piles | <120 | 80 | 800 |
| Typical retaining wall construction | 107 | 20 | 280 |
| Structures piling/foundations | 110 | 40 | 370 |
| Above ground bridge works | 107 | 20 | 280 |
| Pavement construction | 110 | 40 | 370 |
| Staging area/construction yard | 100 | 10 | 150 |

Construction noise is predicted to comply with the day-time limits for the dwellings at 2750 and 2528 Mokau Road. The construction noise effects at these locations during the day-time are considered acceptable.

24/7 construction is proposed for the tunnel and general construction activities are proposed for Monday to Sunday 6:30am to 9:00pm. At 2750 Mokau Road shielding from the local topography is expected to enable compliance with both day-time and night-time noise limits.

At 2528 Mokau Road there is the potential that construction works outside Monday to Saturday 7:30am to 6:00pm will exceed the construction noise limits. Similarly, works at the spoil disposal site at 2397 Mokau Road have the potential to exceed day-time construction noise limits.

To manage noise effects during construction a CNMP has been prepared and implemented to address noise management at these two receivers. The CNMP will be prepared in accordance with the requirements of NZS 6803:1999 and will detail mitigation measures and procedures to enable compliance with the limits, including the management and communication procedures for any night works affecting these receivers (a draft CNMP is presented in Volume 5).

With the adoption of a CNMP and appropriate scheduling night works so that general compliance with the limits is achieved, construction noise effects associated with the Project will be no more than minor.

#### 9.15.3.3 Effects of construction vibration

Vibration generating construction activities have been assessed for a range of plant and equipment and separation distance requirements to meet vibration criteria have been identified in Table 9.10.

The separation distance predictions in Table 9.10 adopt the following thresholds for determining the effects of construction related vibration:

| | |
|---|---|
| High Risk | Vibrations predicted to exceed criteria that avoid annoyance of receivers; and potential damage to buildings. |
| Medium Risk | Vibrations predicted to exceed criteria that avoid annoyance of receivers; but comply with criteria that avoid damage to buildings. |
| Low Risk | Vibrations predicted to comply with criteria that avoid annoyance of receivers; and damage to buildings. |

**Table 9.10 - Vibration generating activities and required separation distances to meet risk criteria**

| Equipment | Separation distances | |
|---|---|---|
| | Occupied Dwellings (Residential) | All Other Buildings |
| Vibrating Roller | High: <20m<br>Med: 20-90m<br>Low: >90m | High: <5m<br>Med: 5-20m<br>Low: >20m |
| Vibropiling | High: <20m<br>Med: 20-120m<br>Low: >120m | High: <5m<br>Med: 5-20m<br>Low: >20m |
| Impact Piling | High: <20m<br>Med: 20-150m<br>Low: >150m | High: <5m<br>Med: 5-20m<br>Low: >20m |

While not currently planned as part of the Project construction activities, vibropiling and impact piling have been included in the analysis as it is possible they could be used during construction of the bridge over the Mimi swamp forest. That site is more than 900m to the nearest dwelling and vibration effects are not expected.

Vibratory roller activity will occur during pavement formation, in which case the separation distance to the nearest dwelling is at 2528 Mokau Road, which is about 100m. Work to the south of Chainage 5250m involves overlay to the existing road profile and hence vibration effects are not expected at 2397 Mokau Road.

Overall, any construction vibration effects are expected to be no more than minor.

### 9.15.4 Management of contaminated land

This section outlines the potential effects of contaminated land on human health and the environment as a result of the works. A detailed assessment of the effects of the Project on Contaminated Land is presented in Technical Report 12 (Volume 3 of the AEE). Along with a site visit, the assessment involved review of:

- Property files from the District Council;
- The Regional Council Register of Selected Land Use (RSLU) and incident register;
- Current and historical aerial photographs; and
- Current and historic certificates of title.

The contaminated land investigation identified the following potential activities which could have resulted in ground contamination along the Project alignment:

- Fly tipping has occurred at locations along existing SH3, particularly at the summit rest area;
- Farm dumps at the rural properties at the northern and southern ends of the Project alignment are likely. Illegal dumping of material has been reported;
- Storage of fuels, chemicals and wastes associated with farming operation; and
- Possible structures containing asbestos-containing materials (ACM).

There have also been reports of spills along existing SH3 where accidents have happened.

Based on this assessment, there is potential for activities to have occurred which are listed on the Ministry for the Environment's (MfE) Hazardous Activities and Industries List (HAIL). If encountered during construction, contaminated soils can present a risk to human health and the environment.

The potential effects of the contaminating activities are likely to be isolated to near surface soils, which are likely to be removed during construction activities. The Contaminated Land Assessment concludes that it is highly unlikely for any contamination to be at a sufficient level to pose a risk to human health and the environment upon completion of the construction works.

To address the risk posed by contaminated soils encountered during construction a CLMP will be prepared (a draft CLMP is presented in Volume 5). The CLMP will address the management, monitoring and reporting requirements with respect to contaminated land encountered during construction.

Overall, the potential adverse effects of the Project on human health and the environment, with the implementation of the CLMP are considered to be no more than minor.

## 9.15.5 Effects of land disturbance activities and construction related water discharges

### 9.15.5.1 Introduction

This section considers the effects of land disturbance activities (earthworks and vegetation clearance) associated with Project construction. It includes consideration of the erosion and sediment control measures that will be used to minimise sediment discharges from construction stormwater. A detailed assessment of construction water discharges is presented in Technical Report 13 (in Volume 3) and management methods are described in the CWMP in Volume 5 and in the erosion and sediment control drawings in Volume 2 (Drawings MMA-DESESC-C0-DRG-1000 to 1010 and 4001 to 4008).

As described in Sections 8.3.4, the Project is located within a sensitive area, with high quality indigenous terrestrial and aquatic flora and fauna. The local geology is dominated

by papa mudstone, which has a large influence on stream substrate and sediment loadings. Stream bed gravels are soft and the stream environments are subject to relatively high natural sediment loads from the associated catchments.

The topography of the area is characterised by steep slopes (typically greater than 20%), and areas of valley floor with slopes typically less than 10%. In general, the Project is located within the lower slopes above the valley floor, to avoid both the steeper slopes and the wetter valley floor environment.

#### 9.15.5.2 Erosion and sediment controls

Erosion and sediment controls for the Project are outlined in the CWMP and will involve the interception and treatment of sediment-laden runoff from the various construction areas along the Project. The controls will be carried out in accordance with the Transport Agency and Taranaki Regional Council land disturbance guidelines.

The erosion and sediment control measures proposed for the Project will be designed to minimise the extent of soil erosion and manage any resultant sediment yield. Erosion control will be the highest priority in the design of Project erosion and sediment control measures as it prevents sediment generation in the first instance. This is particularly important when considering the steep existing slopes associated with the Project.

The general sediment control measures to be used on the Project are:

- Sediment retention ponds;
- Decanting earth bunds;
- Container impoundment systems;
- Silt fences and filter socks; and
- Chemical treatment (use of flocculants).

The CWMP (refer Volume 5) sets out the methods that will be in place to manage all land disturbance aspects of construction, summarised as follows:

- **Vegetation removal** – Prior to undertaking any vegetation removal that creates an erodible surface, erosion and sediment control measures that apply to the subsequent earthworks operation shall be installed.
- **Haul roads and access tracks** – where roads or tracks might become sources of sediment, dirty water diversion drains will be constructed on each side of road to receive and direct runoff to a treatment device.
- **Stockpiles** – SCWMPs will be prepared for temporary stockpile sites which shall identify locations, setbacks from watercourses, clean and dirty water diversions, treatment devices, and dust control methods.
- **Spoil disposal sites** – Erosion and sediment controls will be installed for all spoil disposal sites and will comprise a dedicated treatment device (a sediment retention pond or decanting earth bund), bunding and silt fences to contain all saturated soils or other wet materials (if any), permanent stream diversions within the disposal site, and clean water diversion drains.
- **Construction yards** – controls will comprise silt fences installed around the perimeter of the yard during the yard establishment phase of works (if necessary), stabilised

construction entrances, dirty water diversion drains as required to intercept and divert runoff to a dedicated treatment device, clean water diversions around the upslope perimeter.

- **Stream works** (culverts, diversions – both temporary and permanent) – will comprise both offline diversion, constructed in the dry before the stream diversion takes place (most diversions), and online diversions only in the steeper gullies. For each diversion a SCWMP will be prepared detailing the sequencing and controls required.
- **Bridge construction** – A SCWMP will be prepared for the bridge construction works. Methods will include: treatment of dirty water in a treatment device, super silt fences around and below the bridge abutment and pier locations but above the stream bank profile, pumping any sediment laden or cement laden water within the abutment and pier excavations to the nearest treatment device for pH or to a sucker truck for removal.
- **Tunnel construction** – A SCWMP will be prepared for tunnel construction works. This will address requirements for yards or access associated with tunnel construction. Significant groundwater is not expected to be encountered during tunnelling. Any drainage will be collected and treated in a treatment device. Drainage from concreting activities collected and treated for pH control (where required).
- **Bulk earthworks** – construction water management and erosion and sediment control measures for the bulk earthworks stage of the Project will include measures specific to the site and stage of works, and will include:
    - Decanting earth bunds.
    - Silt fence and super silt fences.
    - Where practical, clean water diversion channels, bunds and checks to separate clean water from sediment laden water, progressively installed as works proceed.
    - Sediment retention ponds.
    - Progressive and rapid stabilisation of disturbed areas throughout the Project. Stabilisation will particularly apply at stockpile areas and batter establishment to reduce both erosion and dust generation.

#### 9.15.5.3 Effects of construction water discharges

Construction of the Project will occur over a total area of approximately 36 hectares. Of this, 19 hectares comprises the proposed road alignment and 17 hectares the works to enable construction (e.g. access, spoil disposal sites, laydown and yards).

Approximately 890,000m$^3$ of excavated (cut) material will be generated from the site and some 835,000m$^3$ of material will be placed in fill embankments on-site. As such, excess fill will be created and disposed of within the designation boundaries either in disposal sites or embankments.

The discharge of sediment laden runoff from disturbed land to aquatic environments has the potential to result in adverse effects on associated flora and fauna through reduced water quality conditions and smothering of habitats. The measures summarised above and

described in the CWMP are designed to reduce sediment losses from disturbed areas during construction.

Sediment yield estimates have been prepared for losses anticipated for the earthworks areas using similar calculations applied on other Transport Agency projects in similar geologies[64]. Yields have been established for the Project in relation to the two catchments draining the Project area, being the Mangapepeke (which is part of the wider Tongaporutu cachment) and the Mimi catchments. Estimates have also been prepared for the natural sediment yield for these catchments. The estimates are for the catchment area draining to the extent of the works site (i.e. from a relatively small catchment area where the Project footprint makes up a significant portion of the overall catchment to that point) and for the wider catchment area at the coastal margin (i.e. a much larger catchment area within which the Project footprint is very small). Results are presented in Table 9.11 below.

**Table 9.11 – Comparative Sediment Yield**

| Catchment | | Catchment area (ha) | Project Earthworks (ha) (% catchment area) | Potential Sediment Yield from Earthworks (tonnes) | Potential Natural Sediment Yield from Catchment (tonnes) | % increase in Sediment Yield |
|---|---|---|---|---|---|---|
| Tongaporutu Catchment | To Project extent | 332.4 | 24.6 (7.4%) | 1207 | 2,625 | 46% |
| | To coast | 21,237 | 24.6 (0.12%) | 1207 | 167,770 | 0.7% |
| Mimi Catchment | To Project extent | 978.4 | 11.4 (1.2%) | 560 | 7,729 | 7.2% |
| | To coast | 13,235 | 11.4 (0.09%) | 560 | 104,550 | 0.5% |

The analysis shows that the significance of the potential Project sediment yield, relative to natural yield from the catchment, reduces markedly with progression downstream in response to inflows and contributions from the wider catchment land area. In the Mangapepeke, as the Project area represents a larger proportion of the catchment, the percentage increase in sediment yield is more significant. In the Mimi the contribution is less significant at the edge of the Project footprint given the large size of the upstream contributing catchment.

Available baseline water quality information indicates that both the Mangapepeke (and downstream Tongaporutu) and Mimi streams carry a relatively high sediment load during storm events. The assessment of freshwater ecology (Technical Report 7b) concludes that provided best practice erosion and sediment controls are in place during land disturbing activities as described above and in the CWMP, any adverse effects on receiving environments can be appropriately mitigated. Some sediment is likely to be discharged from areas of works during rainfall events, but this will generally occur when the streams are under higher flows and receiving sediment from other sources in the catchment. Given the natural conditions that exist, and assuming best practice erosion and sediment control

[64] In particular, the Puhoi to Warkworth Project.

as described in the CWMP, the effects of construction discharges on receiving environments should be no more than minor.

### 9.15.6 Effects of construction on groundwater

Construction activities may encounter groundwater in the underlying rock during excavation works for the cuttings and in the tunnel. While only limited groundwater monitoring information is available from the geotechnical investigations completed to date, the underlying papa rock is known to have low groundwater transmissivity rates. If groundwater is encountered during excavations limited seepage will occur from the cut faces and from the tunnel excavation.

At the cuttings, it is anticipated that a number of perched water tables will be present within the coarser sandstone layers, with limited vertical hydraulic connectivity through the finer-grained mudstone and clayey siltstone beds. Based on the available information, preliminary modelling of possible groundwater seepage from the road cuttings indicates that in the order of 10 to 30$m^3$/day of groundwater could drain from the combined total area of cut faces along the Project alignment.

Significant groundwater inflow to the tunnel is not anticipated based on the available hydrogeological information. Preliminary modelling indicates in the order of 10$m^3$/day of groundwater inflow is possible for the fully excavated tunnel.

General lowering of groundwater levels within the bedrock as a result of the proposed tunnel and rock cuttings is not expected to have any significant impact on the moisture availability for vegetation on the slopes beyond the construction works. This is expected to be controlled primarily by pore water held in the near-surface soils replenished by direct precipitation, rather than root systems reaching down to deeper groundwater sources. However, groundwater lowering and a reduction in moisture availability will occur locally within the soils along the top of cuttings, which may impact on vegetation in the areas affected. Similarly, any ground settlement that occurs as a consequence is not expected to be noticeable and will not result in adverse effects.

There are no know users of groundwater in the vicinity of the tunnel or cuttings. Accordingly the taking and diverting of groundwater from these locations will have no effect on groundwater users.

Overall the effects of construction on groundwater levels or groundwater drawdown are expected to be negligible.