NZ TRANSPORT AGENCY
WAKA KOTAHI

Roads of national significance

Ara Tūhono – Pūhoi to Wellsford

FURTHER NORTH

Pūhoi to Warkworth

Assessment of Environmental Effects

August 2013

Ara Tūhono – Pūhoi to Wellsford Road of National Significance

Pūhoi to Warkworth Section

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1. Introduction

1.1 Ara Tūhono Pūhoi to Wellsford Road of National Significance

Ara Tūhono Pūhoi to Wellsford (P-W) Road of National Significance (RoNS) covers the State Highway 1 (SH1) corridor from the Northern Gateway Toll Road at the Johnstone's Hill tunnels, to just north of Wellsford. The name reflects "the connecting pathways" and has been adopted by the New Zealand Transport Agency (NZTA) with the endorsement of local iwi groups.

1.2 Roads of National Significance

The Government has identified seven essential State highways that are linked to New Zealand's economic prosperity. Improvements are required to these highways to provide for the safe and efficient movement of people and freight between and within New Zealand's five main centres. These highway projects are being delivered by the NZTA over a 10 year period from the announcement of the RoNS in 2009. The Government anticipates that the RoNS will be largely completed by the year 2020.

The RoNS programme represents one of New Zealand's biggest infrastructure investments and is a key part of the Government's National Infrastructure Plan and its Policy Statement on Land Transport Funding. These documents provide the basis of the investment priorities outlined in NZTA's National Land Transport Programme (NLTP).

1.3 The Project

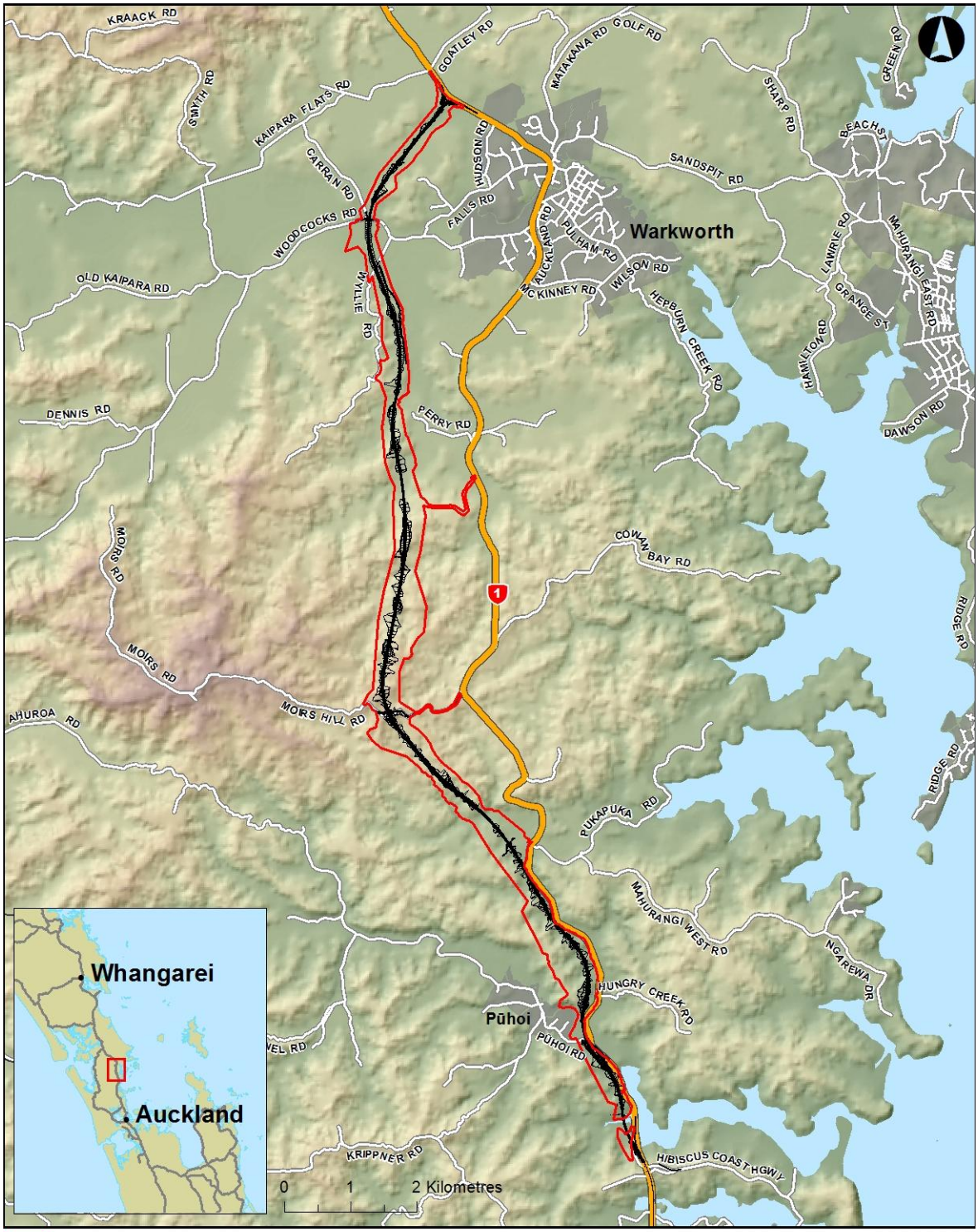
The Pūhoi to Warkworth section (the Project) is the first of two stages of the Ara Tūhono P-W RoNS. The Warkworth to Wellsford section of the Ara Tūhono P-W RoNS will be progressed as a separate project, which is not precluded by the Project.

The Project will provide a new and alternative alignment to the existing SH1 route between the northern termination of the Northern Gateway Toll Road (NGTR) at the Johnstone's Hill tunnels, and SH1 just south of the Kaipara Flats Road intersection, which lies to the north of Warkworth.

The Project will be separate from the existing SH1 (ie off-line), traversing land to the west of the existing State highway and will bypass Warkworth on the western side. The existing SH1 will remain as an alternative route to the new motorway.

The total length of the Project's indicative alignment is 18.5km and will comprise a four-lane dual carriageway motorway. The carriageways will be divided by a central median with a safety barrier, and will be built to motorway design standards.

Refer to Figure 1-1 below for a map of the indicative alignment.



Proposed Designation Boundary

Indicative Alignment

Figure 1-1: Indicative alignment

A full description of the Project is contained in Section 5 of this Report.

1.4 The New Zealand Transport Agency (NZTA)

The NZTA, as a network utility operator under the Resource Management Act 1991 (RMA), is a requiring authority as defined by section 166 of the RMA. The Gazette Notice reference confirming NZTA's status as a requiring authority under section 167 of the RMA is contained in Appendix A to this report. The NZTA replaced Transit New Zealand as the requiring authority approved by this Gazette Notice under clause 29 of Schedule 2 of the Land Transport Management Amendment Act 2008.

The NZTA, in its capacity as a requiring authority, is lodging Notices of Requirement (NORs) and resource consent applications for the construction, operation and maintenance of the Project. These matters are being lodged with the Environmental Protection Authority (EPA) as the NZTA consider them to be part of a proposal of national significance.

1.5 Functions of the NZTA

The functions of the NZTA are defined in section 95(1) of the Land Transport Management Act 2003 (LTMA), and those of relevance to the Project include:

> Section 95(1)(a) - *"to contribute to an effective, efficient, and safe land transport system in the public interest*" and
>
> Section 95(1)(c) - *"to manage the State highway system, including planning, funding, design, supervision, construction, and maintenance and operations, in accordance with this Act and the Government Roading Powers Act 1989."*

In undertaking these functions, the NZTA is required under section 96 of the LTMA to exhibit a sense of social and environmental responsibility, use revenue in a way that seeks value for money, and ensure that revenue and expenditure are accounted for in a transparent manner.

1.6 Assessment methodology

This report, and the supporting information contained in the Assessment Reports (Volume 3) and Drawings (Volume 4), has been prepared in accordance with the requirements of sections 88 and 168 and the Fourth Schedule of the RMA to support the NORs and resource consent applications for the operation, construction and maintenance of the Project.

The Assessment of Environmental Effects (AEE) and Assessment Reports have been derived from detailed investigations to identify an appropriate corridor and indicative alignment, environmental and engineering investigation, public and stakeholder consultation and refinements of design to accommodate environmental constraints in a manner that will ensure that any adverse effects, within reason, are minor or able to be appropriately mitigated within the boundary of the proposed designation.

The indicative alignment is an alignment that can be constructed within the designation, including all ancillary components, such as spoil locations and stormwater wetland treatment devices. The

alignment constructed will be confirmed at the detailed design stage, will comply with the conditions of consent and designation, and will need to go through the RMA's outline plan of works process. The Assessment Reports have been prepared in consideration of the OPW process and reflect an assessment of the alignment in the indicative configuration, with due consideration including sensitivity testing for alternate positions within the proposed designation boundary.

1.7 The Notices of Requirement

The NZTA is lodging two NORs:

1. One for the new designation from the Johnstone's Hill tunnels to just south of the Kaipara Flats Road intersection, north of Warkworth. The extent of the designation proposed is sufficient to construct the Project, and includes land for access to construction sites and construction yards. Once the Project is operational the NZTA will rationalise the designation boundary; and

2. One to alter the existing SH1 designation (Auckland Council District Plan – Operative Rodney Section 2011 (ACDP) reference 401) at the Johnstone's Hill tunnels to accommodate the Project's tie-ins to the Hibiscus Coast Highway and to ensure on-going compliance with the designation conditions in the ACDP reference 401.

Designation 401 and the proposed designation are shown on Figure 1-2. The existing NZTA designations are shown for completeness. A full set of plans showing the designation boundaries and other drawing details is contained in Volume 4 of this AEE (refer Drawings R-100 – R-115).

SH1 has an existing designation (ACDP reference 404). The new designation will sit immediately adjacent to the existing SH1 designation until the indicative alignment heads inland at approximately Mahurangi West Road intersection. Some short lengths the existing designation will overlap the new designation for construction purposes, for example at the Pūhoi Viaduct where the current designation alignment cannot be relied on to facilitate the construction of the piers. There are no conditions attached to Designation 404.

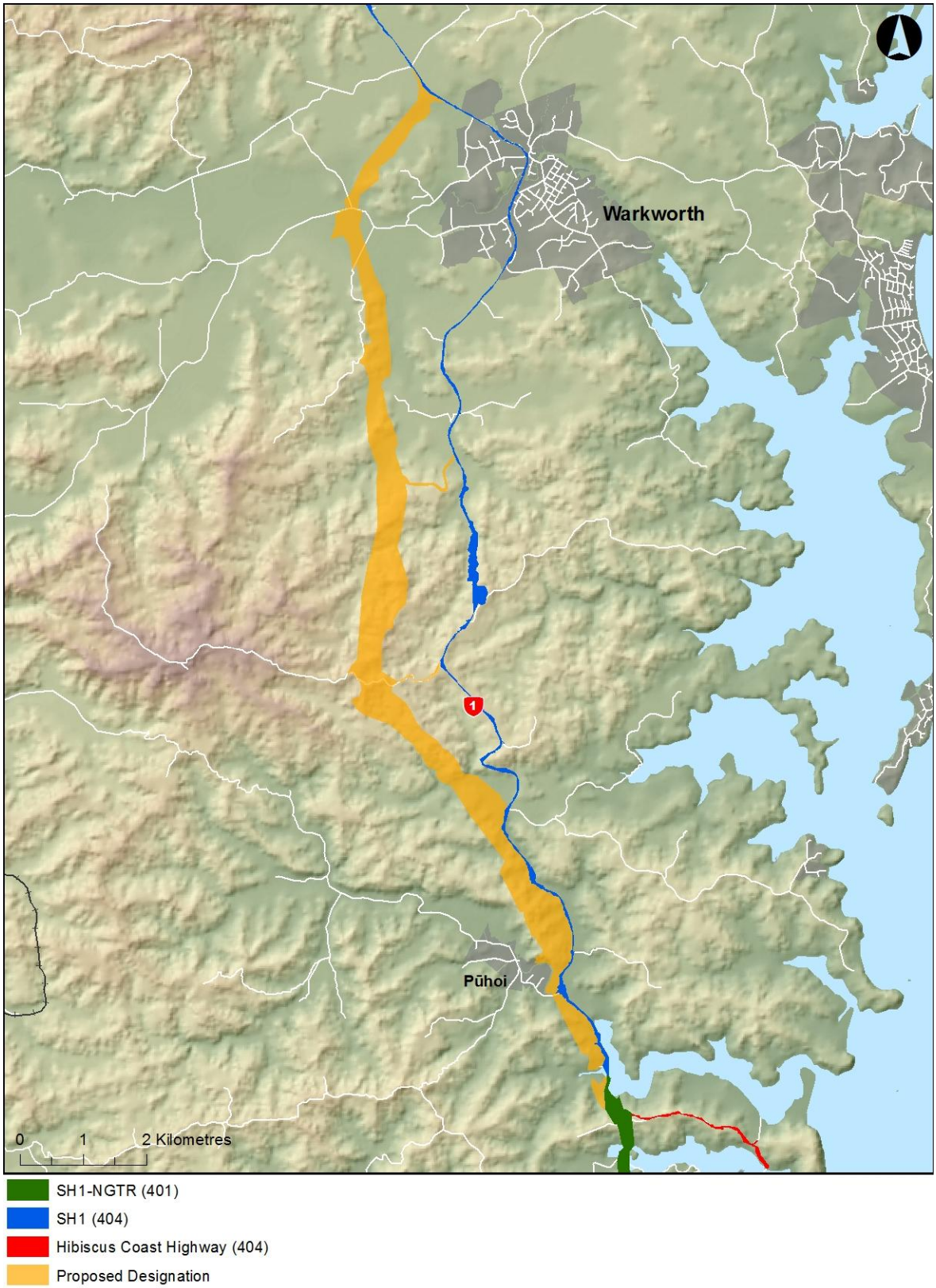


Figure 1-2: Existing and proposed designations

1.8 Resource consents

Resource consents are required pursuant to the following Regional Plans:

- Auckland Regional Plan: Air, Land and Water 2012 (ARP:ALW)
- Auckland Regional Plan: Coastal (ARP:C); and
- Auckland Regional Plan: Sediment Control (ARP:SC).

The NZTA is applying for resource consents for the construction, operation and maintenance of the Project as follows:

- Project wide consent for bulk earthworks;
- Catchment consents for discharge of stormwater from the operation of the built motorway (construction and operation);
- Catchment wide consents for stream works (construction and operation);
- Coastal Consents (construction, use and occupation) and mangrove clearance;
- Site specific consents for the discharge of contaminants from an industrial or trade process.
- Site specific consents for stormwater treatment and discharge from Moirs Hill Road; and
- Site specific consents for access from SH1 into construction area (just south of Perry Road).

Table 1- 1 outlines the groups of activities for which resource consent is sought.

Table 1-1: Resource consents sought for the Project

EPA ref number	Consent type	Activity	Regional rule	Activity class
33/003	Land use consent (s9 RMA)	The use of land for land disturbing activities, including earthworks, roading, tracking and trenching	ARP:SC Rule 5.4.3.1	Restricted Discretionary Activity
33/004	Discharge permit (s15 RMA)	The discharge of stormwater to water as a result of activities undertaken by a highway network operator within the Pūhoi catchment	ARP:ALW Rule 5.5.13	Discretionary Activity
33/005	Land use consent (s13 RMA) and water permit (s14 RMA)	Use, placement and erection of structures in, on, under, or over the bed of the Pūhoi River and its tributaries for the purposes of a river crossing(s), pipe culverts, bridges and associated erosion control structures and stormwater outlet structures, and any associated diversion of water	ARP:ALW Rule 7.5.12	Discretionary Activity
33/006	Water permit (s14 RMA)	Diversion of groundwater	ARP:ALW Rule 6.5.77	Restricted Discretionary Activity
33/007	Discharge permit (s15 RMA)	The discharge of stormwater to water as a result of activities undertaken by a highway network operator within the Mahurangi catchment	ARP:ALW Rule 5.5.13	Discretionary Activity

EPA ref number	Consent type	Activity	Regional rule	Activity class
33/008	Land use consent (s13 RMA) and water permit (s14 RMA)	Use, placement and erection of structures in, on, under, or over the bed of the Mahurangi River and its tributaries for the purposes of a river crossing(s), pipe culverts, bridges and associated erosion control structures and stormwater outlet structures, and any associated diversion of water	ARP:ALW Rule 7.5.12	Discretionary Activity
33/009	Coastal permit (s12 RMA)	Erection, placement, alteration, extension, removal or demolition of structures or any part of a structure that is fixed in, on, under or over the foreshore or seabed within the coastal marine area	ARP:C Rule 12.5.22	Non-complying Activity
33/010	Coastal permit (s12 RMA)	Undertake an activity, being the operation of the state highway	ARP:C Rule 11.5.5	Discretionary Activity
33/011	Coastal permit (s12 RMA)	Occupation of part of the coastal marine area	ARP:C Rule 10.5.10	Non-complying Activity
33/012	Coastal Permit (s12 RMA)	Disturbance including removal of mangroves in the CPA1 and use of motor vehicles in CPA1	ARP:C Rules 16.5.23 and 16.5.24	Non-complying Activity
33/013	Water permit (s14 RMA) and discharge permit (s15 RMA)	Augmenting existing culverts draining road side drains under SH1 in vicinity of Hungry Creek	ARP:ALW Rule 5.5.13	Discretionary Activity
33/014	Water permit (s14 RMA) and discharge permit (s15 RMA)	Widening of Moirs Hill Road and increasing impervious surface by between 5,000m2 and 10,000m2	ARP:ALW Rule 5.5.3	Restricted Discretionary Activity
33/015	Water permit (s14 RMA) and discharge permit (s15 RMA)	Discharge from construction access through 1509 State Highway 1 (Lot 1 DP321568) from SH1 just south of Perry Road into the alignment	ARP:ALW Rule 5.5.13	Discretionary Activity
33/016	Discharge permit (s15 RMA)	Discharge of contaminants to land and/or water from an industrial or trade premises being a precast concrete yard	ARP:ALW Rule 5.5.18	Restricted Discretionary Activity
33/017	Discharge permit (s15 RMA)	Discharge of contaminants to air from a mobile rock crusher	ARP:ALW Rule 4.5.58	Restricted Discretionary Activity

1.9 Outline plan of works

The possible construction methodology for the Project (refer to Section 6) demonstrates that the Project works can be undertaken within the proposed designation. The final design for the Project will be developed when a contractor is procured to undertake the works. At the completion of detailed design and prior to construction starting, the NZTA will submit an outline plan of works (OPW) to Auckland Council under section 176A of the RMA that will outline the detailed design elements of the Project.

An OPW will detail the following information in accordance with section 176(3) of the RMA:

- the height, shape, and bulk of the public work, project, or work;
- the location on the site of the public work, project, or work;
- the likely finished contour of the site;
- the vehicular access, circulation, and the provision for parking;
- the landscaping proposed; and
- any other matters to avoid, remedy, or mitigate any adverse effects on the environment.

The OPW will provide details of the potential effects and proposed mitigation measures in relation to (but not limited to) the following:

- Construction noise;
- Operational noise (including any mitigation measures necessary to achieve relevant noise standards);
- Vibration (including where precondition surveys are proposed to be undertaken);
- Visual and landscape (including design plans and mitigation); and
- Construction traffic.

The OPW approach will allow for a more comprehensive confirmation of the mitigation of any potential effects once design has progressed and a construction methodology has been finalised.

NZTA is proposing to engage with specific communities prior to finalising the detail to be submitted in the OPW. This engagement will enable community consideration (at a local level) of landscaping and urban design details, noise mitigation (if any needed) and information relating to communication during construction.

The OPW may be submitted in stages, or to represent specific elements of the Project, and therefore there may be multiple OPWs. The detail within any OPW will have to address the actual or potential effects of the works and how they will be mitigated. For example, the detailed design will necessitate a specific assessment of potential visual effects especially if new structures are introduced and specific mitigation recommended to address these effects. Currently, the assessment is based on generic design elements with generic responses, but with the knowledge that the potential effects can be adequately mitigated.

On lodgement of the OPW, Auckland Council will review the details as provided and may request changes before construction is commenced. Auckland Council would typically request changes to ensure that conditions of designation are met. The NZTA may then accept or reject the requested changes. The Council has a right of appeal to the Environment Court if the changes are not accepted.

1.10 Additional consents

As the AEE is based on an indicative alignment and a possible construction methodology with a contractor yet to be procured and detailed design undertaken, additional approvals may be required. Such approvals could include:

- Consents for surface and/or groundwater water take and use for dust suppression or other water use required for the construction of the Project;
- Consents required for a concrete batching plant, such as the discharge of contaminants to air, land or water from an industrial or trade process;
- Consents for the discharge of sewage wastewater from site offices and work sites;
- Consent for the discharge of contaminants to land or water from contaminated land that is undergoing disturbance or remediation;
- Consent for the disturbance of contaminated land under the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health;
- Historic Places Act Authority from the New Zealand Historic Places Trust to damage or modify any registered archaeological sites;
- Wildlife Act Authority to relocate any protected species prior to the commencement of construction; and
- Authority under the Freshwater Fisheries Regulations relating to fish passage.

1.11 Structure of this report

The documentation to support the NORs and resource consent applications is contained within four volumes. These are:

Volume 1: NORs and resource consent applications

Volume 2: Assessment of Environmental Effects (this Volume)

Volume 3: Assessment Reports

Volume 4: Drawing Set

A complete glossary of terms and acronyms used in this AEE is attached in Appendix B.

2. Justification for the Project

This Section provides background to the Project and sets out the following:

- The need for the Ara Tūhono P-W RoNS and the Project;
- The development of the Project;
- The strategic context of the Ara Tūhono P-W RoNS and the Project; and
- The benefits of the Project.

2.1 Need for the Ara Tūhono P-W RoNS

Over the last decade, the NZTA has carried out a series of studies on the State highway network connecting the Auckland and Northland Regions. These studies have considered the role of the State highway network in relation to the wider transport system between Auckland and Northland.

As the main inter-regional route connecting the Auckland and Northland regions, SH1 provides a vital lifeline connecting the Far North to Whangarei, Auckland and beyond. SH16 provides an alternative route between Auckland and Wellsford.

A reliable, secure and efficient State highway network is required to provide local, regional and national transport connections.

The NZTA's strategic studies and investigations of the State highway network, including the 'SH1/SH16 Auckland to Wellsford Strategy Study'[1], 'Auckland to Whangarei Strategic Assessment: Strategic Context Report'[2] and the 'Draft Auckland to Whangarei Network Plan'[3], have identified a number of key issues in relation to the State highway network connecting Auckland and Northland including:

- Limited network resilience;
- Safety of the network;
- The efficient movement of freight;
- Accessibility; and
- The capacity of the existing network to accommodate anticipated population growth.

In order to outline the need for the Project, the following discussion also considers the wider Ara Tūhono P-W RoNS context.

2.1.1 Current resilience

From north of the NGTR to south of Warkworth, SH1 is primarily a single carriageway, two-lane rural highway with some passing lanes. The SH1 corridor follows the undulating landform of the surrounding area, with some particularly winding and steep sections. The terrain through which the existing highway passes includes numerous areas of instability, particularly at Schedewys Hill (shown in Photo 2-1) and along Windy Ridge.

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[1] NZ Transport Agency 2008, *SH1/16 Auckland to Wellsford Strategic Study*, prepared by Sinclair Knight Mertz

[2] NZ Transport Agency 2010a, *Auckland to Whangarei Strategic Assessment*, prepared by Sinclair Knight Mertz

[3] NZ Transport Agency 2010b, *Draft Auckland to Whangarei Network Plan*, prepared by Sinclair Knight Mertz

Photo 2-1: SH1 – Schedewys Hill

The existing SH1 route experiences closures several times a year as a result of events, such as crashes, flooding or slips blocking the road. Sections of the network that experience regular closures due to serious or fatal traffic incidents are outlined in the Traffic and Transport Assessment Report and Section 2.1.2 below. The section of the SH1 extending northwards from the base of Schedewys Hill over a distance of approximately 5km has been subject to landslips following periods of sustained rainfall. A number of landslips to affected SH1 in 2008 and 2009[4]. In the event of a natural disaster affecting the current SH1, Northland could be isolated from Auckland for an extended period of time.

SH16, which is located approximately 20km to the west of the existing SH1 between Pūhoi and Warkworth, provides an alternative route for traffic on SH1 between Auckland and Wellsford. It extends from the Port of Auckland in the central city to the west coast then north-east to Wellsford, where it connects to SH1. The North Western Motorway (historically the Auckland – Kumeu Highway) forms part of the SH16 route.

Like SH1, SH16 provides limited resilience and route security for the wider State highway network between Auckland and Northland. SH16 is, in general, a single carriageway route and prone to instability and flooding issues similar to SH1. SH16 is generally of lower geometric standard than SH1 between Auckland and Warkworth, and over 20km longer between Pūhoi to Warkworth than the current SH1. SH16 typically carries small volumes of longer distance traffic.

North of the NGTR, SH1 serves Pūhoi, Warkworth, and the beach communities located east of Warkworth, including Leigh, Omaha, Sandspit, Snells Beach and Mahurangi East. The additional

[4] NZTA, 2010, *Pūhoi to Wellsford Scheme Assessment Pūhoi to Warkworth Preliminary Geological and Geotechnical Appraisal*

settlements of Ahuroa (west of Pūhoi) and Mahurangi West also access SH1. SH16 does not serve communities, but instead predominantly provides access for development near the highway and acts as a strategic relief route in the event of an incident on SH1 and an alternative northbound route during peak holiday periods.

2.1.2 Safety of the network

Several sections of the existing SH1 corridor north of the Johnstone's Hill tunnels have a poor safety performance. Serious incidents on the network, such as fatal head-on collisions, can result in SH1 being temporarily closed and traffic being required to use extensive detours.

The section of SH1 between the NGTR and Warkworth intersects with a number of local roads. Not all of these intersections are provided with adequate acceleration and deceleration lanes on SH1, which increases the potential for conflicts between traffic on SH1 and traffic on local roads. Such conflicts, combined with the steep grades, tight corners and restricted sightlines along SH1 contribute to a crash rate higher than the national average on the State highway network.

The section of SH1 between Valerie Close and McKinney Road (approximately 1.6km in length) is an identified crash black spot[5] with the greatest number of serious and fatal crashes along the network between Pūhoi and Warkworth (two fatal and two serious crashes between 2008 and 2012 as outlined in Section 3.5 of the Transportation and Traffic Assessment Report). The Schedewys Hill section of SH1 (shown in Photo 2–2), to the north of Mahurangi West Road, is another crash black spot[6] and the road between Mahurangi West Road and Hungry Creek Road has also experienced two fatal crashes from 2008 to 2012.

Photo 2-2: Looking south towards Schedewys Hill along Windy Ridge

[5] NZTA, 2010, Auckland Region State Highways Road Safety Report 2005 to 2009

[6] New Zealand Crash Analysis System (CAS) database

A total of 65 injury crashes have occurred during the past five years (2008 to 2012) over the section of SH1 between Pūhoi and Warkworth, with a further 174 accidents classified as non-injury (as noted in Section 3.5 of the Transportation and Traffic Assessment Report). The New Zealand Road Assessment Programme KiwiRAP[7] ranks the section of SH1 between the NGTR and Warkworth 16th riskiest in terms of collective risk across the national State highway network for the 2007-2011 period.[8]

With anticipated population growth along the SH1 corridor between Pūhoi and Warkworth and increased traffic volumes in the future (discussed below), accident exposure rates and the likelihood of crashes will also increase. While the NZTA has made some safety improvements along the route in recent years, the NZTA's ability to achieve reductions in the frequency and severity of crashes along this section of SH1 is constrained by the geometry of the route.

2.1.3 Traffic volumes and travel time reliability

The 2012 Average Annual Daily Traffic (AADT) volume is approximately 17,400vpd for SH1 between Pūhoi and Warkworth (refer to Section 3.2.1 of the Transportation and Traffic Assessment Report). There are pronounced peaks in traffic flows coinciding with weekends and public holidays, particularly in the summertime when the beach settlements east of Warkworth attract people from Auckland and beyond.

Congestion resulting in increased travel times and reduced travel time reliability is already a problem along the SH1 corridor north of Auckland, particularly at Warkworth where congestion regularly occurs during weekday evening commuter peak periods. More severe congestion is experienced when incidents such as crashes or slips occur, or during weekends or holiday periods, the latter due to an increase in both long distance through trips and local traffic travelling within and through Warkworth resulting in in higher traffic volumes.

If no capacity improvements are provided on the State highway network between Pūhoi and Warkworth, travel times in the corridor as a whole are forecast to increase significantly as traffic volumes on SH1 increase in the future. Traffic volumes on the existing section of SH1 between Pūhoi and Warkworth are anticipated to grow by approximately 4% per annum to the year 2026 and be in the order of approximately 25,000vpd (refer to Section 3.2.1 of the Transportation and Traffic Assessment Report). Increasing travel times have an adverse impact on the efficiency of general traffic and freight movements along the corridor.

Travel time variability or journey time reliability affects both individuals and businesses. With higher levels of traffic demand, travel times, along with the variability of travel times, increase. Under such conditions, the consequences of any incidents or disruptions to traffic flow are magnified, with greatly increased travel times. In addition, if there is a high degree of variability, people are not able to plan their travel with certainty.

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[7] A road safety partnership between the Automobile Association and New Zealand's main transport agencies: the NZTA, Ministry of Transport, Accident Compensation Commission and New Zealand Police

[8] 2012 KiwiRAP Risk Mapping National Summary, from www.kiwirap.org.nz

In such situation, commercial traffic must allow longer times in journey planning, which reduces the number of movements that can be made by each driver and vehicle, in turn increasing fleet requirements and impacts on the efficient movement of freight.

The variability or uncertainty of travel times in the SH1 corridor is likely to become a significant issue in the future as traffic volumes and travel times increase.

2.1.4 Efficient movement of freight

As the main inter-regional route between Northland and Auckland, the existing SH1 has an important function in providing freight access between Auckland and Northland, and as such, carries a significant volume of freight movements.

The Northland Region is a major producer of basic commodities, including milk and dairy products, meat, logs and timber products, aggregates and other building materials. In addition, a number of consumer goods and inputs to manufacturing in Northland and north Auckland are sourced from the Auckland Region.

Whangarei contains the country's most northern deep water port (Northport), which handles the movement of bulk products, the import of crude petroleum for use in the adjacent oil refinery (Marsden Point) and the export of refined petroleum products for distribution across New Zealand. The port also handles timber logs for international markets.

These industries are heavily reliant on an efficient transport network to provide reliable access for people and freight to markets in the Auckland Region and beyond. As such, the provision of reliable freight links is an integral part of servicing the economies of the Northland and Auckland Regions.

SH1 currently carries a significant volume of freight traffic, (as can be seen in Photo 2-3 below) with an average of 7% heavy commercial vehicles (HCVs) along the route between Pūhoi and Warkworth. This proportion of freight traffic is similar to that seen on Auckland's Southern Motorway between Manukau and the SH2 interchange[9]. Movement by road is the main means of transport for freight between Auckland and Northland. The National Freight Demands Study (NFDS)[10] attributes 86%[11] (or 4.2M tonnes) of the freight volume crossing the Auckland-Northland regional boundary to road transport. The volumes moved by rail and coastal shipping being small at 3% and 11% respectively, and these are unlikely to increase significantly in the future. The movement of freight, and the activities it supports, is therefore highly dependent on the quality and reliability of SH1.

[9] HCV volumes taken from NZTA's Traffic Monitoring System (TMS) database

[10] Ministry of Transport, NZ Transport Agency and Ministry of Economic Development, 2008, *National Freight Demands Study*

[11] Includes only transport related modes and excludes the 24% of the total interregional freight market transported via oil pipeline

The NFDS expects that by 2031, freight volumes between Northland and Auckland will increase by 84% to 9M tonnes[12]. It also predicts that freight movements originating or terminating in Northland will increase by 34% to 41M tonnes.

One of the key issues with the current SH1 is the variable and generally low standard of SH1 north of Pūhoi. The number of steep and windy sections along the current State highway, particularly the section between Pūhoi and Warkworth, inhibits the effective and efficient movement of vehicles, particularly HCVs. The slow movement of HCVs, combined with limited passing lanes, can cause long delays between Pūhoi and Warkworth for all users, affecting travel time reliability and the efficient movement of people and goods.

With the predicted increased in road freight volumes, the current State highway network will be under pressure if the NZTA does not provide capacity improvements on the existing SH1.

Movement of freight north of Auckland by rail is constrained by the low standard system of the North Auckland Line (NAL). Rail lines north of Auckland must operate at low speed due to the configuration of the existing infrastructure, thus reducing the efficiency of transporting goods inter-regionally via rail. The proposed Marsden Point branch linking the NAL to Northport may increase the amount of freight transported by rail, though the use of this branch would still be constrained by the existing configuration of the NAL.

Photo 2-3: Traffic on SH1 near Pohuehue Scenic Reserve

2.1.5 Economic development

Economic growth and development is particularly important to the Northland Region due to its historically poor economic performance. Northland's economy has grown more slowly than the

[12] Figures adapted from Table 4.5 and 9.20 of the NFDS

national average over the last 10 years and the gap between Northland's GDP per capita and the national GDP per capita has widened over this 10 year period. Northland lags behind average national economic indicators and is often one of the poorest performing regions in areas such as wage levels, employment rates, labour participation rates and economic growth rates.

The Northland Regional Land Transport Strategy 2010 (NRLTS) indicates that the Northland Region has relatively poor access to Auckland and other parts of New Zealand. One of the key strategic outcomes NRLTS is to ensure that the Region is well connected to Auckland and the rest of New Zealand.

The provision of additional freight capacity on the State highway network will allow the Northland Region to accommodate more development, particularly increased processing activities that can substantially increase revenue associated with timber production, which is expected to grow substantially over the next 20 years. The northern part of the Auckland Region will also benefit from additional freight capacity on the State highway network.

Tourism is a key industry for Northland and areas of north Auckland. Public buses between Auckland and Whangarei are operated by Intercity and Nakedbus, which each run three services daily in both directions, with an additional service on weekend days. These buses stop at Warkworth, Wellsford and Kaiwaka for pre-booked passengers. In addition, a large number of tourist shuttle services run between Auckland and destinations to the north. All bus and shuttle services use the existing SH1 and are therefore subject to the same poor road performance conditions as general and freight traffic.

Providing reliable uncongested routes for tourist travel between the Regions will contribute towards increasing economic development at a local and regional level.

Te Rūnanga-Ā-Iwi-O-Ngāpuhi, which represents all people of Ngāpuhi descent (whose rōhe comprises much of the Northland Region), identifies sustainable economic growth and development as a key strategic direction for the iwi.[13] The Government's Regional Economic Activity Report[14] recognises that Northland has a significant Māori population and the lowest employment rate in the country. It identifies the Ara Tūhono P-W RoNS as a business growth agenda action particularly relevant to Northland, which will accentuate Northland's relationship with Auckland and help to improve Northland's economic potential for upskilling local people and enabling them to participate more fully in the economy.

2.1.6 Population growth

The Auckland Region has experienced rapid growth in recent decades and this trend is predicted to continue. Half of New Zealand's population growth between 2001 and 2006 was in the Auckland Region and the population continues to grow at a faster rate than other regions.[15] Given Auckland's history of rapid population growth, a high growth model used in the Auckland Plan predicts *"a*

[13] Te Rūnanga-Ā-Iwi-O-Ngāpuhi, *Strategic Plan 2009-2014*

[14] Ministry of Business, Innovation and Employment, 2013, *Regional Economic Activity Report*.

population of 2.5 million in 2041"[15] (an increase of approximately 1 million people from the current population).

Both the Northland and Auckland Regions have been identified as areas of existing and anticipated future growth in regional growth strategies and planning documents, including the Auckland Plan 2012, the Whangarei District Growth Strategy 2010, and during discussions with Northland Regional Council, Rodney District Council and Kaipara District Council.[16]

Table 2-1 outlines areas of anticipated growth in the north of the Auckland Region and the Northland Region based on the aforementioned sources.

Table 2-1: Anticipated growth in the northern Auckland area and Northland

Area	Summary of anticipated growth
Pūhoi/ Ahuroa/ Mahurangi/ Warkworth	Warkworth is a rural service town offering a range of retail, commercial, community, industrial and recreational services to a population of approximately 4,400 residents and the surrounding rural and coastal communities. Warkworth and its surrounds are highly dependent on the State highway network for the movement of people, goods and services. The Auckland Plan identifies Warkworth as a Satellite Town, suitable for substantial residential and employment growth, subject to appropriate infrastructure being available, and an important area of future rural growth[17]. Satellite Towns are envisaged as being able to "function independently of the main metropolitan area, provide a range of services to the surrounding rural areas, and develop quality transport links"[18]. The Plan anticipates the population of Warkworth will grow to 20,000 over the next 30 years.
Wellsford and Snells Beach	Wellsford and Snells Beach are both identified in the Auckland Plan as a Rural and Coastal Town. While these areas are "less independent from the main metropolitan area"[18] than the Satellite Towns, and will be less of a focus for substantial intensification or development, they are anticipated to grow substantially in the future to up to 10,000 people.
Kaipara District	The Kaipara District extends from north of Wellsford to the Brynderwyn Hills and has a population of 18,500 people. Mangawhai is the key area of residential growth in the district with access to Kaiwaka, Wellsford and Whangarei. Demand for coastal residential lifestyle opportunities in the District will likely continue and Mangawhai is projected to grow rapidly based on predictions in the Mangawhai Structure Plan. Due to its close proximity, there is potential for Kaiwaka to become a main town servicing Mangawhai and also for growth in niche industries such as cheese making, arts and crafts.

[15] Auckland Council 2012, The Auckland Plan: 26

[16] The Northland region is yet to produce a regional growth strategy. In its absence, advice was provided by Council officers.

[17] Auckland Council 2012, Auckland Plan

[18] Auckland Council 2012, Auckland Plan 2040:235

Area	Summary of anticipated growth
Whangarei District	The Whangarei District extends from the Brynderwyn Hills to north of Whangarei and has the greatest concentration of population in the Northland Region at 74,430 people (2006 census), predicted to increase to 110,000 people by 2041[19]. Northland has seen significant growth in coastal development due to its popularity as a holiday destination. The Marsden Point-Ruakaka area is experiencing unprecedented land development, particularly in the subdivision of land for residential, commercial and industrial purposes. Significant population growth can be accommodated in the inner Whangarei City area with major residential, commercial and industrial land developments proposed for the next 30 to 50 years. The rate of development or take up of subdivided land will depend on global, national and local economic factors, together with the ability of Council to provide adequate infrastructure and services.

Future population growth will likely result in economic and social benefits at the local, regional and national levels. However, this level of predicted growth and additional demand needs to be appropriately managed and provided for to avoid significant adverse impacts on the efficiency of the existing State highway network, which has limited capacity.

Increased population growth in areas accessed from the SH1 corridor between Auckland and Northland will result in increased transport demand along the route, which will increase future congestion unless additional capacity is provided.

2.2 Development of the Project

Development of the Ara Tūhono P-W RoNS and the Project has occurred within the last four years. Key stages in the development of the Project are shown in Figure 2-1.

[19] Whangarei District Council, *Whangarei District Growth Strategy: Sustainable Futures 30/50*

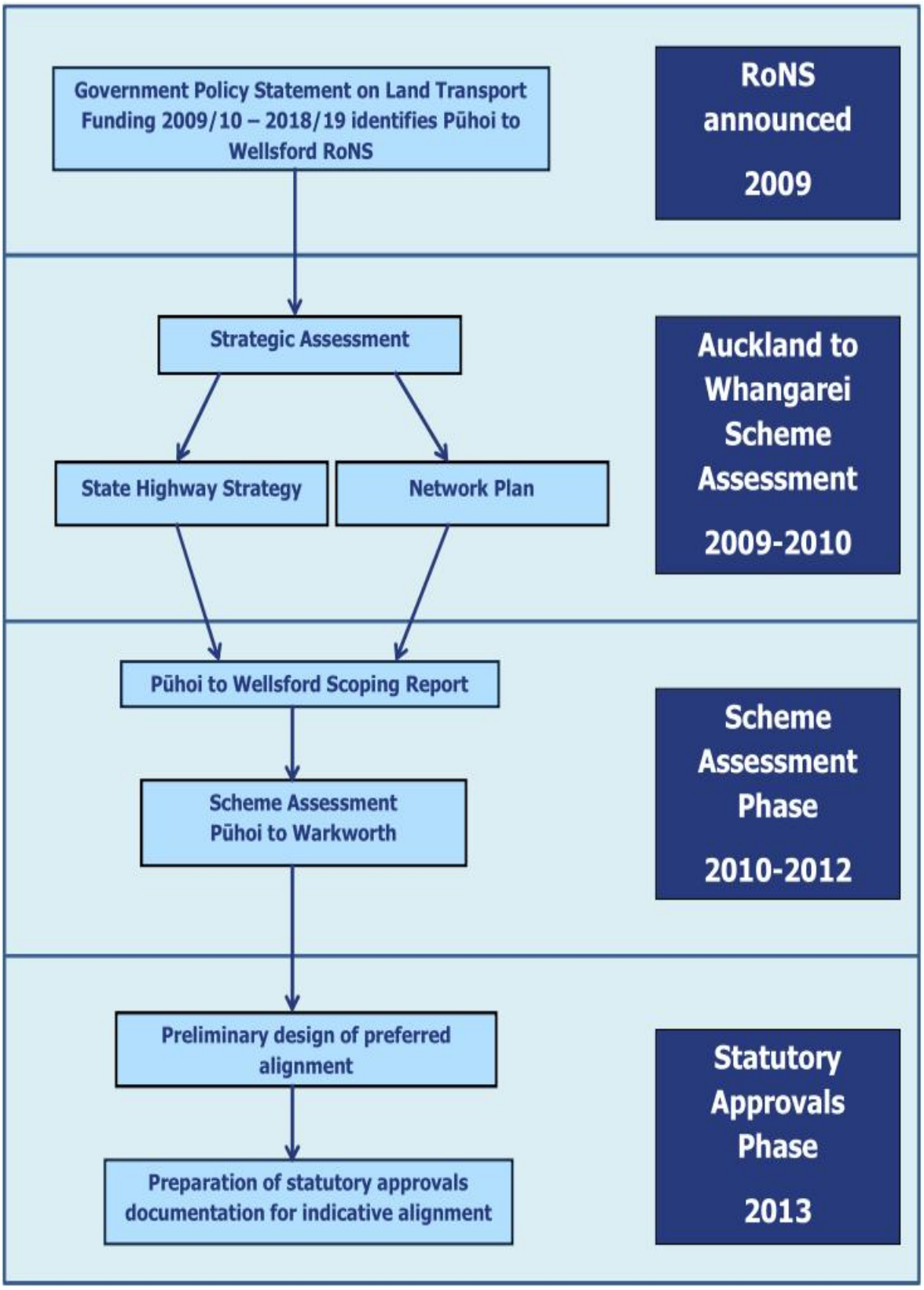

Figure 2-1: Development of the Project

2.2.1 Relevant strategic studies and investigations

In 2006, the NZTA commissioned a strategic assessment of SH1 and SH16 between Auckland and Wellsford: the SH1/SH16 Auckland to Wellsford Strategy Study[20]. The purpose of the Study was to identify the future function and form of SH1 and SH16, and to provide guidance on what level of transport investment would be required on each of those State highway corridors.

The study concluded that the SH1 corridor was the preferred route for future development to meet the long-term inter-regional transport needs of Auckland and Northland. Furthermore, SH1 should be developed to four lanes to accommodate anticipated future demand.

As part of the study, a number of potential corridors were considered for a future upgrade of SH1 to four lanes between the northern terminus of the NGTR and Warkworth. Two broad corridors were considered suitable for the purpose identified in the study given the land use constraints in the area. These two corridors included a western route heading north-west of SH1 from Pūhoi, before broadly following the North Auckland Line railway north to Wellsford, and a route broadly following the existing State highway corridor.

The NZTA commissioned a strategic assessment of land transport needs between Auckland and Whangarei in support of the decision to declare SH1 between Pūhoi and Wellsford a RoNS. The Auckland to Whangarei Strategic Assessment: Strategic Context Report[21] concluded that by 2021, SH1 between Pūhoi and Wellsford would experience significant congestion during the peak traffic periods as a result of the current network capacity.

That Report identifies and confirms the importance of the State highway network to the economic growth and sustainability of the Northland Region and that travel demand arising from planned growth in the Auckland and Northland Regions must be supported by an efficient, safe and economic State highway network.

Subsequent to the Auckland to Whangarei Strategic Assessment, the NZTA developed a Network Plan for SH1 between Auckland and Whangarei for the long-term future (2050). The key purpose of the Network Plan is to support on-going integrated planning, optimisation of benefits and decision making for the local network and activities and infrastructure associated with the P-W RoNS and wider Auckland and Northland Regional networks.[22]

The Network Plan provides clear guidance on the proposed route configuration for the Ara Tūhono P-W RoNS and supports a four lane off-line[23] route as being preferable to an on-line upgrade of the existing highway. The Network Plan considers that a four lane off-line route is most appropriate to meet the strategic objectives set down by the LTMA and the Government Policy Statement on Land Transport Funding penultimate 2009/2010 to 2018/19, as well as the objectives for the P-W RoNS adopted by the NZTA.[24]

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[20] NZ Transport Agency 2008, *SH1/16 Auckland to Wellsford Strategic Study*, prepared by Sinclair Knight Mertz

[21] NZ Transport Agency 2010a, *Auckland to Whangarei Strategic Assessment*, prepared by Sinclair Knight Mertz

[22] NZ Transport Agency 2010b, *Draft Auckland to Whangarei Network Plan* (Draft Network Plan), prepared by Sinclair Knight Mertz

[23] Off-line means that the road is completely separate and follows a different path than the existing road.

[24] See page 33 of the Draft Network Plan.

The LTMA has been amended since the Network Plan was developed, however the broad principles adopted in the Network Plan are not contrary to the LTMA amendments. The Network Plan is a living document and at its next review will incorporate the latest amendments of the LTMA.

2.2.2 Scheme Assessment

The Scheme Assessment for the full length of Ara Tūhono P-W RoNS was undertaken in two sections (Pūhoi to Warkworth and Warkworth to Wellsford), with early investigative work undertaken on both sections. From this initial work it became clear that the Warkworth to Wellsford section will be more challenging from a cost and consenting perspective than originally anticipated. As a result, the NZTA decided to split the Ara Tūhono P-W RoNS into two sections, and subsequent reporting of the Scheme Assessment focused on the Pūhoi to Warkworth section.

The Pūhoi to Warkworth Scheme Assessment focused on determining concept road alignment options in order to identify the preferred alignment. The process involved development of a range of corridor options, including assessment of an on-line upgrade of the current SH1 corridor. The development and assessment of the options lead to the selection of a preferred option.

The Scheme Assessment process is outlined in detail in Section 7 of this report.

2.3 Strategic context of the Ara Tūhono P-W RoNS

2.3.1 National context

As discussed below, increasing capacity and improving the function of the SH1 corridor between Pūhoi and Warkworth is consistent with the national policy framework, including:

- The Government Policy Statement on Land Transport Funding 2012/13 – 2021/22 (GPS);
- National Land Transport Programme; and
- The NZTS.

(a) The Government Policy Statement on Land Transport Funding 2012/13 – 2021/22

The GPS aims to improve New Zealand's economic performance by investing in infrastructure and services that enhance transport efficiency and lower the cost of transportation. The GPS outlines the Government's funding and strategic priorities for the land transport network. These priorities are implemented through the NLTP and the National Land Transport Fund (NLTF).

The current GPS has three key focus areas; economic growth and productivity, value for money, and road safety. It demonstrates continued investment in the national RoNS programme and refers to Auckland as a key investment Region, which is critical to the nation's economic growth.

The Project will contribute to the goals of the GPS by improving the efficiency of freight and traffic movements, and enhancing economic efficiency within the Auckland Region.

(b) The National Land Transport Programme 2012 -2015

The NLTP establishes a funding structure and allocation rationale for delivering transport solutions during a three year period and is consistent with the strategic objectives outlined in the GPS. The key drivers in the current NLTP are supporting economic growth, improved productivity, contributing to a high performing transport system, freight, and road safety. The total investment in the current 2012 – 2015 NLTP is $12.28 billion and State highway projects account for $5.14 billion.

The current NLTP expresses the Government's commitment to the delivery of the Ara Tūhono P-W RoNS and states that approximately $40 million is committed by the Government for property acquisition and investigation work. The NLTP acknowledges the benefits of the Ara Tūhono P-W RoNS as supporting regional economic growth opportunities in Northland and the northern Auckland area, reducing congestion, improving safety, and more reliable journey times.

(c) The NZ Transport Strategy

The NZTS is the Government's primary long-term strategy for the transport sector and sets its vision for transport to 2040 and guides national transport policy. The strategy seeks to ensure that *"*people and freight in New Zealand have access to an affordable, integrated, safe, responsive and sustainable transport system*".*[25]

The Strategy's objectives are:

- Assisting economic development;
- Safety and personal security;
- Access and mobility;
- Protecting and promoting public health; and
- Ensuring environmental sustainability.

The NZTS forms the context for the development of the GPS and provides a focus for the Government's actions over the duration of the Strategy.

The Project will support the key objectives of the NZTS.

2.3.2 Regional context

Regional policy documents contain a number of objectives important to the strategic direction of the P-W corridor.

The key regional policy documents are discussed below while other regional policy documents are outlined in Section 3.4.2 of this AEE (statutory and policy context).

[25] Ministry of Transport, 2008, *The New Zealand Transport Strategy 2008*:5

The Auckland Plan 2012 is a requirement of the Local Government (Auckland Council) Amendment Act 2010 and sets the long-term strategic direction for Auckland over the next 30 years. The overarching objective of the Plan is to "create the world's most liveable city". [26]

The Auckland Plan anticipates that by the year 2040 Auckland's population will grow by approximately 1 million and an additional 400,000 homes will be required to support the population growth.

The Plan seeks to integrate land use, transport planning, environmental protection, housing growth and economic development with a view to ensuring that future growth is accommodated in a manner that ensures the natural environment is not harmed. The majority of growth is proposed within the existing and new greenfield urban areas, with limited development outside the rural urban boundary.

The Ara Tūhono P-W RoNS is identified in the Plan as a key inter-regional connection between Auckland and Northland with benefits relating to safety, journey times from freight, opportunities to revitalise the Northland economy and improving accessibility.

The Auckland Plan identifies Warkworth as a Satellite Town with anticipated population growth of up to 20,000 over the next 30 years (refer Figure 2-2). The Plan's vision is for Satellite Towns to be "strong, accessible, diverse and enhanced centres"[27] and operate independently from urban Auckland. To enable this growth in Warkworth, the Ara Tūhono P-W RoNS is referred to as an integral inter-regional connection with multiple benefits.

[26] Auckland Council, 2012, *Auckland Plan 2040*:10

[27] Auckland Council 2012, Auckland Plan 2040:235

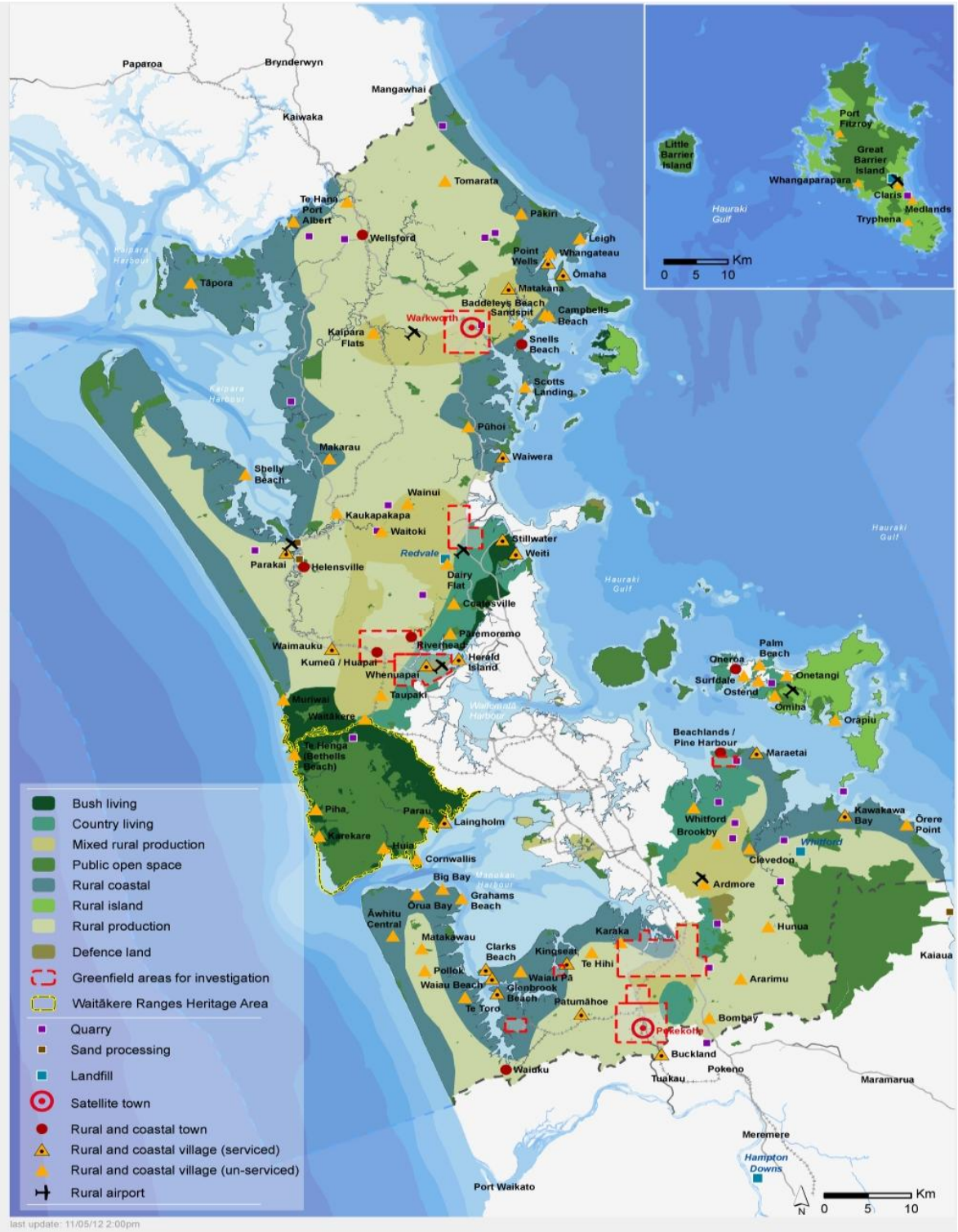

Figure 2-2: Auckland's rural strategy[28]

[28] Auckland Council, 2012, *Auckland Plan*, map 9.1

(a) Regional Land Transport Programme 2012-2015 and Regional Land Transport Strategy 2010

The Regional Land Transport Programme (RLTP)[29] was developed in accordance with the LTMA requirements[30] and outlines all land transport activities undertaken in the Auckland Region. The Programme sets out Auckland Transport's funding priorities over a three year period and is also intended to provide the basis of requests for government funding through the NZTA (through the NLTP).

The Regional Land Transport Strategy 2010 (RLTS)[31] was developed by Auckland Transport in alignment with the RLTP and in accordance with the LTMA requirements[32]. The document is a 30 year strategy and establishes Auckland Transport's desired outcomes for the land transport system in Auckland.

The Ara Tūhono P-W RoNS is identified in the RLTP and RLTS. The RLTP refers to the Ara Tūhono P-W RoNS as having inter-regional significance. A key emphasis in the RLTS is reducing congestion for freight vehicles and the Project will improve journey times for freight.

2.4 Objectives for the Ara Tūhono P-W RoNS and the Project

The NZTA objectives for the Ara Tūhono P-W RoNS, which reflect the economic, safety and transportation outcomes of the RoNS, are as follows:

- To enhance inter-regional and national economic growth and productivity;
- To improve movement of freight and people between Auckland and Northland;
- To improve the connectivity between the medium to long-term growth areas in the northern Rodney area (Warkworth and Wellsford); and
- To improve the reliability of the transport network through a more robust and safer route between Auckland and Northland.

The Project is the first of two stages of the Ara Tuhono P-W RoNS, and to give effect to the Ara Tūhono P-W RoNS objectives, the objectives for the Project are to:

- Increase long-term corridor capacity, improve route quality and safety (eg gradient, alignment, overtaking), improve freight movement and provide resilience in the wider State highway network through the addition of a 4 lane route;
- Increase travel time consistency and decrease travel times to and from the north end of the Johnstone's Hill tunnels and the north end of Warkworth;
- Alleviate congestion at Warkworth by providing a Warkworth bypass for through traffic; and
- Ensure the Warkworth to Wellsford section of the Pūhoi to Wellsford Project is not compromised.

A discussion of how the Project achieves these objectives is contained in Section 2.5 below.

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[29] Auckland Transport, 2012, *Regional Land Transport Programme*.

[30] RLTPs are no longer a requirement under the LTMA (as amended), but existing RLTPs continue through to 2015.

[31] Auckland Regional Council, 2010, *Regional Land Transport Strategy*.

[32] RLTSs are no longer a requirement under the LTMA (as amended), but existing RLTSs continue through to 2015.

2.5 Benefits of the Project

The Project will provide a number of benefits as outlined in the Transportation and Traffic Assessment and in consideration of the wider economic benefits (WEBs) (refer Appendix C). The anticipated benefits from the Project include:

- Improved route security and resilience of the State highway network north of Auckland through reducing the reliance on one main route (the current SH1);
- Improved safety performance compared to the existing SH1 between Pūhoi and Warkworth with the indicative alignment designed to RoNS standards;
- Reduced travel times and improved travel time reliability along the State highway network north of Auckland increasing accessibility across many parts of the Region's road network; and
- Potential for economic development as a result of travel time savings, improved trip time reliability and improved inter-regional accessibility between Auckland and Northland.

Each of these benefits is discussed below.

2.5.1 Route security and resilience benefits

The indicative alignment is separate from the existing SH1 and will employ RoNS design standards and current engineering and construction techniques. Once operational, the built motorway will become the main arterial road (SH1) between the Johnstone's Hill Tunnels and Warkworth. The existing SH1 will likely become a local road.

The Project will improve the security and resilience of the current State highway network in two main ways:

- The new motorway will have greater resilience to natural hazards, in comparison to the existing SH1 between Pūhoi and Warkworth; and
- The Project will provide an alternative route to the existing SH1 between Pūhoi and Warkworth. As traffic heading south will not be able to exit the alignment until south of NGTR the central median will contain breaks where practical to facilitate safe controlled manoeuvring for traffic backed up by a traffic incident to the south of Warkworth.

2.5.2 Safety benefits

The Project is expected to significantly improve the safety performance of the State highway network with better vertical and horizontal alignment on the new road, as compared to existing SH1. The Project will be designed, operated and constructed as a new motorway in accordance with RoNS standards and have an improved safety performance when compared with the existing SH1. The average annual number of injury crashes in the corridor is forecast to decrease by five (23%) in the year 2026 in comparison to the future traffic volumes on the existing SH1 route.[33]

[33] Refer to Section 5.2 of the Transportation and Traffic Assessment Report

The road safety performance that can be achieved for the Project is greater than would be possible through an upgrade of the existing SH1. The Project will also reduce the volume of traffic on the existing SH1, thereby improving safety for road users in that corridor.

2.5.3 Travel times

Through the provision of a new 100kph four-lane motorway, the Project will significantly reduce travel times outside peak hours and allow journeys to be planned with a greater level of certainty around travel times. The Project will also reduce congestion and travel times between Pūhoi and Warkworth during typical peak periods, but also during the summer weekend and holiday periods when large delays are currently experienced. This benefit will be received by both general and freight traffic.

By enabling reduced travel times with increased levels of certainty in relation to travel times during all time periods, the Project will remove deterrents to travel in the corridor and improve accessibility between Auckland, Warkworth and Northland.[34]

2.5.4 Economic development

The Project will provide a number of economic benefits for the local north Rodney area and the Auckland and Northland Regions, both during construction and operation (refer letter from M Copeland, Appendix C). In addition to direct economic benefits, a number of the traffic-related benefits of the Project will give rise to positive economic effects by increasing activity and facilitating commercial and residential growth in Warkworth. As noted in Mr Copeland's letter, although some existing businesses on SH1 may be bypassed by the Project, the redistribution of passing traffic will not necessarily result in adverse economic effects.

2.5.5 Construction

Mr Copeland notes that the construction of the Project (approximately five years from 2016-2020) will increase economic activity in Auckland and Northland as a consequence of:

- Additional expenditure;
- Employment and incomes directly generated by the Project's construction; and
- The indirect (or multiplier) expenditure, employment and incomes generated as a result of impacts on suppliers of goods and services to the Project and those employed on it.

2.5.6 Operation

The Project will better enable SH1 to deliver its local, regional, national and strategic functions of providing a safe, integrated, efficient and responsive route for the movement of goods and people. This improved function will result in travel time savings, reduced congestion and improvements to travel time reliability for local traffic, through traffic and freight movement. The improved function will in turn lead to reductions in vehicle operating costs for local residents and businesses with trip origins and destinations within the north Rodney area.

[34] Refer to Section 5 of the Transportation and Traffic Assessment Report

For vehicles travelling on the existing SH1 or on local roads that intersect with it, the consequent reduction in traffic (especially HCVs) as a result of the Project will result in less congestion on these parts of the network. Less congestion will lead to savings in travel time and vehicle operating costs, particularly during peak periods.

Savings in vehicle operating costs, travel times and accident costs, and improvements in trip time reliability will result in increased productivity and improvements in competitiveness for businesses. Traffic-related benefits for residents will include reduced expenditure (vehicle operating costs) and less unproductive “buffer time” allowances due to reduced journey times and improved travel time reliability, giving residents more free time for other productive or leisure activities.

Improving accessibility within north Rodney and the Auckland and Northland Regions will increase the attractiveness of these areas for commercial and residential development. Population and employment growth in these areas will result in increased levels of economic activity (increasing economies of scale for businesses and service providers); increased competition leading to more choices for residents; and improved efficiency and quality of services. The Project will provide opportunities for Auckland Council to facilitate its urban growth aspirations for Warkworth to become a Satellite Town (as reflected in the Auckland Plan) and achieve the critical mass necessary to achieve greater economic efficiencies.

A small number of businesses on the existing SH1 will be bypassed by the Project. However, we consider that the Project will not give rise to significant business redistribution effects, and that the removal of through traffic on SH1 may in fact enhance business opportunities by improving customer accessibility (refer to Appendix C).

Overall, the net economic effects of the Project will be positive and significant at a national, regional and local level.

3. Statutory and policy context

This section provides the statutory and policy context for the Project. By way of overview, Figure 3-1 demonstrates the relationship between the national, regional and local statutory context, along with the policy documents relevant to the Project, the latter largely driven by central and local government transport policy in addition to those documents discussed in Section 2 above.

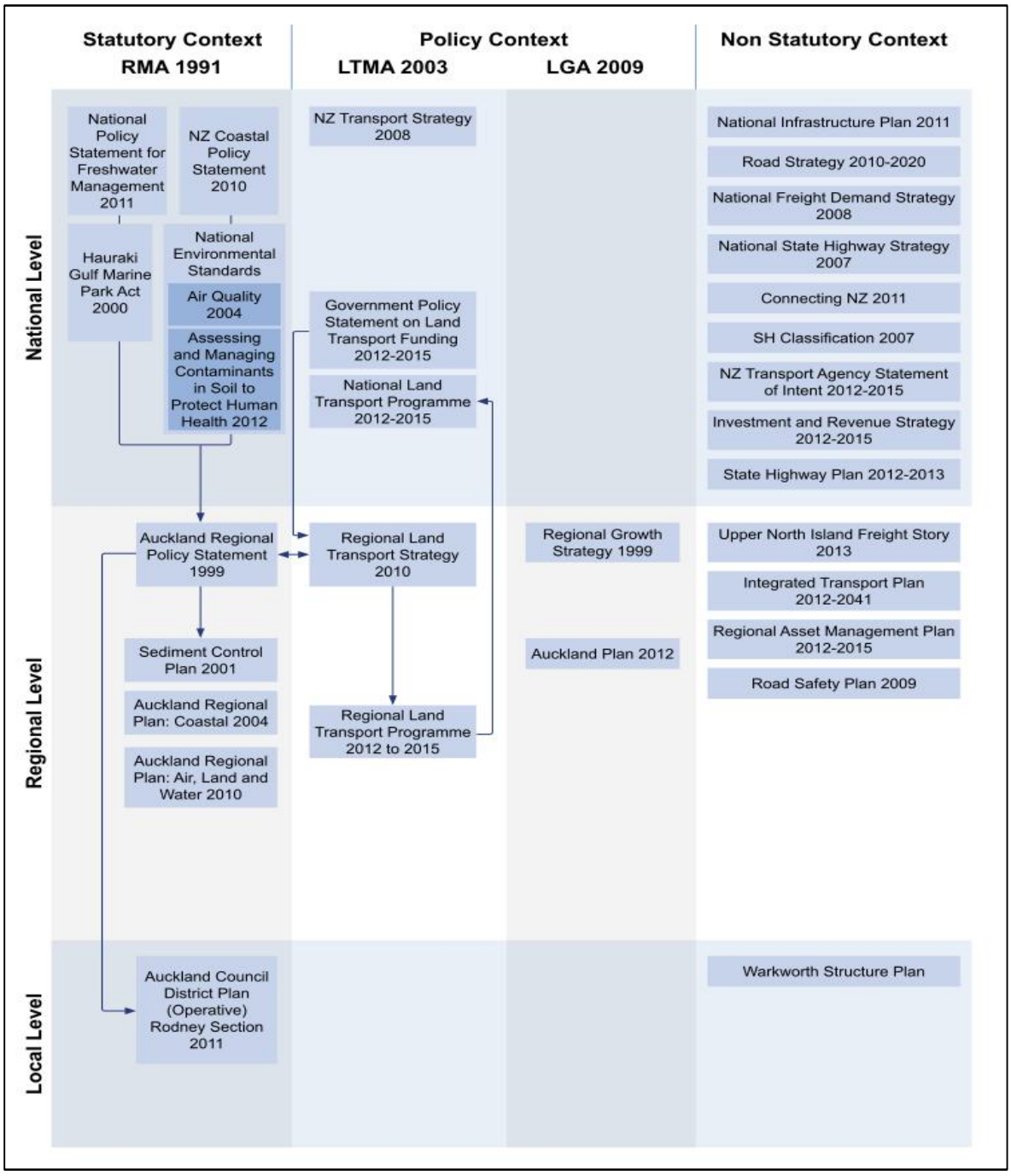

Figure 3-1: Strategic document framework

3.1 Resource Management Act 1991

The RMA is New Zealand's cornerstone resource management legislation that governs the use and development of natural and physical resources.

The purpose of the RMA is outlined in Part 2 section 5 of the Act, which is to "promote the sustainable management of natural and physical resources".

The RMA prescribes a number of relevant considerations for the determination of notices of requirement (NORs) and applications for resource consent lodged by the NZTA, including:

- Part 2 (sections 5-8), which establishes the purpose and principles of the Act;
- Section 104, which sets out the principal matters, subject to Part 2, that a consent authority shall have regard to (and other matters it must disregard) when considering an application for resource consent and any submissions received;
- Section 105, which relates to matters relevant to applications for discharge permits;
- Section 107, which outlines restrictions on the granting of discharge permits and coastal permits;
- Part 6AA (sections 140-149), which sets outs the procedures for matters in relation to Proposals of National Significance, including how they are lodged, considered and decided; and
- Sections 166 to 186, which set out the process and procedure for a requirement for a designation or alteration to a designation.

An assessment of the Project against the relevant provisions of the RMA is provided in Section 29 of this report.

In addition to the over-riding Part 2 considerations, sections 104 and 171 of the RMA contain the key considerations for assessing resource consent applications and NORs. In relation to NORs, the decision-maker must have regard to the matters in section 171(1) and comply with section 171(1A). These provisions state that:

> *"(1A) When considering a requirement and any submissions received, a territorial authority must not have regard to trade competition or the effects of trade competition.*
>
> *(1) When considering a requirement and any submissions received, a territorial authority must, subject to Part 2, consider the effects on the environment of allowing the requirement, having particular regard to -*
>
> *(a) any relevant provisions of -*
>
> *(i) a national policy statement:*
>
> *(ii) a New Zealand coastal policy statement:*
>
> *(iii) a regional policy statement or proposed regional policy statement:*
>
> *(iv) a plan or proposed plan; and*

(b) whether adequate consideration has been given to alternative sites, routes, or methods of undertaking the work if -

(i) the requiring authority does not have an interest in the land sufficient for undertaking the work; or

(ii) it is likely that the work will have a significant adverse effect on the environment; and

(c) whether the work and designation are reasonably necessary for achieving the objectives of the requiring authority for which the designation is sought; and

(d) any other matter the territorial authority considers reasonably necessary in order to make a recommendation on the requirement.

In relation to resource consent applications, section 104(1) requires a decision-maker, when considering an application for resource consent, and any submissions received, to have regard to (subject to Part 2):

(a) any actual and potential effects on the environment of allowing the activity; and

(b) any relevant provisions of—

(i) a national environmental standard:

(ii) other regulations:

(iii) a national policy statement:

(iii) a New Zealand coastal policy statement:

(iv) a regional policy statement or proposed regional policy statement:

(v) a plan or proposed plan; and

(c) any other matter the consent authority considers relevant and reasonably necessary to determine the application.

As required by sections 171 and 104, consideration of NORs and applications for resource consent must have regard to various matters, principally the relevant provisions of national, regional and district planning documents. In addition, there are a range of 'other matters' that may be considered, which can include matters outside the RMA, including non-statutory policy documents.

Section 3.4 below provides a brief description of the main statutory considerations of relevance to the Project that are derived from the RMA. Our assessment of statutory considerations is provided in Section 29 of this AEE and non-statutory documents are considered in Section 29.4.6 of this AEE.

3.2 Land Transport Management Act 2003

The LTMA provides the statutory framework for New Zealand's land transport system, including funding and managing land transport activities and development. It is the statute under which the NZTA operates (in conjunction with the Government Roading Powers Act 1989).

The purpose of the LTMA as outlined in section 3 of the Act is "to contribute to an effective, efficient, and safe land transport system in the public interest". Consistent with that purpose, the NZTA's objective is to "undertake its functions in a way that contributes to an effective, efficient, and safe land transport system in the public interest" (section 94). The relevant NZTA functions are outlined in Section 1.5 above.

The Project will meet the purpose of the LTMA through the provision of a new off-line alignment between Pūhoi and Warkworth to ensure that SH1 and the transport network between Auckland and Northland operate more effectively and provide a safer, more efficient roading corridor for freight and motor vehicles.

The Project will improve connectivity and accessibility between growth areas in the north of the Auckland Region, such as Warkworth, and inter-regionally between Northland and Auckland. As a result of the improved connectivity, the Project will provide opportunities for economic growth and productivity improvements at a local, regional and national level through more effective movement of freight and people between Auckland and Northland, thus leading to economic benefits at a local, regional and national scale. The Project's relationship with key LTMA documents such as the GPS, NLTS and RLTP is discussed in Section 2.3.1 of this AEE.

3.3 Other legislative matters

This section provides a brief introduction to other legislation that will be relevant in the delivery of the Project. We have included this discussion to provide a context for other authorisations that may be necessary for the Project, but do not form part of the suite of consents and NORs required under the RMA.

3.3.1 Historic Places Act 1993

The purpose of the Historic Places Act 1993 (HPA) is set out in section 4 of the Act as being "to promote the identification, protection, preservation, and conservation of the historical and cultural heritage of New Zealand."

Sections 9 to 19 of the HPA apply specifically to archaeological sites, which are defined in section 2 as any place in New Zealand that:

(a) Either –

(i) Was associated with human activity that occurred before 1900; or

(ii) Is the site of the wreck of any vessel where that wreck occurred before 1900; and

(b) Is or may be able through investigation by archaeological methods to provide evidence relating to the history of New Zealand.

All archaeological sites are afforded protection under sections 9 and 10 of the HPA (whether they are formally recorded and registered or not). It is unlawful for any person to modify, damage or destroy the whole or any part of an archaeological site without the prior authority of the New Zealand Historic Places Trust (NZHPT).

Applications to the NZHPT for an authority to modify, damage or destroy an archaeological site are made under sections 11 and 12 of the HPA. Under section 14, the NZHPT may, among other things, grant an authority (subject to conditions as it sees fit), or decline to grant an authority in whole or in part.

Prior to the commencement of construction of the Project, an application will be made to the NZHPT for a general authority to destroy, damage or modify known or unknown archaeological sites within the Project's designation boundary (refer Heritage Assessment Report).

3.3.2 Reserves Act 1977

The Reserves Act 1977 was established to acquire, preserve and manage areas for their conservation values or public recreational and educational values.

Section 3(1) of the Reserves Act states that the purpose of the Act is:

(a) providing, for the preservation and management for the benefit and enjoyment of the public, areas of New Zealand possessing—

(i) recreational use or potential, whether active or passive; or

(ii) wildlife; or

(iii) indigenous flora or fauna; or

(iv) environmental and landscape amenity or interest; or

(v) natural, scenic, historic, cultural, archaeological, biological, geological, scientific, educational, community, or other special features or value:

(b) ensuring, as far as possible, the survival of all indigenous species of flora and fauna, both rare and commonplace, in their natural communities and habitats, and the preservation of representative samples of all classes of natural ecosystems and landscape which in the aggregate originally gave New Zealand its own recognisable character:

(c) ensuring, as far as possible, the preservation of access for the public to and along the sea coast, its bays and inlets and offshore islands, lakeshores, and riverbanks, and fostering and promoting the preservation of the natural character of the coastal environment and of the margins of lakes and rivers and the protection of them from unnecessary subdivision and development.

Part 3 of the Reserves Act outlines the classification and management of reserves.

The Project designation will include the Okahu Creek Scenic Reserve and the Hikauae Creek Marginal Strip, but the designation will skirt the western edge of the Pohuehue Scenic Reserve.

Okahu Creek is a Scenic Reserve under the Reserves Act, which is defined in section 19(1) of the Act as being:

(a) for the purpose of protecting and preserving in perpetuity for their intrinsic worth and for the benefit, enjoyment, and use of the public, suitable areas possessing such qualities of scenic interest, beauty, or natural features or landscape that their protection and preservation are desirable in the public interest;

(b) for the purpose of providing, in appropriate circumstances, suitable areas which by development and the introduction of flora, whether indigenous or exotic, will become of such scenic interest or beauty that their development, protection, and preservation are desirable in the public interest.

The indicative alignment for the Project shows a very minor intrusion on the Okahu Creek Scenic Reserve as a result of the toe of an embankment in the north eastern corner of the reserve.

If necessary, any exchange of reserve land or revocation of reserve status as a result of the Project will be carried out in accordance with the Reserves Act 1977, after the designations for the Project have been confirmed.

3.3.3 Wildlife Act 1953

The Wildlife Act 1953 addresses the protection and control of wild animals and birds and the management of game. Permits are necessary under the Act to deal with certain wildlife. The Act also provides protection to a small number of terrestrial invertebrates and marine species.

Part 1 of the Wildlife Act addresses the protection of wildlife. It provides varying levels of protection to different species. Most native birds, reptiles, bats and frogs are protected under the Act. Some native and some introduced bird species have limited protection.

The potential effects of the Project on protected species are discussed in Section 11 (Freshwater ecology) and Section 14 (Terrestrial ecology) of this AEE. If required, an application will be made under the Wildlife Act for an authority to relocate any protected species prior to the commencement of construction of the Project.

3.3.4 Freshwater Fisheries Regulations 1983

Part 6 of the Freshwater Fisheries Regulations 1983 (FFR) relates to the provision of fish passage in dams and diversion structures within natural rivers, streams or freshwater.

The Project will require the culverting of a number of streams, and as such the provisions in Part 6 of the FFR are relevant.

Refer to Section 5.10.2 of this AEE and Section 7.7.2 of the Operational Water Assessment Report for detail on the fish passage proposed for the Project.

Requirements under the FFR will be confirmed once detailed design has established whether any fish passage will been impeded by the Project and any necessary approvals will be obtained.

3.4 Statutory planning documents

This section provides a brief description of the main statutory documents relevant to the Project. An analysis of the Project against the relevant provisions in these documents is contained in Section 27 of this AEE.

3.4.1 National documents

(a) New Zealand Coastal Policy Statement 2010

The New Zealand Coastal Policy Statement (NZCPS)[35] is New Zealand's principal policy for managing the coastal environment in order to achieve the purposes of the RMA. The NZCPS outlines a series of objectives and policies that relate to sustainable management of New Zealand's coastal environment and unitary, regional, and territorial authorities must give effect to the NZCPS in their statutory documents and decision making.

The objectives of the NZCPS focus on the following key matters:[36]

> *Objective 1 - To safeguard the integrity, form, functioning and resilience of the coastal environment and sustain its ecosystems, including marine and intertidal areas, estuaries, dunes and land*
>
> *Objective 2 - To preserve the natural character of the coastal environment and protect natural features and landscape values*
>
> *Objective 3 - To take account of the principles of the Treaty of Waitangi, recognise the role of tangata whenua as kaitiaki and provide for tangata whenua involvement in management of the coastal environment*
>
> *Objective 4 - To maintain and enhance the public open space qualities and recreation opportunities of the coastal environment*
>
> *Objective 5 - To ensure that coastal hazard risks taking account of climate change, are managed*
>
> *Objective 6 - To enable people and communities to provide for their social, economic, and cultural wellbeing and their health and safety, through subdivision, use, and development*
>
> *Objective 7 - To ensure that management of the coastal environment recognises and provides for New Zealand's international obligations regarding the coastal environment, including the coastal marine area*

Refer to Section 27.2 for the full analysis of the Project against the relevant NZCPS objectives.

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[35] Department of Conservation, 2010, *New Zealand Coastal Policy Statement*

[36] Ibid pp 9-10

NZCPS Policy matters relevant to the Project are:

- The extent and characteristics of the coastal environment (Policy 1);
- The Treaty of Waitangi, tangata whenua and Maori heritage (Policy 2);
- Activities in the coastal environment (Policy 6)
- Indigenous biological diversity (Policy 11);
- Preservation of natural character (Policy 13);
- Natural features and natural landscapes (Policy 15);
- Public open space (Policy 18);
- Enhancement of water quality (Policy 21);
- Sedimentation (Policy 22); and
- Discharge of contaminants (Policy 23).

(b) National Policy Statement for Freshwater Management 2011

The National Policy Statement for Freshwater Management (NPSFM)[37] is New Zealand's principal policy for managing freshwater resources in order to achieve the purpose of the RMA. The purpose of the NPSFM is to promote sustainable management of New Zealand's freshwater resources, provide for economic growth and establish water quantity and quality limits. It contains objectives and policies that direct local government to manage water in an integrated and sustainable way, while providing for economic growth within set water quantity and quality limits.

The NPS sets out objectives and policies in terms of 'water quality', 'water quantity', 'integrated management' and 'Tangata whenua roles and interests' which are intended to provide policy direction for the Regional Policy Statement and consequently Regional and District Plans. An assessment of these provisions is contained in Section 27.6.1 of the AEE.

(c) National Environmental Standards

The National Environmental Standards (NES) for Air Quality 2004 (AQNES) and Assessing and Managing Contaminants in Soil to Protect Human Health 2012 (Soil NES) are regulations issued under the RMA.

NES for Air Quality

The AQNES sets minimum standards that are intended to protect human health. Five ambient air quality standards in the AQNES are relevant to the Project given the proposed vehicle emissions. Specifically, Schedule 1 of the Regulations sets out ambient air quality concentration limits for the following contaminants:

- Carbon monoxide (CO);
- Nitrogen dioxide (NO_2);
- Sulphur dioxide (SO_2);
- Ozone; and
- Fine particulate matter that is less than 10 micron in diameter (PM10).

[37] New Zealand Government 2011, National Policy Statement for Freshwater Management

An assessment of the Project in relation to the air quality is contained in Section 18 of this AEE.

NES for Assessing and Managing Contaminants in Soil to Protect Human Health

The Soil NES establishes a nationally consistent set of planning controls and soil contaminant values.

The Soil NES contains a national set of soil contaminant standards for 12 priority contaminants for five standard land use scenarios (rural residential, residential, high density residential, recreational and commercial/industrial).

Preliminary investigations of historic and current land use activities within the proposed designation have not raised any cause for concern regarding contaminated land. The sites identified that may be potentially contaminated are typical of working rural farm land, including sites such as sheep dips and workshops, and potential contamination issues are addressed in Section 20 of this AEE. Due to the scale of the Project, consent will be required under the Soil NES to disturb contaminated soil. The Soil NES consent will be sought prior to the commencement of construction of the Project, and upon confirmation by the contractors of the likely sites affected and remediation options identified.

(d) Hauraki Gulf Marine Park Act 2000

The Hauraki Gulf Marine Park Act 2000 (HGMPA) recognises the national significance of the Hauraki Gulf, including the interrelationship between the Hauraki Gulf, its islands and catchments, and the ability of that interrelationship to sustain the life-supporting capacity of the environment.

The HGMPA outlines broad policy matters, which recognise the features that contribute to the national significance of the Hauraki Gulf and appropriate objectives for the Gulf's management. The purpose of the HGMPA is to (among other things):[38]

> *(a) Integrate the management of the natural, historic, and physical resources of the Hauraki Gulf, its islands, and catchments;*
>
> *(b) Establish the Hauraki Gulf Marine Park;*
>
> *(c) Establish objectives for the management of the Hauraki Gulf, its islands, and catchments; and*
>
> *(d) Recognise the historic, traditional, cultural, and spiritual relationship of the tangata whenua with the Hauraki Gulf and its islands;*

Section 7 of the HGMPA recognises the Hauraki Gulf as an area of national significance, providing direction on this specific area of the CMA pursuant to the matters of section 6 of the RMA.

Section 8 of the HGMPA provides further specific direction on those resource management matters that contribute to the Hauraki Gulf's significance.

[38] Hauraki Gulf Marine Park Act 2000, section 3

The Project area is located in the Pūhoi and Mahurangi catchments, both of which are catchments of the Hauraki Gulf. The Okahu Viaduct at the southern extent of the Project will be within the CMA (the Pūhoi Estuary).

Section 10(1) of the HGMPA requires that sections 7 and 8 of the HGMPA be treated as a NZCPS under the RMA[39].

An assessment of the above legislation is provided in Section 27.3 of this report.

3.4.2 Regional documents

Further to the key regional documents described in Section 2.3 above, the following regional planning documents are relevant to the Project.

(a) Auckland Regional Policy Statement 1999

The Auckland Regional Policy Statement (ARPS)[40] is a strategic document, which sets out the direction of management for the use, development and protection of natural and physical resources in the Auckland Region. Regional Plans and the District Plan must be consistent with the ARPS.

Chapters of the ARPS relevant to the Project include:

- Regional Overview and Strategic Direction (Chapter 2);
- Resource Management Matters of Significance to Iwi (Chapter 3);
- Transport (Chapter 4);
- Heritage (Chapter 6);
- Coastal Environment (Chapter 7);
- Water Quality (Chapter 8);
- Air Quality (Chapter 10);
- Natural Hazards (Chapter 11); and
- Soil Conservation (Chapter 12).

These chapters contain issues, objectives, policies, methods, reasons, environmental results anticipated and monitoring. The relevant objectives and policies from the ARPS are outlined in Section 27.4 of this AEE.

The concept of regionally significant infrastructure is outlined in Chapter 4 'Transport' of the ARPS, which is directly relevant to the Project. Regionally significant infrastructure is defined in Appendix D of the ARPS as:

> *.... infrastructure which is of greater than local significance. This can include infrastructure that is nationally significant.* [41]

[39] It is noted that section 10(2) provides qualification that for any conflict between the HGMPA and a NZCPS prepared under the RMA, then that NZCPS will take precedence.

[40] Auckland Regional Council, Auckland Regional Policy Statement 1999

[41] Auckland Regional Council, Auckland Regional Policy Statement Appendix D:11

Proposed Change 8 to the ARPS was notified in 2005 and separated into two parts in 2007 – 'Volcanic Features and Viewshafts' and 'Landscape'. The Volcanic Features and Viewshafts part of Proposed Change 8 became operative on 21 March 2012. The Landscape part of Proposed Change 8 remains subject to appeal. Proposed Change 8 introduces several 'outstanding natural landscapes' within the Project area, which need to be considered in any section 104 analysis, (refer Section 29.4.3 of this Report and the Landscape and Visual Assessment Report).

(b) Other Regional Plans

There are three Regional Plans relevant to the Project. These Plans enable Council to exercise their functions pursuant to section 30 of the RMA and are:

- Auckland Regional Plan: Air, Land and Water 2012 (ARP:ALW);
- Auckland Regional Plan: Coastal 2004 (ARP:C); and
- Auckland Regional Plan: Sediment Control 2011 (ARP:SC).

(i) Auckland Regional Plan: Air, Land and Water 2012

The ARP:ALW was notified in October 2001. The Plan is now considered operative and known as the Auckland Council Regional Plan: Air, Land and Water (2012). There are no outstanding appeals relevant to the consideration of this Project under the ARP:ALW.

The ARP:ALW assists the Council in its management of air, land and water resources within the Region.

The NPSFM must be considered when assessing an application under the ARP:ALW and the ARP:ALW has incorporated the transitional provisions of the NPSFM in relation to water quality and water quantity.

The Project is located within the Mahurangi catchment and the Pūhoi catchment. The Mahurangi catchment, along with its sub-catchments, is identified as 'a High Use Stream Area' in the ARP:ALW. High Use Stream Areas are defined in the ARP:ALW as those streams that are under pressure and have stream values that are under threat from demands for water take, or use by a number of users.

One section of the Project is indicatively located within a Natural Stream Management Area (NSMA) (refer to Appendix D of this AEE), identified in the ARP:ALW as being stretches of streams that retain a significant amount of natural character mainly through the retention of significant indigenous riparian vegetation. We have applied the definition of NSMA from Chapter 3 of the ARP:ALW to this site and consider that the area does not meet the definition. Auckland Council has agreed with this analysis (refer Appendix D). Accordingly, we have not considered NSMAs any further.

Consents for the Project are required under the ARP:ALW for the discharge of contaminants to air, discharge of contaminants to water, stream works (the diversion of watercourses, the disturbance of a watercourse and the placement of structures in, on, under, over or above a watercourse), diversion of groundwater, and discharge from an industrial or trade premises. Refer to Section 1.8 of this AEE, which outlines the specific consents sought for the Project.

Additional consents for the Project may be sought by the contractor, once appointed and the detailed design is progressed.

(ii) Auckland Regional Plan: Coastal 2004

The ARP:C applies to activities within the CMA of the Auckland Region, and covers related parts of the coastal environment. The purpose of the ARP:C is to provide a framework to promote the integrated and sustainable management of Auckland's coastal environment.[42] The coastal environment is defined in the ARP:C as including three distinct parts, namely the coastal marine area, active coastal zone, and landward component.[43]

The Project will pass through the Okahu Inlet CMA at the southern end of the Project area south of Billing Road. The Okahu Inlet (referred to in the ARP:C as *Okahu Creek*) is identified as Coastal Protection Area 1 (CPA1)[44] in the ARP:C and forms part of the Pūhoi River coastal environment and is identified as an Area of Significant Conservation Value (ASCV).

Consent is sought under the ARP:C for the Project for the occupation and use of the CMA, and for the placement of structures and mangrove removal within CPA1 at Okahu Inlet.

(iii) Auckland Regional Plan: Sediment Control 2001

The ARP:SC[45] provides a framework for the Council to manage the effects of sediment discharge in the Auckland Region. The ARP:SC seeks to promote a sediment control programme, through the introduction of objectives and policies, rules and methods to avoid, remedy or mitigate adverse effects resulting from sediment laden discharges entering the receiving environment.

The ARP:SC was amended in 2012 to include the transitional water quality provisions contained within Part 4 of the NPSFM.

Applications for resource consents for the Project for bulk earthworks and sediment control are being made under the ARP:SC.

3.4.3 Auckland Council District Plan – Operative Rodney Section 2011

The ACDP is applicable to the Rodney Section of Auckland in which the Project is located. The overarching focus of the ACDP is “to ensure sustainable management of the District's natural and physical resources” [46]

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[42] Auckland Regional Council, Auckland Regional Plan 2004

[43] Auckland Regional Council, Auckland Regional Plan Coastal 2004:2

[44] CPA 1 includes those areas which, due to their physical form, scale or inherent values, are considered to be the most vulnerable to any adverse effects of inappropriate subdivision, use and development. These areas include regionally or nationally rare habitat types, such as saline herbfields, as well as the best examples of saltmarshes and mangroves in the Auckland Region.

[45] Auckland Regional Council, Sediment Control Plan 2001

[46] Auckland Council, Auckland Council District Plan – Operative Rodney Section 2011: Chapter 4:9.

The Plan contains objectives, policies and methods to avoid, remedy or mitigate the effects of development and activities in a range of zones including rural, residential, business, future development and open space.

Refer to Section 4.1.4 of this AEE for additional detail in relation to the planning environment of the Project.

3.4.4 Other relevant non-statutory documents

A number of national and regional policy documents are relevant to the Project as "other matters" under s104 and s171 of the RMA. The key documents are outlined below with planning analysis provided in Section 29.4.6 of this AEE.

In terms of the national context, key non-statutory documents include the National State Highway Strategy (2007), the Upper North Island Freight Story (2013), the National Infrastructure Plan (2011) and the Road Safety Strategy 2010-2020. These documents are in addition to previously discussed documents including the GPS and the NZTS. Relevant regional policy documents include the Integrated Transport Plan 2012-2014 and the Regional Asset Management Plan 2012-2015.

(a) National State Highway Strategy 2007

The National State Highway Strategy (NSHS) outlines the NZTA's goals, objectives, policies and priorities for the State highway network. It also outlines how the State highway system will support economic transformation and the objectives of the NZTS, while meeting the needs and expectations of road users and communities.

The NSHS incorporates five goals that contribute to the objectives of the NZTA and provide context for this Project, namely: [47]

- Ensure State highway corridors make the optimum contribution to an integrated multi-modal land transport system;
- Provide safe State highway corridors for all users and affected communities;
- Ensure State highways enable improved and more reliable access and mobility for people and freight;
- Improve the contribution of State highways to economic development; and
- Improve the contribution of State highways to the environmental and social wellbeing of New Zealand, including energy efficiency and public health.

The NSHS identifies sections of SH1 between Auckland and Northland as being some of the most dangerous stretches of road in the country. Road user safety is a key driver of the NSHS and one of the main motivations for the Project. Further, the NSHS indicates that capacity development between Pūhoi and Wellsford is required to relieve congestion and enhance functionality of this section of the State highway network. The NSHS anticipates the upgrading of SH1 between Pūhoi and Wellsford to increase future capacity.

[47] Transit New Zealand, National State Highway Strategy 2007:5

(b) Upper North Island Freight Story 2013

The Upper North Island Freight Story[48] is the product of a partnership between central and local government organisations. It identifies critical issues for the upper North Island in relation to freight efficiencies and the cost of trade that are limiting New Zealand's economic productivity. One of the key elements is the need for integration of networks inter-regionally, and not just between Auckland and Northland, but realising the freight potential from Northland south to the Bay of Plenty, the Waikato and further south. The Story identifies the "lack of strategic, integrated land use and transport planning and investment" as a critical issue.

The Story notes that the current section of SH1 between Pūhoi and Warkworth is of a variable and generally low standard. The Story identifies this as a key constraint for freight movement in the Upper North Island[49].

(c) National Infrastructure Plan 2011

The National Infrastructure Plan[50] is a 20-year vision relating to the provision of infrastructure in New Zealand. The Plan identifies the direct linkages between economic growth, good living standards and the provision of infrastructure. It acknowledges the role of the State highway network, in particular the national RoNS programme in connecting regions, and enabling the movement of people and freight.

(d) Road Safety Strategy 2010-2020

The Safer Journeys Strategy (2010) is the Government's strategy for "a safe road system increasingly free of death and serious injury",[51] which will be achieved by safe speeds, safe vehicles, safe road use, and safe roads and road sides. As identified in the Strategy, road safety is an integral consideration in the RoNS programme as those roads are designed to a high level of safety (in fact the highest level of safety in NZ).

(e) Integrated Transport Plan 2012-2014

The ITP is a 30-year investment programme (2012-2041) developed by Auckland Transport and the NZTA in conjunction with Auckland Council. The ITP outlines a four stage process to optimise the operation, maintenance and renewal of transport infrastructure, managing demand efficiently and safely, and investment in new infrastructure, services and technology. The Project is identified as a network improvement to a strategic road.

(f) Regional Asset Management Plan 2012-2015

The Regional Asset Management Plan describes the planning, delivery and operations of Auckland Transport assets with a view to ensuring it is consistent with the guiding strategic documents. The

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48 Upper North Island Strategic Alliance in partnership with Auckland Transport, KiwiRail and NZTA, 2013, *Upper North Island Freight Story*

49 *Upper North Island Freight Story* Shared Evidence Base pg 13

50 National Infrastructure Unit, 2011, *National Infrastructure Plan*

51 Ministry of Transport, *Safer Journeys 2010-2020*:3

Plan recognises the importance of the Ara Tūhono P-W RoNS in terms of influencing growth in Warkworth, identified as a growth area in the Auckland Plan.

4. Existing environment

The Assessment Reports that accompany this AEE provide detailed descriptions of specific environmental features. The human, natural and physical aspects of the existing environment are described below.

4.1 Human environment

We have analysed land use and settlement patterns, current and consented activities and resource use to provide a picture of the human environment in the wider Project area. Figures 4-4 to 4-10 illustrate a number of environmental and social constraints.

4.1.1 Land use

The majority of land within the Project area is rural land either in productive use or used for rural lifestyle living. Pastoral grazing is a dominant activity near Warkworth.

Photo 4-1: Land use – exotic forestry

Exotic plantation pine forestry is a significant land use in the Project area (Ahuroa north east of Pūhoi, Moirs Hill near Pohuehue and at The Crag around Hungry Creek north of Pūhoi), as shown in Photo 4-1. Smaller areas of hardwood forest, such as eucalyptus, are scattered along the indicative alignment.

Genesis Aquaculture operates a fish farm located at the end of Perry Road. The farm has a number of ponds used for carp and goldfish rearing (refer to Photo 4-2).

Photo 4-2: Genesis Aquaculture fish farm

A cluster of horticultural activities is located in the Mahurangi catchment beyond the designation boundary on the outskirts of Warkworth, including orchards and vineyards (Ransom Wines) and Southern Paprika Limited, which operates large scale greenhouses producing capsicums for the commercial market (mostly exported overseas).

Other business activities and enterprises located outside the designation boundary, but within proximity to the Project, include the Honey Centre in Perry Road, which incorporates the Honey Café and the Honey Mead and Fruit Wine Shop, the Pūhoi Valley Cheese factory, a café and cheese store in Ahuroa Road, a car garage and workshop in Pūhoi, Hungry Creek Arts School on SH1, Sheepworld and the adjacent holiday park, and The Wooden Wheel toy shop.

Figure 4-1 shows the key land use features in proximity to the Project, including some of the business activities listed above.

4.1.2 Public walkways

Public walkways within Pohuehue Reserve are accessed off the existing SH1. This reserve is managed by DOC. An existing easement through forestry land to the west of the reserve offers an extended walking track through to Moirs Hill Road, the exit point of which lies to the west of the proposed designation.

The Moirs Hill Walkway through Pohuehue Scenic Reserve is adjacent to the designation boundary north of Moirs Hill Road. There is an existing walkway provided for by easement across private land currently in forestry plantation heading toward Moirs Hill Road from the south west corner of Pohuehue Reserve.

Figure 4-1: Land use in the Project area

4.1.3 Settlements / communities

Warkworth is the main area of settlement at the northern extent of the alignment Pūhoi is located at the southern end of the alignment. Refer to Figure 4-1 for the location of these two main settlements in relation to the proposed designation.

(a) Pūhoi

Pūhoi is a small, historic settlement located on the Pūhoi River just to the west of the existing SH1. The village has a population of around 200 residents with the population in the wider Pūhoi and Moirs Hill area approximately 1,100. The village retains an historic look and feel due to the presence of several historic buildings within an intimate valley setting absent of modern day development.

Pūhoi is characterised by a combination of rural lifestyle settlements and rural industries, such as farming and forestry. Pūhoi provides very limited services to the surrounding rural area. A number of commercial and tourism-related activities exist within the village, including the Pūhoi Pub and Hotel, the Pūhoi General Store (shown in Photo 4-3), Pūhoi River Canoe Hire, Pūhoi Cottage Tea Rooms, and Pūhoi Valley Cheese. Pūhoi provides access for heavy vehicle traffic servicing the farming and forestry industries in the Pūhoi and Ahuroa valleys.

Photo 4-3: Pūhoi Village General Store

From a regional perspective, Pūhoi Village is not recognised as a future growth area (beyond that already allowed under the current zoning rules and the Pūhoi Heights Plan Change), as development opportunities have largely been realised (refer to Section 4.1.4 of this AEE). Pūhoi is identified as a rural and coastal village (un-serviced) in the Auckland Plan.[52]

[52] Auckland Council, 2012, *Auckland Plan* pp237

(b) Warkworth

Warkworth is the largest urban area in the vicinity of the Project. It acts as a sub-regional retail and service centre for the surrounding rural areas and the eastern beach settlements. It provides a full range of retail, commercial and community facilities and services. The rural fringe at the perimeter of the town comprises a mixture of pasture and productive rural land combined with scattered urban and lifestyle subdivisions, industrial activities and recreational facilities.

The existing SH1 passes through the town to the west of the commercial centre. The commercial core and residential areas are located to the east of the road corridor and the schools and additional residential areas to the west.

Mahurangi College is located at the intersection of Woodcocks Road and SH1, along with The Early Childhood Learning Centre and Kowhai Kids Educare. Warkworth Primary School and the Warkworth Private Kindergarten are located on Hill Street. Summerset Falls Retirement Village is located on Mansel Drive, Warkworth. A small Catholic cemetery is located north of Warkworth on SH1 to the south of the proposed tie-in to the existing SH1.

The commercial centre (shown in Photo 4-4) provides a range of retail, commercial, healthcare, community and other professional services. A new commercial centre off Woodcocks Road to the west of Mahurangi College and the existing industrial estate comprising 'big box' format land use is currently being developed. Industrial and trade activities are largely concentrated in the industrial area to the south of Woodcocks Road, at Hudson Road and to the north of the town. These activities are a key traffic generator of HCV traffic.

Photo 4-4: Warkworth town centre

The spatial distribution of traffic-generating activities in Warkworth, in combination with the road network pattern, leads to congestion, and conflicts with SH1 at peak periods. As a result, Warkworth acts as a bottleneck for traffic travelling both north and south and is particularly congested at evening peaks, school closing times, weekends and holidays, as the volume of traffic driving to and from the town centre, as well as through traffic on SH1, increases.

The McKinney Road Structure Plan incorporated into the ACDP indicates an area of planned growth in the vicinity of McKinney Road to the south of Warkworth town centre. The Plan provides for medium intensity urban development, a school, a cemetery and open space areas.

Warkworth is identified as a Satellite Town in the Auckland Plan[52] (refer to Section 2.3.2 above), for which substantial residential and economic growth is proposed.

(c) Smaller residential settlements

Several concentrations of rural residential enclaves are located in the vicinity of the Project, including:

- Scattered rural and lifestyle dwellings along the ridgeline at Moirs Hill Road, which also provides primary access to the forestry operations around the Moirs Hill area;
- A lifestyle settlement along Perry Road, south of Warkworth, comprising approximately 25 dwellings, the Genesis Aquaculture fish farm, the Honey Centre and a number of smaller commercial lifestyle block based operations. Perry Road is a well-established rural-residential hamlet nestled into the foothills of the surrounding area (refer to Photo 4-5);
- A low density but evenly distributed pattern of rural dwellings around the Wyllie Road and Woodcocks Road area, particularly in proximity to the main roads; and
- A rural-residential subdivision at Viv Davie-Martin Drive in the vicinity of Falls Road to the west of Warkworth.

Photo 4-5: Perry Road

The coastal settlement of Mahurangi West is located off Mahurangi West Road, north east of Pūhoi and to the west of the existing SH1. The small rural settlement of Ahuroa is located to the north west of Pūhoi.

Individual rural-residential lifestyle properties are also scattered throughout the Project area between the more concentrated settlement areas. The nature and scale of these rural-residential and lifestyle settlements contribute to the local landscape character and rural amenity of the Project area.

4.1.4 Zoning and planning environment

The majority of the land within the designation boundary is zoned General Rural under the ACDP. Around the southern extent of the indicative alignment near the NGTR, the land is zoned East Coast Rural. The indicative alignment crosses the Inland Water (General) zone at several stream crossings along its length and extends above land zoned Open Space 1 adjacent to the Pūhoi River. Refer to Figure 4-2, which shows the zoning within the designation boundary and within the wider Project area.

Land in the wider Project area outside the designation boundary is zoned Special Zone 14 (Pūhoi historic village), Countryside Living Rural at the north western extent of the Pūhoi settlement, Open Space 1 (Pūhoi Reserve, Pohuehue Scenic Reserve and Wairere Reserve) and Countryside Living Town at Viv Davie-Martin Drive.

The designation boundary will skirt the edges of several Significant Natural Areas (SNAs) (as identified in the ACDP) classified as being of moderate or moderate–high significance adjacent to SH1 north of Moirs Hill Road, to the east and west of the existing SH1 at Schedewys Hill, and adjacent to the existing SH1 south of Mahurangi West Road. The designation boundary will encroach on a small area at the northern extent of the SNA north of Fowler Access Road at the exit of the Johnstone's Hill tunnels and a small area at the western extent of the SNA adjacent to Woodcocks Road to the west of Falls Road (refer to Section 4.3.1 for further detail on the SNAs).

The indicative alignment passes through a number of Scheduled Activity[53] areas identified in the District Plan. Scheduled Activity 208 extends north from the Pūhoi River up over Moirs Hill and west of Pohuehue Scenic Reserve to a point south of Perry Road and Wyllie Road. Scheduled Activity 208 allows for the development of approximately 240 new dwellings located in clusters over an area of approximately 1,800 ha. Resource consents would need to be obtained from Auckland Council prior to the commencement of the development. At the time of writing no such applications have been made.

Scheduled Activities 101 and 152 are shown on Figure 4-2.

Scheduled Activity 101 refers to the Riverhead, Woodhill, Mahurangi and Mangawhai Forests, excluding those areas identified as SNAs and the area within the Coastal Protection Yard. It allows for "outdoor recreation, horse trekking, dog sled racing, and motor sports which do not involve the

[53] Scheduled Activities accommodate or recognise sites where existing or proposed activities can be undertaken and which are not provided for by the underlying zoning. These are activities that would not usually be permitted within the zone, but can be accommodated under certain circumstances. Scheduling allows the activity to occur on a defined site, subject to particular controls, without having to individually zone each area.

construction of permanent hardseal track surfaces, and ancillary buildings related to these activities, provided they are less than 100m^2 gross floor area per activity"[54].

Scheduled Activity 152 refers to the Woodhill, Riverhead, Mahurangi, Ararimu and Topuni Forests, excluding any areas identified as SNAs and any area within a Shoreline Yard. It allows for "quarrying, for the purpose of winning and/or processing of minerals, rock, sand, gravel or clay occurring naturally in the vicinity"[55], subject to conditions.

[54] Auckland Council District Plan (Rodney Section) 2011, Chapter 14, page 10

[55] Auckland Council District Plan (Rodney Section) 2011, Chapter 14, page 50

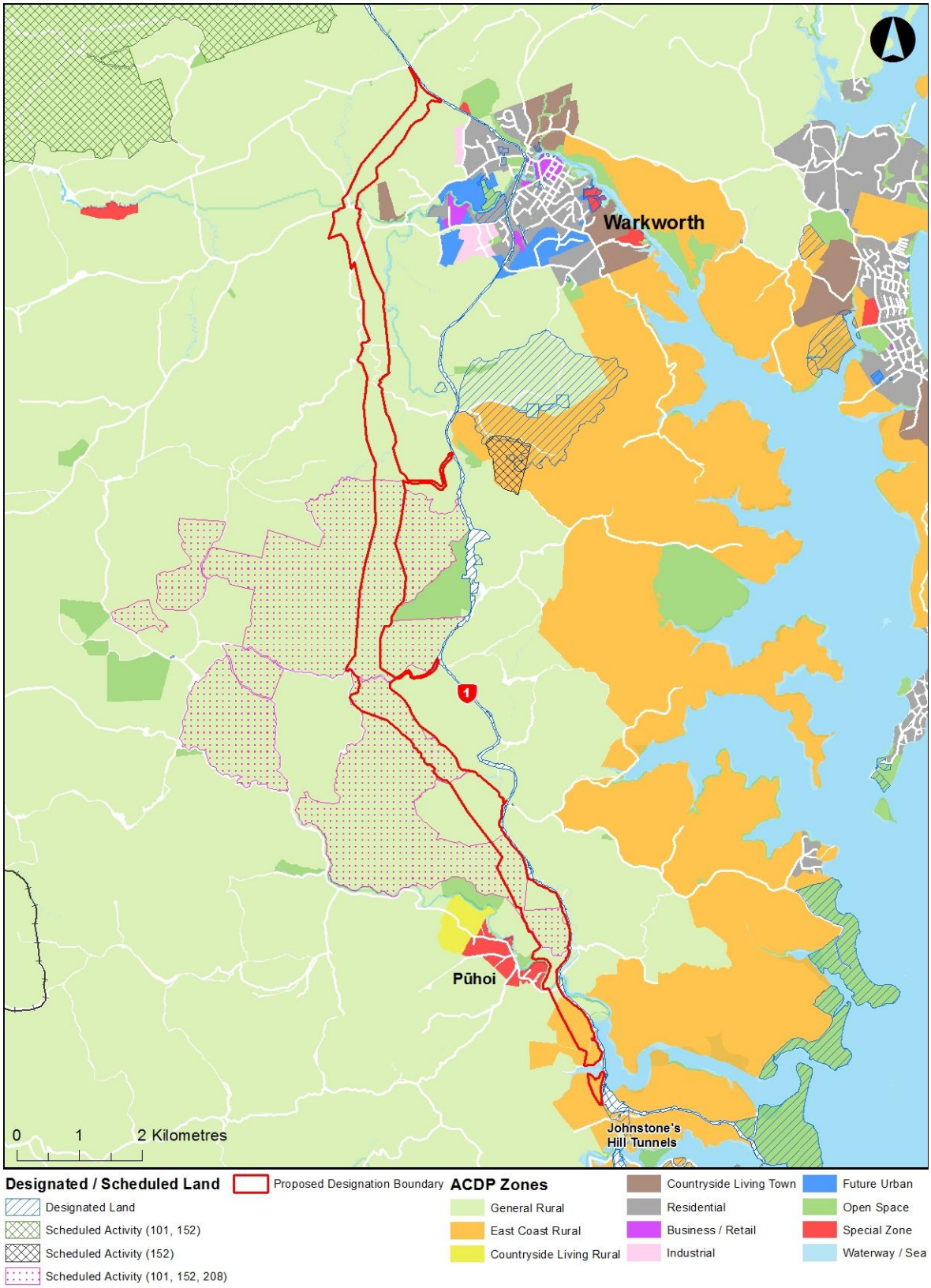


Figure 4-2: Auckland Council District Plan zoning and special features

The indicative alignment passes through an area of Coastal Marine Area (CMA) identified as CPA (75c–h) 'Pūhoi Estuary'. Further detail on the Pūhoi Estuary is provided in Section 4.2.6 of this report.

The proposed designation boundary includes two areas of land administered by the Department of Conservation (DoC). The Okahu Creek Scenic Reserve (DoC 262) sits to the west of the existing SH1. The other area of DoC land is contiguous and forms part of a riparian margin along the Pūhoi River, being the Hikauae Creek Marginal Strip (DoC 428). These two areas are zoned Open Space 1 in the ACDP.

The Project will extend through two Outstanding Natural Landscapes (ONL) - West Mahurangi Harbour (43) and Mahurangi – Waiwera (44) as defined in Proposed Change 8 to the ARPS. Further detail on these ONLs is provided in Section 4.3.1 of this AEE.

4.1.5 Consented activities and resource use

Consents for a range of activities have been granted under the various Plans for land use and activities in the wider Project area. These consents are relevant to establishing the existing Project environment especially in relation to the assessment of potential surface water and groundwater effects (refer to Sections 10, 19 and 21 of this AEE).

(a) Water takes

There are currently 11 consented groundwater takes between Pūhoi and Warkworth within 2km of the indicative alignment, the majority of which are located around the area to the south of Warkworth. These consents provide for water takes for a number of purposes, including irrigation, potable, municipal and industrial supplies.

The recently consented Watercare Services Limited (Watercare) bore at Sanderson Road Warkworth (Consent no. 35264) for municipal water supply allows for a take of 6,912m^3/day. The total consented groundwater allocation between Warkworth and the north of Moirs Hill Road (which includes the Watercare take), is 7,972m^3/day.

Consents for surface water takes within the wider Project area outside the designation boundary are limited to one permit to take and use water from an unnamed tributary of the Mahurangi River (Consent no. 21828 for irrigation of a 1.5ha nursery) and consent for Watercare to take water from the Mahurangi River for municipal supply (Consent no. 35555).

Surface water and groundwater takes for reasonable domestic or stock watering purposes that are within permitted activity thresholds and do not require consent are likely to occur throughout the wider Project area.

(b) Other Regional consents

Other existing regional consents in the wider Project area that are relevant to the description of the existing environment include:

- Watercare consent to discharge partially treated water from the Warkworth Water Treatment Plant to the Mahurangi River;

- Diversion and discharge of stormwater from the NGTR motorway to the Pūhoi river catchment (among others);
- Diversion and discharge of stormwater from a 16 lot rural-residential subdivision at Moirs Hill Road;
- Discharge of contaminants to air, land or water from the Atlas concrete batching plant located in Hudson Road, Warkworth;
- Consents associated with the construction and operation of a heliport facility located at the intersection of Kaipara Flats Road and SH1;
- Discharge of treated winery wastewater to ground on-site at Ransom Wines at Valerie Close, Warkworth; and
- Earthworks for the purpose of constructing vehicle tracks within forestry land.

(c) District Consents

A resource consent has been granted for a walkway that passes out of the Pūhoi Pioneer Memorial Park and up the hill to the north onto the unformed Cooks Road. Cooks Road is unformed, but used for forestry activities and has a vehicle track formed on it alongside the path used for walking.

A number of small residential and rural residential subdivision consents have been granted by Auckland Council in the wider Project area in recent years. The consents are largely clustered in the following areas:

- Krippner Road west of Pūhoi;
- Moirs Hill Road;
- The western side of Warkworth around Woodcocks Road;
- Kaipara Flats Road;
- Eastern Beach suburbs of Snells Beach and Algies Bay; and
- Cowan Bay Road, north of Pohuehue.

A number of these consents have been, or are currently being implemented.

4.1.6 Transport infrastructure

Transport infrastructure within the Project area includes the existing State Highways 1 and 16, the Hibiscus Coast Highway and the local road network. The North Auckland Railway Line (NAL) is located well west of the Project.

A description of the existing SH1 and SH16 is provided in Section 2.1.1 of this AEE and is not repeated below.

(a) Hibiscus Coast Highway

The Hibiscus Coast Highway is the old SH1 route through Orewa, which was bypassed by the NGTR. It currently connects with SH1 immediately north of the northern portals of the Johnstone's Hill tunnels and provides a free alternative route to the NGTR. The Hibiscus Coast Highway is managed by Auckland Transport.

(b) Local roads

Auckland Transport administers the local roads within the Project area. All formed and unformed public roads in the Rodney Section of the Auckland District Plan are designated (refer ACDP Chapter 15 Existing Roads and Railway Designations).

The existing SH1 intersects with the following local formed roads between the Johnstone's Hill tunnels and Warkworth as shown on Figure 4-3:

- Billing Road;
- Pūhoi Road;
- Hungry Creek Road;
- Mahurangi West Road;
- Schollum Access Road;
- Moirs Hill Road;
- Cowan Bay Road;
- Perry Road;
- Twin Stream Road;
- Thompson Road;
- Valerie Close;
- Toovey Road;
- Mckinney Road; and
- Wech Drive.

These local roads provide access to small towns or settlements such as Pūhoi, Mahurangi West, Cowan Bay, Snells Beach, Sandspit, Omaha, Matakana and Kaipara Flats. Local roads also provide access to businesses and places of interest to tourists on the scenic Twin Coast Discovery Highway route linking Auckland and Northland.

The roads noted above have generally low traffic volumes and only some have adequate acceleration and deceleration lanes where they join SH1, increasing the potential for conflicts between local and State highway traffic.

SH1 intersects with the following local roads within Warkworth itself:

- Woodcocks Road;
- Whitaker Road;
- Shoesmith Street;
- Hill Street;
- Sandspit Road; and
- Hudson Road.

Photo 4-6: Warkworth - Sandspit Road (Hill Street) intersection with SH1

The Hill Street intersection in particular is a key constraint in the current road network (refer to Photo 4-6).[56] This intersection caters for SH1 through traffic, provides access to the eastern beach communities, and also provides access from the north to Warkworth town centre. NZTA and Auckland Transport have a combined project looking to improve the SH1 intersections in the town. As part of that combined project a contract was recently let to upgrade Hudson Road. The combined project includes improving the SH1 connections with Hill Street and McKinney Road. The Woodcocks Road and SH1, Whitaker Road and SH1 intersection improvements were completed at the end of 2010

[56] Refer to Section 3 of the Transportation and Traffic Assessment Report.

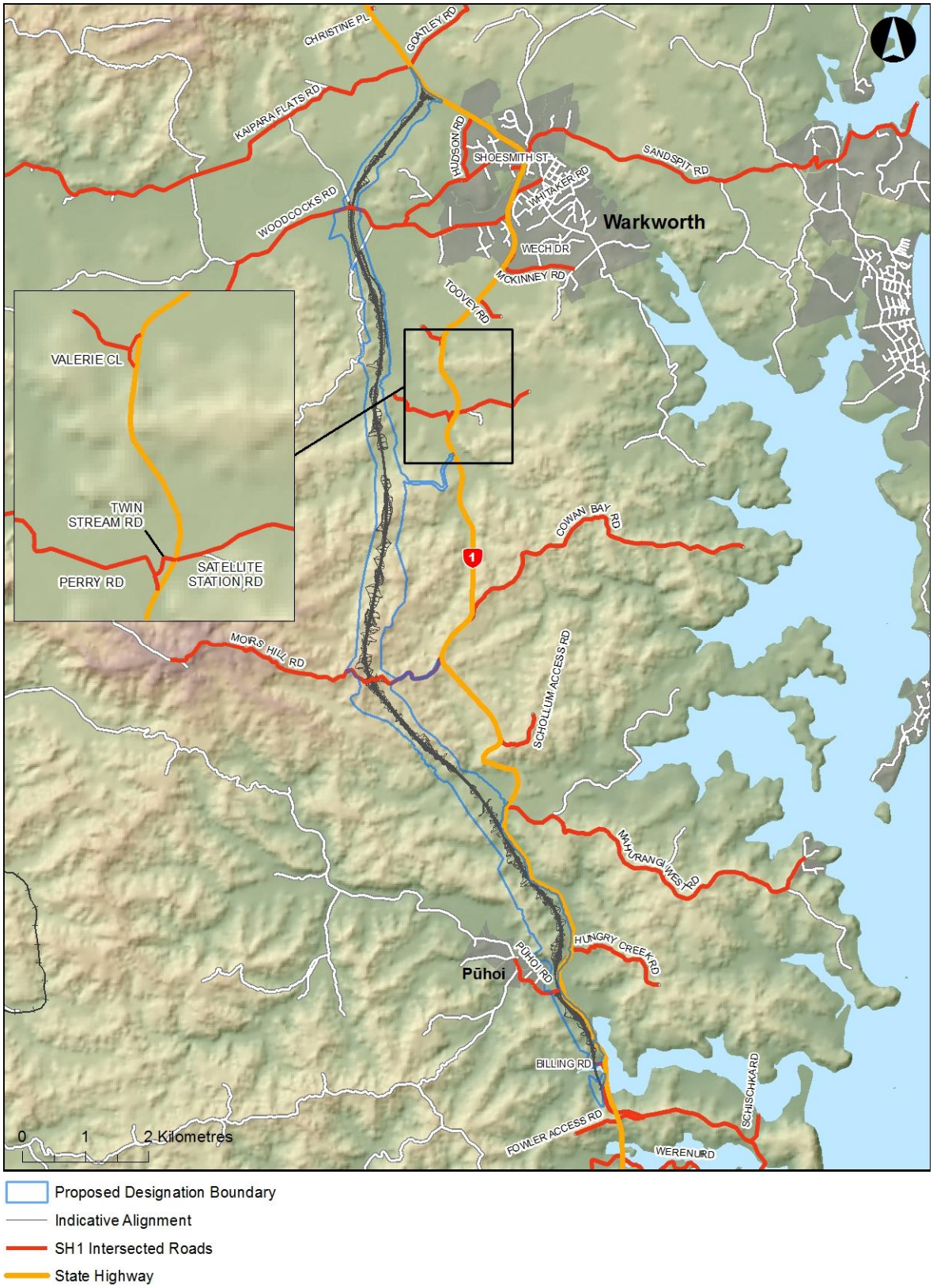


Figure 4-3: Local roads intersecting with SH1 between Pūhoi and Warkworth

(c) North Auckland Railway Line

The NAL extends from a junction with the North Island Main Trunk Railway in South Auckland to Otiria in Northland. The NAL runs through Ahuroa, Woodcocks and Kaipara Flats well to the west of the Project, and does not provide direct rail transport to Warkworth.

The NAL carries approximately 3% of the total freight market between the Auckland and Northland Regions. The line was closed to dedicated passenger services in the mid-1960s, at which time, passenger carriages were attached to freight trains. These services ran until the mid-1970s. Rail passenger services on the Auckland Western Line commuter service currently extend only as far as Waitakere Station.

4.1.7 Utilities and services

The following network utilities and services infrastructure are located in the Project area, some of which will need to be protected and/or relocated for the Project as follows:

- Watercare provides reticulated water supplies to the Warkworth township, however outside the Warkworth urban area, houses rely on independent water supply (mostly roof or bore).
- Chorus NZ Ltd has an underground copper cable and high capacity fibre optic cable network located in the western verge of the existing SH1 at the southern tie-in and will be relocated as part of the Project. At the northern tie-in with SH1 the Chorus cable network is located in the western verge of SH1 and will also be relocated. The copper network may be affected by construction activities on local roads, such as Moirs Hill Road and Wyllie Road, where it will be relocated. Residential properties along the indicative alignment that will be acquired by the NZTA will also require overhead cable disconnections.
- A Telstra Clear Ltd fibre optic cable network is located in the same underground infrastructure trench as the Chorus NZ Ltd copper cable and will be affected at both the Project's southern and northern tie-ins with the current SH1.
- Vector Limited has an extensive network of 11kv and 415kv overhead cables located along the current SH1 and local access roads. Overhead cable relocations at both the Project's southern and northern tie-ins with the current SH1 and local road crossings will be necessary. Residential properties along the indicative alignment acquired by the NZTA will also require overhead cable disconnections.
- Vector's Northland High Pressure Gas transmission main extends from north of Wellsford to south of Pūhoi. The 50mm diameter branch of the high pressure transmission main that crosses under Wyllie Road, to service Warkworth, will require a local relocation as part of the Project.

The Project area also contains a number of other utilities such as local telecommunications and electrical supply infrastructure providing smaller connections. These utilities will be managed to maintain supply during Project construction.

4.1.8 Existing noise environment

Ambient noise levels in the Project area are relatively low in most locations due to the absence of major local roads and industry[57]. Noise levels range from relatively noisy beside the existing SH1 to relatively quiet in places such as Pūhoi Village and areas to the west of Warkworth, which are located further from the existing SH1. Noise from the existing SH1 is not generally audible in Pūhoi Village. However, it is audible at rural-residential developments to the east of Pūhoi, such as Pūhoi Close.

The Noise team measured background noise levels at various dwellings adjacent to the indicative alignment. Noise levels ranged from 40dB L_{Aeq} in rural areas to 73dB L_{Aeq} adjacent to SH1. Refer to Table 1 in Section 2.2 of the Construction Noise Assessment Report for monitoring results.

4.1.9 Cultural environment

Hōkai Nuku was formed between the mana whenua of the Project land in the wider Project area to provide cultural advice to the NZTA on the Project. The group comprises five Ngāti Whātua Iwi, Ngāti Mauku/Ngāti Kauwae, Ngāti Rango and Ngāti Manuhiri with the support of Ngāti Paoa.

The cultural values pertaining to the wider Project area and environment have been identified by Hōkai Nuku in the Cultural Effects Assessment prepared for the Project.[58] Key concepts relating to cultural values are:

- Mauri – All elements of the natural environment, including people, possess mauri (life force) and all forms of life are related. The interconnectedness of all things means that the wellbeing of any part of the environment will directly impact on the wellbeing of the people. The primary objective of Māori environmental management is to maintain the integrity of mauri and the interconnectedness of all forms of life.

- Kaitiakitanga – Māori therefore, have an obligation to protect and enhance the mauri of all natural resources, for the benefit of themselves, other people living in their homeland and for future generations.

- Ki uta, ki tai (from inland to the sea) – The mauri of the waterways is also viewed holistically and includes from the source of the waterway (mountains, springs and wetlands) to the sea. This reinforces the view that activities upstream also impact on the well-being of the river downstream and aligns with the integrated management of catchments. Hōkai Nuku also note the hierarchy of water use values – first to sustain the waterway itself, then to sustain human life and lastly for stock and commercial activities.

- Hauhake, Kohikohi (harvest and gather) – the use of flora and fauna to sustain the people. The value Hōkai Nuku place on the environment is not only based on its 'existence' and desires to 'preserve' it, but also on its 'use' to Māori and its ability to sustain te tangata (the people). For example many of the areas impacted by the Project would have been

[57] As determined through noise level surveys and computer noise modelling of the existing situation undertaken for the Construction (Section 2) and Operational (Section 5) Noise Assessment Reports.

[58] Refer to Section 2 of the Hōkai Nuku Cultural Effects Assessment.

used for food foraging, harvesting and collecting of rongoa (traditional medicines), among other activities, and one of the aspirations of Hōkai Nuku is to regenerate their whenua (land) to a state where these activities may once again be viable.

The Cultural Effects Assessment identifies specific places of significance to iwi (Ngāti Wai and Ngāti Whātua) and hapu (Ngāti Manuhiri, Ngāti Mauku, Ngāti Kauwae and Ngāti Rongo), as well as principles relating to mana tangata (including authority, whakapapa and whanaungatanga), mana whenua (culturally important links to the physical landscape and features), and uptake (historical and contemporary issues relating to the areas, and future aspirations of iwi and hapu).

Specific areas and features of cultural significance in the Project area:[59]

- Te Pā o Te Hēmara Tauhia and a previously unrecorded pā site (which collectively are referred to as Ngā Pā o Te Hēmara Tauhia, par of which is shown in Photo 4-7);
- Te Koroto (an island in the Waiwera River);
- Te Huarahi o Kahumatamoemoe (a traditional route between the east and west coasts);
- Pohuehue – Nohonga and Scenic Reserve;
- Te Awa Pūhoi (Pūhoi River);
- Waihe (Mahurangi River and Harbour);
- Punaha Taupuhi Kaiao Taketake (indigenous ecosystems – flora and fauna); and
- Ahuahu (earthworks).

Photo 4-7: Large terrace of the rediscovered pā

[59] Refer to Section 3 of the Hōkai Nuku Cultural Effects Assessment.

4.1.10 Archaeological heritage environment

Section 5 of the Heritage Assessment Report has identified 24 recorded heritage sites within the wider Project area (see Figure 4-4 to Figure 4-10). A full description of these features and the history of settlement in the Project area are provided in Section 16 of this report. Most of the Project area consists of sparsely populated rural land, which has little known history of concentrated settlement or human activity. As a result, the Heritage team has identified relatively few historic heritage buildings in the vicinity of the indicative alignment. Of the 24 sites identified, three are historic buildings and 11 are archaeological sites. The remaining nine are the remnants of former World War II US military camps established between 1942 and 1944, where American military personnel carried out exercises before being sent to the Pacific War campaigns.

The heritage sites are generally spread out along the length of the Project alignment. However, two main clusters are apparent. The first cluster is located around Pūhoi Village, where the sites relate to both 'pre-contact' Maori and early European settlement. The second cluster is along the Right Branch of the Mahurangi River where the World War II military camps are located.

The Titford buildings, Te Pā o Te Hēmara Tauhia, two platforms and midden areas that overlook the existing SH1 just to the north of the Johnstone's Hill tunnels within Pt Lot 1 DP 55676 fall within the proposed designation. The previously unrecorded pā site is located close to Billing Road on the Straka property. It overlooks the estuary and Te Pā o Te Hēmara Tauhia to the south and the Pūhoi Estuary to the east. The indicative alignment has been designed to avoid the previously unrecorded pā site, although the pā environs will fall within the proposed designation. Three (possibly four) of the World War II military camps near Warkworth are located within the proposed designation.

The actual and potential effects of the Project on heritage within the Project area are assessed in Section 6 of the Heritage Assessment Report.

Refer to Figure 4-4 for the location of the heritage and archaeological sites in relation to the indicative alignment and the designation boundary. Figure 4-5 to Figure 4-10 show the location of these sites and other environmental and social features by Sector.

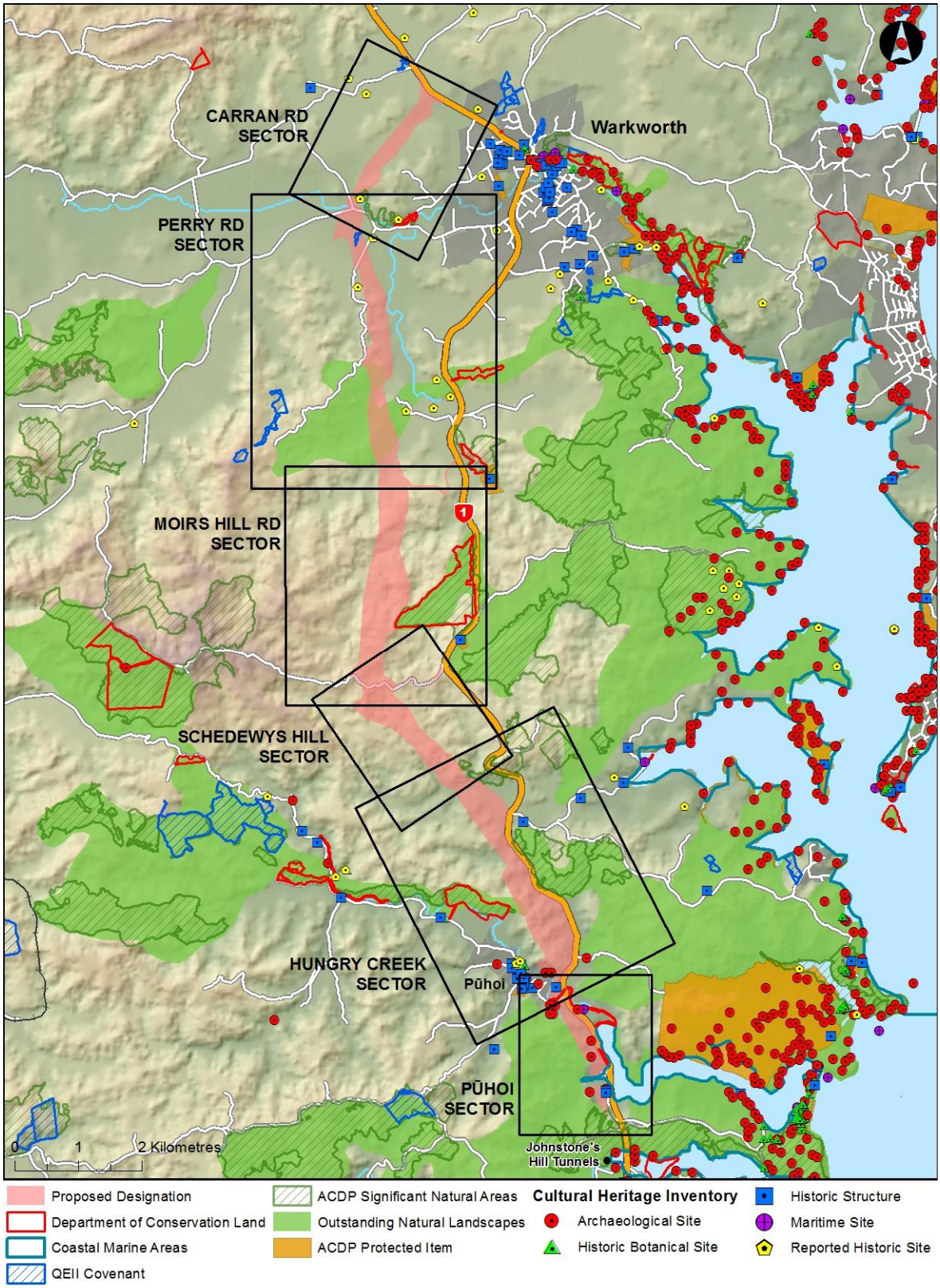


Figure 4-4: Environmental and social features

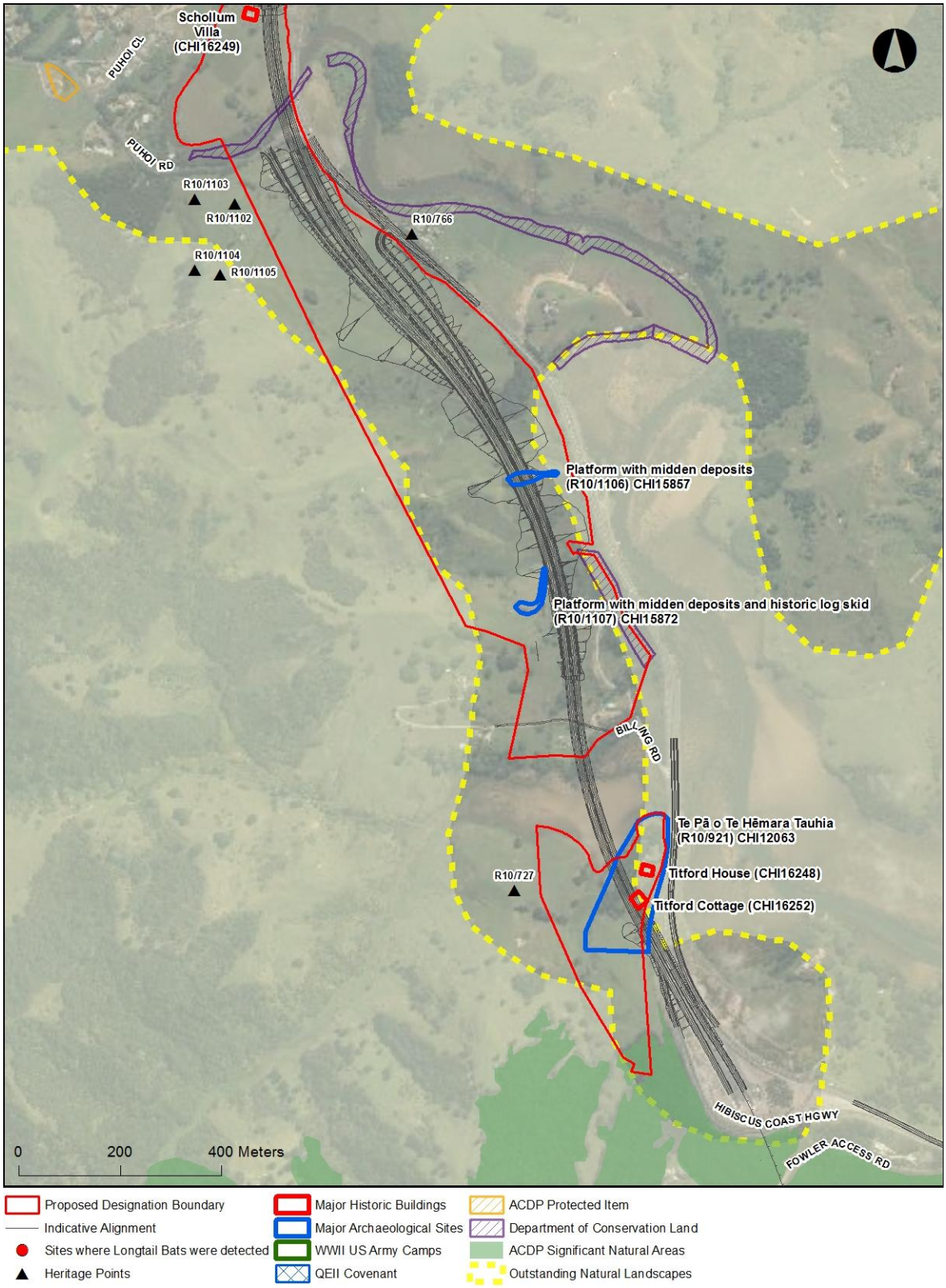


Figure 4-5: Environmental and social features - Pūhoi Sector

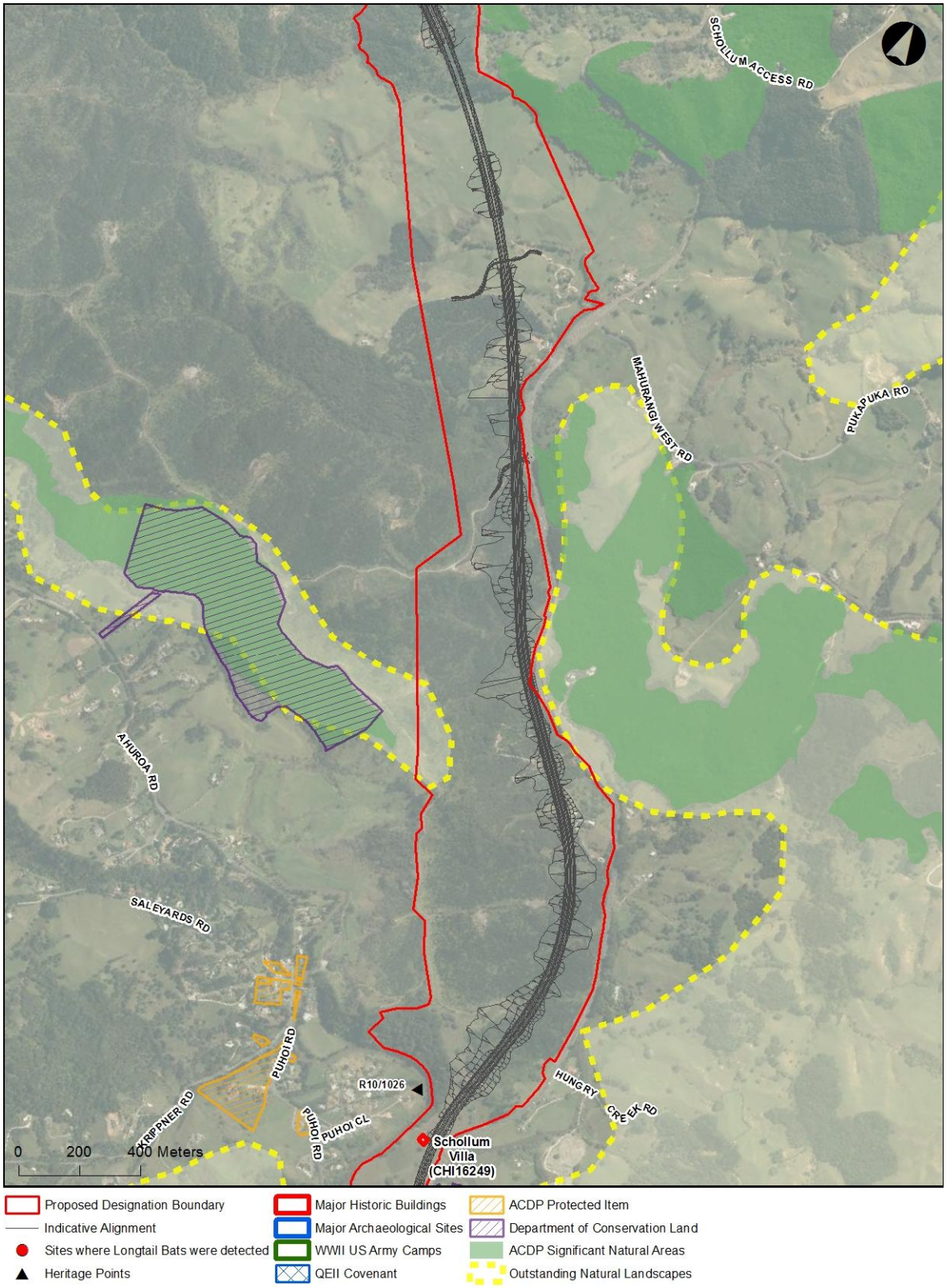


Figure 4-6: Environmental and social features - Hungry Creek Sector

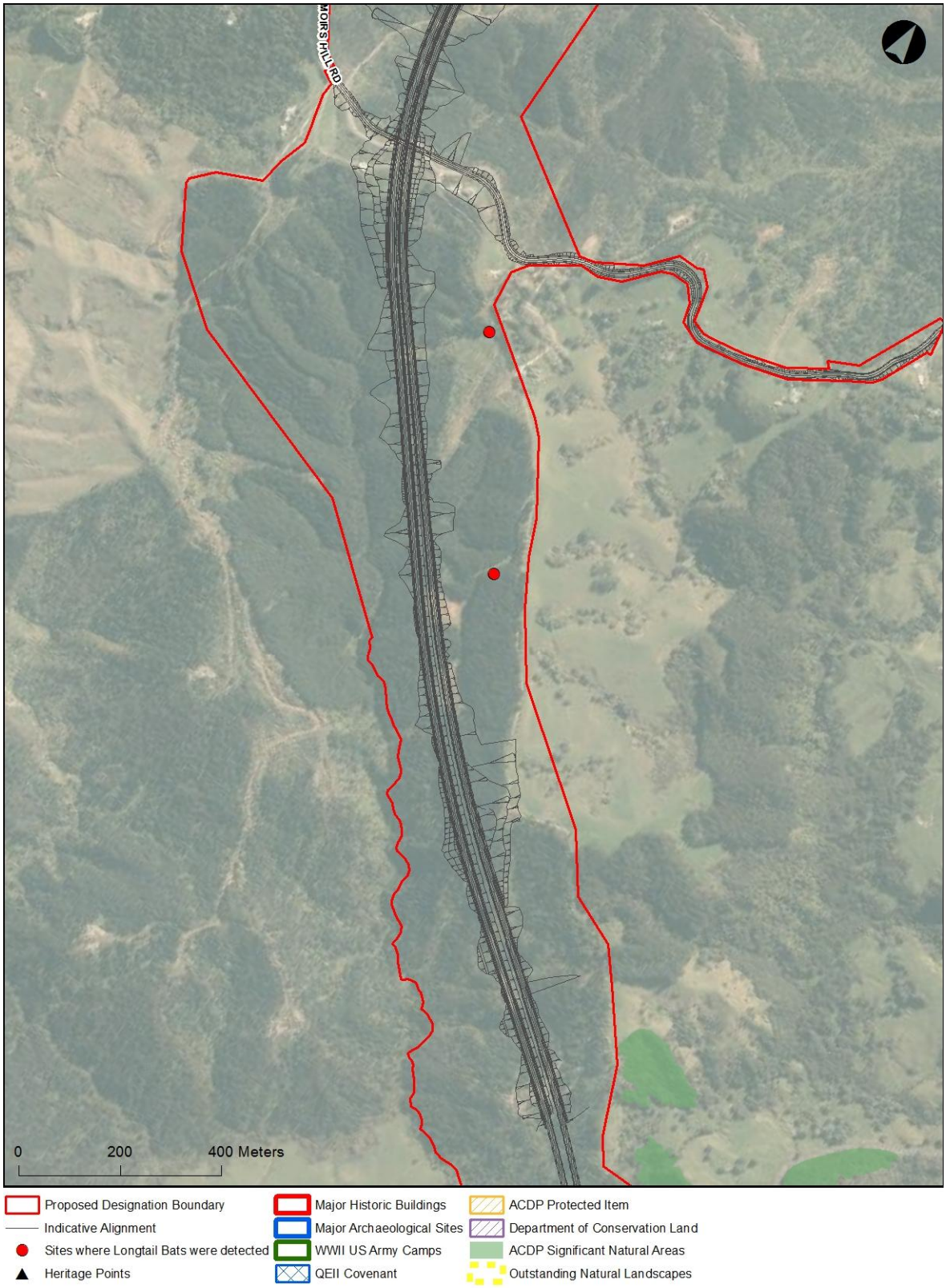


Figure 4-7: Environmental and social features - Schedewys Hill Sector

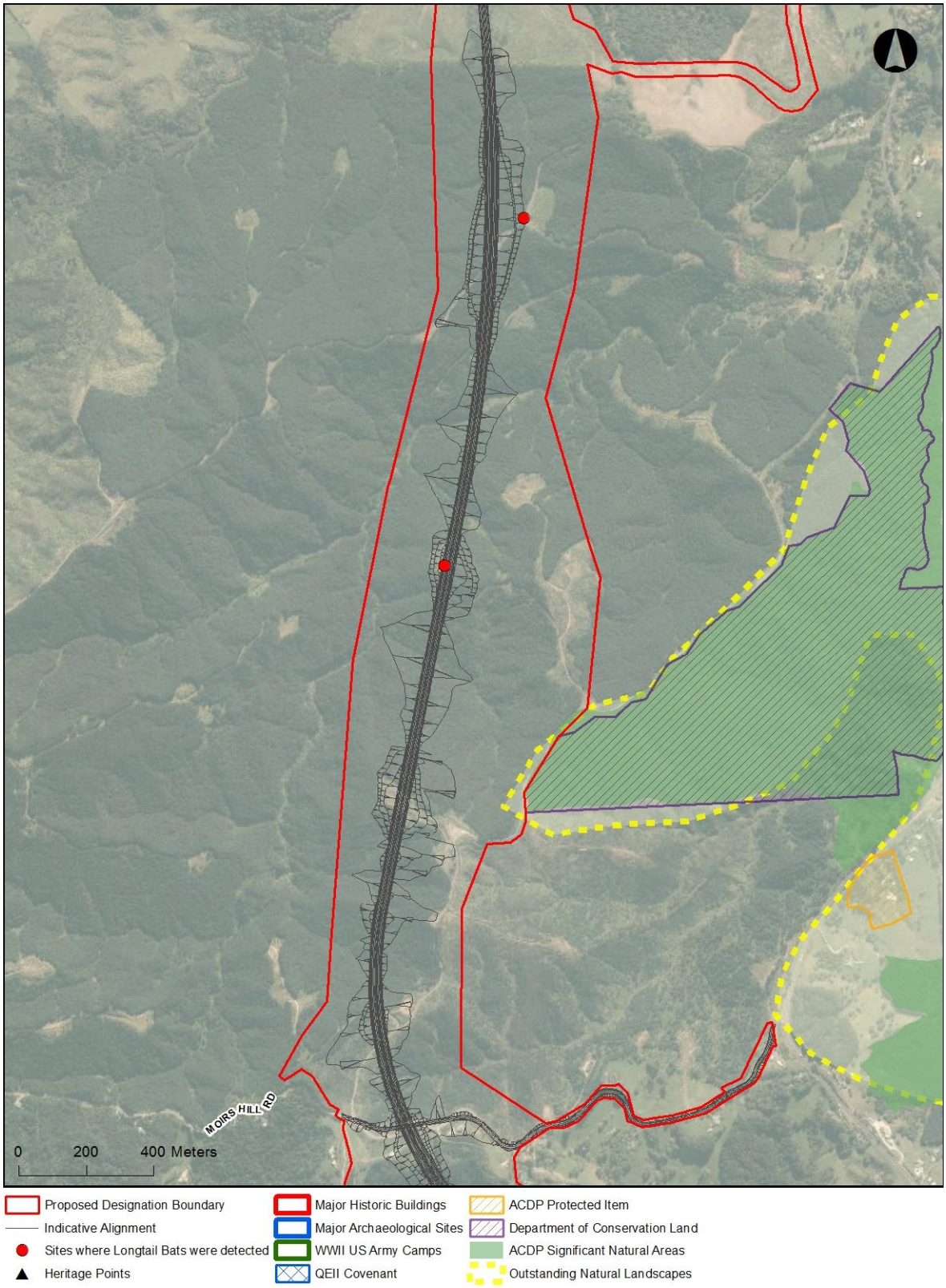


Figure 4-8: Environmental and social features - Moirs Hill Road Sector

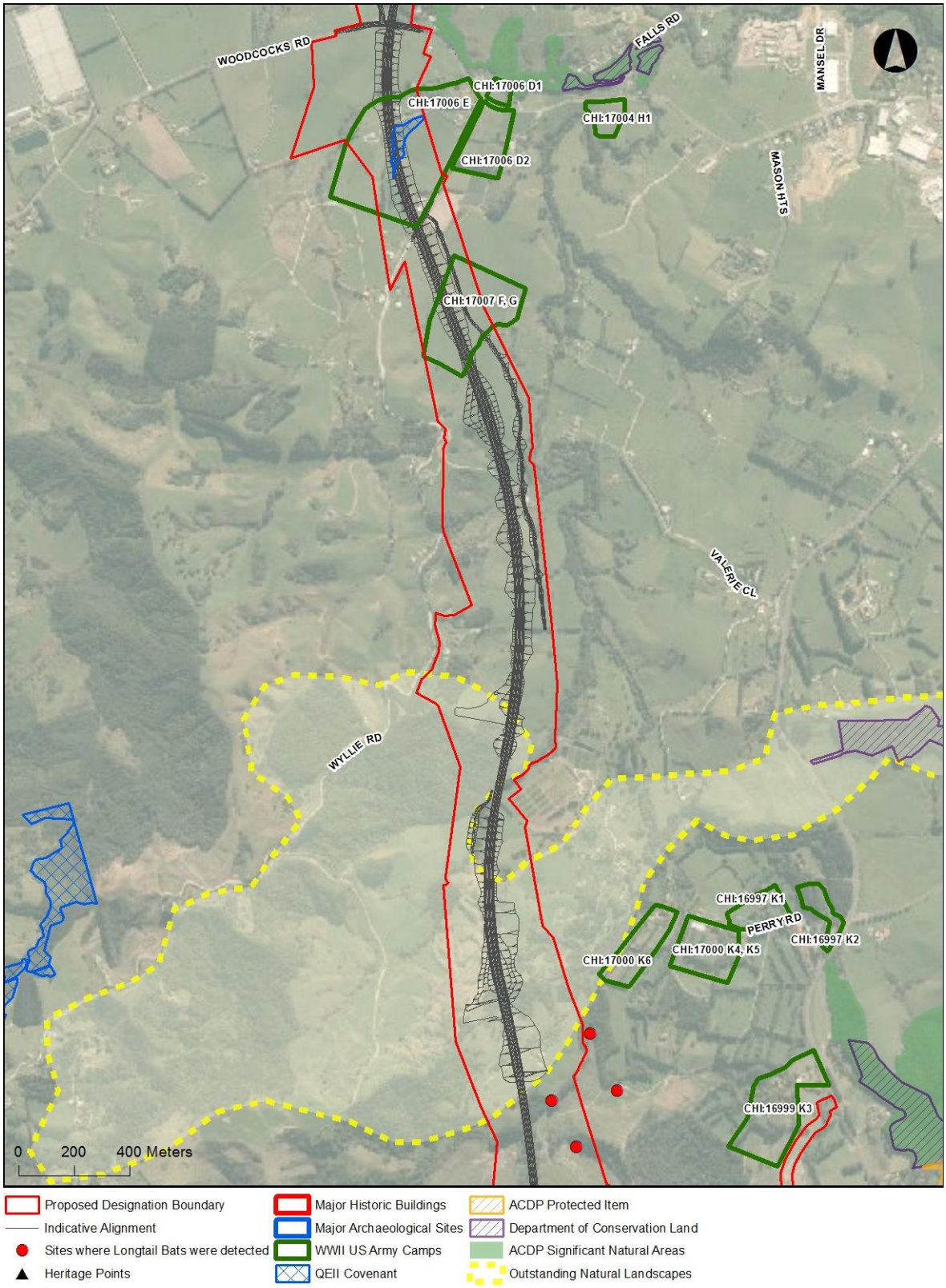


Figure 4-9: Environmental and social features - Perry Road Sector

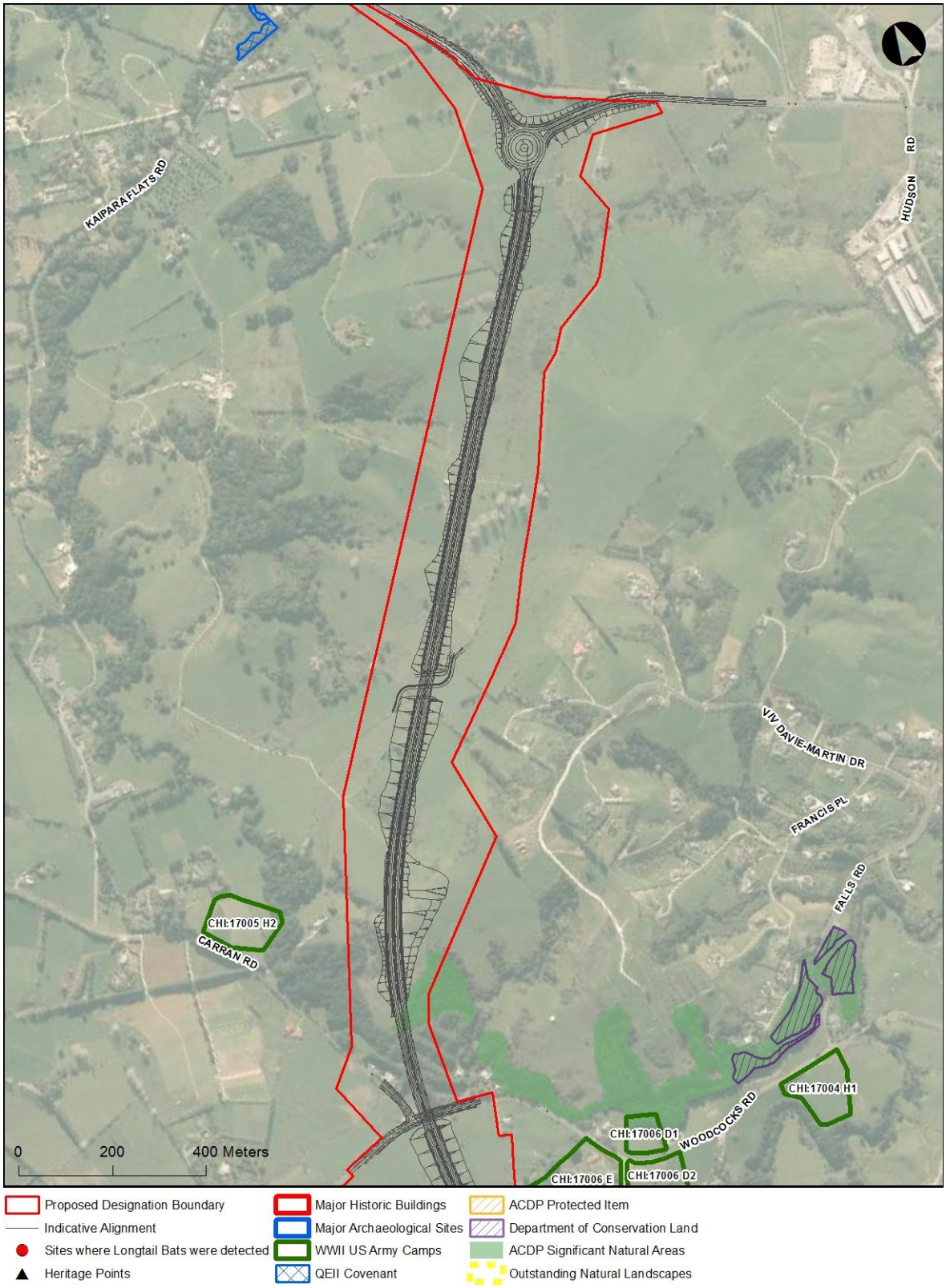


Figure 4-10: Environmental and social features - Carran Road Sector

4.2 Natural environment

4.2.1 Vegetation and land cover

Historically, the Project area was almost entirely covered with broadleaf and podocarp forest. The upland slopes of the hill country were dominated by kauri, rimu, mountain totara, tawa, taraire, towai, quintinia, tawari and toro. The mid-slopes were colonised mainly by rimu, miro, totara, northern rata, tawa, taraire, kohekohe and nikau. Kahikatea, matai, puriri and puketea were associated with lower slopes and the deeper alluvial soils of valley floors.

Widespread felling of almost all kauri and areas of podocarp forest for timber and further clearance for kauri gum pursuits changed the predominant land cover to pasture following European settlement. Remnant pockets of native vegetation, though comparatively small and fragmented, remain throughout the area (as shown in Photo 4-8). Notable stands of vegetation are present around the Moirs Hill area. Regenerating bush is widespread, particularly mixed with exotic scrub around the edges of forestry, riparian areas, damp gullies and abandoned pasture within more hilly country. Scattered native specimen trees are frequent throughout areas of pasture in association with exotic tree species.

Photo 4-8: Remnant native vegetation near Perry Road and Wyllie Road

Plantation pine forestry is the dominant vegetation type across much of the hill country through which the indicative alignment extends. A small pocket of native mistletoe is located in a stand of trees opposite the SH1/Mahurangi West Road intersection. A regionally rare native orchid is known to exist on land to the south of Perry Road.

Refer to Section 2 of the Landscape and Visual Assessment Report and Section 4.1 of the Terrestrial Ecology Assessment Report for further detail on the vegetation and land cover in the Project area.

4.2.2 Hydrological catchments

The Project traverses two major hydrological catchments: the Pūhoi and the Mahurangi. Moirs Hill Road represents the catchment divide. The Pūhoi River discharges into the Hauraki Gulf through the Pūhoi estuary, an extended shallow mangrove estuary. The Mahurangi River discharges into the Hauraki Gulf via the Mahurangi Harbour. The catchments are shown on Figure 4-11.

Notably, the catchments that lie east of the Project and drain directly to the Mahurangi catchment (namely the Te Muri Beach, Pukapuka Inlet and Western Shore Upper catchments) do not extend to the Project area, as shown on Figure 4-11. Therefore, any water derived from the proposed designation runs ultimately to either the Pūhoi River or Mahurangi River. As such, the hydraulic pathways for any effects of the Project upon the ultimate marine receiving environment are relatively lengthy and well defined.

The Pūhoi and Mahurangi catchments contain a number of permanent and intermittent watercourses that intersect the indicative alignment. Further information on each of the main catchments is provided below.

(a) Pūhoi catchment

The Pūhoi catchment covers a total area of 5,643ha, of which 306ha (approximately 5%) will be within the proposed designation boundary. The catchment is characterised by moderate and steep slopes, largely occupied with plantation forestry and pastoral farming. Pūhoi Village, along with some discrete patches of residential settlement, are present within the catchment.

The catchment boundaries coincide with Tolhopf Road in the west and the low hill country to the south of Pūhoi around Fiddler Hill and Noakes Hill and fall to the tidal estuary of the Pūhoi River. The tidal confluence reaches up into Pūhoi Village; however, the tidal range is small.

Rolling to very steep pasture landscapes occur on steep coastal margins and headlands associated with the Pūhoi River and estuary. Upper estuarine areas include mudflats, mangroves and pastured river flats to the east of the existing SH1. The remainder of the catchment typically comprises steep to very steep ridges and hill slopes with very little flat or gently-sloping terrain.

The Project will cross the Hikauae Creek, a major sub-catchment of the Pūhoi catchment.

(b) Mahurangi catchment

The Mahurangi River catchment covers a total area of approximately 5,742ha, of which 369ha (approximately 6%) will be within the proposed designation boundary. The headwaters of the Mahurangi River Right Branch are on the northern slopes of Moirs Hill. The Left Branch originates from the southern slopes of The Dome further to the north and beyond the Project area. The Mahurangi River mainstem forms to the west of Warkworth in the vicinity of Falls Road with the confluence of the Left and Right Branches and flows through the town before entering the estuary

and ultimately discharging into the Mahurangi Harbour. A number of smaller streams and watercourses within the catchment discharge into the Mahurangi River or directly into the Harbour.

Rural production and pastoral farming occupies the majority of the Mahurangi River catchment. Most of the remainder of the catchment is covered with native forest or production forestry. Indigenous forest is present around the Right Branch of the Mahurangi River and north of Schedewys Hill, changing to pastoral farmland where the topography flattens out to the west of Warkworth.

The Mahurangi River catchment is noted as a source of potable water in the ARPS and the Mahurangi River is identified as a High Use Stream Management Area in the ARP:ALW. The catchment is currently under pressure from demand and use of water, and existing water quality indicates elevated turbidity and levels of some nutrients. Sediment accumulation in the Mahurangi catchment has impacted on the quality of the Harbour and the Mahurangi River, and has been linked to deforestation, pastoral farming, development and land use intensification.[60]

North of Moirs Hill Road, the Project will cross numerous steeply incised gullies. North of Perry Road, the valleys become undulating with tributaries flowing to the Right Branch of the Mahurangi River. Just north of Woodcocks Road, the indicative alignment crosses the Left Branch of the Mahurangi River and a further series of gentler valleys and streams drain to the Left Branch of the Mahurangi River.

[60] Mahurangi Action Plan, 2010.

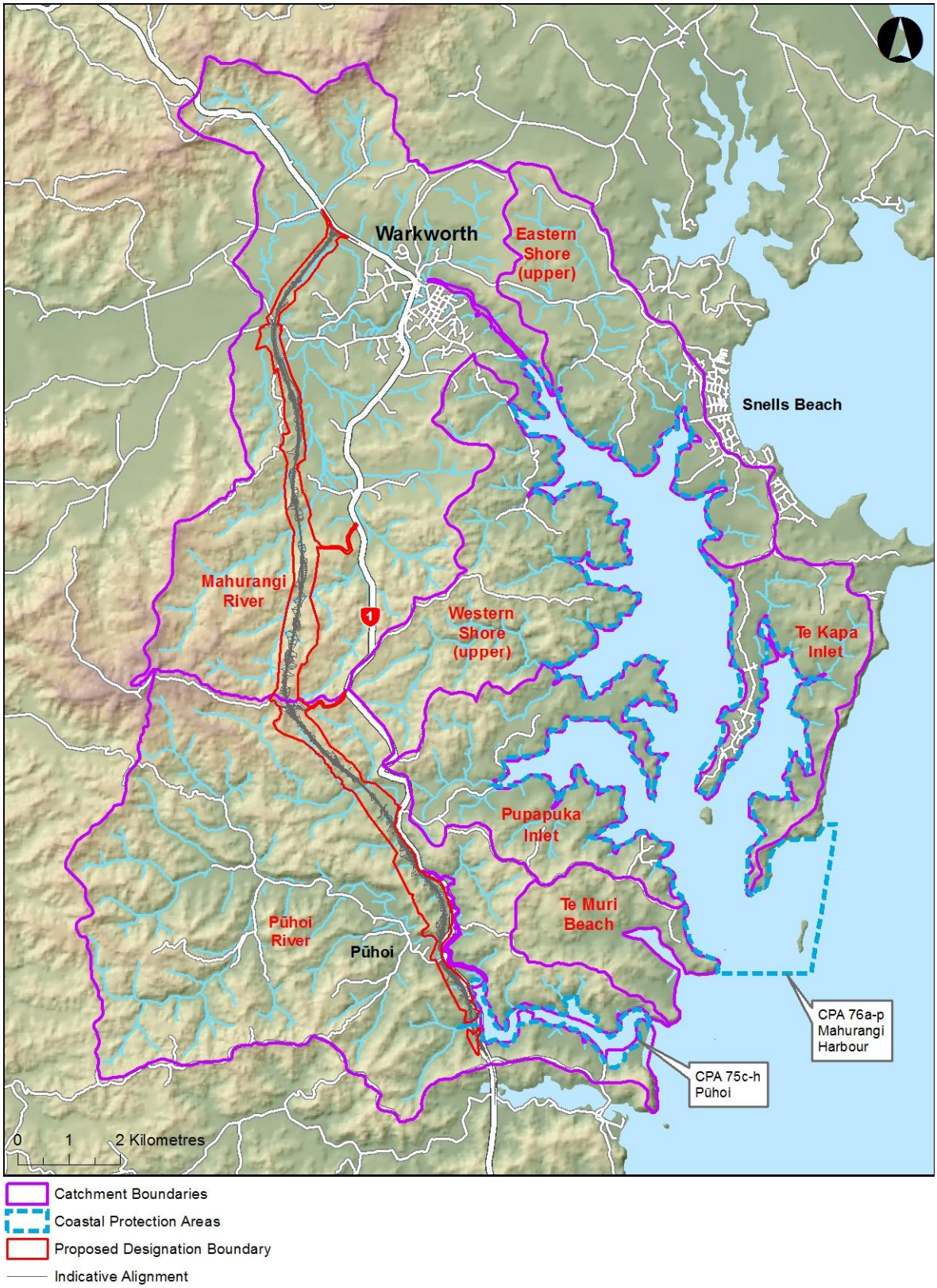


Figure 4-11: Hydrological catchments and Coastal Protection Areas

4.2.3 Water quality

The Mahurangi catchment has been the subject of long-term monitoring and studies. Limited data is available for the Pūhoi catchment.

Water quality from the Mahurangi catchment is generally good. Monitoring results indicate that:

- Turbidity in both the upper and lower Mahurangi catchment is on average slightly above guideline values, indicating elevated total suspended solids and reduced clarity;
- Nitrogen and phosphorus concentrations are generally within or at guideline values with levels higher in the lower catchment than the upper catchment, likely due to surrounding land use impacts;
- Water quality appears to be suitable for the protection of aquatic ecosystems and also for uses such as stock watering, irrigation and aquaculture; and
- Microbiological contamination exists in the lower reaches that would affect contact recreation.

Based on the data gathered for the Project, there do not appear to be notable differences between the water quality of the Pūhoi and Mahurangi catchments.

Further detail regarding water quality within the Pūhoi and Mahurangi catchments is provided in Section 3.6 of the Construction Water Assessment Report and Section 4.4 of the Operational Water Assessment Report. Initiatives between users of the Mahurangi catchment and Auckland Council regarding improving water quality have culminated in the production of the Mahurangi Action Plan, which is considered in Section 30.3.6 of this AEE.

4.2.4 Terrestrial ecology

A description of the flora and vegetation within the Project area is provided in Section 4.2.1 of this report.

The Terrestrial Ecology team's investigations have identified long tail bats, land snails and native and exotic lizards within the Project area in addition to a range of bird species. In addition to desktop analysis, the Terrestrial Ecology team undertook a number of field surveys for the Project to collect information on the existing environment with regard to terrestrial ecology in the Project area. The terrestrial and wetland vegetation sites surveyed are shown in Figure 4-12 and Figure 4-13. A detailed explanation of the methodology and description of the results of the survey are provided in Sections 3 and 4 of the Terrestrial Ecology Assessment Report.

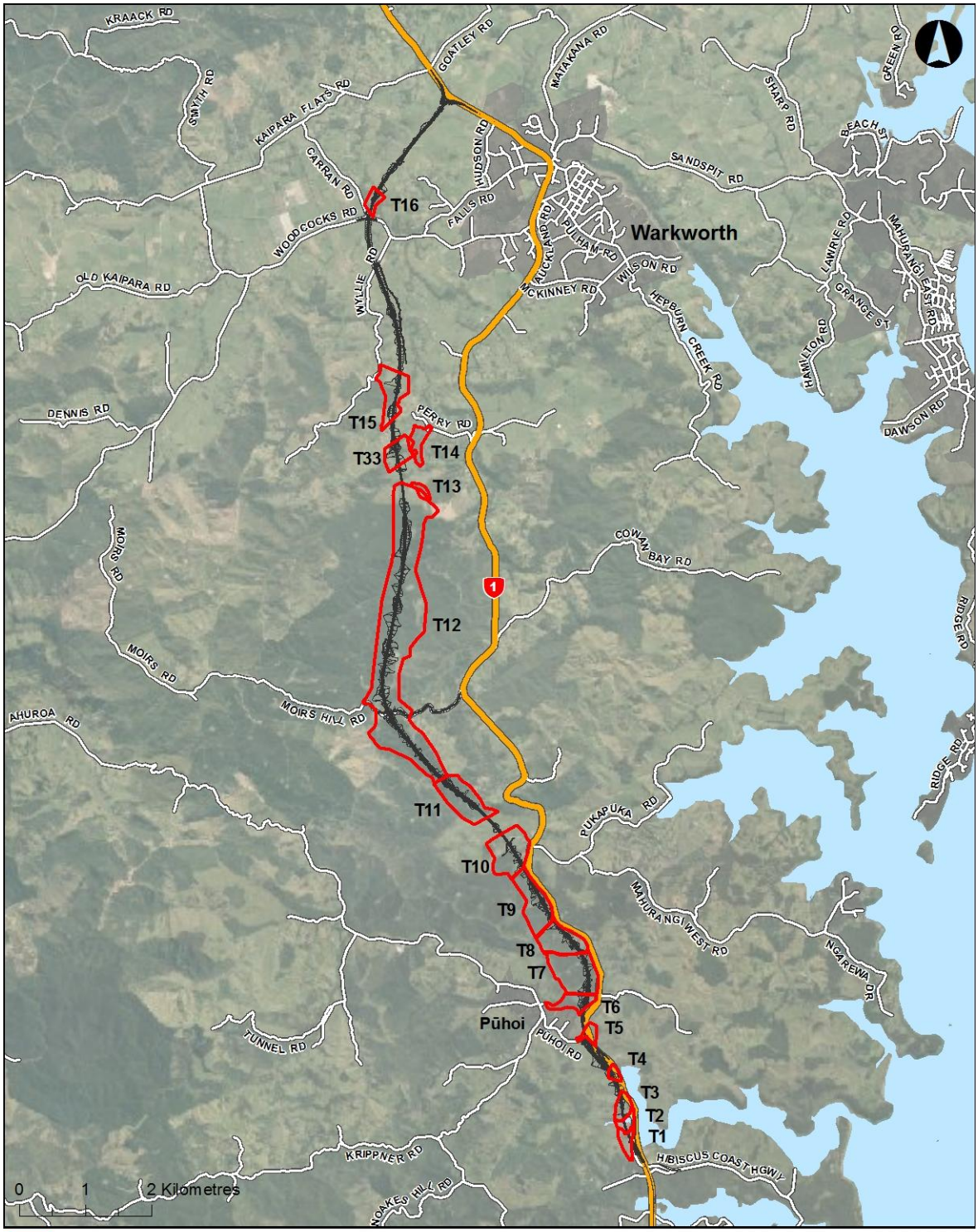


Figure 4-12: Assessed terrestrial sites

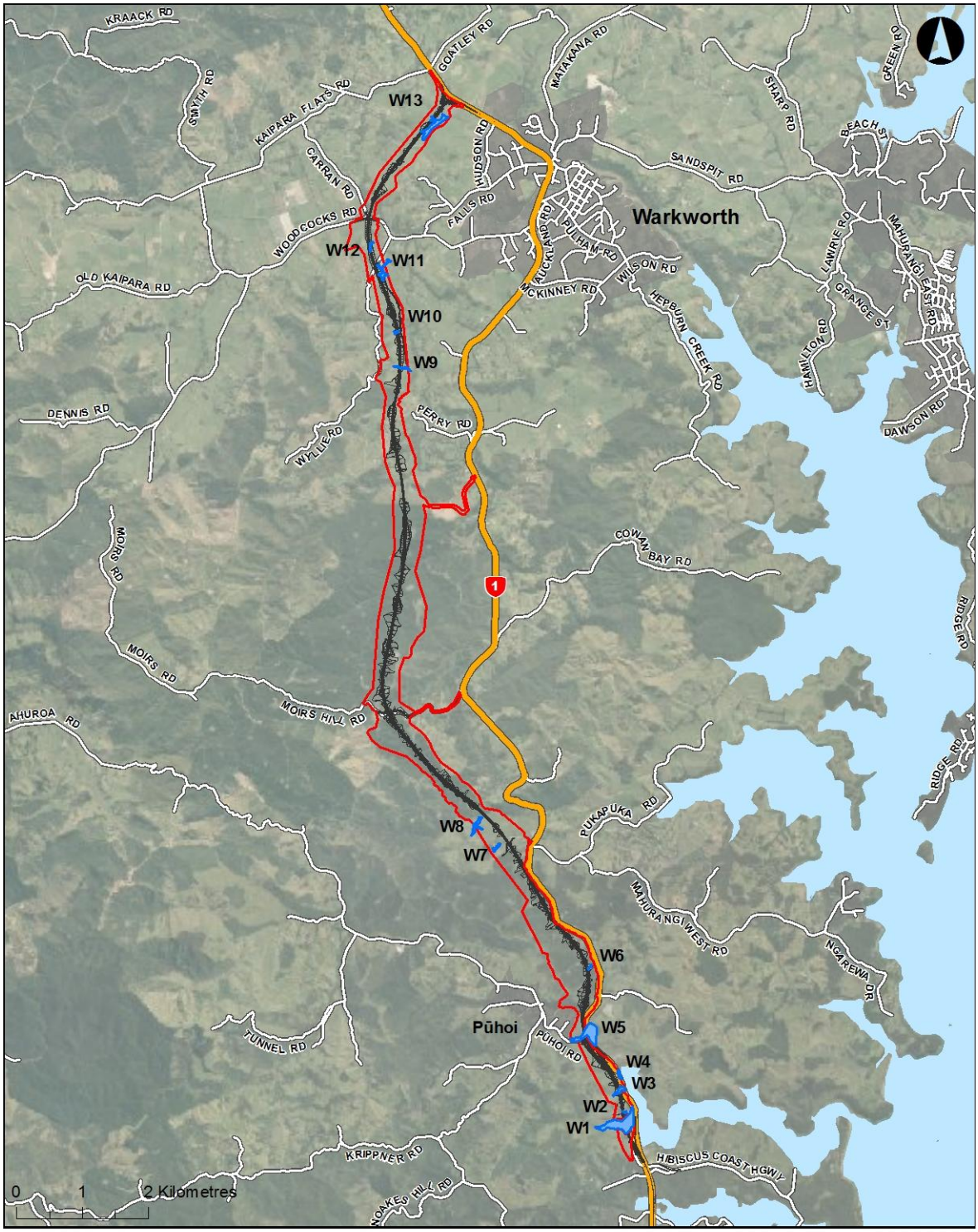


Figure 4-13: Assessed wetland sites

The Project area falls within the Rodney Ecological District. At least six species of native lizard are known to occur within the Rodney Ecological District, and may occur within areas of potential habitat along the indicative alignment. Of these six species, four are recognised as 'At Risk' under the New Zealand Threat Classification System. During the surveys undertaken for the Project, only native copper skinks (refer Photo 4–9) and forest geckos, and introduced rainbow skinks (classified as an 'Unwanted Organism'[61]) were found.

Photo 4-9: Copper skink

Surveys undertaken within the wider Project area have recorded 38 terrestrial bird species. These species are predominantly common endemic, native and introduced birds that also occur widely throughout the Auckland Region. Of the species identified, the North Island kaka is classified as 'Threatened' and the NZ pipit and red-crowned parakeet are classified as 'At Risk'. The kaka and red-crowned parakeet are likely to visit the pine plantation and remnant native habitats along the indicative alignment, although probably more likely to frequent larger tracts of native bush nearby.

A number of wetland birds, including three 'At Risk' species, marsh crake, spotless crake and fernbird are known to exist within the Project area.

Native long-tailed bats have been detected in the large pine plantation around Moirs Hill and the native forest remnants north of it around Perry Road (refer to Figure 4-4 to Figure 4-10). Long-tailed bats are classified as 'Nationally Vulnerable' in the North Island and are at risk of becoming extinct in the wild.

[61] Biosecurity Act 1993.

The Rodney Ecological District is home to a large diversity of land snails, including the larger kauri snail *(Paryphanta busbyi)* and smaller Rhytid snails *(Rhytida spp.)*, both of which are classified as 'At Risk – Declining' by the New Zealand Threat Classification System. The Terrestrial Ecology team did not encounter any species of land snails during the surveys undertaken for the Project.

Frog surveys undertaken for the Project did not identify any native Hochstetter's frogs at any of the sample sites.

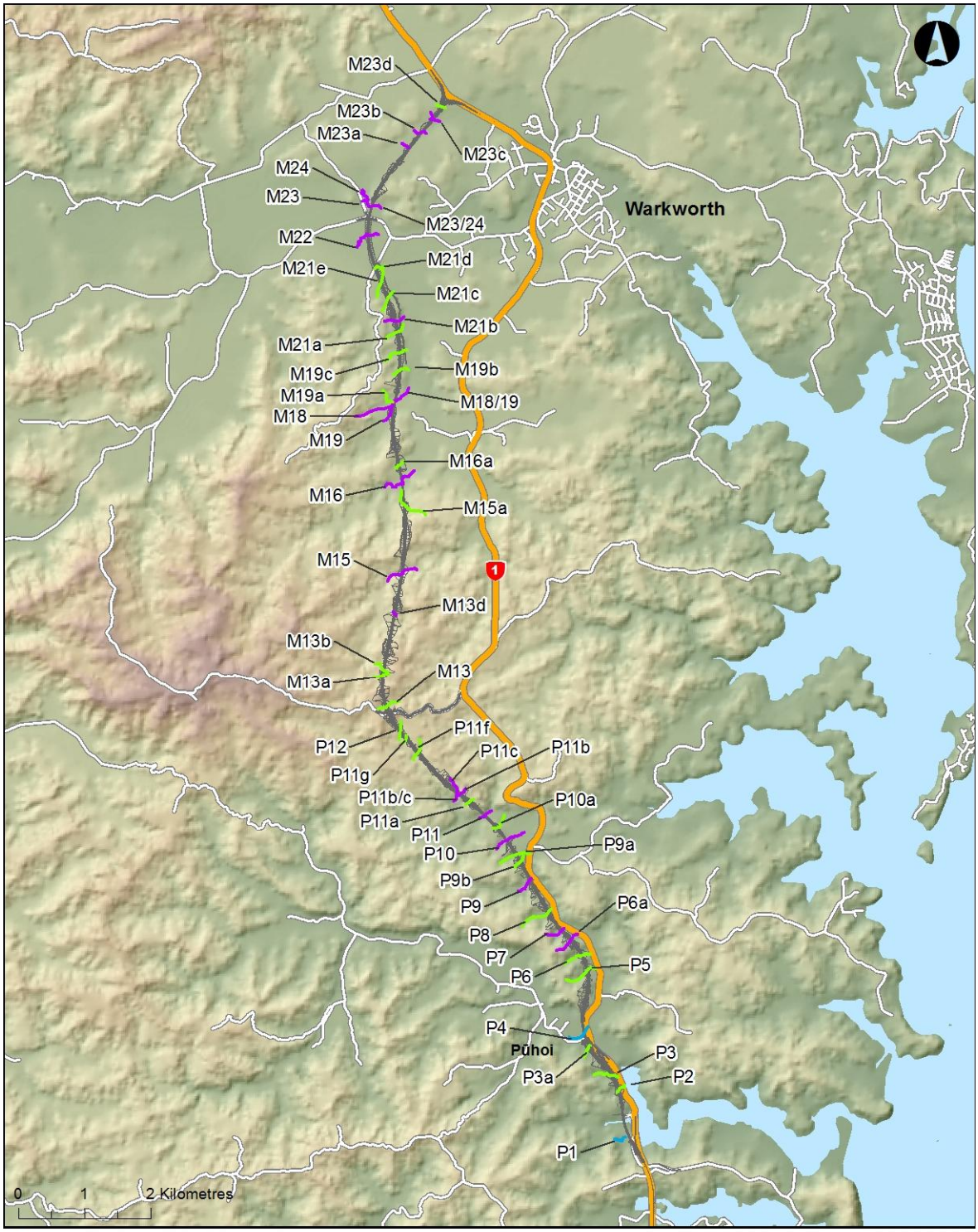
4.2.5 Freshwater aquatic ecology

The Project requires 22 crossings of permanent and intermittent watercourses, which are typical of those in the Auckland Region and reflect the land uses within the Pūhoi and Mahurangi catchments and their sub-catchments. These streams contain a paucity of aquatic plants, macroinvertebrates and fish species. The Okahu Inlet and Pūhoi River are addressed in the Marine Ecology Assessment Report and Section 12 of this AEE.

The Freshwater Ecology team has undertaken surveys of representative watercourses for the Project. Detailed information regarding the description of aquatic environments in the Project area is provided in Section 5 of the Freshwater Ecology Assessment Report. The main areas of potential aquatic habitat are described below.

South of the Pūhoi River main-stem, two intermittent watercourses drain small catchments of open pasture. Small wetlands formed at the lower extent of these watercourses retain some permanent aquatic habitat. North of the Pūhoi River, several small tributaries of the Hikauae Creek drain the forestry plantation block to the east. Waterways within the forestry plantations are typically small, soft-bottomed and densely overgrown by weeds and scrub vegetation beneath young pine trees. Most of these watercourses are considered to be intermittent.

The Hikauae Creek main-stem is considered to provide an important corridor for fish passage to upstream habitats. The main-stem and a small tributary at Site P10 (refer to Figure 4-14 for locations and descriptions of survey sites) within the farmland south of Schedewys Hill provide habitat for a range of fish species, including banded kokopu, as well as Cran's bully, inanga and shortfin eel, an abundance of koura and a moderate diversity of macroinvertebrates.



Stream types Indicative Alignment

Estuarine

Intermittent

Permanent

Note P = Pūhoi catchment and M = Mahurangi catchment

Figure 4-14: Assessed freshwater sites

The Project will require stream crossings within forestry blocks in the Mahurangi catchment.

Tributaries of the Mahurangi River Right Branch to the southwest and west of Perry Road have retained a ribbon of native riparian vegetation that provides shade for aquatic habitats. A large tributary of the Right Branch at Site M16 (refer to Figure 4-14) is a high quality freshwater environment that provides habitat for several fish and invertebrate species. A smaller tributary of the Right Branch at site M19 close to the Genesis Aquaculture facility provides habitat for a similar diversity of species, despite catchment modifications and land use changes (including vegetation removal and pastoral intensification) affecting some aspects of the watercourse.

Between Wyllie Road and Woodcocks Road, a tributary of the Mahurangi River Left Branch (Site M22) drains a predominantly rural catchment. Catchment modifications have adversely affected many components of the stream, resulting in a relatively poor quality freshwater habitat.

Surveys of the Mahurangi River Left Branch (Site M24) recorded shortfin eel, common bully, inanga, koura and freshwater mussels. The Freshwater Ecology team's assessment of this section gave an overall indication of a fair quality habitat. This section of the Left Branch functions as a pathway for upstream migrating fish such as shortfin and longfin eels and banded kokopu.

4.2.6 Marine ecology

(a) Okahu Inlet and the Pūhoi River and Estuary

The Auckland Council's State of Auckland Marine Report Card system monitors water quality, ecological health and contaminants in sediments and attributes grades from A to F for each of these variables (A being the highest and F being the lowest), and an overall grade for the area monitored.

The Pūhoi Estuary has been given an overall ecological health grade of C, while the marine report card for the Pūhoi Region attributes an overall grade of B. Sediment quality sampling of three sites in the Pūhoi Estuary by Auckland Council in 2010 identified very low contaminant concentrations. Subsequent sediment sampling undertaken for the Project in 2013 also indicated that contaminant results are below relevant thresholds. Water quality for the wider Warkworth/Wellsford Coast, in which the Pūhoi Estuary is located, has been ranked as 'good'[62]. Further information regarding the ecological values of the Pūhoi Estuary is provided in Section 3.2 of the Marine Ecology Assessment Report.

The ARP:C identifies Okahu Inlet (referred to in the ARP:C as *Okahu Creek*) as CPA (75g) and the Pūhoi River and Estuary as CPAs (75c–h) (refer to Figure 4-11).

The ARP:C's wider description of the Pūhoi River and Estuary, including Okahu Inlet, states:

> *This area is characterised by a considerable variety of intertidal substrates which together form a complex array of habitats which support a variety of animals and plant communities.*
>
> *The intertidal flats within the Pūhoi estuary (75c) are used as feeding grounds by a variety of birds, many of which use this area as a stepping stone in their travels.*

[62] Refer to Section 3.2 of the Marine Ecology Assessment Report

The saline vegetation areas in the Pūhoi estuary are more substantial and are some of the best in the district (75d-h).

These too are inhabited by a variety of secretive coastal fringe birds particularly where habitat quality is enhanced by the adjoining terrestrial vegetation which provides shelter for the birds and offers potential nesting sites.[63]

In addition to the CPA classifications, DoC has identified the Pūhoi Estuary as one of 62 ASCVs in the Auckland Region.

The lower half of Okahu Inlet is vegetated with rushes. Mangroves are common further towards the existing SH1. Mud crabs and large mud snails are also common. Estuarine birds present in the Inlet include banded rail, pukeko and NZ kingfisher.

Photo 4-10: Okahu Inlet and Pūhoi Estuary

The main channel of the Pūhoi River has a typical soft mud substrate and contains mangroves and native riparian vegetation on its southern bank with flax on its northern bank. There are occasional rushes, saltmarsh ribbonwood bushes and Mercer grass. Downstream from the bridge on the SH1 side there is a large area consisting predominantly of willows and giant reed, and a smaller area of rushes surrounded by marsh ribbonwood, manuka, flax and pampas. The river channel provides good habitat for banded rail and both NZ kingfisher and pied shag were recorded by the Terrestrial Ecology team roosting in a dead riparian tree upstream from the SH1 bridge. Mud crabs are common in the Pūhoi River.

[63] Auckland Council Regional Plan: Coastal, 2004, Schedule 3-18.

The lower reaches of the Pūhoi Estuary are dominated by extensive intertidal flats fringed by mangroves and patches of saltmarsh. Towards the upper reaches, where the intertidal flats are relatively high and expansive, dense mangrove stands are present and continue upstream into the Pūhoi River.[64]

Marine invertebrates in the Pūhoi Estuary are dominated by corphidae, *Capitella* spp. and oligochaetes and pipi. Sites of sandy intertidal flats with some mud toward the central part of the estuary contained the highest species richness. Mud crabs are reported to be common within the main channel of the river. Sites toward the mouth of the estuary show more variability in community composition over time than sites higher up the estuary. Although some surveys have reported low diversity and richness of benthic invertebrates within the Pūhoi Estuary in comparison to samples collected at other estuaries, the Marine Ecology team considers that the community composition is characteristic of upper estuary mudflats with low inundation time and low current within a mature estuary.[65]

It is likely that the Pūhoi Estuary provides habitat for fish species when inundated at high tide, due to the presence of large stands of mangroves. Typical species using this kind of habitat include sand and yellow-belly flounder and snapper. In fish surveys undertaken in comparable mangrove habitat in the Mahurangi Harbour in 2005, NIWA identified yellow-eyed mullet as the most abundant fish, in addition to juvenile short-finned eels, parore and grey mullet.[66] It is likely that these species are also present within the Pūhoi Estuary at various times. It is expected that stingrays may use the Pūhoi Estuary as a feeding ground during high tide, given that the extensive intertidal flats provide suitable foraging habitat. The intertidal flats also provide foraging habitat for a variety of wading and migratory birds. The Marine Ecology team considers the estuary to be a potential transitory habitat for migratory birds.[67]

Surveys undertaken by the Terrestrial Ecology team recorded the presence of mallard, pukeko, kingfisher, welcome swallow and pied shags upstream and downstream of the SH1 bridge over the Pūhoi River. NZ kingfisher, pied stilt, variable oystercatcher, Caspian tern and red-billed gull were also observed during marine field surveys undertaken for the Project.

(b) Mahurangi Harbour

Auckland Council undertakes long-term monitoring of marine water quality in the Mahurangi Harbour. In 2012 the Council ranked the overall water quality of the Mahurangi Harbour as 'excellent'[68] and it has shown signs of improvement over time (up to 2012). Contaminant concentrations in sediment are low and below effects thresholds at all but two of the sites surveyed. Copper concentrations at Vialls Landing and Jamiesons Bay were in the amber range of Auckland Council's Environmental Response Criteria. Contamination of estuarine sediments at these sites is likely due to anti-fouling of boat hulls arising from current and historic boat-related activities.

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64 Refer to Section 3.1.1 of the Marine Ecology Assessment Report.

65 Refer to Section 3.2.5 of the Marine Eclogy Assessment Report.

66 Refer to Section 3.2.6 of the Marine Ecology Assessment Report.

67 Refer to Section 3.2.8 of the Marine Ecology Assessment Report.

68 Refer to Section 3.1 of the Marine Ecology Assessment Report

The Mahurangi Harbour is identified as ASCV 24 and listed in the ARP:C as CPA (76a-p) 'Mahurangi Harbour'. It has been given an overall grade of B, with water and sediment quality achieving a high grade of A, and ecological values graded C. The upper estuary and upper reaches of the inlets provide habitat for dense stands of mangroves, with some patches of seagrass identified in a number of inlets in the middle to lower reaches. Seagrass beds provide important nursery habitat for juvenile fish and benthic macrofauna.

Benthic invertebrate community composition in the Mahurangi Harbour is dominated by bivalves and polychaetes. Horse mussels have declined in abundance in subtidal sites over the past two years[69] (up to 2012). The Mahurangi Harbour is also a regionally important centre for oyster faming, with several aquaculture farms established in the 1970s in the embayments of the Mahurangi Harbour.

A range of fish species are known to use the harbour, the most common being exquisite gobies, snapper, yellow-eyed mullet, anchovy, jack mackerel, red mullet and mottled triple-fin. Refer to Section 3 of the Marine Ecology Assessment Report for further information on fish species present in the Mahurangi Harbour.

The Mahurangi Harbour is likely to provide breeding, feeding or resting habitat for a number of coastal bird species. Among those species whose primary habitat may include the coastal and estuarine areas of the Mahurangi Harbour are the following species:

- Banded dotterel;
- Banded rail;
- Black-backed gull;
- Caspian tern;
- Eastern bar-tailed godwit;
- Northern NZ dotterel;
- Red-billed gull;
- Reef heron;
- Royal spoonbill;
- Variable oystercatcher;
- White-faced heron;
- White-fronted tern; and
- Wrybill.

Of those listed above, the banded dotterel, Caspian tern, northern NZ dotterel, red-billed gull, reef heron and wrybill are classified as Nationally Vulnerable[70].

A number of other species for whom coastal and estuarine areas are a secondary habitat and which may be present in the Mahurangi Harbour are listed in Section 3 of the Marine Ecology Assessment Report.

[69] Refer to Section 3.1.7 of the Marine Ecology Assessment Report.

[70] Refer to Section 3 of the Marine Ecology Assessment Report.

4.3 Physical environment

4.3.1 Topography and landscape

The Project area is largely characterised by low open undulating hill country in the north, and steeper rolling hill country with distinctive complex incised landforms of interconnected ridge and valley systems in the central and southern parts.

Pūhoi is situated at a low elevation within the Pūhoi River Valley. Generally, the topography to the north and west of Pūhoi rises steeply to several prominent landforms in the area including The Crag, Schedewys Hill (see Photo 4-11below), Windy Ridge and Moirs Hill.

The topography immediately south of Warkworth is generally flatter and lower in elevation. Warkworth is situated on low hills and ridges and framed to the west (Falls Road) by a low ridge and to the east by the Mahurangi River and Mahurangi Harbour.

The extensive network of rivers and streams throughout the area reflects the relative complexity of the landform along much of the indicative alignment. Refer to Figure 4-15 for the topography of the Project area.

Photo 4-11: Schedewys Hill

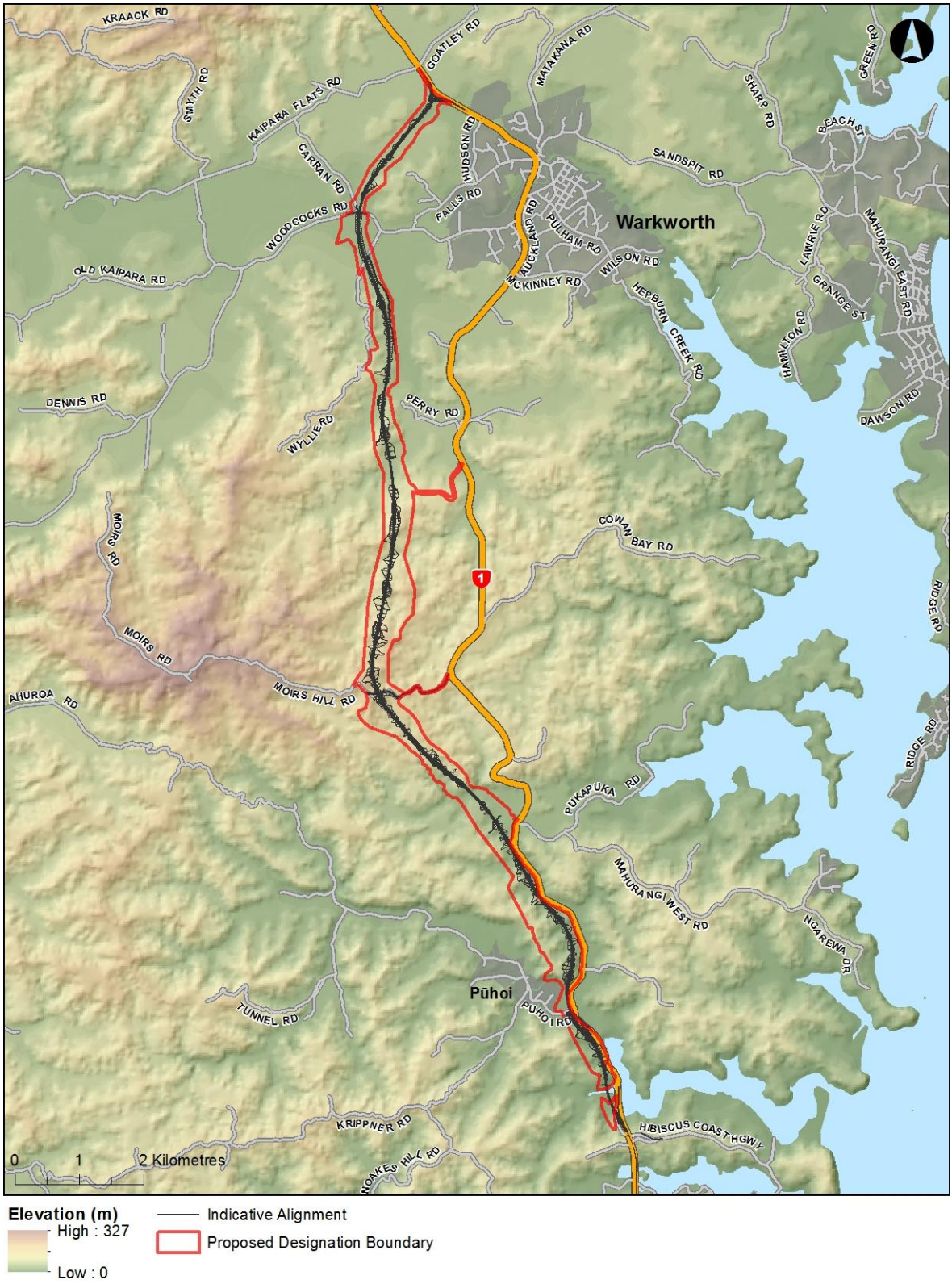


Figure 4-15: Topography of the Project area

ONLs within the Auckland Region are identified by Proposed Change 8 'Landscapes' to the ARPS. ONLs relate to aspects including topography, ecology and aesthetic value. A key objective of the ARPS is to protect ONLs from inappropriate subdivision, use and development. Section 3 of the Landscape and Visual Assessment Report describes the different landscape units and values that make up these ONLs.

The proposed designation only crosses ONLs 43 and 44 (refer to Figure 4-4 for locations). All three ONLs are classified as 'Hill Country' and all share the same landscape type descriptors, including relatively high relief with significant areas of maturing vegetation and a low level of built modification.

A number of locations along the indicative alignment are identified as Significant Natural Areas (SNAs) under the ACDP. Although these areas generally coincide with the ONLs noted above, their determination is more based on their values as areas of natural habitat for native flora and fauna rather than broader landscape values. A detailed description of significant natural landscape features is provided in Section 5 of the Landscape and Visual Assessment Report (refer to Figure 4-4 for the location of the SNAs in the Project area).

Photo 4-12: Pohuehue Scenic Reserve

The designation boundary will largely avoid the SNAs, passing to the west of most SNAs, including the Pohuehue Scenic Reserve (as shown in Photo 4-12), the SNA at Schedewys Hill and south of Mahurangi West Road. The designation boundary will extend through a small section of the northern extent of the SNA north of Fowler Access Road at the exit of the Johnstone's Hill tunnels

and a small section at the western extent of the SNA adjacent to Woodcocks Road to the west of Falls Road.

4.3.2 Coastal

(a) Okahu Inlet and the Pūhoi River and Estuary

Section 3.2 of the Marine Ecology Assessment Report describes Pūhoi Estuary as a highly infilled, tidal lagoon with narrow drainage channels intersecting extensive intertidal sand and mud flats fringed by dense mangrove stands. A sand barrier has reduced the mouth to a narrow channel, which provides protection from the sea and allows little to no ocean waves to enter the estuary. The estuary has a high tide surface area of 1.7km^2 and a tidal volume of 2.7M m^3.

The upper reaches of the Pūhoi Estuary are characterised by large mudflat and mangrove regions and pastured river flats. The mangroves thin out towards the estuary mouth. The estuary has high sedimentation rates with deposition occurring mainly along the inland sand barrier and upper reaches of the estuary, indicated by the extensive intertidal flats. This mature estuary is described as having sandier sediments and a low inundation in the upper reaches compared to lower reaches.

Okahu Inlet is an intertidal area adjacent to the Pūhoi Estuary. It consists of a broad open mudflat largely devoid of vegetation in its upper reaches but with a narrow, patchy fringe of manuka and maritime vegetation around its grazed-through upper fringes.

(b) Mahurangi Harbour

Although not directly affected by the Project, the Mahurangi Harbour is the ultimate receiving environment for a number of streams within the Mahurangi River catchment, some of which are within the Project area.

The Mahurangi River is the main tributary of the Mahurangi estuary and harbour; this is a long estuary flowing southwards from Warkworth. Several small bays and estuaries are located along the sides of the estuary with two larger arms (Pukapuka Inlet and Te Kapa River) to the south.

The Mahurangi Harbour is a drowned river valley (a former valley inundated by a rise in sea level) covering some 24.6km^2. It is characterised by large areas of intertidal mudflats and subtidal areas present in its middle to lower reaches. A variety of more exposed shores ranging from broad rock platforms to small sandy beaches exist outside the mouth of the harbour. Dense mangrove stands fringe the tidal flats of the upper estuary and side embayments. The Marine Ecology team has noted seagrass patches in the middle to lower reaches of the Harbour. The upper estuary has a narrow and shallow tidal creek that extends 6.4km from the town of Warkworth to Hamilton's Landing, near Dawson's Creek.

Historical deforestation and land use intensification have led to high sedimentation in the River and Harbour. This sedimentation has altered the marine environment and resulted in an increase in the extent of intertidal flats and changes in benthic communities.[71]

[71] Auckland Regional Council, 2010, *Mahurangi Action Plan: A strategic plan for the catchment 2010-2030*.

4.3.3 Geology

The geological structure is the dominant mechanism controlling slope stability, and the existing topography of the Project area is largely controlled by the underlying geological structure. The geology of the Project area is shown in Figure 4-16.

The geology of the indicative alignment is dominated by sedimentary rocks of the Waitemata Group, in particular the alternating layers of sandstone and siltstone of the Pakiri Formation. The Pakiri Formation forms the majority of the steep rugged topography found in the Project area.

The indicative alignment encounters sheared Northland Allochthon mudstone and extensive alluvial deposits (clays, sands, silts and gravels) in the low-lying areas around Warkworth. These areas were carved out by major rivers and infilled with deep, soft estuarine and alluvial sediments.

Geological processes have resulted in a complex arrangement and combination of weak to moderately strong sandstones and mudstones with large areas of significantly weaker, highly sheared mudstones, siltstones, sandstones and limestones of the Northern Allochthon.[72]

Thrust faults define many of the boundaries between Pakiri Formation and Northern Allochthon sheets.

The steep terrain along much of the Project alignment results in much of the overlying soils being either unstable or highly susceptible to erosion when exposed to certain climatic and ground cover conditions. In addition, on the NGTR (immediately south of the Project), ongoing sediment has been observed to be generated from exposed cut batters post construction, which is evidenced in a number of the operational stormwater ponds and rock lined swales along this section of NGTR. The management of these slopes during construction is discussed in Section 6 of the Construction Water Assessment Report. Measures to minimise, control and mitigate the generation of sediment following construction are identified in the Operational Water Assessment Report.

Six discrete locations within the designation boundary have been identified as having potential to contain acid sulphate soils. Acid sulphate soils are naturally occurring soils rich in iron sulphide minerals. The disturbance of acid sulphate soils has the potential to release acid and toxic concentrations of metals that, without management, may lead to environmental and infrastructure degradation. The presence and extent of acid sulphate soils will be confirmed through further investigations at the detailed design stage of the Project. Appropriate management regimes are available and, on confirmation of the degree of disturbance a management plan, will be developed to manage the potential effects accordingly.

4.3.4 Regional hydrogeology

Groundwater in the Pakiri Formation is strongly influenced by incised valleys, with groundwater typically being elevated along ridgelines and depressed along valley sides and floors. Perched and leaky water tables may be present in the Project area at higher elevations than the local water table in discrete localities, reflecting the interbedded nature of the sandstone/siltstone formation and the typically low permeability of the siltstones providing the basal layer for perching.

[72] Refer to Section 3 of the Construction Water Assessment Report

Permeability of the Northern Allochthon is typically very low, and groundwater is typically observed as a line of seepage or minor springs at geological boundaries between units within the formation.

The majority of valleys in the Project area have been infilled with deep, soft estuarine and alluvial sediments comprising clay, silt, peat and fine sand.

Overall, the underlying geology of the Project area has resulted in typically low yielding aquifers. The exception to this is localised zones of higher yields associated with faulting and the localised more gravelly components of the generally silty shallow alluvial deposits infilling valleys.

A more detailed explanation of the hydraulic parameters for each of the geological units within the wider Project area is provided in Section 2.1 of the Hydrogeology Assessment Report.

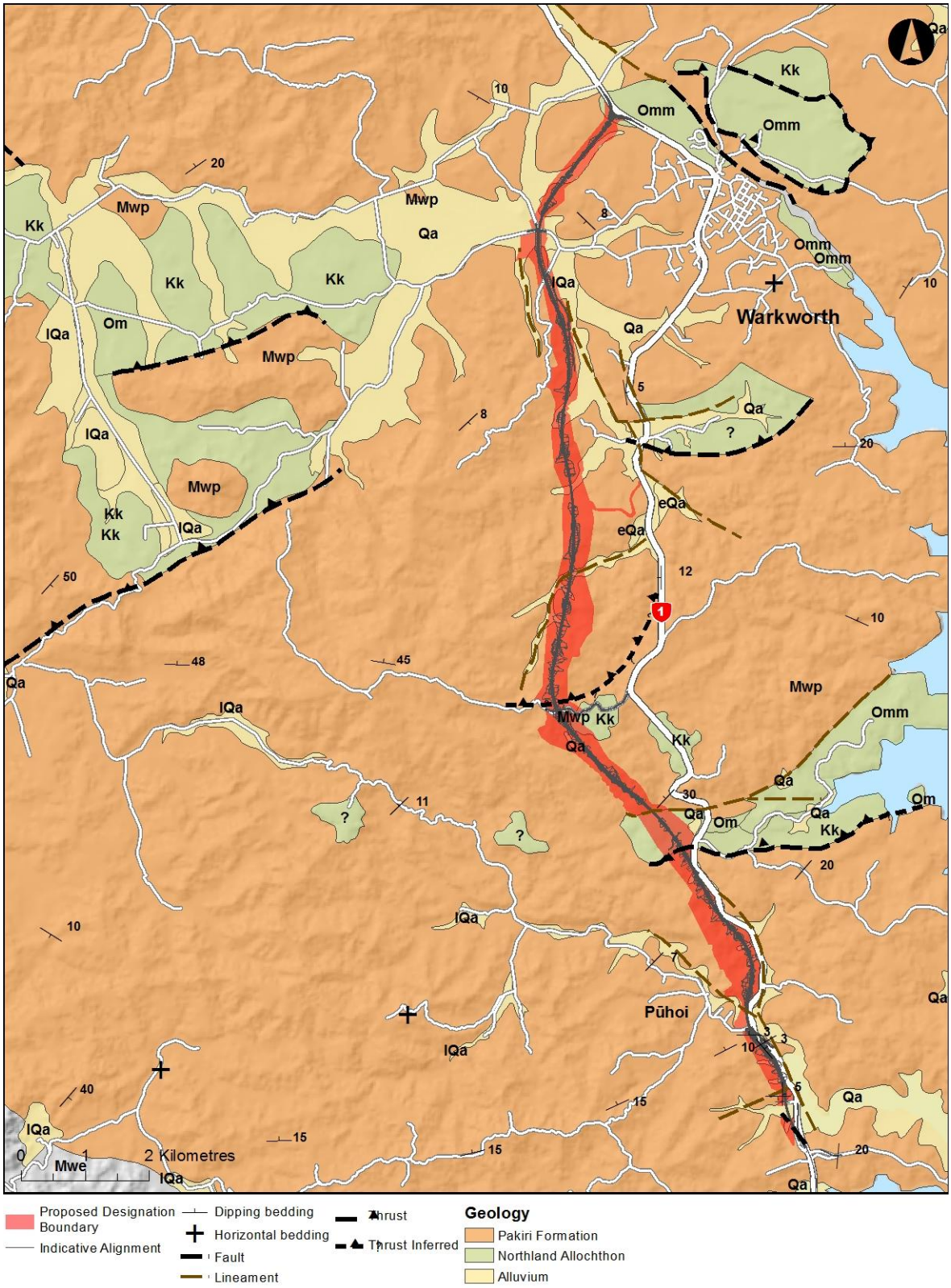


Figure 4-16: Geology of the Project area

5. Project description

This section should be read in conjunction with the Drawings (Volume 4) and Assessment Reports (Volume 3) that form part of the AEE documentation.

The information provided in this section and in the Drawings shows an 'indicative alignment'. Detailed design may result in refinements of the alignment, which will remain within the designation boundary. The detailed design will be subject to consideration under the conditions of resource consent and the outline plan of works (OPW) process under s176A of the RMA. The OPW process is described in greater detail in Section 1.9 of this AEE.

This section discusses the following components of the Project:

- The design philosophy;
- Motorway design;
- Local private access roads;
- Traffic services;
- Walkways and cycleways;
- Emergency vehicle access;
- Permanent access tracks for maintenance activities;
- Cut slopes and fill embankments;
- Viaducts and bridges;
- Operational water management;
- Urban design; and
- Landscaping.

5.1 Design philosophy

In accordance with the objectives and design standards for the national RoNS programme, the Project will be designed, constructed and operated as a new motorway, being an extension of the existing SH1 from the NGTR at the Johnstone's Hill tunnels to just north of Warkworth.

The Project will be a new off-line (ie an alignment that does not sit within the existing SH1 alignment) four-lane, dual carriageway road over a total length of 18.5km.

The overall approach to the design for the Project is as follows:

- Design elements of the Project to the relevant design standards, including the NZTA's RoNS design standards and guidelines;
- Avoid, remedy or mitigate adverse effects on the environment;
- Minimise adverse effects on adjacent properties and identify appropriate mitigation measures;
- Maintain connectivity provided by existing infrastructure including local roads, providing property access and farm access;
- Provide for route security on the State highway network, including provision for alternate routes and adopting appropriate design standards for aspects such as stormwater (flooding);

- Adopt a 'whole of life' approach to the Project design in order to provide opportunities for optimised construction, operation and maintenance and associated effects, mitigation and costs; and
- Continue the NGTR, including carriageway capacity, approach to pavement and structure design, levels of accessibility, and landscaping and visual appearance.

5.1.1 Whole of Life

The GPS requires the NZTA to consider a range of matters in relation to transport projects and programmes, including value for money. This concept requires taking a long-term, whole-of-life approach to the design, operation and maintenance of the State highway network, inclusive of the social, environmental, cultural and economic effects.

The indicative design for the Project has been developed cognisant of adopting a whole of life approach to the design, operation and maintenance of the motorway as outlined through various sections of this report. Detailed design of the Project will consider whole of life factors in further detail, particularly in relation to:

- Pavements and surfacing – consideration of the predicted design life seal, predicted traffic volumes, median treatment and maintenance requirements and costs;
- Viaduct and bridge structures – consideration of material types and surface coatings, standardisation of structural fittings and components, future capacity requirements and drainage;
- Retaining walls and embankments – consideration of material types and structural design;
- Lighting – consideration of lighting design, levels and typologies;
- Traffic and safety services – consideration of whole of life requirements in relation to barriers, line marking and signage, traffic signals, Intelligent Transport Systems and gantries, inclusive of existing systems, technological advances and functional requirements;
- Stormwater collection, conveyance, treatment and disposal – consideration of the drainage design ie. culvert designs account for future development in the catchment and climate change, debris blockage, maintenance requirements such as wetland or swale planting in comparison to overall aesthetic considerations;
- Landscaping – consideration of ongoing maintenance requirements of various plant species, pest management, areas to be maintained by weed spraying, and metaled areas, litter and graffiti management; and
- Utility services – consideration of both existing and future utilities.

Coupled with the design and construction aspects outlined above, the whole of life considerations must extend to consent compliance and renewal in relation to stormwater discharges and coastal structures.

5.2 Motorway design

5.2.1 Design standards

The Project has been designed in accordance with the following standards:

- NZTA's Motorway Design Standards for the south facing ramps at Pūhoi and grade separation of all local roads. The motorway will transition back to the existing State highway network via a roundabout located to the northwest of Warkworth.
- A minimum design speed of 100kph.
- A minimum Stopping Sight Distance (SSD) of 221m.
- A median divided carriageway incorporating:
    - 2 x 3.5m wide traffic lanes in each direction;
    - 2.5m wide left hand shoulder; and
    - 6m minimum median width including a 1.0m minimum right hand sealed shoulder and a Test Level 4 wire rope median barrier.
- A safe system approach for the motorway edge treatment, where continuous Test Level 4 wire rope barriers are located 4.0m from the edge line.
- A minimum horizontal curve radius of 820m.
- A maximum gradient of 6%.
- Vertical curves meeting both appearance and head light sight distance requirements of:
    - Sag curve minimum K = 50;
    - Crest curves minimum K = 109.

Refer to Drawing R-211 in Volume 4 for the typical carriageway details.

5.2.2 Design speed

The Project will extend through two distinct regions of topography and land use. In the northern third of the Project, the indicative alignment is elevated above rolling farmland, gently graded with gradients of less than 3% and provides large radii flowing curves where operating speeds are likely to be high. In these sectors a design speed of 110kph has been adopted.

For the southern two thirds of the Project, where the indicative alignment is more constrained by steep topography and the existing SH1, and includes a series of sustained gradients of up to 6.5%, a design speed of 100kph has been applied.

5.2.3 Indicative alignment description by Sector

For assessment and communication purposes, the indicative alignment has been split into six sectors as shown on Figure 5-1.

A description of the indicative alignment in each of the Sectors is outlined below. The description should be read in conjunction with the Drawings in Volume 4: Drawing R-100 – R-115 for detailed road plans of the indicative alignment, Drawings R-120 – R-151 for plan and long sections of the indicative alignment and Drawings R-211 – R-228 for typical cross sections.

The description of the Project Sectors commences at the NGTR (Johnstone's Hill tunnels), where the indicative alignment will connect with the existing SH1, and extends northwards to the tie-in with the existing SH1 just south of Kaipara Flats Road. The chainages adopted for the Project start at Kaipara Flats Road.

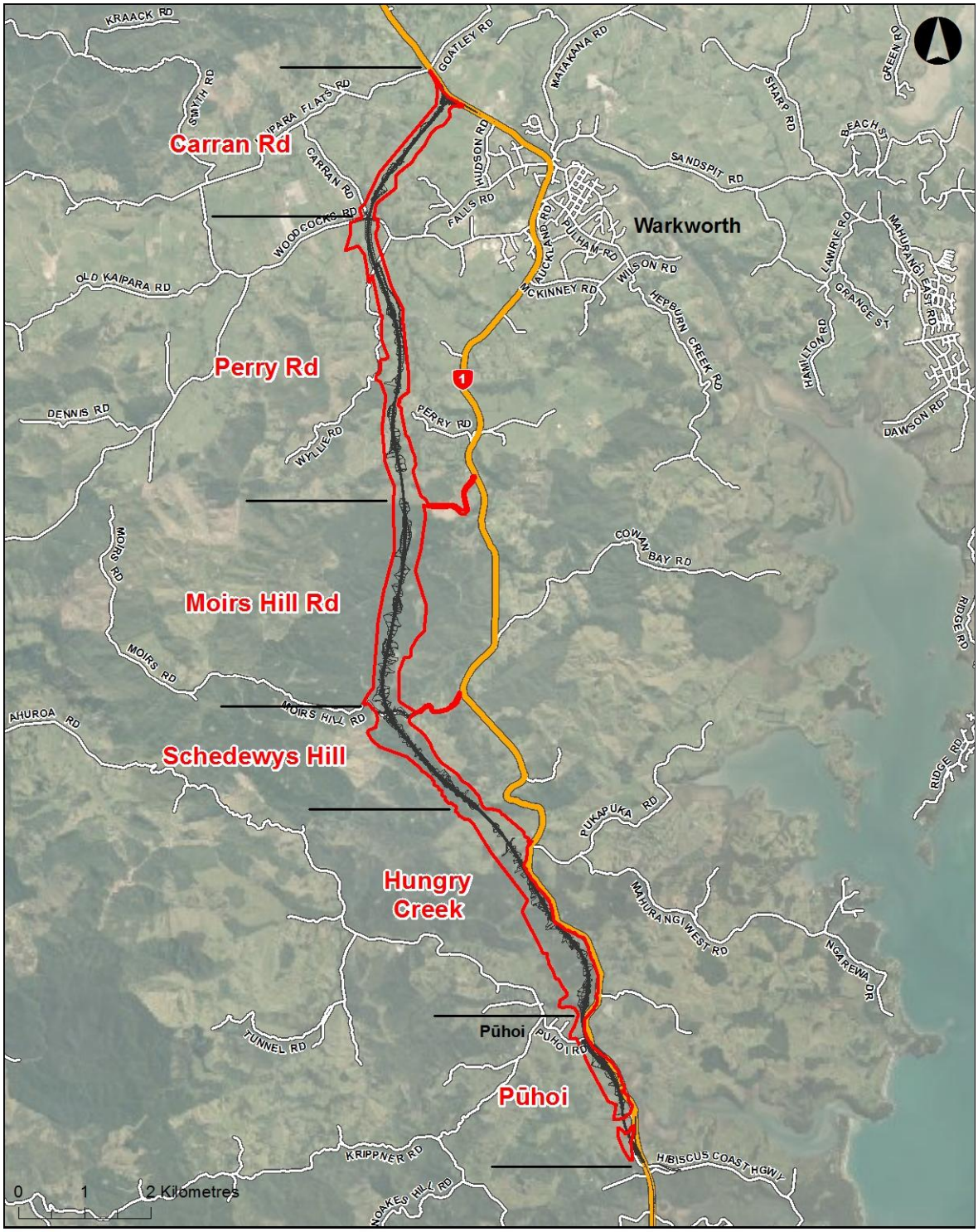


Figure 5-1: Project Sectors

(a) Pūhoi Sector

The Pūhoi Sector extends from the northern portals of the Johnstone's Hill tunnels to the vegetated escarpment north of Pūhoi Road.

Heading north from Johnstone's Hill, the indicative alignment exits the Johnstone's Hill tunnels at approximately Ch. 65040m and curve west along the western side of SH1. The Okahu Viaduct, approximately 520m in length, will extend across the Okahu Inlet. The maximum height of the viaduct will be approximately 28m above the existing ground level.

The recorded heritage sites of Te Pā o Te Hēmara Tauhia, Titford Cottage and Titford House are located immediately to the east of the proposed alignment near Okahu Creek. On leaving the Okahu Viaduct the indicative alignment passes to the east of a previously unrecorded pā site and continues to the Pūhoi Interchange located near Pūhoi Road, approximately 1.5km from the northern portals of the Johnstone's Hill tunnels. The interchange will provide a connection between the existing section of SH1, north of Pūhoi to the built motorway (refer to Section 5.2.5 for further detail).

The indicative alignment extends over Pūhoi Road and the Pūhoi River on the Pūhoi Viaduct, approximately 300m in length with a maximum height of approximately 20m above the existing ground level.

This Sector incorporates a connection between the Hibiscus Coast Highway and SH1 immediately north of Johnstone's Hill (refer to Section 5.2.5 for further detail).

5.2.4 Hungry Creek Sector

The Hungry Creek Sector extends from the vegetated escarpment north of Pūhoi Road to Schedewys Hill. The indicative alignment through the initial part of this Sector is generally parallel to, and up to approximately 200m west of, the existing SH1. The indicative alignment in this sector requires substantial cut slopes and fill embankments. A cut slope approximately 600m in length with a maximum cut slope of approximately 50m is proposed between Ch. 61925m to Ch. 62525m (Cook Road) and a slope of approximately 460m with a maximum cut slope of approximately 50m is proposed between Ch. 60280m to Ch. 60740 (Watson Road).

An overpass, approximately 13m above the existing ground level with a length of approximately 35m, will be provided at Watson Road at Ch. 60220m to provide for the new motorway to pass over the private forestry road.

North of the intersection of Mahurangi West Road and the current SH1, the indicative alignment veers west away from the existing State highway. Between Ch. 59408m to Ch. 59588m, the indicative alignment passes over Hikauae Creek on the Hikauae Viaduct, approximately 180m in length with a maximum height of approximately 18m above the existing ground level. The Hikauae Viaduct maintains farm access beneath the structure.

(c) Schedewys Hill Sector

The Schedewys Hill Sector extends from Schedewys Hill (at the SH1 Bridge at Hikauae Creek) to Moirs Hill Road.

Upon exiting the Hikauae Viaduct, the indicative alignment extends west of Schedewys Hill and continues along the western side of a north-south oriented valley towards Moirs Hill Road. The indicative alignment extends across the Schedewys Viaduct. The viaduct will be approximately 370m in length with a maximum height above the existing ground level of approximately 44m.

At the southern extent of the forestry areas in this Sector, the indicative alignment separates into a split level carriageway over a length of approximately 4 km with a maximum vertical difference of approximately 10m.

The indicative alignment in this Sector will require substantial cut slopes and fill embankments. At Wreaks Road (a private forestry road) a cut slope of approximately 45m in height is proposed. Where the indicative alignment passes beneath Moirs Hill Road, approximately 1km west of the current SH1, a 'box cut' slope of approximately 40m is proposed.

(d) Moirs Hill Road Sector

The Moirs Road Hill Sector extends from Moirs Hill Road through to Perry Road.

A section of Moirs Hill Road between the existing SH1 and the Project will be realigned as part of the proposed designation to provide access for both local traffic and construction traffic.

From Moirs Hill Road, the indicative alignment continues through a series of valleys and ridges beyond the western edge of the Pohuehue Scenic Reserve. The largest cut slopes and embankments along the indicative alignment are proposed in this Sector. Specifically, four cut slopes approximately 50-60m in height are proposed between Ch. 56760 to Ch. 53820 from Moirs Hill Road north to a new access track south of Perry Road. Three major embankments approximately 20-50m in height are proposed.

Upon exiting the forestry area, the indicative alignment extends across the Perry Road Viaduct to the south west of Perry Road. The viaduct will be approximately 500m in length with a maximum height of approximately 45m above the existing ground level.

(e) Perry Road Sector

The Perry Road Sector extends from just south of Perry Road to the Woodcocks Road/Carran Road intersection.

The indicative alignment extends northward through the valley between Perry Road and Wyllie Road. The indicative alignment passes to the west of Genesis Aquaculture and extend for approximately 220m on the Kauri Eco Viaduct (approximately 20m above the existing ground level). The indicative alignment continues north before crossing Wyllie Road.

Two large cut slopes, approximately 50m in height between Ch. 52430m to Ch. 52930m (west of Perry Road) and 35m approximately Ch. 50540m to Ch. 50820m (east of Wyllie Road), are

proposed within this Sector. An embankment of approximately 30m in height is proposed between Ch. 52880m and Ch. 53160m.

Between Ch. 48982m and Ch. 49262m, the indicative alignment is located on the Woodcocks Road Viaduct across the Carran Road/Woodcocks Road intersection and the Left Branch of the Mahurangi River. The northbound viaduct will be 250m in length and the southbound viaduct approximately 280m in length. The viaduct will be approximately 12m above the existing ground level. The Woodcocks Road and Carran Road intersection will be realigned to improve local traffic access beneath the viaduct.

(f) Carran Road Sector

The Carran Road Sector extends from Woodcocks Road to the northern extent of the alignment at the existing SH1 just south of Kaipara Flats Road.

North of Woodcocks Road the indicative alignment heads eastward along a south-facing slope adjacent to the floodplain of the Mahurangi River Left Branch. The indicative alignment then heads along the base and lower northern slopes of a narrow valley to the new roundabout that will provide a connection to the existing SH1 just south of Kaipara Flats Road in the vicinity of the current weigh bridge (station).

5.2.5 Interchanges and tie-in points

The indicative alignment includes the following connections:

- the Pūhoi interchange;
- southern tie-in connecting the alignment with the existing NGTR; and
- northern tie-in connecting the alignment with the existing SH1 through a roundabout just south of Kaipara Flats Road north of Warkworth.

(a) Pūhoi Interchange

The indicative design proposes an interchange providing a single lane northbound off-ramp and a single lane southbound on-ramp to and from Pūhoi in the vicinity of the Pūhoi Road and SH1 intersection. The vicinity is shown on Photo 5-1 below.

Photo 5-1: Pūhoi Road intersection with SH1

The northbound off-ramp descends from the main alignment to connect with Pūhoi Road approximately 80m from the existing intersection with the existing SH1. The intersection will be priority controlled with a splitter island between left and right turn lanes to channel traffic and will be designed so as to minimise wrong way movements onto the ramp. The south bound on-ramp intersection with SH1 will be located approximately 250m south of the existing SH1 and Pūhoi Road intersection. The on-ramp will allow for two ramp-metered lanes and at the ramp signalling, will point drop to a single lane ramp merge.

There is no provision in the indicative alignment for a northbound connection onto the new alignment at Pūhoi, or a southbound exit.

(b) Southern tie-in

At its southern extent, the indicative alignment connects directly with the existing NGTR (shown in Photo 5-2 below). From the southern abutment of the Waiwera Viaduct the existing single lane northbound through the northbound tunnel at Johnstone's Hill will be remarked to provide two northbound lanes. These works will fully realise the design capacity of the Johnstone's Hill Tunnels. Existing signage will be updated accordingly.

Photo 5-2: Johnstone's Hill Southern Tie-in and Hibiscus Coast Highway connection

The existing SH1 Hibiscus Coast Highway southbound off-ramp, to the east of the indicative alignment, will be remarked as a 2-lane carriageway (one lane in each direction) to maintain a connection between the existing SH1 and the Hibiscus Coast Highway for traffic travelling to and from Orewa and Waiwera. This connection will provide local access and function as an alternate route to the motorway.

The existing northbound link from the Hibiscus Coast Highway to the existing SH1 will be closed to general traffic but will be retained to provide access for northbound emergency services only.

(c) Northern tie-in

At the northern extent of the Project, a new roundabout will provide a connection to the existing SH1 just south of Kaipara Flats Road (in the vicinity of the current weigh bridge). The roundabout will provide connections to the built motorway from both SH1 to the north and to Warkworth via the existing SH1 route.

5.3 Local and private access roads

All local roads that intersect with the indicative alignment will be grade separated.

The indicative alignment passes over Pūhoi Road and Woodcocks Road on viaducts in order to maintain access to Pūhoi Road, Woodcocks Road and Carran Road respectively. The indicative alignment passes over Wyllie Road on an overpass, and under Moirs Hill Road, maintaining local access.

A number of private access roads and access tracks may require realignment in order to maintain existing links east and west of the indicative alignment. These include:

- Watson Road, a private forestry access road;
- The Hikauae Access Track; and
- A cattle access track at the approach to the new roundabout at the northern extent of the Project.

A new access road may also be needed to provide access on the eastern side of the indicative alignment to land off Wyllie Road as the current access is severed by the indicative alignment.

5.4 Traffic services

Traffic services along the indicative alignment will include features such as:

- Permanent road signs (including variable message signs);
- Road lighting;
- Road markings;
- Barrier protection;
- Traffic count stations
- Closed-circuit Television (CCTV);
- Speed enforcement;
- Emergency phones; and
- Emergency laybys.

The traffic services that will be in place when the motorway opens to traffic will be confirmed during the detailed design phase and will be designed in accordance with the relevant standards at the time the Project is constructed. Throughout the life of the motorway, it is anticipated that traffic services will be renewed and upgraded as required, to ensure the continued safe and efficient operation of the new State highway.

The Design team has provided for lighting at the Pūhoi Interchange on-and off-ramps and the approaches to the roundabout south of Kaipara Flats Road. The lighting design will comply with AS/NZS 1158:2005 (Standards New Zealand and Standards Australia, 2005) to a V3 category, or the equivalent standard applicable at the time the Project is constructed. Refer to Drawings R-201 and R-202.

5.5 Walkways and cycleways

In accordance with its intended status as a motorway, no separate provision will be made for pedestrians or cyclists along the alignment. Pedestrians and cyclists will be directed to the existing State highway through appropriate signage.

5.6 Emergency vehicle access

The existing Waiwera southbound off-ramp will be formed into a two-way road for both the northbound and southbound local traffic that is not using the NGTR toll road. This reformation will enable the existing Waiwera northbound link to be retained to form an emergency vehicle access

onto the northbound carriageway. Access will be controlled by a barrier at the motorway shoulder edge. This access point could also be used under traffic management to provide part of the diversion route for northbound traffic during any planned maintenance closure of the Johnstone's Hill tunnels, or during closures on the existing SH1 north of this point (eg due to accidents).

The carriageway will, where practical, contain splits in the median barrier to provide safe controlled manoeuvring of southbound traffic where an accident is causing delays.

5.7 Permanent access tracks for maintenance activities

Permanent access tracks will be constructed to provide long-term access to the built motorway for maintenance and emergency vehicles only. This access is required for on-going maintenance of the road, and for bridges, stormwater treatment devices and culverts. The location and design of the access tracks will be confirmed during the Project's detailed design phase.

5.8 Cut slopes and fill embankments

5.8.1 Cut slopes

The indicative alignment will extend through steep terrain with numerous ridges and valleys. As such, numerous cut slopes ranging in height up to 60m with many exceeding 10m will be required. Cut slope gradients adopted in the indicative design vary depending on the geology, weathering profile and designation boundary constraints, and range from 40° to 11°. Detailed cut slope designs will be carried out during the detailed design phase of the Project in accordance with standard geotechnical design guidelines and accepted New Zealand design criteria and standards.

A range of common stabilisation and construction management measures are available to manage potential slope instability (including rock fall hazards). Likely stabilisation measures include:

- Flattened cut batters and/or the rounding of the soil profile;
- Drainage, including horizontal bored drains, cut off drains and surface counterfort drains;
- Rock anchors or rock bolting;
- Undercutting to remove existing landslide masses and shear surfaces;
- Vegetation cover;
- Retaining structures, including anchored bored pile retaining walls;
- Scaling of the cut face to remove rocks;
- Compacted shear keys or buttress fill; and
- Rock fall barriers.

Refer to Drawing R-011 for typical cut slope details.

5.8.2 Fill embankments

Given the terrain through which the indicative alignment will extend, the alignment will require the construction of embankments up to 50m above ground level. Embankment slope angles will vary from 14° (1V:4H) in Northland Allochthon terrain to 27° (1V:2H) in Pakiri Formation terrain. The majority of the embankment construction will likely be over Pakiri Formation, although some embankments will be required over Alluvium and Northland Allochthon.

Detailed and site-specific embankment designs will be carried out during the detailed design phase of the Project in accordance with standard geotechnical design guidelines and accepted New Zealand design criteria and standards.

Embankment construction will require the placement of large volumes of earthworks fill material and localised or site-specific treatment and additional stabilisation measures will be incorporated during detailed design and construction phases where they are demanded by the foundation conditions encountered. Shear keys and horizontal drainage layers are likely to be required for the majority of the large embankments to ensure their stability.

Reinforced embankments comprised of mechanically stabilised earth (MSE) slopes are proposed along the alignment to provide additional stability where steeper embankments (typically 45° or greater) will be required. MSE slopes will comprise geogrid reinforcement placed horizontally as layers of embankment fill are built up. The MSE slopes will be finished with a grassed slope facing. Erosion protection mesh may be pinned to the slope face to reduce the risk of erosion and establish vegetation if required. An example of a vegetated MSE slope is shown in Photo 5-3 below.

Photo 5-3: Example of a vegetated MSE slope under establishment

Refer to Drawing R-215 for typical fill embankment and MSE slope details.

5.9 Viaducts and bridges

The indicative alignment requires the construction of seven major viaducts[73]. Approximately five bridges may also be required to maintain local road access, provide farm access and flood relief.

Based on the indicative design, two different structural forms of viaducts and bridges will likely be used for the Project; concrete box girder and concrete beam and slab. Table 5-1 contains further details about each of these types of viaducts and bridges, including illustrative examples.

Table 5-1: Structural Form of viaducts proposed for the indicative alignment

Structure type	Description	Illustrative example
Concrete box girder structure	A concrete box girder will likely be used for viaducts with spans typically in the range of 70-75m. The concrete box girder viaducts will likely involve construction of the superstructure on precast segmental balanced cantilever technology.	
Concrete beam and slab structure	A concrete beam and slab structure will likely be used for viaducts with spans typically in the range of 30-35m. The concrete beam and slab viaducts will likely involve construction of the superstructure on precast pre-stressed concrete super-tee beams and an in situ concrete deck.	

The Sector descriptions in 5.3.3 provided details on the indicative viaducts and bridges proposed for the indicative alignment. Refer Drawings S-021 – S-111 for the general arrangement and typical sections of the proposed viaducts and bridges.

[73] For the purpose of this report – a viaduct is a bridge structure with three or more spans

5.10 Operational water management

This section outlines the stormwater management proposed for the operation of the Project. Stormwater treatment proposed during the construction of the Project, ie erosion and sediment control, is described in Section 6.6 of this report and the Construction Water Assessment Report.

The proposed stormwater design for the operation of the Project adopts the following principles:

- Ensure the performance of the motorway to NZTA standards;
- Avoid, remedy or mitigate adverse environmental effects;
- Integrate the total operational water system (collection and conveyance network; treatment devices; culverts and diversions and consideration of the Mahurangi floodplain);
- Include full consideration of stormwater operational implications throughout the design life of the asset;
- Mimic the existing hydrologic regime and setting, to deliver outcomes that avoid, remedy or mitigate adverse environmental effects;
- Avoid or mitigate changes that might make the current flood issues in the Mahurangi River catchment worse;
- Provide for habitats in stream diversions where they existed prior to the Project. The designs will restore streams and recreate habitats to replicate the natural state and habitats that existed prior to the Project;
- Provide for fish passage in culverts for all permanent streams with future upstream habitats, and for intermittent streams where there is potential for fish habitat upstream; and
- Provide a Best Practicable Option (BPO) to avoid, remedy or mitigate adverse environmental effects, determined through a robust evaluation of options and adopting relevant standards.

5.10.1 Stormwater treatment

All stormwater runoff from the built motorway and rock cuts will be treated prior to discharge into the receiving environment. Stormwater quality treatment will be designed to:

- Remove at least 75% total suspended solids (TSS) on a long-term average basis in accordance with the ARP:ALW requirements;
- Remove many contaminants, such as particulate trace metals, particulate nutrients, oil, grease and bacteria on sediments; and
- Remove gross litter and floatables such as oil and volatile hydrocarbons.

Stormwater quantity treatment will be designed to:

- Convey flow for 100 year Average Recurrence Interval (ARI) by bypass or emergency overflow to minimise erosion; and
- Minimise erosion of streams by providing ‘extended detention’ and controlled release of runoff generated in a rainfall event of 34.5 mm over a 24 hour period. Exceptions are where discharges are in close proximity to the Pūhoi Estuary, where erosion is not considered to be a significant adverse effect due to continual changes in estuary bed conditions as a result of the tidal receiving environment.

The Water team has demonstrated that detention of runoff for the 2 year, 10 year and 100 year ARI rainfall events for flood attenuation is not required. Refer to Section 8 of the Operational Water Assessment Report.

The Water team has adopted stormwater treatment devices based on consideration of the BPO to prevent or minimise the effects on the environment. This BPO approach is based on the ARP:ALW requirement for the BPO to be implemented with respect to minimising the effects of operational water management and stormwater discharges. The concept design of stormwater management devices is based on Auckland Regional Council's Stormwater Treatment Devices: Design Guidelines Manual (2003) (TP10).

Wherever possible, the Operational Water team has designed permanent devices so that they can be located within the areas of earthworks for the Project, such as spoil locations. This serves to minimise the overall Project footprint.

The catchment areas identified for stormwater treatment include:

- All new motorway surfaces. These surfaces are assumed impervious, including the pavement, median and shoulder, drainage channels, rock trap channels, and longitudinal swales; and
- Rock cuts and re-vegetated areas above rock cuts where they cannot be readily separated.

Constructed wetlands are the Operational Water team's preferred stormwater treatment device to treat new impervious areas within the Project area. Constructed wetlands perform well as treatment devices removing a range of contaminants and provide additional filtering and biological treatment performance in comparison to other treatment devices, such as ponds. In addition to water quality treatment, wetlands provide extended detention. Wetlands are also the BPO for stormwater treatment as they are durable and safer/easier to maintain for a motorway application.

Photo 5-4: Example of a constructed wetland - NGTR Nukumea Wetland

Approximately 27 wetlands may be required for the Project (refer to Drawings SW-101 – SW-115 for the indicative location of wetlands). Typical details for stormwater wetlands are provided in Drawing SW-501. An example of a constructed wetland is shown in Photo 5-4 above.

Sediment traps are proposed for the Project in drains at the base of rock cut faces designed to remove sediment at source. Refer Drawing SW-307 for the typical sediment trap details.

5.10.2 Culverts

Within the Pūhoi and Mahurangi River catchments many small tributaries and some larger rivers are crossed by the indicative alignment. Conveyance of normal flows and flood waters from one side of the motorway to the other will be required. In general, to minimise adverse effects on the natural functioning of streams, viaducts or bridges will cross the major streams, including the Okahu Creek, Pūhoi River, Hikauae Creek and the major branches of the Mahurangi River. Culverts are proposed for the crossing of stream tributaries, many of which are intermittent.

The Project includes 40 culverts within the proposed designation, with three culverts being concrete arches (two in the Mahurangi River catchment and one in the Pūhoi River catchment). (Refer Drawings SW-101 – SW-115 for the indicative location of the culverts). The total length of culverts in permanent streams will be approximately 1,120m and in intermittent streams approximately 3,000m.

The design and selection of culvert forms is influenced by a number of factors, including:

- Hydraulic capacity for the 100 year ARI storm event;
- Degree of hydraulic surcharge at the inlet and the effect of inundation upstream;
- Risk of debris blockage;
- Fish passage requirements;
- Energy dissipation requirements;
- Road geometry;
- Constructability and
- The ecological values of the stream.

The design of the culverts has taken the potential effects of climate change into account for life cycle sizing requirements.

For two culverts where the indicative alignment crosses the main tributaries of the Mahurangi River (Culvert 49500 and Culvert 54700), large concrete arch culverts are proposed because the design flows calculated for their respective catchments are too large for conventional concrete pipe culverts.

Culverts have been designed with best practice to include consideration of fish passage; erosion control and debris management; and energy dissipation, which are described in the following sections.

(a) Fish passage

The Project incorporates provision of fish passage in new culverts placed within the watercourses, in accordance with Auckland Council policy. Fish passage will be provided for all permanent streams with upstream habitats, with the exception of two culverts where the locations present hydraulic constraints. (Upstream drop structures create a barrier to fish passage at sites M23a and M23b.)

Fish passage will be provided in culverts for all intermittent streams where there is potential for upstream fish habitat (refer Sections 7.7.2 and 8.5.3 of the Construction Water Assessment Report and Section 7.1.5 of the Freshwater Ecology Assessment Report).

Two methods of providing fish passage are proposed Baffle type fish passage and Natural bed type fish passage. Refer Drawings SW-202 and SW-203 for typical details of the fish passage typologies.

(b) Erosion control and debris protection

Erosion control and debris protection measures are proposed upstream and downstream of culverts to provide for the on-going functioning and performance of culverts by reducing the likelihood of debris blockages and erosion of the stream bed.

(c) Inlet debris structures

Debris can accumulate at a culvert inlet or become lodged in the inlet or barrel. Avoiding the blockage of culvert entrances is critical to maintaining the flow capacity of the structure and ensuring the culvert performs as designed.

A debris control structure is proposed at Project culvert inlets servicing large catchment areas with extensive bush or forestry. The structure will likely comprise of a steel rack at least 20m upstream of the culvert that will trap a proportion of large debris before it reaches the culvert. The debris rack will allow flow to overtop the trapped debris to maintain conveyance of flow through the culvert.

Culverts at high risk of blockage will be sized to accommodate 100 year ARI flow with the top water level not exceeding the culvert soffit level. For culverts servicing moderate sized catchment areas that include predominantly bush or forestry, the preferred mitigation measure is to install a relief inlet. The relief inlet will assist in avoiding flooding further up the embankment during any blockage of the culvert inlet by providing a secondary inlet for flows to enter the culvert. For culverts at low risk of debris blockage, no debris protection measures are proposed. Refer Drawings SW-305 and SW-306 for typical details of the proposed inlet debris measures.

(d) Outlet structures – energy dissipation

High velocity and energy of flow at culvert outlets can result in the erosion of stream channels and banks, causing adverse environmental effects. Energy dissipation structures are proposed at all Project culvert outlets prior to discharge into the natural stream.

Three types of energy dissipation structures are proposed for the Project:

- Riprap Basin - a rock lined basin containing a water pool at the culvert outlet. The basin is followed by a rock apron that spreads the flow and further reduces the velocity of the flow, helping to transition flow to the natural waterway downstream. Riprap basins are suitable for fish passage and are proposed for many of the culvert outlets.

- St Anthony Falls (SAF) Stilling Basin - a concrete structure that receives discharges from a culvert into a basin via a baffled chute with blocks on the invert and baffle blocks and a sill

at the downstream end. Combined, these three elements dissipate energy and return water downstream in a movement similar to the existing flow regime. Because a SAF stilling basin is not suitable for fish passage, it is proposed only for culverts where fish passage is not necessary based on the ecological assessments (refer Section 7.1.5 of the Freshwater Ecology Assessment Report).

- Impact Basin - a box structure at the culvert outlet that dissipates energy by directing the flow onto a vertical baffle. It is applicable to a range of flows but is not suitable for fish passage or where there is potential for debris load. Impact basins are not proposed for any culverts but may be used for stormwater outfalls from wetlands.

Refer to Drawings SW-301 to SW-303 for typical energy dissipation structure details.

Photo 5-5: Example of an Impact basin - NGTR Otawera Wetland outfall

5.10.3 Permanent Stream Diversions

Permanent stream diversions and flow channels are proposed where it is necessary to realign a natural stream channel for the Project. The mitigation objective for stream diversions is to recreate streams and habitats to replicate as much as possible the natural state and habitats of the streams that existed prior to the Project.

A number of stream diversions are proposed within three stream typologies the Water team has developed as follows:

- Stream Diversion Type 1 – 'Lowland Stream' that recreates habitats associated with a natural lowland stream. The total proposed stream diversion length is approximately 1,500m;
- Stream Diversion Type 2 – 'Steep Stream' that recreates habitats associated with a natural steep stream. The total proposed stream diversion length is approximately 1,575m; and
- Stream Diversion Type 3 – 'Flow Channel' for flow conveyance only. The total proposed stream diversion length is approximately 4,695m.

These typologies are shown on Drawings SW-401 to SW403.

Refer to Section 7.10 of the Operational Water Assessment Report for further detail on the proposed stream diversions.

5.11 Urban design

This section sets out the urban design principles incorporated into the Project design. The section has been. *Bridging the Gap* notes that at a national level "the primary guiding document promoting good urban design is the New Zealand Urban Design Protocol (NZUDP) (MfE 2005)".[74]

The NZUDP identifies seven essential design qualities (known as the 7 Cs):

- Context: integration of the project with surrounding natural and land-use patterns;
- Character: reflecting and enhancing the distinctive character, heritage and identity of the surrounding environment, including its people;
- Choice: ensuring diversity and choice for people;
- Connections: maintaining and enhancing how different networks link communities together;
- Creativity: encouraging innovative and imaginative solutions that build a strong and distinctive local identity;
- Custodianship: ensuring design is environmentally sustainable, safe and healthy; and
- Collaboration: achieving appropriate solutions through collaboration with other experts and stakeholders.

NZTA has built on the NZUDP and identified a number of objectives (as contained in *Bridging the Gap*) by which to install urban design as an integral component of any project. The NZTA Urban Design Objectives are:

- Transport networks fit in sensitively with the landform, built and natural environment, and communities through which they pass.
- All systems of movement along and across the transport corridor are integrated into the design of projects with good connections and access for communities.

[74] NZTA, 2013, *Bridging the Gap,* para 1.4

- Design contributes to the quality of the built environment, public spaces and the road user experience.

Bridging the Gap identifies ten principles for urban design as follows:

- Designing for the context;
- Designing with nature;
- Integrating transport and land use;
- Contributing to good urban form;
- Integrating all modes of movement;
- Supporting community cohesion;
- Maintaining local connectivity;
- Respecting cultural heritage values;
- Creating a positive road user's experience; and
- Achieving a low maintenance design.

The following discussion uses the "7 Cs" of the NZUDP and the *Bridging the Gap* objectives and principles as reference points, to illustrate the matters relevant to the overall urban design of the Project, which will be confirmed during the Project's detailed design phase.

5.11.1 Pūhoi Sector

(a) Context (effects on land use activities and form)

The indicative alignment in the Pūhoi Sector has been influenced by a number of features in the surrounding context, including:

- the location and orientation of the existing SH1 tunnel portals;
- the undulating topography of the area;
- the location of water courses and particularly Pūhoi River;
- the configuration of local roads and the Hibiscus Coast Highway;
- the location of cultural features including Te Pā o Te Hēmara Tauhia, the rediscovered and unnamed pā and historic Schollum House; and
- the location of Pūhoi Village.

In urban design terms, this Sector is the most complex because the features set out above create a range of constraints, and have potentially conflicting needs. The indicative alignment, both horizontal and vertical, seeks to meet functional requirements while minimising the intrusion of roading structures in relation to these elements of the surrounding context.

(b) Character (Effects on Urban Form)

The existing SH1 infrastructure already influences the character of the Pūhoi area and the roading infrastructure north of the Johnstone's Hill tunnels creates a modified environment. Consideration during the Project's detailed design phase will be given to provide a seamless transition from the existing NGTR to the Project.

The detailed design of the Okahu Viaduct and the Pūhoi Viaduct structures, together with planting design along the motorway embankments will be important to assist the roadway to integrate with its surrounding environment. Further guidance on design considerations for bridge design can be found in *Bridging the Gap* (see 4.11) and in NZTA's "Urban Design Principles: Road Bridges". Such guidance includes:

- The balance of structural elements should be carefully considered to minimise the bridge profiles, achieve symmetry and create a simple and elegant whole;
- Consideration should be given to the creation of light and shadow on the structure and how this will contribute to the overall appearance of the bridge structures;
- Particular attention should be paid to the design of piers and barriers. The substructure elements should not be designed in isolation. Their design should be integral to the overall form of the bridge. Structures that eliminate the need for headstocks and enable simple, elegant pier design will better draw the eye to the horizontal lines of the bridge deck and barrier;
- The external surface of the bridge should be free of drainage pipes or other services;
- The draining system should be concealed from all views; and
- Barriers should create clean, continuous lines that are not obscured or interrupted by non-structural elements. They should extend well past the abutments to anchor the bridges into the landscape.

The design of these elevated structures will be addressed in Urban and Landscape Design Sector Plans to be submitted as part of any OPW.

The Project affords an opportunity for iwi to realise the identity of Ngā Pā o Te Hēmara Tauhia in the landscape. The Hōkai Nuku Cultural Effects Assessment discusses these features and values in more detail.

Pūhoi Village has a distinct character that strongly relates to its cultural heritage and landscape context. The current entrance to the Village from SH1 is understated. While ensuring the maintenance of connections to the village, the ramps and, more particularly the viaduct structure, will significantly alter the character of the arrival experience from SH1 to the Village. The SH1/Pūhoi Road intersection is a critical location that will require careful consideration in the Project's detailed design phase. Particular attention to the design of feature entry elements, lighting, planting and signage will be co-ordinated to enhance the arrival experience.

The Pūhoi River has cultural significance for both pre-European and European settlement, as it was historically an important transportation route. Today it is an important recreation route, being used by kayakers travelling from Pūhoi down to the coast and Wenderholm Regional Park. Detailed design will have particular regard to how the Project's structures will be experienced from the River.

(c) Choice

In relation to the Project, the urban design quality of 'choice' is mainly relevant to enabling and maintaining choice of transport routes.

The ability to achieve wider transport choice is balanced against the needs to maintain route choices in the immediate environment.

(d) Connections (effects on circulation)

As noted previously, this Project is one component of an improved State highway route that will contribute to achieving improved connectivity between Auckland and Northland and more immediately between Auckland City and the northern area of the Auckland Region.

The alignment will maintain a connection between SH17 and the existing SH1 immediately north of Johnstone's Hill. This connection will maintain local access and the alternate route to the NGTR.

Importantly, the Project will provide a northbound off-ramp and southbound on-ramp at Pūhoi, providing a connection to the historic village and maintaining connections to the existing SH1. While the indicative alignment results in an increased prominence of roading structures in this area, which impact on the character of the entry to Pūhoi Village, it also improves the legibility of the turn-off for visitors. Given the understated character of the existing turn-off, it is currently easy for visitors to miss the turn-off to the Village. The new configuration will improve the connectivity to the Village for visitors. With appropriate design consideration it can function as a gateway feature.

The indicative alignment maintains the recreational connection provided by the Pūhoi River, by bridging over the river. The Pūhoi Structure Plan (discussed in Section 29.4.6 below) outlines opportunities to improve open space linkages through the Pūhoi area, particularly along stream and river corridors. There are currently no walkways connecting from Pūhoi Village through to the estuary or beyond to the Wenderholm Regional Park. The elevated nature of the proposed Pūhoi Viaduct provides the opportunity to provide pedestrian connections across (under) the motorway in the vicinity of the Pūhoi River.

While there is no proposal to make provision for cycle access within the indicative alignment, the Project may open up opportunities to provide improved cycle access along the existing SH1 alignment in the future.

The Project also affords an opportunity to improve access to the pā sites in the Pūhoi area if this is considered appropriate by local Iwi. The pā sites are currently in private ownership. The pā sites provide historical context to the long settlement history of the area. These opportunities are addressed in the Hōkai Nuku Cultural Effects Assessment.

(e) Creativity (effects on amenity for road users and from surrounding areas)

At the time of detailed design (preparation of urban and landscape design sector plan) there will be an opportunity to apply creativity to ensure context-sensitive design for structures, earthworks and management of stormwater. Input of suitable expertise, including landscape architecture, art, bridge architecture, and cultural advice will be required to ensure appropriate outcomes. It will be particularly important to recognise the history of settlement (pre- and post-European) and to create a distinctive sense of arrival in relation to the Pūhoi Village. The design of structures, earthworks, and landscape treatment and incorporation of art features should contribute to creating a distinct sense of place. The road will be experienced both by those travelling along the

route and those in the surrounding areas (refer to the Landscape and Visual Assessment Report). Creativity in detailed design will respond to the following:

- Established corridor treatment for the adjoining NGTR;
- Natural patterns/ecology of the land and waterways;
- Natural waterway systems;
- Landform patterns;
- Cultural values of the area (both Maori and Pakeha); and
- Sense of arrival at Pūhoi Village.

(f) Custodianship

For the Pūhoi Sector, the urban design quality of 'custodianship' relates particularly to the protection of the natural waterways and the ecology of the area, the protection of landforms and the landscape values of the area and the protection of cultural heritage resources. These matters are addressed by specific Assessment Reports (refer to the Freshwater and Landscape and Visual Assessment Reports, and the Hōkai Nuku Cultural Effects Assessment).

(g) Collaboration

At the time of detailed design it will be important to consider the inter-relationship between a number of factors including: engineering technical requirements; potential for ecological enhancement; respect for cultural values; respect for landscape values; the enhancement of visual qualities. The development of an Urban and Landscape Design Framework (DLDF) (in accordance with the NZTA ULDF Guideline) will require collaboration between a number of disciplines including: urban design, engineering, cultural, heritage, landscape architecture, ecology, and noise.

5.11.2 Perry Road Sector

The Perry Road Sector passes to the west of a rural area that contains a concentration of rural residential properties clustered along Perry Road. The indicative alignment does not impact on any road or walkway connections used by these properties. The indicative alignment is visually contained by intervening topography and will not adversely impact on the rural character enjoyed by the majority of properties in this rural residential area. A detailed assessment of potential landscape and visual effects is set out in Section 5 of the Landscape and Visual Assessment Report.

The indicative alignment passes along the toe of the hills that rise to elevated properties on Wyllie Road, to the west of the right branch of the Mahurangi River. The indicative alignment crosses the northern end of Wyllie Road (approximately 480m south of Woodcocks Road), and will maintain the road access by creating an overpass. An additional accessway to the east of the alignment will be required to maintain access to properties located east of the indicative alignment that are currently accessed from Wyllie Road south of this crossing.

At the detailed design phase, careful consideration will be given to the treatment of the Wyllie Road overpass and immediate surroundings in order to mitigate the adverse character effects arising from an elevated structure within a rural environment. The overall design of the elevated structure will be carefully considered to minimise the structure's profile, achieve symmetry and

create a simple, elegant whole. In particular, the design of substructure elements will be considered as an integral part of the design. Colour, texture and lighting can be used to enhance the experience for those travelling under the alignment along Woodcocks Road. Abutments will be designed to integrate the elevated structure into the surrounding landscape. The external surface of the elevated structure will be free of drainage pipes and other services.

5.11.3 Carran Road Sector

(a) Context (effects on land use activities and form)

The indicative alignment is located well to the west of the existing Warkworth settlement and ties into the existing SH1 just south of the Goatley Road / Kaipara Flats Road intersection. In the long-term the new motorway will provide a strong defensible edge to the Warkworth settlement in an appropriate location.

(b) Character (effects on urban form)

Detailed design of the road margins and batter slopes will be important to assist with integrating the new motorway infrastructure with the rural context and reduce the visual prominence of the roadway. In particular, the use of landforms and planting to integrate the road infrastructure into the rural setting will be important.

The dense mature vegetation to the northwest of the Goatley Road / Kaipara Flats Road intersection creates a threshold defining a change to a more rural character. The location of the Project's northern tie-in is appropriate in this context. Detailed design of the roundabout intersection, using references to cultural associations with the area will be important to achieve a suitable arrival point to Warkworth.

The provision of a bypass to Warkworth and the removal of heavy freight traffic from the existing SH1 route through the settlement will reduce the severing effect of the existing SH1 corridor. This will improve the character and amenity within the core of the town. Consideration will be given to the treatment of this corridor when the new alignment is established.

(c) Choice

The Project will provide additional choice by enabling those travelling both north and south to bypass Warkworth. This choice is a positive effect of the Project both for those using the route and for residents and users of Warkworth.

(d) Connections (effects on circulation)

The Carran Road Sector does not diminish any existing connections through Warkworth and its hinterland. The Project has the potential to improve local connectivity within Warkworth. The removal of heavy traffic and general traffic diverted to the Project will reduce the severing effect of the current SH1 and will enable more cohesive connections between different areas of the town and will improve access across the existing SH1 corridor to a number of community facilities. Traffic modelling for the Project predicts greater traffic flows entering central Warkworth from the north (refer to the Operational Traffic Assessment Report).

For those travelling north to Warkworth the last off-ramp before the northern Warkworth connection will be Pūhoi. Accordingly, the northern Warkworth entrance is likely to become the more prominent entrance to the town centre. This change in entrance will provide a catalyst for changes to the land-use pattern within the town and at its periphery as it grows.

The indicative alignment does not impact on any existing walking trails within the Carran Road Sector.

(e) Creativity (effects on amenity for road users and from surrounding areas)

At the detailed phase of the Project's design it will be important to apply creativity to the design of the northern tie-in intersection as an entry point to the settlement of Warkworth. Features of the intersection design, including landscape design and art features, will reflect the distinct characteristics of the settlement and its historic, cultural associations. Input of suitable expertise, including landscape architecture, art and cultural advice will be required to ensure appropriate outcomes.

Creativity will be applied to stormwater management to respect and enhance the natural landscape patterns through the rural area. As the indicative alignment connects to the existing SH1 within a valley system that is poorly drained, there is an opportunity to re-establish the natural wetland features within this part of the proposed designation.

Creativity applied to the treatment of the margins of the roadway will assist to define the long-term growth boundary of the Warkworth settlement.

(f) Custodianship

For the Carran Road Sector, the urban design quality of 'custodianship' relates particularly to the management of stormwater and its relationship to natural watercourse systems. This relationship is addressed in detail in the Construction Water, Freshwater Ecology and Operational Water Assessment Reports.

The Project will also have implications in relation to the land-use patterns in the surrounding area and particularly how the settlement of Warkworth grows. As Warkworth has been identified in a number of growth management planning documents as a rural settlement that is suitable for growth, the indicative alignment is well located to provide a long-term defensible growth boundary, enabling flexibility to accommodate growth at the settlement's periphery.

(g) Collaboration

In order to ensure context sensitive design is achieved in relation to the indicative alignment margins and the northern tie-in to the existing SH1, collaboration between a number of areas of expertise will be required. The development of an ULDF (in accordance with the NZTA ULDF Guidelines) as a condition of designation and an associated sector specific ULDSPs, will require collaboration between a number of disciplines, including: urban design, engineering, cultural heritage, landscape architecture, land art and ecology.

Collaboration by the Project team with Auckland Council and Auckland Transport will also be beneficial to understand and plan for the potential land-use and amenity changes within Warkworth when the bypass enabled by the Project is achieved.

5.11.4 Experience of corridor users

The Project provides a continuation of the NGTR to the south. A consistent design treatment will be used to provide continuity to the travel experience for road users. This consistent treatment will include use of landscaping and planting, treatment of earthworks and batter slopes, structure design, and highway furniture. It is important that there is a transition to the context and that appropriate features are introduced that respond to the immediate surroundings.

Elevated structures through the corridor will afford visual connections to the wider landscape. Particular attention will be paid to the design of barriers across elevated bridges and viaducts. Achieving good visual connections to the wider environment will need to be balanced with considerations of minimising noise effects on surrounding receivers and creating a suitable edge to the structures.

Particular design attention will be required in relation to the connections with the Pūhoi Village and Warkworth entrance. The treatment of structures and the corridor in these areas will enhance the sense of arrival and reflect the distinct characteristics of the settlements and their historic, cultural associations.

Recommendations in accordance with NZTA practice to ensure that during the Project's detailed design phase the context of the structures, especially at Pūhoi and in the Carran Road and Woodcocks Road Sectors, are appropriately addressed.

5.12 Landscaping

Landscaping will be undertaken as part of the Project and will serve a number of purposes, including to:

- Integrate the Project into the landscape;
- Mitigate the visual and landscape effects of the Project;
- Mitigate the ecological and stormwater effects of the Project; and
- Stabilise batter slopes.

Detailed landscape plans will be provided as part of future OPW(s) for the Project.

Broadly, the following roadside landscaping is proposed:

- Retention of existing vegetation and extensive planting between the alignment and the existing SH1 in areas where the alignment is not contained by the landform, to provide screening and visual integration; and
- Planting based on established vegetation patterns along the alignment to integrate the highway and screen it from the residential settlement areas.

Planting design will draw from the existing patterns and compositions within the landscape (both natural and culturally induced, eg shelter belts, where applicable) to ensure appropriate aesthetic and environmental outcomes. New planting will reflect subtleties in local landscape character.

Further consideration is contained in Section 7.3 of the Landscape and Visual Assessment Report.

6. Construction of the Project

This section contains information in relation to a possible construction methodology for the Project to provide a basis for the assessment of the environmental effects. This section should be read in conjunction with the Construction Water Assessment Report and the Drawings, which form part of the AEE documentation.

Based on the current degree of detail available, the information provided in this section is indicative but serves to provide certainty that the Project can be practically and feasibly constructed. It is intended to provide sufficient detail on the proposed construction activities to assess their potential environmental effects and to identify any necessary measures to avoid, remedy or mitigate those effects, where appropriate.

The final construction methodology for the Project will be influenced by a number of factors, including:

- The detailed design and value engineering process for the Project, which will occur once consents have been obtained and a contractor(s) appointed;
- The construction duration, and target completion date;
- The procurement method adopted; and
- Technological advances.

Detailed design may result in some refinement of the alignment within the designation boundary and changes to the indicative construction methodology outlined in this section.

The detailed design will be subject to an OPW process under s176A of the RMA and conditions of the designation and resource consents. The OPW process is described in greater detail in Section 1.9 of this AEE. The conditions of the resource consent and designation will control the environmental effects of the Project and will dictate the key design parameters.

In order to assess the environmental effects associated with the construction of the Project, this section outlines the following indicative construction aspects:

- Construction zones;
- Construction yards and bridge staging areas;
- Enabling works;
- Materials required for construction;
- Water use requirements for construction;
- Erosion and sediment control;
- Works in streams;
- Earthworks;
- Hazardous substances and materials;
- Viaducts and bridges;
- Protection and relocation of existing network utilities; and
- Construction programme.

6.1 Construction Zones

For the purposes of assessing the environmental effects related to the construction of the Project, the Project Sectors (outlined in Section 5.2.3 of this AEE) have been divided into 11 indicative construction zones based on delineation by earthworks, major structures and catchment areas.

The indicative construction zones are shown on Figure 6-1 and in Drawings C101 – C117 in Volume 4 and are summarised in Section 6.2 of this AEE.

It is anticipated that construction of the Project will be staged, with a number of the construction zones being open and worked on concurrently. The total area of open earthworks in Mahurangi and the Pūhoi catchment will be subject to constraints that have been identified in the Construction Water Assessment Report. These constraints are discussed further in Section 10.7.2 below.

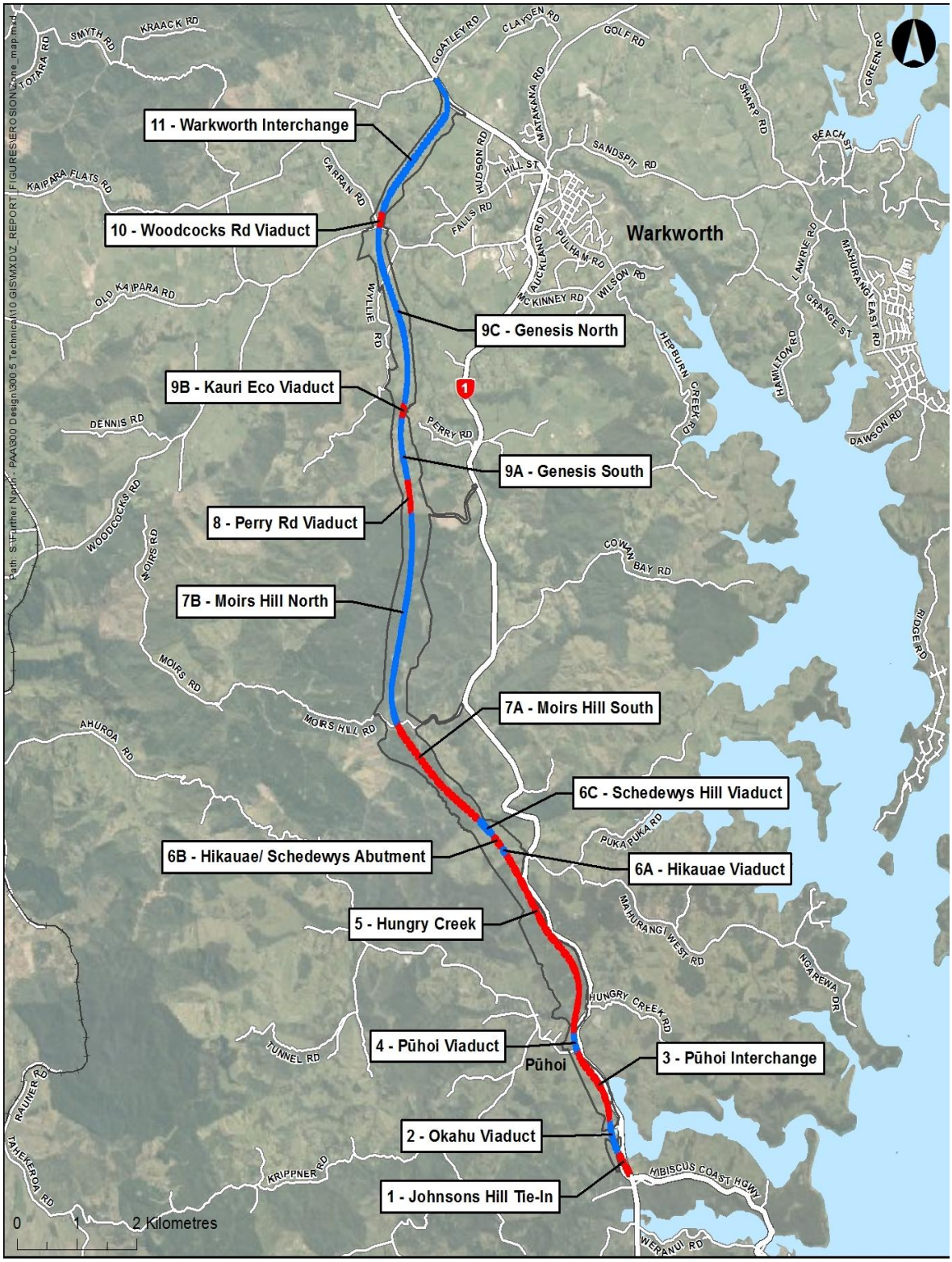


Figure 6-1: Indicative Project construction zones

6.2 Construction yards and bridge staging areas

Each construction zone will require the establishment of a construction yard and/or bridge staging area. These areas will be required for the construction of the viaducts, earthworks activities, the project and design offices and the precast yard (refer to Section 6.2.1 below) as outlined in this section.

It is likely that the indicative construction yards and bridge staging areas shown in Table 6-1 will be required. The designation is wide enough to accommodate construction yards and bridge staging areas. Final locations and areas required for the construction yards and bridge staging areas will be confirmed in the OPW.

Table 6-1 Indicative Project construction yards and areas

Purpose	Approximate size required
Bridge Staging Area-1	10,000m^2
Construction Yard-2	10,000m^2
Project and Design Office Area-2	10,000m^2
Bridge Staging Area-3	5,000m^2
Construction Yard-4	10,000m^2
Construction Yard-5	10,000m^2
Bridge Staging Area-6A and 6B	10,000m^2
Construction Yard-7	5,000m^2
Construction Yard-8	10,000m^2
Construction Yard-9	10,000m^2
Bridge Staging Area 9a	5,000m^2
Bridge Staging Area-10	5,000m^2
Construction Yard-11	10,000m^2
Construction Yard-12	10,000m^2
Bridge Staging Area-13	5,000m^2
Construction Yard-14	10,000m^2
Precast Yard Area-15	20,000m^2

Bridge staging areas are required for the assembly of launching gantries, lay down and storage areas for materials delivery, workshops, project offices and ablution facilities. The assembly area required for balanced cantilever structures will be approximately 200m–250m in length and approximately 100-150m in length for the precast super-tee structures.

Construction yards are required for repairs, maintenance and re-fuelling of earthmoving equipment, lay down and storage areas for materials delivery, workshops, project offices and ablution facilities.

The main project and design office is proposed to be located at the corner of Pūhoi Road and the existing SH1. The compound will contain features commonly associated with construction facilities, including:

- Temporary site office buildings;
- Material laydown areas;
- Workers' office and workshop accommodation;
- Ablution facilities
- Plant and equipment maintenance facilities;
- Fuel storage and refuelling facilities;
- Wheel washing and cleaning facilities;
- Car parking; and
- Plant and equipment storage areas.

Section 6.4.13 of the Construction Water Assessment Report contains methodologies for managing surface water drainage from these yards during the construction phase.

6.2.1 Precast yard

A temporary, purpose built, precast concrete manufacturing facility is proposed for the construction of the precast concrete segments, beams and barriers for the seven major structures proposed for the Project. The Precast Yard is proposed to be located at Woodcocks Road as it is suitable for heavy vehicle access and is in close proximity to local ready mix concrete batching plants. No concrete batching for the Project is anticipated to occur on-site. The precast yard location is shown on Drawing C-115.

The layout of the Precast Yard will consist of an industrial factory requiring a likely area of 2,000m^2 to 3,000m^2, a hard stand area of approximately 20,000m^2 and administration and site office facilities. The facility set up could include 4 moulds for match casting the balanced cantilever segments, two moulds for casting the pre-stressed super-tee beams, areas for the fabrication of reinforcement and the areas for the storage of pre-stressing wire strand and reinforcement bar.

An example of a precast manufacturing facility is shown in Photo 6-1 and Photo 6-2.

Photo 6-1: A precast manufacturing facility

Photo 6-2: Interior of a precast manufacturing facility

Refer to Section 6.4.13 of the Construction Water Assessment Report for detail on the management of stormwater from the yard, including consideration as an industrial or trade process.

6.3 Enabling works

Prior to the commencement of construction of the Project, some early enabling works may be necessary. Such works include the creation of access tracks. Enabling works will require soil disturbance and vegetation clearance, which will be undertaken in accordance with the principles as outlined in Section 6 of the Construction Water Assessment Report and the associated erosion and sediment control and earthworks principles outlined later in Section 6.6 of this AEE.

Access tracks for construction activities will be required in a number of locations along the length of the Project. Access is required to construction and laydown sites, bridge staging areas, construction yards, site and project offices and other construction related activities.

The indicative location of proposed construction access tracks is shown on Drawings C101 – C-117 in Volume 4. The indicative access tracks are as follows:

- Existing SH1 at the connection point with the proposed Pūhoi southbound ramp;
- Existing SH1 just north of the intersection with Pūhoi Road to provide access to the main project and design office area;
- Existing SH1 north of the intersection with Hungry Creek Road;
- Existing SH1 south of the intersection with Mahurangi West Road;
- Existing SH1 just south of, and at the intersection with Hungry Creek Road;
- Moirs Hill Road, on the eastern side of the alignment;
- Moirs Hill Road, on the western side of the alignment;
- Existing SH1 south of Perry Road;
- Wyllie Road;
- Woodcocks Road; and
- Existing SH1 just north of the northern tie-in.

The effects of forming construction access tracks will be addressed in the Construction Erosion and Sediment Control Plans (CESCP), which will be developed subsequent to consents being granted and detailed design being undertaken. Section 6 of the Construction Water Assessment Report provides a conceptual approach to construction water management including construction access tracks.

6.4 Materials required for construction

The Project will require approximately 6.2M m^3 of fill for the proposed embankments as outlined in Section 6.8 of this report.

A mobile rock crusher will be required to crush cut material as needed. The rock crushing plant will require resource consent under the ARP:ALW for the discharge of contaminants to air. There is the potential for dust to be generated from the crushing of the rocks and the conveying of crushed materials. The potential for dust emissions will largely depend on the moisture content of the materials and the amount of fines generated. Refer to Section 18.3.1 of this report for further information on the potential dust effects associated with the mobile rock crusher (refer to Section 7.4.4 of the Air Quality Assessment Report for further detail). The location of rock that may require

crushing is shown in Drawings C101 – 117 in Volume 4. Areas where crushing may be required are the hill country, and primarily from Pūhoi to the northern extent of the existing forestry area.

Other common materials required for the construction of the Project will be manufactured off-site and transported in as required. These will likely include but not be limited to:

- Road surfacing materials (including bitumen);
- Road furniture, for example lighting columns, traffic signage; and
- Steel required for structural components.

6.5 Water use requirements for construction

Water will be required for construction activities, such as dust suppression.

Water supply may be obtained from a variety of sources, including but not limited to, stored sources, groundwater or the Pūhoi River. The Mahurangi River is fully allocated and therefore is not an available water supply source for the Project at this stage.

The successful contractor will be required to obtain sufficient water supply for construction of the Project. At this stage it is not desirable to restrict the contractor to a particular source or sources, given the linear nature of the Project and the segmentation of the Project works due to the viaduct structures required. If the contractor's chosen source requires additional resource consents, they will be required to obtain these from Auckland Council prior to the commencement of works.

6.6 Erosion and sediment control

The scale of the Project will require the disturbance of a large area of land within the designation. An overriding principle for the Project has been to minimise the land disturbance required in order to reduce construction related sediment from entering streams and watercourses and, in turn, the Pūhoi Estuary and the Mahurangi Harbour (refer the Construction Water Assessment Report).

A key erosion and sediment control principle will be to minimise the area and length of time that particular areas of ground are open in conjunction with the use of proven structural and non-structural control devices and methods. The extent of open areas in any one catchment will be restricted and will be stabilised on a progressive basis. Consent conditions will ensure this requirement will be achieved.

From an erosion and sediment control perspective, the Project has been classified into two distinct types of terrain as follows:

- Hill Country – including the prominent landforms of Pūhoi, Schedewys Hill and Moirs Hill; and
- Flat Country – including the relatively flat areas from Perry Road to Warkworth along the Mahurangi River Right Branch.

The proposed erosion and sediment control methodology detailed below is considered a practical approach to achieving the associated cut and fill operations within these locations while minimising

erosion, increasing the capture of sediment generated, and minimising sediment yield during the construction of the Project.

The methodologies proposed incorporate some procedures and measures that are conservative and exceed the guidance provided in Auckland Regional Council's 'Technical Publication 90 – Erosion and Sediment Control: Guidelines for Land Disturbing Activities in the Auckland Region' (TP90).

6.6.1 Erosion control measures

Erosion control on the Project will be based on the minimisation of sediment generation in the first instance through a reduction in the erosion potential of exposed soils. Erosion control will be the highest priority in the design of erosion and sediment control measures as it prevents, as far as practicable, sediment generation through a range of structural (physical) and non-structural (construction sequencing and staging and site management practices) measures.

Erosion control measures proposed for the Project will be designed to minimise the generation of sediment in the first instance and will include:

- A maximum open area for each catchment, including the Hill Country and Flat Country areas within the Mahurangi catchment (as defined in the Construction Water Assessment Report (Section 1.7));
- Construction staging and sequencing;
- Diversion channels;
- Contour drains;
- Stabilisation construction entranceways; and
- Flumes and pipe drop structures.

The key erosion control measure remains the use of industry recognised best practice including progressive stabilisation and the limitation of exposed open area at any one time.

Construction staging and sequencing: The extent of exposed soil and length of time that area is exposed has a direct influence on the sediment yield leaving a particular area of the site. Bulk earthworks and construction activities will be staged and sequenced in order to limit the area of exposed soil required to complete an element of the work. Open earthworks areas will be progressively stabilised to reduce the potential for erosion to occur.

Stabilisation for erosion and dust management purposes: Open soil areas will be progressively stabilised by the placement of topsoil, grass seed, mulch, geotextile and the use of hard fill material to reduce the potential for erosion to occur to assist with minimising dust and erosion potential.

Mulch will include hay/straw and wood bark generated on site though the removal and mulching of existing vegetation as appropriate. Stabilisation will particularly apply at stockpile areas and batter establishment to reduce both erosion and dust generation.

Clean and dirty water diversions (CWD and DWD): CWDs provide for the controlled conveyance of stormwater runoff and will be used on the Project to prevent run on water from the

undisturbed catchment above the works from entering the construction area. DWDs are effectively a conveyance device that transfers sediment laden water to sediment retention devices for treatment. Both systems are designed to take the 20 year rainfall event (refer to Drawing ES-152 in Volume 4 for a typical cross section).

Contour drains: Contour drains are temporary ridges or excavated channels or a combination of the two that are constructed to convey water across a slope at a minimum gradient. They reduce the slope length, the velocity of water flowing down disturbed slopes and reduce the erosive power of construction runoff.

Check dams: Check dams are small dams made of rock or other non-erodible material constructed across a swale or channel to act as a control structure. The purpose of a check dam is to reduce the velocity of flow within the channel and prevent scour of the channel surface. Check dams also allow for some settlement of suspended solids within the channel.

Pipe drop structure / flume: Temporary pipe drop structures or flumes are constructed to convey construction runoff down a slope face without causing erosion of the slope and will be used to ensure no scour of these batters occurs. These structures will be designed and implemented as per Drawing ES-153 in Volume 4.

Stabilised construction entranceways: Stabilised construction entranceways are a pad of aggregate placed on a filter base located where construction traffic will exit or enter a construction site. They help to prevent site entry and exit points from becoming a source of sediment and also help to reduce dust generation and disturbance along public roads.

No vehicles will be allowed to leave the site unless tyres are clean (refer to Drawing ES-153 in Volume 4 for a typical cross section).

6.6.2 Sediment control measures

Sediment control on the Project will involve the interception and treatment of sediment-laden runoff from the various construction areas along the Project and as a minimum will be carried out in accordance with the guidelines contained in TP90. Sediment control will be established through the use of recognised sediment control measures and site management practices.

Sediment control measures proposed for the Project include:

- Sediment retention ponds;
- Decanting earth bunds;
- Super silt fences;
- Container impoundment systems; and
- Chemical treatment.

Typical details of these are contained in Drawings ES 151-152 and 154-155 in Volume 4. An example of erosion and sediment controls are shown in Photo 6-3 below.

Photo 6-3: Erosion and sediment controls – NGTR

Sediment retention ponds: Sediment retention ponds (SRP) are detention structures used during the construction phase of earthworks activity to capture and treat any sediment laden runoff and retain sediment. SRPs operate by storing sediment laden runoff allowing the sediment to fall out of suspension and be retained within the pond.

Treatment of construction runoff, collected in the SRPs, will be carried out to ensure that sediment is removed to the maximum extent possible from the runoff before being discharged to the receiving environment.

The number, sizing and location of SRPs will be relative to the size and slope of the catchments. Where higher sediment loads are expected, typically in larger catchments and/or on steeper slopes, the effectiveness of ponds will be increased through the addition of chemical flocculation (outlined below).

The indicative operational stormwater treatment for the Project will include a number of permanent stormwater treatment wetlands. Where the location of a SRP coincides with a permanent stormwater treatment wetland, the wetland will be used on a temporary basis as a SRP. These will be converted to long term stormwater wetland features at the completion of the earthworks activity within that sub-catchment.

Decanting earth bunds: Decanting earth bunds (DEB) are temporary berms or ridges of compacted soil, which are constructed to create impoundment areas where ponding of sediment-

laden runoff can occur and provide time for suspended solids to fall out of suspension before the runoff is discharged to the receiving environment.

Pumping activities: It is proposed that all SRPs and DEBs be fitted with floating decants with a mechanism to control outflow, such as a manual decant pulley system to be used during pumping activities to these structures. Wherever possible, gravity flow will be used rather than pumping.

Pumping flows to SRPs and DEBs ensures that any sediment laden flows are discharged to a treatment device prior to entering the receiving environment.

Super silt fences: Super silt fences (SSF) are fabric fences reinforced with stakes and netting backing to allow a physical barrier to flows leaving the area of earthworks. The design and placement of SSFs will be based upon the criteria contained within TP90. SSFs will be used in those areas of work adjacent to, or in the immediate vicinity of watercourses.

Container impoundment systems (CIS): In locations where SRPs or DEBs cannot be located due to slope, area constraints or instability issues, CIS will be used. These will be fitted with a decant system and will also be subject to chemical flocculation. It is expected that these systems will be used primarily in the early stages of earthworks for small catchment areas prior to the ability to develop SRP structures.

Flocculation: Flocculation is a chemical treatment method for increasing the retention of suspended solids from construction earthworks runoff in SRPs and DEBs. Flocculent is added to construction runoff flowing into a SRP or DEB via a rainfall activated system (flocculent shed) or via manual batch dosing.

The use of flocculation chemicals increases the efficiency of SRPs and DEBs and reduces the amount of sediment discharged to the receiving environment.

All SRPs and DEBs will be chemically treated on an as required basis with a flocculants appropriate for the soil type and discharge location.

6.6.3 Construction Erosion and Sediment Control Plans

Various Construction Erosion and Sediment Control Plans (CESCPs) will be submitted for consideration by Auckland Council for specific work areas or activities prior to commencement of works. They will provide the detailed design, erosion and sediment control measures, staging and sequencing of works for that location. The plans will include how devices will be maintained.

Further detail regarding the development of CESCPs is contained in Section 4.3 of the Construction Water Assessment Report.

6.7 Works in streams

6.7.1 Stream realignment

Some temporary stream diversions will be required during the construction of the Project to allow construction works to progress or to provide access to a construction area. Permanent stream

diversions will also be required to divert the stream around or through permanent Project features, such as an embankment, bridge or culvert. In both cases, stream diversions will be necessary in order to establish an 'off-line' environment to allow construction works to be completed outside of the active stream channel.

Stream works activities are generally considered to have a greater potential for adverse effects than earthwork activities due to the works being undertaken within the immediate receiving environment and the associated increased potential for sediment yield and direct impacts. Stream works required for the Project will be undertaken in a manner that recognises this risk and the sensitivity of the receiving environment.

Where practical, stream work activities and any associated works within these environments will be undertaken in an 'offline' environment, being outside of the watercourse itself. This strategy will be based upon the temporary diversion of flows around the area of works or working immediately next to the stream.

The works will be programmed and undertaken so that fish spawning and migration periods will be managed accordingly.

A conceptual sequence of events for temporary and permanent stream diversions is outlined in Section 6.1.5 of the Construction Water Assessment Report. During the detailed design phase of the Project and prior to any stream works commencing on the site, a final stream works methodology will be developed, with particular emphasis on timing, staging and sequencing of stream works. The typology (refer 5.10.3 above) will be determined based on site-specific analysis prior to construction.

A CESCP will be developed for each circumstance where stream realignment works are required.

6.7.2 Culverts, erosion control and protection structures

Temporary and permanent culvert construction will be required in a number of locations throughout the Project. Temporary culverts will be provided to allow construction vehicles to cross watercourses and overland flow paths, and these will be removed when no longer needed and the stream bed will be rehabilitated.

Culverts will be constructed in a dry condition, isolated from the existing stream flows. A stream diversion will be required either prior to construction works commencing on the culvert or to direct flows into the culvert once construction works have been completed. Temporary and permanent stream diversions are discussed in Section 6.7.1 above.

Where culvert installation or an extension is required within a stream channel, the culvert works, depending on stream flows and fish passage requirement could be carried out either by bypassing the flows around the culvert footprint establishing a stream diversion as discussed in Section 6.7.1 above or by pumping the flows around the culvert works areas.

Prior to undertaking the works at a particular culvert location, a specific construction methodology will be developed and will be detailed within the CESCP for the particular location.

6.8 Earthworks

The Project will involve large volumes of earthworks, approximately 189ha. The total volume of cut material is approximately 8.0M m^3, approximately 6.2M m^3 of fill material and approximately 1.8M m^3 difference.

It is anticipated that most earthworks operations and movements can be contained within the designation boundary with minimal movement of spoil using public roads. Mass haul distances will be minimised to increase efficiency of the operation.

An example of bulk earthworks is shown in Photo 2–4 below.

Photo 6-4: Bulk earthworks NGTR

6.8.1 Disposal of surplus material

With the indicative design approximately 1.8M m^3 of surplus material is likely to be generated. Surplus material will be cut from the various cuttings zones within the Project and disposed of within spoil sites and embankment widening works associated with the Project. The locations of the spoil sites are indicated on Drawings R-100 to R-115 in Volume 4.

The majority of the disposal areas identified are located close to the indicative alignment and involve extensions to the upstream sides of embankments, using some large gullies above the road. These require design and drainage measures to minimise any discharge of sediments onto the road alignment or blocking of culverts.

The final disposal site locations for surplus material and final volumes will be determined during the detailed design phase of the Project as part of the OPW process.

Section 5 of the Construction Water Assessment Report provides details of the proposed water management to be employed for the spoil sites during the construction phase.

6.9 Hazardous substances and materials

Construction activities and site works will include a wide range of machinery and construction plant, the majority of which will be motorised and require a regular supply of fuels and oils. The machinery will require refuelling on-site; hence fuel, oils and other lubricants will be stored on site. These products can become pollutants if discharged both directly or indirectly to land or water. Other construction materials such as cement, bitumen sealants, flocculants, degreasers and adhesives can also have environmental effects if they are not managed in an appropriate manner.

The management of hazardous substances, including storage, handling, transport and disposal, will be subject to specific management practice and industry guidelines. This management will minimise potential effects on health and safety from exposure to hazardous substances and reduce potential effects on the environment.

Refer to Section 7.1.1 of the Construction Water Assessment Report for further detail on hazardous substances and associated site management.

Ultimately, the management of hazardous substances will form part of the OPW, which will identify the suite of hazardous substances to be stored on site and the methods to manage these to prevent unlawful discharges to the stormwater system or receiving environment.

6.10 Viaducts and bridges

The construction of the major structures, including seven viaducts and several smaller bridges, will be a significant part of the Project. Where possible, viaduct and bridge components will be precast at the main site compound off Woodcocks Road, or elsewhere offsite. Where required, it is anticipated that bored piles will be cast in-situ.

The concrete box girder viaducts may involve construction of the superstructure on precast segmental balanced cantilever technology. A launching gantry of approximately 600-800t capacity and 150-200m long will likely be required to erect the precast segments.

The concrete beam and slab viaducts may involve construction of the superstructure on precast prestressed concrete super-tee beams and an in situ concrete deck. The precast concrete beams will likely be erected span by span using a launching girder approximately 100-150t and 70-100m in length.

6.11 Protection and relocation of existing network utilities

As outlined in Section 4.1.7 of this AEE, existing network utilities affected by the construction of the Project will need to be maintained, protected or relocated.

Protection or relocation of existing utilities will generally occur in conjunction with the construction of the Project. The appointed contractor(s) will need to work closely with the relevant network utilities to undertake the necessary protection and/or relocation works. The scope and timing of the necessary utility relocation and protection works will be developed and agreed between the NZTA and network utility providers to mitigate any safety hazards and provide cost efficiency for the required works.

The construction activities require the relocation of the Vector gas supply that feeds Warkworth and works within road reserve (notably Moirs Hill and Wyllie Roads).

An approval is required pursuant to section 177(1)(a) of the RMA prior to any works occurring in an earlier designation. The NZTA continues to work with Auckland Transport and Vector Limited to obtain approvals in this regard.

6.12 Construction programme

An indicative construction programme of five years has been scoped to inform the AEE. This is based on a typical sequence of works and a 100-120 day earthworks season (October-April) with works within the CMA, the Pakiri formation and on structures having no seasonal constraint. The programme includes:

- Temporary works such as construction access tracks, erosion and sediment control and temporary and permanent stream diversions;
- Underfill works including ground improvement, undercuts, and shear keys;
- The installation of culverts;
- Clearing and stripping;
- Bulk earthworks (cut to fill and cut to waste);
- Roadworks (drainage, pavement and traffic services); and
- Landscaping.

Construction of some individual elements of the Project, such as the large viaducts and some of the cut to fill operations, will require construction duration of several years (potentially up to 3 years depending on the final design and construction methodology for the Project). The indicative programme for structures based on the indicative alignment and conceptual construction methodology is based on a typical sequence of works, namely:

- Temporary works such as access tracks, staging areas and erosion and sediment control;
- Foundations including piling and pile caps to abutment and piers;
- Sub-structure including abutments, piers and headstocks;
- Superstructure beams or segments, diaphragms and bearings and joints; and
- Deck and barriers.

Construction staging is likely to involve the progressive construction of the Project, with material from cuts being used at adjacent fill sites. This methodology reduces transport generation external to the site, times and distances. The Construction Noise and Construction Traffic Assessment Reports reflect this principle.

7. Alternatives

7.1 Statutory requirements to consider alternatives

Section 171(1)(b) of the RMA requires a territorial authority, when considering a NOR, to have particular regard to whether adequate consideration has been given to alternative sites, routes, or methods of undertaking the work.

Section 105 of the RMA requires regard to be had to various matters including "*any possible alternative methods of discharge, including discharge into any other receiving environment*". Alternatives assessment required by section 105 is addressed in Section 29.5 below.

7.2 Overview of the option evaluation and design process

Identification of the indicative alignment involved a process of option development, evaluation and refinement. The process involved experienced roading engineers and designers working in conjunction with traffic engineers, planning, environmental and geotechnical specialists to identify options, which were subsequently assessed in workshops attended by experts in those relevant fields. Workable options were then carried forward and developed as the amount and level of information increased.

The options evaluation and design process is outlined in Figure 7-1 below.

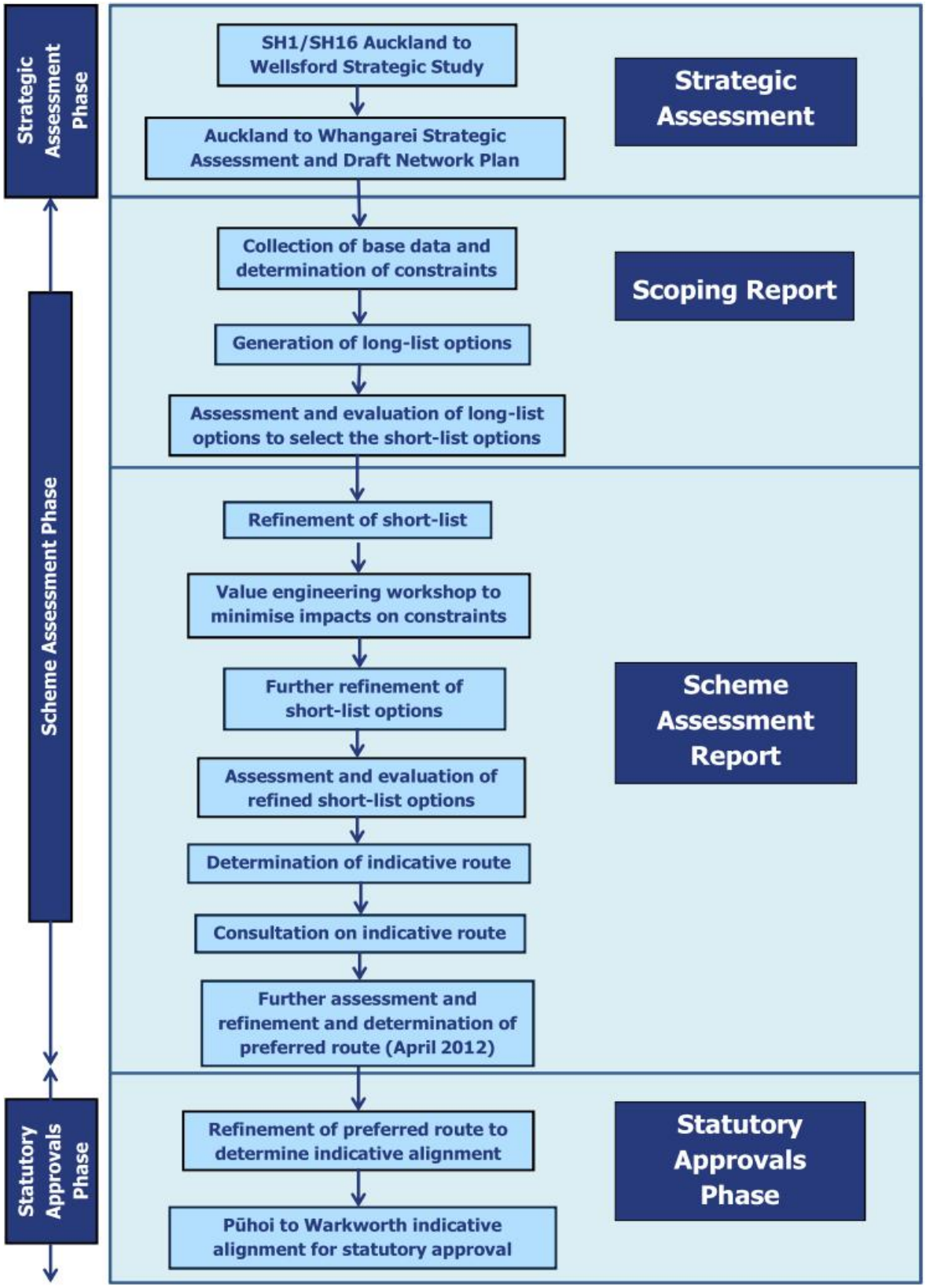


Figure 7-1: Options development process

7.3 Scheme assessment phase options development and evaluation

The Scheme Assessment phase options evaluation and design process initially comprised the development of alignment options for the Pūhoi to Wellsford RoNS. This initial work established that an inland corridor following close to the NAL was less favourable that the more direct corridor northwards to Warkworth and then on to Wellsford. Accordingly, the inland option did not progress to the shortlist analysis and the Scheme Assessment for the section of the corridor between Pūhoi and Warkworth was progressed.

The process to develop and evaluate alternatives for the Project during the Scheme Assessment phase included:

- Stage 1: Collection and collation of base data and mapping of physical and social constraints;
- Stage 2: Development of a long-list of options/corridors and assessment of these against an evaluation framework to determine a short-list of route options; and
- Stage 3: development and further assessment of the short-list of route options and selected preferred route.

Feedback received from the first two phases of consultation with the community and stakeholders (refer to Section 8 of this AEE) was considered by the NZTA during the design process and in the evaluation of alternatives. The outcome from some of the feedback was to re-evaluate or modify sections of the route as appropriate.

7.3.1 'Do-minimum' option

The 'do-minimum' option is the baseline against which the options were assessed.

Section 2.8 of the NZTA EEM[75] specifies the following with respect to the 'do-minimum' for transport activities:

> *"Most forms of activity evaluation involve choices between different options or courses of action. In theory, every option should be compared with the option of doing nothing at all, ie the do-nothing.*
>
> *For many transport activities, it is often not practical to do nothing. A certain minimum level of expenditure may be required to maintain a minimum level of service. This minimum level of expenditure is known as the do-minimum and shall be used as the basis for evaluation, rather than the do-nothing.*
>
> *It is important not to overstate the scope of the do-minimum, ie it shall only include that work which is absolutely essential to preserve a minimum level of service.*
>
> *Particular attention is required if the cost of the do-minimum is comparable to the cost of the options being considered. In such cases, the do-minimum should be re-examined to see if it is being overstated."*

[75] NZ Transport Agency 2010, *Economic Evaluation Manual*

The future infrastructure improvements through the study area that are considered by the NZTA to be essential to preserve a minimum level of service include:

- A Memorandum of Understanding (MOU) was agreed between the former Rodney District Council (RDC) and the NZTA (as Transit New Zealand) in October 2006. This MOU sets out agreed intersection improvements required in Warkworth to accommodate planned levels of development in the Warkworth area to 2021, as set out in the Warkworth Structure Plan (refer to Section 29.4.6 of this AEE). The MOU recommended a staging programme for the improvements to ensure these remain consistent with the planned level of development.
- The NLTP provides a list of proposed projects within the study area. These were reviewed to determine those essential to preserve a minimum level of service and those not required if alternatives considered as part of this study were to be implemented.

Both the MOU and NLTP were reviewed by the NZTA to determine which network improvements should be included in the 'do-minimum' for the Auckland to Whangarei Strategic Assessment and subsequently for the Project.

The 'do-minimum' option assumes that the existing SH1 alignment and configuration remains with the exception of committed intersection improvements at Warkworth in line with the MOU staging recommendations. A Warkworth western collector road, also referenced in the MOU, has also been assumed to form part of the 'do-minimum' option refer Figure 7-2 below for the proposed route of the Warkworth Western Collector.

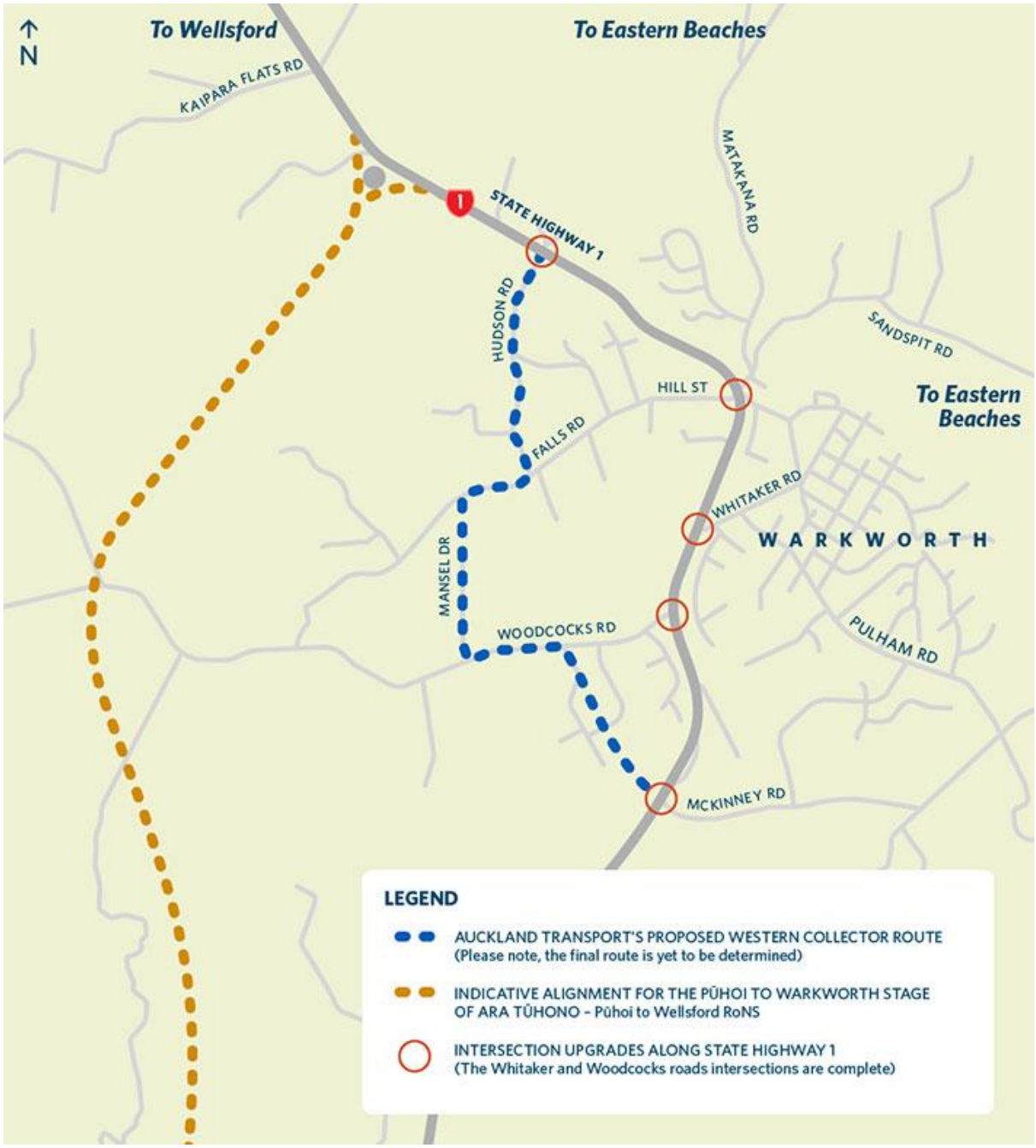


Figure 7-2: Proposed Warkworth Western Collector route[76]

No other improvements recommended in the NLTP were included in the 'do-minimum' option.

[76] Sourced from http://www.nzta.govt.nz/projects/warkworth/index.html

7.3.2 Long-list corridor options development

Development of the initial route options for the Pūhoi to Warkworth section of the Ara Tūhono P-W RoNS involved physical constraints mapping across the entire study area to enable composite constraint analysis. The study area was analysed in terms of a wide range of bio-physical constraints, including waterbodies, topography, geology, Department of Conservation reserves and Auckland Council regional parks and local reserves, sites of ecological value, the CMA, ONLs, and SNAs.

This analysis enabled the development of a long-list of route options in Phase 2 of the Scheme Assessment that sought to avoid or minimise effects on major constraints while addressing the NZTA's project objectives cognisant of the influence of social and environmental factors. A 'line of best fit' was generated for each route option. The 'line of best fit' had the least cumulative impacts over its length, based on the categorisation of the constraints.

The start point for the route options was the northern end of the NGTR and a nominal end point was determined on SH1 in the vicinity of the intersection of SH1 and Kaipara Flats Road, to afford a bypass of Warkworth.

The alignments of 'best fit' were then developed into possible routes, in the context of a broader corridor, using 3-dimensional road modelling software.

A preliminary concept design of the routes was undertaken by the NZTA to derive basic information for use in the assessment of the performance of the corridors against the relevant evaluation criteria. The preliminary concept design included identification of horizontal and vertical alignments, cut and fill requirements, waterway crossings and indicative cost estimates. While indicative routes were developed for each of the long list options, it was recognised that there was potential for the alignment of the options to be adjusted as investigations advanced.

Additional inland options were developed to follow the NAL railway in the west.

A long-list of 13 route options was developed between Pūhoi and Warkworth.

(a) Long-list corridor evaluation

The evaluation framework for the long-list to short list corridor assessment was developed from the Auckland to Whangarei Strategic Assessment Context Report and Network Plan and refined to provide a more detailed quantitative and qualitative assessment of the corridors. In addition, the Ara Tūhono P-W RoNS and Project objectives (as outlined in Section 2.4 above) informed the scope of the evaluation criteria. A number of measures for evaluating the criteria were developed that were then used to inform the evaluation of the options.

Following the development of the 13 route options, technical assessments of the options were undertaken. The assessments included:

- An engineering and functional assessment based on geometric parameters, construction requirements, and structural requirements;
- A traffic assessment drawing upon outputs from the 2026 strategic traffic model developed for the Auckland to Whangarei Strategic Assessment;

- An environmental and social assessment undertaken against the objectives of relevant legislation and policy documents, including the NZTS, GPS, LTMA, NZTA Policy and the RMA, the extent of potential environmental, social and cultural effects and the ability to gain approvals for each option; and
- An indicative cost assessment.

Road designers, planners, environmental specialists, geotechnical engineers and traffic engineers attended workshops to review the long-list route options against the Project's evaluation framework.

Following the long-list workshop, the 13 possible route options were grouped into seven broad corridors (refer to Figure 7-3 for evaluation prior to the identification of a short-list of options.

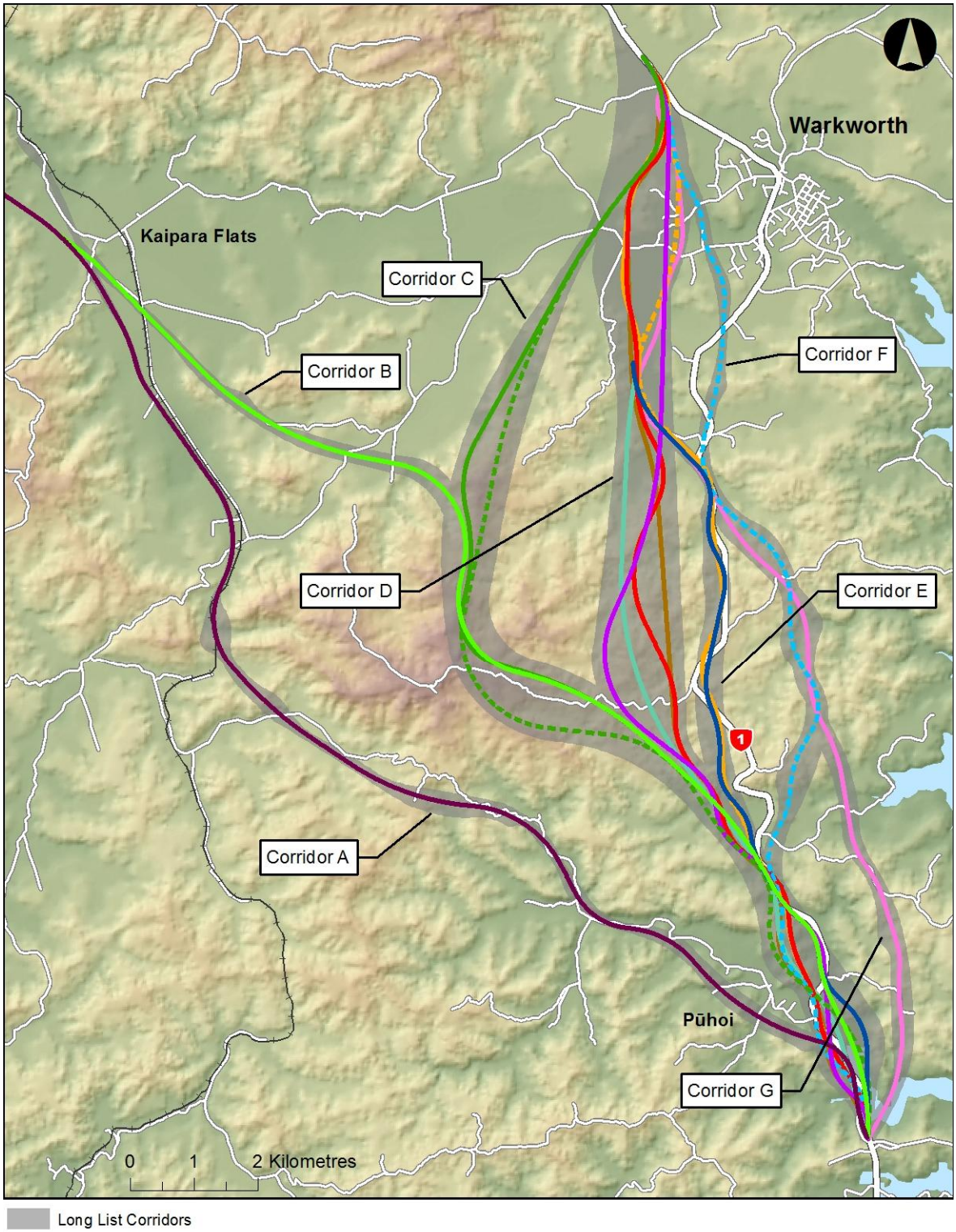


Figure 7-3: Long List Options

Each of these corridors included between one and four of the long-list route options, and varied in width between several hundreds of metres and more than one kilometre. While the options generally re-join SH1 north of Warkworth in the vicinity of its intersection with Kaipara Flats Road, the northern end of the corridors was flared to reflect the ability to tie into the existing SH1 further to the north if required.

During the long-list workshop, the conclusions of the Auckland to Whangarei Network Plan and the option of an on-line upgrade to the existing SH1 were considered. The Network Plan conclusions and analysis at the long-list workshop resulted in the discounting of an on-line upgrade as an option for the short-list given that it would not be in line with the Network Plan or the Project objectives. However, following feedback from consultation undertaken on the broad principles of the route selection in June 2010, evaluation of an on-line option was undertaken as described in Section 7.5 of this AEE.

Corridors C, D, E, F and G were not dependent on any particular alignment north of Warkworth and hence do not preclude development of a range of alignment options north of Warkworth for the northern section of the Ara Tūhono P-W RoNS through to Wellsford. Corridors A and B were discounted on this basis and did not go forward for consideration of the short list options.

7.3.3 Identification of short-list corridor options

The categories and criteria used to evaluate the long list options are outlined in Table 7-1.

Table 7-1: Evaluation framework categories and criteria

Category	Criteria
Assisting Economic Development	The extent to which the option will enhance inter-regional and national economic growth and productivity.
	The extent to which the option will improve movement of freight and people between Auckland and Northland.
	The extent to which the option will improve connectivity between the medium to long term growth areas in the northern Rodney area (Orewa, Warkworth and Wellsford).
	The extent to which the option will support local economic development.
Safety and Personal Security	The extent to which the option is expected to improve road safety in the area and reduce all road crashes.
Improving Access and Mobility	The extent to which the option achieves the strategic (through traffic) function of SH1 as a nationally significant route linking the Auckland and Northland regions.
	The extent to which the option provides a strategic alternative to address route security, resilience and flexibility.
	The extent to which the option provides a strategic alternative to address a point incident.
	Proximity of the option's interchange locations to activity nodes.
	The extent to which the option will improve the reliability of the transport network through providing a more robust and safer route between Auckland and Northland.

Category	Criteria
	The extent to which the option maintains convenient local access and connectivity.
	Impacts on and realignment of SH1 during construction.
Protecting and Promoting Public Health	The extent to which the option can provide for walking and cycling to contribute to positive health outcomes and provide more transport choices, both through and between towns.
Environmental Sustainability	The extent to which the option will minimise the physical extent and significance of the project.
	The extent to which the option will avoid potential environmental impacts on areas of high ecological value or high landscape value.
	The extent to which the option will impact on coastal areas or water courses.
	The extent to which the option will impact on sensitive receptors with regards air quality and noise during both construction and operation.
	The extent to which the option will reduce overall energy use and greenhouse gas emissions (NEECS).
	The extent to which the option will avoid impacts on places of archaeological or heritage significance (eg Protected Items – RDC).
	The extent to which the option will avoid impacts on places of cultural significance.
	The extent to which the option will impact on communities during both construction and operation.
	The extent to which the option will minimise social effects on community facilities (eg schools, hospitals, sports fields).
	The extent to which the option will minimise economic effects including community attractions (egRansom Wines, Honey Centre) and businesses (eg Genesis Aquaculture, Sout hern Paprika Ltd).
	The extent to which the option will support regional and local land use planning intentions.
Value for Money	The overall cost of the option.
	Geotechnical cost risk (construction and operation).
	Constructability cost risk.
	The ability of the option to be tolled.
	The ability of the option to be staged.
	The extent to which difficulties through the consenting process may delay the date for opening the RoNS.
	The extent to which the difficulty of construction may need to the construction period to be extended - delaying the date for opening the RoNS.

A workshop was held to evaluate the seven broad corridor options (Corridors A – G) and identify the short-list options between Pūhoi and Warkworth. Some of the corridors contained more than one possible alignment developed for assessment purposes.

The assessments were undertaken by reference to each route option within a particular corridor rather than the corridor as a whole. This approach was taken so that the wider corridors, and especially those offering a number of possible routes, were not assessed as having greater effects than the narrow corridors where these would be further refined.

Within each category and criterion, the results of the evaluation against criteria were averaged and then summed to give the overall rankings. In addition, sensitivity testing was undertaken to rank options under a series of scenarios that saw the weighting for each of the objectives doubled in turn.

In undertaking the evaluation of the options, workshop participants agreed that the northern portion of Corridor F was not acceptable due to the large impact from the alignment passing through the Warkworth town boundary and effectively splitting the town in half. Consequently, the evaluation of this corridor was undertaken on the basis that the northern third of this corridor would adopt a similar alignment to Corridor E.

Corridors D, E and F were recommended to be considered further during Stage 3 of the Project's Scheme Assessment.

7.3.4 Short-list corridor options evaluation

The short-list options (refer to Figure 7-4) were split into sectors to enable the different options to be 'mixed and matched'. The sectors included:

- Pūhoi to south of Schedewys Hill;
- South of Schedewys Hill to Perry Road; and
- Perry Road to Warkworth.

Additional desktop and initial field investigations were undertaken across a range of specialist areas, including ecology, heritage and cultural, geological and geotechnical, acoustic, urban design, landscape, social, air quality and water quality.

A value engineering workshop was also held to minimise impacts on known features. Following this workshop, the options were further refined and developed, and then assessed across a broad range of criteria for the evaluation and selection of the preferred option. The options resulting from the value engineering workshop are discussed below.

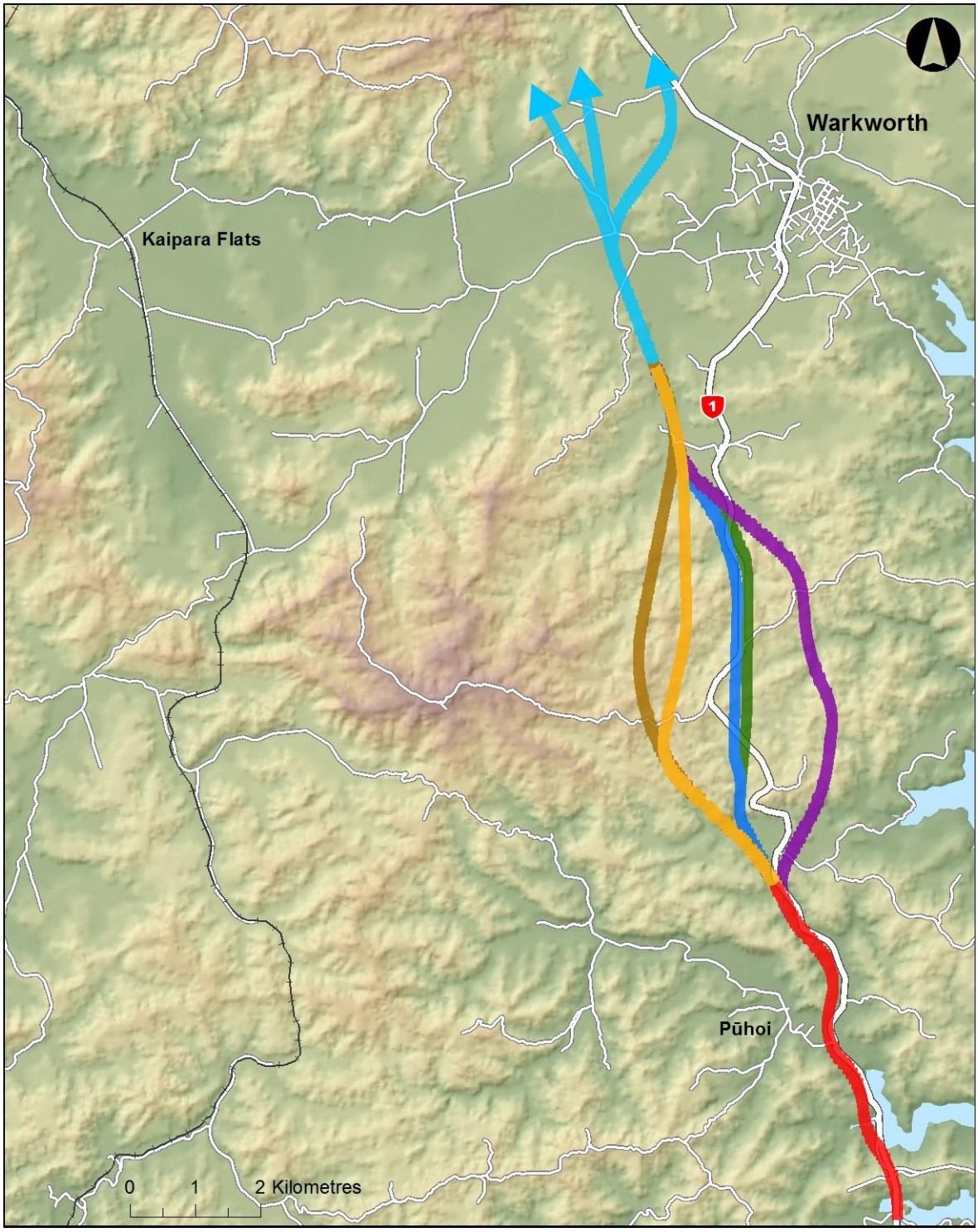


Figure 7-4: Short-list options

(a) Pūhoi to south of Schedewys Hill (Sector 1)[77]

This sector included only one short-list option, parallel to SH1. The development of the single short listed option in this sector was the result of avoiding environmental and social constraints in and around the Pūhoi area and the need to tie into the existing NGTR alignment.

Initially, the alignment of this option headed north from the Johnstone's Hill tunnels and crossed SH1 from east to west, adjacent to Te Pā o Te Hēmara Tauhia. The alignment continued along the western side of SH1 past Pūhoi Road and north towards Schedewys Hill.

Following the initial value engineering workshop, the alignment through this sector was amended in two areas:

- North of Johnstone's Hill tunnels the option was realigned to the west of Te Pā o Te Hēmara Tauhia. This reduced the length of the bridge over the Pūhoi Estuary north of the Pā site and shifted the alignment away from the bulk of the CPA1 along the Pūhoi River; and
- North of Pūhoi Road, the alignment was shifted closer to SH1 to reduce the earthworks volumes and limit the area of land that would be isolated between the motorway and SH1.

(b) South of Schedewys Hill to Perry Road (Sector 2)

This sector initially included three options:

- Option 1 was located west of SH1. This option crossed Moirs Hill Road approximately 800 m west of SH1 and continue north through the western end of the Pohuehue Scenic Reserve. This option crossed Perry Road approximately 800 m west of SH1 and passed to the east of Genesis Aquaculture;
- Option 2 was generally parallel to SH1. The alignment was located to the west of SH1 at Schedewys Hill and then cut across to the eastern side of SH1 half way along Windy Ridge. The alignment then crossed SH1, just south of the Pohuehue Viaduct and continued parallel to SH1 through the eastern end of the Pohuehue Scenic Reserve. The alignment crossed Perry Road approximately 800 m west of SH1 and passed to the east of Genesis Aquaculture; and
- Option 3 was located generally to the east of SH1. Option 3 crossed SH1 approximately 700m south of Mahurangi West Road and passed about 900m east of Schedewys Hill. The alignment crossed SH1 approximately 900m south of Perry Road before crossing Perry Road approximately 800m west of SH1 and passed to the west of Genesis Aquaculture.

Following the value engineering workshop, modifications were undertaken on Options 1 and 2:

- Option 1A extended further west to avoid directly impacting the Pohuehue Scenic Reserve; and

[77] The description of Sectors used in the short-list assessment is not to be confused with the indicative Project sectors outlined in Section 5.2.3 of this report used to assist with assessment of the Project for the purposes of this AEE and the assessment reports.

- Option 2A remained on the eastern side of SH1 past the Pohuehue Scenic Reserve and crossed SH1 approximately 1,100m south of Perry Road.

These additional options were included in the short-list for evaluation.

(c) Perry Road to Warkworth (Sector 3)

The options for this sector followed the same alignment between Perry Road and Woodcocks Road and then generally followed two corridors between Perry Road and north of Warkworth:

- For one group of options, the alignment skirted Warkworth north of Perry Road, crossed Woodcocks Road to the west of Carran Road and continued north towards Kaipara Flats Road near Phillips Road; and
- For the other group of options, the initial portion of the alignment was the same as the group above between Perry Road and Woodcocks Road. From this point, the alignment turned north east and follow the edge of the Warkworth Structure Plan area towards SH1 before turning north again and crossing Kaipara Flats Road just to the west of SH1.

(d) Short-list Evaluation Workshop: Identification of Indicative Option

In summarising the results from the short-list evaluation workshop, the following points are highlighted:

- The 'do-minimum' option did not meet the Project objectives;
- Corridors A and B offered no positive benefits in assisting economic development, assisting safety and personal security or protecting and promoting public health (through proximity to services) due to their distance from Warkworth making them unattractive to traffic. In addition, they have relatively high costs and do not offer staging options. Consequently, these corridors compared poorly with the others;
- Corridor C offered low positive benefits in assisting economic development, assisting safety and personal security or protecting and promoting public health due to the length of the corridor. This alignment also has a high cost and compared poorly with the others;
- Corridor G offered positive benefits for economic development, assisting safety and personal security or protecting and promoting public health compared to the other remaining corridors, it had the highest impact on environmental values; and
- Corridors D, E and F were viewed as the best performing corridor options as they had positive benefits for economic development, assisting safety and personal security or protecting and promoting public health and lower impacts on environmental values.

The sensitivity testing, in which each category of criteria was emphasised, demonstrated that in all cases Corridor D performed better than other corridors. In all but one case, Corridor F was the next best option and where it did not rank second, it ranked third. Corridor E ranked second in one case, fourth in one case and third in the remaining four cases.

Accordingly, Corridor D was adopted as the indicative option for the purposes of Phase 2 of consultation (refer to Section 8 of this AEE).

7.3.5 Corridor refinements during Stage 3

Refinements to Corridor D in Stage 3 of the Scheme Assessment occurred in response to both community inputs (refer to Section 8 of this AEE) and in response to the findings of further, more targeted environmental investigations. The main changes included:

- Options for the connection to SH1 at the Johnstone's Hill tunnels were considered with reference to potential impacts on Titford Cottage, Titford House and Te Pā o Te Hēmara Tauhia. Detailed information on these features was not available due to the lack of access for site investigations. Hence two options for this connection were developed for further assessment;
- The alignment was shifted west at Moirs Hill Road to reduce the fill heights to the north (west of the Pohuehue Scenic Reserve);
- Batters in some environmentally sensitive areas were steepened reducing the footprint and improving the overall cut/fill balance;
- The alignment between the Warkworth Interchange and SH1 was shifted south at Woodcocks Road to minimise the length of the bridge over the Mahurangi River (Right Branch). An additional benefit of this change was the extension of the bridge over Carran Road, avoiding the need for a substantial realignment of Carran Road;
- The alignment was shifted to the western side of Genesis Aquaculture property to avoid direct impacts on the fish farm; and
- The alignment at Perry Road was shifted west.

As a result of these refinements, a preferred route was determined, which was announced to the public in April 2012 (refer to Section 8 for further detail).

7.3.6 Refinements in the statutory approvals phase

Further refinements of the preferred route have been undertaken during the period leading up to lodgement of NORs and resource consent applications. The refinements relate to localised areas, or the design of specific structures along the indicative alignment. The indicative alignment is the result of this work, as shown in Drawings R-100 – R115 in Volume 4.

The main refinements are as follows:

- The link from the existing SH1 carriageway to Waiwera (Hibiscus Coast Highway) has been modified so that both the northbound and southbound lanes pass to the east of the new motorway mainline as a single two-way carriageway. This change removes the need to provide the Waiwera link overpass structure, thereby reducing the extent of works required in this location. The existing northbound Waiwera link road pavement has been retained to provide an access for emergency vehicles onto the northbound carriageway of the new motorway;
- In consultation with Hōkai Nuku, the indicative alignment has been modified between the Johnstone's Hill tunnels and the proposed Pūhoi Viaduct to minimise impacts on a previously unrecorded pā site north of Billing Road, identified during site investigations to support the statutory approvals. Specifically, the indicative alignment has shifted to the east by approximately 50m and the vertical level of the road has increased by around 7.5m

adjacent to the previously unrecorded pā site, mitigating what would have otherwise been a significant impact on the pā site. As a result of this alignment modification, the length of Okahu Viaduct has increased to 520m, requiring an additional set of piers;

- The indicative alignment includes the provision of south-facing ramps at Pūhoi. These ramps consist of a northbound off-ramp and a southbound on-ramp. North-facing ramps are not provided;

- A fill embankment south of Schedewys Viaduct that would have been located on unstable ground has been replaced with a 180m long viaduct (Hikauae Viaduct);
- The section of the indicative alignment between a point south of Perry Road and a point at Wyllie Road has been modified to better optimise earthworks volumes and minimise effects on a stand of Kauri trees identified as being of high ecological value. Other changes in this section include:
  - New Kauri Eco Viaduct proposed to replace a large embankment. The viaduct will cross the Mahurangi River (Right Branch), thereby removing the need to culvert the river at this point and also reducing the length of stream diversion required;
  - The indicative alignment has been shifted both westwards and eastwards by up to 120m laterally along this section;
  - The length of the Perry Road Viaduct has increased in length to 510m;
- The indicative alignment in the vicinity of the northern tie-in (to the north of Viv Davie-Martin Drive) has shifted to the northwest to minimise the footprint of the indicative alignment on an existing floodplain, based on new information from Auckland Council. This movement has included the provision of a new bridge structure (Carran Road flood relief bridge) where the indicative alignment will pass across the floodplain;
- The provision of an underpass structure proposed at Cook Road (unformed legal road) has been removed;
- Minor upgrade works are proposed on Moirs Hill Road to provide for safe operation of the road during the construction phase of the Project; and
- Minor realignment works on Woodcocks Road and Carran Road in the vicinity of Woodcocks Road Viaduct are proposed to improve safety at the Woodcocks Road/Carran Road intersection.

7.4 Interchange options

7.4.1 Pūhoi Interchange

Based on the expected land use and growth predictions in the Pūhoi area outlined in relevant strategic documents, including the Auckland Regional Growth Strategy, along with discussions with Auckland Regional Council and Rodney District Council at the time, the Auckland to Whangarei Strategic Assessment[78] and the draft Network Plan for SH1 between Auckland and Whangarei[79] recommended that no interchange be provided at Pūhoi.

[78] NZ Transport Agency 2010a, *Auckland to Whangarei Strategic Assessment*, prepared by Sinclair Knight Mertz

[79] NZ Transport Agency 2010b, *Draft Auckland to Whangarei Network Plan*, prepared by Sinclair Knight Mertz

The preferred route announced to the public in April 2012 did not provide for an interchange at Pūhoi.

Feedback from the communities at Pūhoi and Mahurangi West throughout the Scheme Assessment phase indicated a preference for retention of the current level of access for these settlements. In the absence of an interchange at Pūhoi, trips between Pūhoi and Orewa would need to travel via the Hibiscus Coast Highway, which is longer than the NGTR (both in terms of distance and time), with a lower geometric standard and lower level of service.

Further to this feedback, coupled with subsequent discussions with Auckland Transport and Auckland Council, south-facing ramps have been included in the indicative alignment.

7.4.2 Warkworth Interchange

During the Scheme Assessment phase, four interchange locations were investigated for the Warkworth Interchange, including:

- North – a northern interchange, the location of which would be dependent on the ultimate alignment selected for the upgrade of SH1 between Warkworth and Wellsford. Accordingly, two northern interchange options were assessed as follows:
  - North 1 – located 1-2km west of SH1;
  - North 2 – located adjacent SH1;
- Central – an interchange located near, and connecting to, Woodcocks Road; and
- Southern – a southern interchange in the vicinity of Valerie Close.

The interchange options each provided full movement on and off the motorway in both northbound and southbound directions. Some additional works would be required to local roads in order to ensure adequate connection to SH1. In particular, Woodcocks Road west of the potential interchange is restricted by a one-lane bridge. Following the evaluation a northern interchange location was selected as being preferred.

A summary of the results of the evaluation is as follows:

- The northern options scored highest on:
  - safety and personal security due to the lower volumes of traffic that pass the schools (Mahurangi College, Warkworth Primary);
  - improving access and mobility due to their greater ability to provide effectively for peak traffic volumes; and
  - value for money as they do not require as much improvement to the local road network as the other options.
- The central option performed best in assisting economic development of the Warkworth area, due to the improved movement of freight between planned industrial and commercial areas and the P-W RoNS and the improved connectivity between the P-W RoNS and the town centre.
- The central and southern options performed best in protecting and promoting public health due to the greater overall reduction in traffic volumes on local roads.

- Overall, the northern options ranked highest. Sensitivity testing showed the northern options performed best when the weighting for each of the objectives was doubled in turn.
- The advantages of the northern options compared to the other options include:
  - reduced traffic past Mahurangi College and Warkworth Primary School;
  - connectivity to any future potential link from SH1 to the Matakana and Sandspit areas;
  - greater flexibility for construction staging; and
  - greater potential to service future population growth and development in Warkworth and the surrounding area.

The North 2 option (located adjacent to SH1) was adopted for the indicative alignment as it provides opportunities for greater connectivity with the Ara Tūhono P-W RoNS and the Eastern Beaches and does not preclude the development of the more northern section of the Ara Tūhono P-W RoNS through to Wellsford.

7.5 SH1 'on-line' upgrade

Community feedback received during the Scheme Assessment Phase indicated strong public perception that the upgrade of SH1 would provide better value for money than a new off-line alignment. Accordingly, an 'in corridor motorway' alignment, generally following close to SH1, and an 'on-line expressway' upgrade of the existing SH1 alignment between Pūhoi and Warkworth were investigated following the short-list options evaluation.

7.5.1 In-corridor motorway

A 100km/h 'in-corridor' motorway alignment was developed between Pūhoi and Warkworth that closely followed the existing SH1 northwards from the NGTR as far as Perry Road and included a bypass of Warkworth. This alignment followed as much of the existing road corridor and State highway designation as possible. The alignment was based on the design standards for a RoNS configuration, similar to that used for the short-list options. The alignment would allow the existing SH1 to be maintained as a separate road with grade-separated crossings as necessary.

However, due to the difference between the existing SH1 geometry and that required to meet the standards for a 100km/h alignment, there was little commonality between the required motorway alignment and the existing SH1 alignment either vertically or horizontally. The resulting alignment for the 'in-corridor' motorway was similar to a combination of Sector 1 Option 1 and Sector 2 Option 2A, which was originally Corridor E in the long-list assessment (refer Section 7.3.2 of this AEE). Further, the 'in-corridor' alignment would require a large area of additional land outside the existing State highway designation boundary. In addition, the alignment would need to cross the existing SH1 in two locations, which would create difficulties in relation to construction and on-going operational requirements.

Overall environmental effects of the 'in-corridor' motorway alignment were comparable to that of Corridor E, including:

- Land take and effects on properties and property accesses (especially as a motorway would preclude private access directly to it) along the existing SH1;

- Constructability impacts on the existing SH1 resulting from the crossing of SH1 in two locations and the construction adjacent to SH1 between Pohuehue Scenic Reserve and Perry Road;
- Similar potential adverse effects to known environmental and social features as Corridor E, including:
  - Te Pā o Te Hēmara Tauhia and a midden south of Pūhoi
  - Pohuehue Scenic Reserve
  - Honey Centre and Ransom Wines
  - Historic US Army Camps north of Perry Road.

In summary, the 'in-corridor' motorway alignment did not provide better value for money than the short-listed options, with higher costs than the estimated cost for the short-listed options, and had similar environmental effects.

The in-corridor motorway alignment option was not considered to warrant inclusion as a separate short-list option and it was therefore excluded from further consideration.

7.5.2 On-line expressway (upgrade of SH1)

An on-line expressway upgrade of SH1 was initially considered as part of the Auckland to Whangarei Strategic Assessment[80]. Analysis concluded that the on-line expressway option did not perform as well in comparison to the off-line options and the Auckland to Whangarei Strategic Assessment did not identify an online expressway as the preferred option due to the following reasons:

- The cost estimate to upgrade the existing State highway alignment would be similar to that of a new off-line alignment;
- An on-line expressway upgrade would not provide a secure alternative route to the existing SH1 network; and
- It would not be possible to toll an on-line expressway as there is no free alternative route as required under the legislation.

Subsequent analysis undertaken for the Network Plan confirmed this conclusion.

Following community feedback through the Phase 2 consultation undertaken during the Scheme Assessment phase, further assessment of an on-line upgrade to widen the existing SH1 between Pūhoi and Warkworth to a four–lane expressway was undertaken. A summary of the assessment is provided below.

(a) Functional assessment

The RoNS design standards require a design speed of 100km/h. The existing SH1 alignment does not comply with the 100km/hour design speed required for a RoNS. The geometry of the existing State highway alignment is constrained by the terrain through which the alignment passes. The majority of the alignment is well below the desired design standard. For an on-line expressway alignment to comply with the 100km/h design standard, the upgrade would occur within the

[80] NZ Transport Agency 2010, *Auckland to Whangarei Strategic Assessment*, prepared by Sinclair Knight Mertz

existing SH1 alignment in relatively few places. Further, the current State highway design, geometry and associated safety record are key reasons for the upgrade of the existing route as outlined in Section 2 of this report.

Based on the review of the existing road alignment and the standards deemed achievable, a design speed of 80km/h was adopted for the purposes of assessing this on-line expressway option even though this speed limit is below the requirement for a RoNS. Whilst an expressway with 80km/h design speed is able to more broadly follow the existing highway alignment, a bypass of Schedewys Hill/Windy Ridge was included due to the challenges of this existing vertical and horizontal geometry compared with an 80km/h design speed standard. A bypass of Warkworth was also included as it is generally accepted that this is required to alleviate congestion on SH1 through Warkworth.

The key design features of the on-line expressway option were as follows:

- 80km/h horizontal design speed with a 65km/h minimum design speed (20% reduction) when using existing carriageway (by comparison all the short-list options were designed for 100km/h);
- 80km/h vertical design but retain the existing vertical alignment where the existing highway is used ie below the 80km/h design speed;
- 100km/h vertical and horizontal design speeds for the Schedewys Hill and Warkworth bypasses;
- The bypass of Schedewys Hill extends past Windy Ridge in order to achieve allowable gradients (connecting to the southern end of Windy Ridge would result in grades in excess of 10%);
- The bypass of Warkworth starts between Perry Road and Valerie Close and would head north-west to follow an alignment similar to that of the indicative alignment from a point to the south of Woodcocks Road. It would then continue and connect with the SH1 north of Warkworth, south of Kaipara Flats Road;
- 3.5m traffic lanes;
- 2.5m outside and 1m inside shoulders;
- 4m median with a wire rope barrier;
- Full movement intersections with local roads (intersection treatment based generally on roundabouts);
- Left-in, left-out only access to properties (whilst not ideal, deemed allowable for 80km/h design speed) and unless allowed, considerable additional access road works would be required).
- The addition of two lanes to SH1 would require the existing formation to be substantially reconstructed.

Ancillary items such as utility services, safety barriers and signage would also require significant works as a result of the construction of additional lanes.

Table 7-2 provides a comparison of the on-line expressway to an off-line motorway option for the Project from a functional perspective.

Table 7-2: Functional comparison of on-line expressway and off-line motorway

Category	On-line expressway	Off-line motorway
Overall Length (Johnstone's Hill tunnels to Kaipara Flats Road)	19.2km	18.5km
Design Speed	80km/h (nominal)	100km/h
Access	Numerous at grade intersections for local roads and properties.	Access at interchanges only with SH1 maintained as separate facility providing for access.
Minimum Radii	240m	820m generally with 550m approaching Warkworth roundabout.
Maximum Grade	8%	5.6% up / 6.5% down
Length of Grades over 4%	4.1km	3.5km
Earthworks Volumes	4M m^3	8.9M m^3
Overall Bridge Lengths	Approximately 1,000m	Approximately 1,860m
Number of traffic lanes within Corridor	4	4 – 6 on motorway + 2 on existing SH1
Ability to be staged	Yes	Limited
Ability to be tolled	No	Yes
2026 Level of Service (existing SH1 is LoS 'E')	C	A
2051 Level of Service (existing SH1 is LoS 'E')	D	A

(b) Geotechnical constraints

While there are a number of geotechnical constraints to an on-line expressway upgrade along the length of the existing SH1 alignment, the main constraints are as follows:

- Pūhoi River Valley – from the northern portal of the Johnstone's Hill tunnels, the existing SH1 corridor occupies the west bank of the Pūhoi River estuary. Widening the highway to four lanes over this 2km length would require extensive reclamation of the CMA. In addition, to form a stable, widened highway through this low-lying, soft terrain would require extensive ground improvement and foundation strengthening to prevent on-going stability and settlement problems;
- Schedewys Hill – significant earthworks would be required to re-align the existing SH1 alignment at Schedewys Hill to four lanes with a design speed of 80km/h. Further, the section of SH1 along Windy Ridge is constructed over the unstable Northland Allochthon geological formation, which would require significant ground strengthening and stabilisation to upgrade the existing alignment to four lanes; and
- Pohuehue Reserve – to widen the existing SH1 alignment through Pohuehue Reserve (currently on a viaduct and cut to fill embankment) to accommodate four lanes, an

additional multi-span bridge with piers in the Reserve and river bed would be required. Land take from the reserve would also be required.

(c) Access

Approximately 14 local roads connect to the existing SH1 between the Johnstone's Hill tunnels and Valerie Close, along with a number of direct property accesses. An upgrade of the existing SH1 would require the current accesses to be maintained.

The inclusion of at-grade intersections along the expressway would, in general, not affect local road travel patterns; however, they would likely slow traffic on SH1 at these locations, increasing travel times. Property access would likely be restricted to left-in, left-out property accesses to eliminate any 'higher safety risk' right turns. While this would likely facilitate easier left turn access from private properties onto SH1, it would increase overall travel distances.

(d) Constructability

An on-line expressway upgrade of the existing SH1 would result in a number of complex construction issues including:

- Maintaining traffic flows while providing adequate working widths and safety zones during construction would likely be problematic in a number of places and require speed restrictions for traffic on SH1. The absence of a suitable alternative route would compound traffic disruption during construction;
- Maintaining the operation of the existing SH1 would complicate construction activities, particularly the movement of materials across the highway and the construction and maintenance of structures, including retaining walls and viaducts, culverts and sediment ponds. Working adjacent to the existing SH1 and moving traffic would restrict construction work areas, particularly on narrow and constrained sections, which would result in reduced construction efficiencies, greater construction disruption to road users, programme and cost implications;
- Creating a number of crossings of SH1 along with reconstruction of the existing carriageway resulting in complex construction staging and multiple traffic switches, again impacting on road users;
- Increasing the risk of a landslide event impacting the highway due to major earthworks immediately adjacent to the existing highway and known areas of geotechnical instability; and
- Land use and development on either side of the existing State highway limits the availability of nearby sites for water quality control ponds, spoil sites, storage areas and construction compounds.

(e) Environmental and social assessment

The on-line expressway upgrade would likely have greater social and environmental effects than an off-line option for the following reasons:

- The existing SH1 is adjacent to or passes through, or in close proximity to various sensitive environments, including SNAs, an area of native mistletoe near the SH1/Mahurangi West Road intersection, ONLs, estuarine and wetland habitats, significant waterways and DoC reserves, including the Pohuehue Scenic Reserve. The narrow corridor width would limit options to avoid environmental constraints along the alignment;
- An on-line upgrade would require large areas of land, beyond the current SH1 designation boundary, for construction and operational requirements. A new designation would be required along large lengths of the existing SH1, including at Schedewys Hill and Warkworth in order to provide sufficient width for the widened alignment. A larger footprint would have notable effects on the environment and land use immediately adjacent to the existing SH1 with notable areas of habitat removal and permanent land take from reserves likely; and
- The on-line upgrade would be in close proximity to dwellings and facilities and schools, which are sensitive to air and noise effects during both construction and operation. A greater number of landowners would be affected than an off-line upgrade.

(f) Conclusion – on-line expressway upgrade

The assessment of the on-line expressway upgrade undertaken during the Scheme Assessment phase confirmed the conclusion of the Auckland to Whangarei Strategic Assessment in that this option does not perform as well as an off-line upgrade option. The on-line upgrade option does not provide benefits that are commensurate with those of the off-line option in terms of:

- Improved travel times and travel efficiencies;
- Safety improvements;
- Route security and resilience;
- Journey time reliability; and
- Environmental and social impacts.

Whilst the overall cost of the on-line expressway would likely be less than the off-line RoNS upgrade option, it would still require a significant level of capital expenditure and is considered to provide reduced value for money overall. The on-line expressway upgrade would not meet all of the objectives required for this section of the Ara Tūhono P-W RoNS.

Given the findings of this analysis, the option was not considered further in the Scheme Assessment.

7.6 Conclusion – alternatives

The Project has been selected following a rigorous options development, evaluation and design process undertaken during the Scheme Assessment phase for the Pūhoi to Warkworth section of the Ara Tūhono P-W RoNS and the current statutory approvals phase. This process involved a long-list of potential alignments being reduced to a short-list and refinement through additional investigation and design advancement and two phases of consultation with project stakeholders and the wider community to select the indicative alignment.

The indicative alignment will avoid major environmental, social and cultural constraints within the Project area and provide a large number of benefits.

To summarise, the indicative alignment will provide the following:

- Opportunities for positive economic development for the north Auckland and Northland Regions and wider areas;
- Better value for money (when compared to other options);
- Improved safety and personal security through a better quality road with less travel times and better safety features for road users;
- Protection and promotion of public health, including a reduction of through traffic in Warkworth and in proximity to sensitive receivers, such as Mahurangi College;
- Route security and resilience through the provision of alternative options to SH1; and
- Avoidance of impacts on sensitive environmental areas such as the Pohuehue Scenic Reserve and overall lower impacts on environmental values in comparison to the other options assessed.

8. Consultation and communication

Between 2010 and 2012, the NZTA delivered a three-phase consultation programme to gather feedback on possible alignments for the Project.

The Project was formally introduced to the public with the production and distribution of the first newsletter in April 2010. Following that, Phase One consultation sought public feedback on three key principles for the entire Pūhoi to Wellsford corridor. Phase Two consultation took place between November 2010 and January 2011 to gather feedback on an indicative route for the Project.

Public feedback and further technical analysis were taken into account, leading to Phase Three consultation, being the announcement of a preferred route for the Project in April 2012.

A fourth phase of consultation in relation to the proposed NORs and applications for resource consent is currently being undertaken by the Further North Alliance and the NZTA, and will continue through until August 2014.

Details regarding the delivery of each of the Phases are provided in Section 8.2 of this AEE.

8.1 Consultation purpose and objectives

Each phase of the consultation programme was guided by the IAP2 Public Participation Spectrum and the NZTA's own guidelines for best practice consultation under the RMA and LTMA.

The purpose of Phase One and Phase Two was to inform, consult, and obtain public feedback to inform the development of alternatives, and the multi-criteria analysis underpinning the NZTA's decision-making in relation to the preferred alignment.

Specific consultation objectives were identified for Phase One and Phase Two. These same principles were applied to Phase Three and are being applied to Phase Four. The principles are:

- Provide inputs of local knowledge and stakeholder concerns, aspirations and preferences to the Project, including feedback on the analysis, alternatives and/or decisions;
- Identify impacts and risks and potential mitigation measures as inputs to option evaluation and scheme development;
- Enable potentially affected and interested parties to understand how they may be affected by the Project;
- Build positive relationships with affected and interested parties for the consultation phase of the scheme assessment and subsequent stages of Pūhoi to Warkworth, including consenting, design and construction;
- To meet or exceed best practice consultation processes under the relevant legislation and the NZTA consultation policy and guidelines;
- To enhance the reputation of the NZTA among the community of interest; and
- Visits to all landowners for Phase 2 – a 'door knocking' exercise.

The primary purpose of Phase Three and Phase Four was and is to provide the public with balanced and timely information to assist them to understand the Project and the approval process and to engage with those parties whose land would be subject to purchase under the Public Works Act.

8.2 Consultation delivery

8.2.1 Phase One

Phase One consultation occurred from June to August 2010. It aimed to inform potentially affected and interested parties about the Project, consult with the public about existing and future constraints, and seek feedback on proposals for interchanges, bypasses and the principle of an off-line route.

Targeted meetings and interviews were held with selected business and stakeholder groups. In addition to this, a number of meetings with property owners were also held. Warkworth Area Liaison Group and Pūhoi meetings were held in the RSA and Pūhoi Sports Club respectively.

Local displays were used throughout this Phase to summarise the Project principles and promote consultation and feedback opportunities.

The following activities were undertaken during this period:

- Newsletter 02 was released on 21 June 2010;
- Radio advertisements were played on Times FM from 21 June 2010 to 9 August 2010;
- Two sets of newspaper advertisements were placed in the Rodney Times, Northern Advocate, New Zealand Herald and North Shore Times;
- Static poster displays were developed and displayed – at two locations in Wellsford and six locations in Warkworth;
- A website (www.nzta.govt.nz/puhoi-wellsford) and electronic feedback form went live on 21 June 2010;
- A free post office box was created;
- A free call phone number was set up;
- Three media releases were made; and
- Live interviews with the NZTA's Project Manager were conducted on Times FM;

During Phase One of consultation, there were 932 individual pieces of consultation and communication conducted with or received by the NZTA from the community groups, the public and businesses:

- 367 electronic feedback forms;
- 224 hard copy feedback forms;
- 175 feedback emails;
- 108 phone calls;
- 30 ministerial requests for information and letters to the NZTA CEO were received; and
- The NZTA attended four council meetings and 24 stakeholder and community consultation meetings.

Meetings were held with the following parties:

- Network Co-ordination Group (attendees from Rodney District Council, North Shore City Council, Auckland Regional Council, Auckland Regional Transport, Whangarei District Council and Northland Regional Council)
- Iwi Working Group (Ngāti Manuhiri, Ngāti Whātua and Ngāti Paoa)
- Police (Warkworth)
- Warkworth Primary School Board of Trustees
- Road Transport Heavy Haulage
- Warkworth Business Association
- Eastern Beaches Residents & Ratepayers Stakeholders Meeting
- Department of Conservation
- Warkworth liaison group stakeholder meeting
- Pūhoi Community Forum
- Wellsford Promotions Association
- Business Owners including Honey Centre, Ransom Wines, Sheep World, Sheep World Caravan Park, Perrendale Holdings, Pūhoi Cheese, Southern Paprika Ltd, and Top of the Dome Cafe
- Iwi meeting with members of Ngāti Whātua and Ngāti Manuhiri
- Northern police liaison group
- Wellsford Residents & Ratepayers
- Mahurangi College
- Rodney College
- Wellsford Schools
- Kaipara Flats School and Ahuroa School
- Automotive Association
- Southern Paprika Ltd
- Top of the Dome Cafe

8.2.2 Phase Two

Phase Two consultation occurred from November 2010 to January 2011. It focused on gathering feedback about the selected indicative route from Pūhoi to Warkworth.

A door knocking exercise was undertaken prior to the public announcement of the indicative route, and all landowners directly affected by the indicative route were visited.

Public information days were held in Warkworth and Pūhoi. These included information posters, videos and a 3D simulation to convey information about the indicative route.

The consultation process was focussed on five public information days – four in Warkworth and one in Pūhoi – to give people the chance to meet the Project Team and talk face to face about the indicative route and any concerns people had about it. All five information days were well-attended, each attracting between 100 and 250 people. The Project Team that attended the open days included those involved in the design of the indicative route and technical specialists able to discuss property issues, noise, and ground conditions. The Project team received valuable feedback through these discussions. A feedback sheet was provided on the back of Newsletter 4 (November

2010) and available on the website. The NZTA received hundreds of feedback forms through the Project's website, in the post, and over the phone.

8.2.3 Phase Three

Phase Three consultation occurred from March 2012 to June 2012. It announced a preferred route between Pūhoi and Warkworth. Phase Three sought to inform potentially affected landowners, neighbours, and the wider community of changes that had been made to the indicative route to determine the preferred route. This phase also involved consultation with several new landowners and neighbours that would become directly affected as a result of changes made to the route.

A door knocking exercise was undertaken prior to the public announcement of the preferred route and all directly affected landowners were visited and once again were given a letter, a plan and neighbours' letter drop showing the portion of the property required. A 'Connecting Auckland to Northland' presentation was delivered to select stakeholders to communicate the wider vision for the Auckland to Northland State highway corridor.

Further information days were held to provide opportunities for the community to view plans of the alignment and ask questions. The 3D simulation was also updated at this time to reflect design changes.

8.2.4 Phase Four

Phase Four consultation is currently being delivered by the Further North Alliance. Since March 2013 the Further North Alliance has been liaising with directly affected landowners to organise on-site technical investigations and discuss the upcoming designation and consenting process.

The Further North Alliance continues to work closely with Hōkai Nuku to consult regarding the environmental assessments and to conduct on-site investigations including around Ngā Pā o Te Hēmara Tauhia in the Pūhoi area and in relation to freshwater and marine ecology.

Early and on-going engagement was established with the EPA and Auckland Council. The Further North Alliance has also met with community groups, road user organisations, government and non-governmental organisations and local businesses to discuss the Project and the upcoming consent process.

For the purposes of the statutory process, a proposed designation boundary was endorsed in June 2013 and communicated to all stakeholders in July via a printed newsletter, website update, phone calls and drop-in days. All potentially directly affected landowners received updated maps showing the areas of their properties that would be required by the Project and the team visited the majority of the land owners.

In July 2013, the Further North Alliance identified approximately 180 neighbours of the proposed designation. These neighbours were invited by personalised letter to meet with the Project Team to discuss the upcoming consenting process and any issues or concerns they may have about potential effects during the construction or operational phases of the Project. Many neighbours have responded, and Project team members have been meeting with the neighbours concerned. This process is ongoing.

Engagement with the Pūhoi and Warkworth communities and key stakeholders will continue through the submissions and hearing process.

8.3 Iwi consultation

Discussions with mana whenua about the Project were initiated by the NZTA prior to the commencement of work on the Scheme Assessment phase.

Regular meetings were held with mana whenua during 2010 to explore how cultural advice for the Project would be provided. These meetings led to the formation of Hōkai Nuku, a collective of iwi representing Ngāti Manuhiri, Ngāti Rango, Ngāti Mauku/Ngāti Kauwae/Te Uri o Hau of Ngāti Whatua, and Ngāti Whatua Iwi with the support of Ngāti Paoa.

Hōkai Nuku has provided a Cultural Effects Assessment for the Project. The NZTA and the Further North Alliance continue to meet with Hōkai Nuku on a regular basis to discuss issues of interest and address any areas of concern. Hōkai Nuku participated in site walkovers with technical specialists in early 2013, including the site walkover that identified the previously unrecorded pā site. The Cultural Effects Assessment has informed the consideration of the Project against statutory documents and Part 2 of the RMA.

8.4 Stakeholders

Several stakeholder groups were identified for targeted consultation during Phase One and Phase Two. These can be grouped as follows: directly-affected landowners, Government agencies, Auckland Council, utility providers, industry groups, community groups, iwi, and local businesses. Liaison with key stakeholders has continued during Phase Three and Phase Four. Where possible, the NZTA and the Further North Alliance continues to meet with all stakeholders face-to-face. A list of parties consulted with is attached at Appendix E.

8.4.1 Directly affected landowners

We have defined directly affected property owners as those whose properties are physically crossed by the proposed designation. Project neighbours are those whose properties adjoin the proposed designation and those whose dwellings are within 200m of the centreline of the indicative alignment. We updated our definition of ‘neighbour’ during Phase Four of consultation to include people whose properties may experience potential visual, noise, air quality or other effects during construction or operation of the Project.

8.4.2 Government agencies

A local government liaison group was established for Phase One and Phase Two of the consultation programme. This group brought together local and territorial authorities from Northland and Auckland, prior to the Auckland Council amalgamation. Post-amalgamation, engagement has continued with Auckland Council and Auckland Transport and the relevant councils from the Northland Region.

8.4.3 Community groups

Pūhoi, Mahurangi West, Warkworth and surrounds are represented by a wide variety of community groups. The NZTA and the Further North Alliance have given presentations to a number of these groups throughout the different phases of consultation. A list of these groups and local businesses is included at Appendix E.

8.4.4 Utility providers

The NZTA has worked with utility providers to determine the location of existing services and to discuss any necessary relocations and proposed upgrades or new services within the vicinity of the alignment. Engagement with Vector Limited, Watercare Services Limited and Chorus is ongoing in regards to effects on network utility infrastructure.

8.4.5 Statutory organisations and interest groups

Consultation was undertaken with organisations potentially interested in the Project, including DoC, Fish and Game, NZHPT and the Royal Forest and Bird Protection Society of New Zealand (Forest and Bird).

Consultation with DoC focused on the conservation values of sites within the Project area, the natural values of flora and fauna, recreational access and opportunities and environmental effects and benefits. A list of organisations consulted is included at Appendix E.

8.4.6 Road user organisations

Road user organisations, including emergency services, freight associations and driver associations were consulted regarding the Project. This engagement sought to identify any areas of concern and solicit feedback on the alignment.

8.5 Consultation channels

Communities within the Project area are spread over a large area, reflecting the rural characteristics of the Project area. This distribution dictated the use of a variety of communication channels to ensure widespread dissemination of key messages and to ensure that opportunities to provide feedback on the Project were open to everyone.

8.5.1 0800 number, freepost address and email address

Early in the Project, a toll-free 0800 telephone number, freepost mailing address and Project email address were established. These channels provided a number of convenient and free of charge mechanisms for stakeholders and interested parties to provide their views on the Project. The Project email address assisted in managing public queries and distributing Project information.

8.5.2 Printed newsletters

Printed newsletters continue to be a key line of communication with the local and regional community. These newsletters provide a single source of information that can be shared and

provide a record of Project information for future reference. During active consultation periods, a detachable feedback form was affixed to the newsletters to allow the public to send feedback conveniently via the freepost mailing address.

8.5.3 Advertising

Advertising in local newspapers and on regional radio stations kept the community informed about Project progress, consultation periods, public information days, feedback opportunities and key design principles.

8.5.4 Information days

Information days provided the public with an opportunity to ask questions face to face with members of the Project team, view larger plans of the Project area and alignment, and read more information about the planning process and progress of the Project. The information days also gave the public ready access to Project specialists and representatives from the NZTA Property Team to address any queries.

8.5.5 Media

Media releases and liaison with local and national outlets accompanied all significant announcements about the Project. These notices kept the community informed about Project milestones and opportunities to provide feedback.

8.5.6 Digital channels

As the consultation has continued through the four stages, there has been a particular focus on digital channels of communication such as the Project website and the community email distribution list. Phase Three saw the addition of messages delivered via the NZTA's Auckland Twitter and Facebook accounts.

8.5.7 Project website

The creation of the Project website[81] was a key line of communication in the consultation programme and ensured accessibility and dissemination of information to a wide, potentially global audience. The website was structured into nine main sections, as follows:

- Home page;
- Project overview;
- Indicative route;
- News and media;
- Gallery;
- Publications;
- Consultation;
- Frequently asked questions (FAQs); and
- Contact details.

[81] http://www.nzta.govt.nz/projects/puhoi-wellsford/index.html

It was updated during each phase of consultation to ensure current information was readily available. The full suite of applications including NORs, AEE, technical reports and plans will be hosted on the Project website.

8.5.8 3D visual animation

A 3D visual animation of the Project was released in November 2010 to show how the completed motorway may look in the landscape. This was updated in April 2012 and has been integral in providing a visual explanation of the alignment. A further update is planned to support the approvals process.

8.5.9 Videos

Phase Two included the production of a series of informative videos on the Project alignment. The videos communicated how ground conditions, road design, noise, traffic, ecology, landscape and the environment have been considered as part of the Project planning process.

8.5.10 Email newsletters

A significant database of email addresses was collected during Phase One and Phase Two. Electronic newsletters were used to provide regular Project updates in Phase Three and continue to be used in Phase Four. Starting in late 2012, regular updates were distributed via email to directly affected property owners to keep them informed of progress, particularly when on-site investigations commenced.

8.6 Consultation themes

Phase One and Phase Two of the consultation saw a wide variety of feedback received from the community. Several themes became evident during analysis of the feedback from these two phases.

Five primary issues were identified in the feedback from Phase One of consultation for the Ara Tūhono P-W RoNS relevant to the Pūhoi to Warkworth section, namely:

1) The potential economic impact of establishing a new alignment and bypassing existing businesses (both isolated individual businesses and those in Warkworth and Wellsford). This feedback provided input into decisions on the number and location of access points to the new motorway. Responses to these issues addressed concerns that there would be significant loss of trade, particularly in Warkworth and Pūhoi and sought to access robust data on local and interregional tourism;

2) Safety concerns about the existing State highway and the Hibiscus Coast Highway from Titfords Bridge to Orewa;

3) The possibility of a western interchange at Warkworth feeding into Woodcocks Rd and past Mahurangi College. The issue was compounded by uncertainties over the completion of the Western Collector, which also had the potential to impact Warkworth School in Hill Street; and the prospect of a link road to Matakana Road past the Showgrounds (with some form of

additional link to Sandspit Road which would effectively form an eastern ring road for Warkworth). There was also an interaction between the route through the Dome Valley and the location of the Warkworth interchange. Routes closer to or along the existing alignment that pass close to the junction of SH1 and Kaipara Flats Road would enable a northern interchange to be close to the town;

4) The demand for an access point at Pūhoi. The subsequent decision on this issue has been informed by technical considerations. South-facing ramps will address the vast majority of issues and concerns and incidentally support tourist business on the existing SH1 south of Warkworth;

5) The economics of the new highway as a separate alignment was challenged in terms of:

- availability of investment funds;
- cost effectiveness of addressing the major safety issues on the existing State highway: and
- appetite for major investment in highway construction.

Themes that emerged from Phase Two of the consultation can be grouped into three broad groups:

1) The need for the road:

- People supported the need for the road and wanted it built as quickly as possible.
- People wanted the road to continue to Wellsford.
- People were opposed to the idea of a new road. Reasons included:
  - They did not believe that the country can afford the road;
  - They did not believe that the economic case for the road is viable at all; and
  - They believed major traffic problems only occur rarely and particularly at holiday times.
- People who oppose the road want different alternatives. These included:
  - Do nothing;
  - Upgrade the existing road;
  - Upgrade the Hill Street intersection;
  - Bypass Warkworth and Wellsford only;
  - Improve public transport; and
  - Improve rail and sea links with Northland.

2) The features of the road (the 'pieces' that make up the whole):

- People suggested prioritising a by-pass for Warkworth (and Wellsford) in any staged construction. Some also suggested that the rest of the route can be reassessed after these have been built.
- Some people supported the indicative alignment and want it built as quickly as possible.
- People were supportive of the northern access at Warkworth.
- Some people wanted an access south of Warkworth as well as in the north.
- Some people supported an access to Warkworth at Woodcocks Road.

- Some people were opposed to an access to Warkworth at Woodcocks Road.
- People wanted access to the motorway at Pūhoi/Mahurangi West. Reasons for this included:
  - It is necessary for the communities and local businesses to survive;
  - It is necessary for the access of emergency services or the diversion of traffic in an incident;
  - Otherwise the existing access to the Northern Gateway Toll Road will be denied; and
  - No access will reduce toll revenue on the Northern Gateway Toll Road.
- Some people did not want access to the motorway at Pūhoi/Mahurangi West. Reasons for this included:
  - It would negatively impact the village of Pūhoi; and
  - It would add a lot of cost to the Project.
- People wanted other improvements to the local road network incorporated into the Project including a Matakana link road and the Western Collector road.

3) The local issues or challenges included:

- Some people identified areas where they believed local conditions would make building a road difficult, namely:
  - The low lying land between Carran Road and SH1 (where the indicative route reconnects to SH1) – flooding; and
  - Where the route crosses the Mahurangi River or its tributaries.
- Some people were concerned that a bypass of Warkworth would have a negative impact on the town.
- Some people believed that a bypass of Warkworth would have a positive impact on the town.
- Some people were concerned about the impact the road would have in the vicinity of Perry Road and suggested that the road is moved further west.
- Some people were concerned about the impact the road would have on the area of Moirs Hill Road.
- People were concerned about the effects the road would have on the air and noise quality on their property/lifestyles.
- People were concerned about the visual impact the new road wold have in their area or on their property/lifestyles.
- People were concerned about how construction traffic would access the construction area.

Themes emerging from Phase Three and Phase Four of the consultation largely mirrored those received in Phase One and Phase Two. Most of the feedback received in Phase Three focused on the desire for access to the new motorway at Pūhoi. Following a decision by NZTA to include south-facing ramps at Pūhoi, Phase Four feedback centred around discussions of a Matakana Link road and a western interchange at Warkworth.

8.7 Consultation outcomes

All key themes identified in the feedback have been considered along with further technical information that has come to hand as the Project has progressed. Input received from the consultation process has informed the design and process, for example local knowledge has been valuable regarding flooding and ground conditions. The feedback has contributed to, but has not been solely responsible for, decisions regarding:

- Variations to the alignment in the vicinity of Perry Road – as noted in Section 7.3.5above the alignment options to the west of Perry Road included one to the east of the indicative alignment. This option was discounted after consultation with residents and the owners of the Genesis Fish Farm;
- Easterly movement south of Pūhoi to avoid a pā site – during the site investigations that informed the Assessment Reports, the identification of a previously unrecorded pa site influenced the alignment in the immediate vicinity of Billing Road;
- Adjustment to the northern tie-in to avoid a small cemetery alongside SH1;
- Review of the alignment between Carran Road and the northern tie-in – during the investigations that informed the Assessment Reports the identification of the 100 year flood plain necessitated a north-west shift of the indicative alignment to its current location to avoid the flood plain;
- A north-west interchange at Warkworth; and
- Inclusion of a northbound off-ramp and southbound on-ramp at Pūhoi – further to feedback on the preferred option that was derived from the scheme assessment phase, NZTA resolved to include south-facing on- and off-ramps in the Project for consents and designation.

8.8 Conclusion – consultation

Consultation for the Project has been undertaken in accordance with good practice techniques and pursuant to the NZTA's operating principles under Section 96 of the LTMA 2003.

Consultation has identified the persons and parties affected by the Project and obtained feedback from these participants. The feedback received to date has been taken into consideration and has positively contributed to decisions regarding refinement of the design of the indicative alignment and proposed designation boundary for the Project.

9. Overview of actual and potential effects

The following sections are a précis of the content provided in the suite of Assessment Reports produced for the Project. Each section presents a summary of the actual and potential effects of the Project relating to specific technical areas.

The assessments are broadly divided into two parts, as follows:

- Construction effects (Sections 10 to 20 of this AEE):
  - Construction water management;
  - Freshwater ecology;
  - Marine ecology;
  - Construction traffic;
  - Terrestrial ecology;
  - Construction noise;
  - Heritage;
  - Vibration;
  - Air quality;
  - Hydrogeology; and
  - Contaminated land.
- Operational effects (Sections 21 to 26 of this AEE), including whole of life:
  - Operational water management;
  - Landscape and visual;
  - Operational traffic and transportation;
  - Operational noise;
  - Cultural;
  - Social;
  - Urban design; and
  - Economic.

The Project team based their assessment on the proposed designation boundary and the indicative alignment. The construction methodology developed for the Project (refer to Section 6 of this AEE) has informed the assessment.

9.1 Summary of environmental effects

A summary of the actual and potential effects of the construction and operation of the Project is outlined in Table 9-1 below.

Table 9-1: Summary of actual and potential environmental effects

	Significance	Positive Effects	Adverse effects	Potential for mitigation	Duration	Scale
High / long-term / regional	●	●	●	●	●	●
Moderate / medium	●	●	●	●	●	
Minor / short-term / local	○	○	○	○	○	○
Economic						
Increase in economic activity in Auckland and Northland during construction	●	●			●	●
Reductions in vehicle operating costs	●	●			●	●
Opportunities for commercial and residential development and economic growth in northern Auckland and Northland Regions	●	●			●	●
Effects of the Project on businesses on the existing SH1	○	○	○		●	○
Operational Traffic and Transport						
The Project will increase capacity within the corridor	●	●			●	●
Road safety improvements	●	●			●	●
Improvements in travel time reliability	●	●			●	●
Reducing journey times for general traffic and freight	●	●			●	●
Improved route security by providing an alternative route resilient to incidents	●	●			●	●
Changes to the existing local road network within the Project area and increased flexibility of trip options	●	●			●	○
Increased accessibility, connectivity and journey time reliability to major urban communities south of Johnstone's Hill tunnels.	●	●			●	●

	Significance	Positive Effects	Adverse effects	Potential for mitigation	Duration	Scale
High / long-term / regional	●	●	●	●	●	●
Moderate / medium	●	●	●	●	●	
Minor / short-term / local	○	○	○	○	○	○
Social effects						
Enhanced accessibility and connectivity	●	●			●	●
Community patterns of living (access to community facilities and services)	●	●			●	○
Community cohesion and networks	●	●			●	○
Community values and attributes (facilities, services, places, functions)	●	●			●	○
Community structure due to property acquisitions	○		○	○	●	○
Effects of construction traffic management on community way of life	●	●	○	●	●	○
Urban Design						
Avoids urban settlement areas	●				●	○
Urban design effects on the Pūhoi, Perry Road and Carran Road sectors	●		○	●	●	○
Construction water management						
Effect on the Genesis Aquaculture (specific water user)	○		●	●	○	○
Contaminants from the precast concrete yard	○		○	●	○	○
Potential effects of acid sulphate soils	○		○	●	●	○
Freshwater Ecology						
Effects associated with the sedimentation of waterways during construction	●		●	●	○	○
Disruption to fish passage (construction, operation)	○		○	●	●	○
Effects associated with increased in-stream	○		○	●	●	○

	Significance	Positive Effects	Adverse effects	Potential for mitigation	Duration	Scale
High / long-term / regional	●	●	●	●	●	●
Moderate / medium	●	●	●	●	●	
Minor / short-term / local	○	○	○	○	○	○
contaminants (operation)						
Habitat loss due to culverting of streams and the disposal of spoil	●		●	●	●	○
Marine Ecology and Coastal Processes						
Effects of sediment discharge on marine ecological values (construction)	●		●	●	○	○
Construction of piers within the CMA	○		○	●	○	○
Discharge of stormwater from motorway surfaces (operations)	○		○	●	●	○
Terrestrial Ecology						
Effects on wetlands through vegetation loss and hydrogeological impacts	○		○	●	●	○
Habitat loss and direct mortality of bats (vegetation clearance)	●		●	●	●	○
Direct loss of native forest vegetation	●		○	●	●	○
Direct loss or mortality of birds, lizards and snails (construction)	●		●	●	●	○
Creation of edge effects due to vegetation loss	○		○	●	○	○
Changes in soil moisture related to changes in surface hydrology	○		○	●	○	○
Effects of dust deposition on vegetation	○		○	●	○	○
Hydrogeology						
Effects on groundwater quality and quantity, and stream baseflows	○		○	○	●	○
Construction Traffic						
Effects on traffic flows on SH1	●		○	●	●	●

	Significance	Positive Effects	Adverse effects	Potential for mitigation	Duration	Scale
High / long-term / regional	●	●	●	●	●	●
Moderate / medium	●	●	●	●	●	
Minor / short-term / local	○	○	○	○	○	○
Effects of construction traffic on local roads and access points	●		○	●	●	○
Construction Noise						
Effects of construction activities	●		●	●	●	○
Effects of possible night time construction	○		●	●	●	○
Effects associated with blasting	○		●	●	○	○
Effects of construction traffic along access roads and the existing SH1	●		●	●	●	○
Construction Vibration						
Effects of construction activities	○		○	●	●	○
Effects associated with blasting	○		○	●	●	○
Construction Air Quality						
Effect of dust emissions from construction activities.	●		●	●	●	○
Effects of dust emissions on Genesis Aquaculture	○		○	●	●	○
Heritage						
Effects on Titford Cottage and the Schollum villa	●		●	●	●	○
Effects on historic heritage within the Perry Road Sector	○		○	●	●	○
Effects of the Project on heritage values	○		○	●	●	○
Cultural						
Effects on the Cultural Footprint of Hōkai Nuku	●		○	●	●	○
Potential effects of the Project on Te Awa Pūhoi (Pūhoi River)	○		○	●	●	○

	Significance	Positive Effects	Adverse effects	Potential for mitigation	Duration	Scale
High / long-term / regional	●	●	●	●	●	●
Moderate / medium	●	●	●	●	●	
Minor / short-term / local	○	○	○	○	○	○
Potential effects of the Project on Waihē (Mahurangi River and Harbour)	○		○	●	●	○
Pūnaha taupuhi kaia taketake (indigenous ecosystems – flora and fauna)	○		○	●	●	○
Effects on cultural values as a result of ahuahu (earthworks)	●		○	●	●	○
Effects on cultural values of terrestrial and aquatic ecology	○		○	●	●	○
Effects on cultural values of water and land	○		●	●	●	○
Landscape and Visual						
Effects on landscape character areas	●		●	●	●	○
Effects of large scale earthworks, retaining walls, bridges and viaducts	●		●	●	●	○
Operational Air Quality						
Effects of operation for properties adjacent to SH1.	●		○	○	●	○
Effects of operation for properties adjacent to the Project.	○		○	○	●	○
Operational Water						
Effects relating to stormwater quantity and quality	●		○	●	●	○
Effects in relation to flooding	●		●	●	●	○
Operational Noise						
Reduction in noise generated from traffic reduction on SH1	●	●			●	○
Increase in ambient noise levels in proximity to the motorway	○		○	●	●	○

10. Construction water management

10.1 Water-related assessments

The Project's water-associated assessments of effects are presented in four key reports:

- Construction Water Assessment Report
- Operational Water Assessment Report (see Section 21)
- Freshwater Ecology Assessment Report (see Section 11)
- Marine Ecology Assessment Report (see Section 13)

The Construction Water and Operational Water Assessment Reports are co-authored by the Project's specialists to provide a comprehensive, integrated assessment for each phase of the Project.

The Construction Water Assessment Report contains:

- Erosion and Sediment Control (ESC); and
- Construction Water Management (for temporary structures).

The Operational Water Assessment Report, which is discussed in Section 21 below, contains:

- Hydrology;
- Stormwater Quality and Quantity; and
- Flood Modelling.

The freshwater and marine ecologists have also contributed to the assessment reports listed above by identifying sensitive environments and mitigation or management requirements for their own assessments.

10.2 Construction Water Assessment

The Construction Water Assessment Report provides an assessment of the environmental effects of construction-related water on the receiving environment during the construction stage of the Project.

The Construction Water Assessment Report describes the methods and practices that will be implemented to minimise environmental effects. The assessment has been undertaken based on the identification of construction-related water issues and principles, the development of methodologies for key construction activities, and the assessment of environmental risks associated with sediment yield and the eventual sediment loads in the receiving environment.

The following is a summary of the issues and potential effects identified in the Construction Water Assessment Report. This summary and the Report subsequently inform the recommended mitigation contained in Section 28 and will inform the Project conditions.

10.3 Assessment framework

10.3.1 Erosion and sediment control Focus Areas

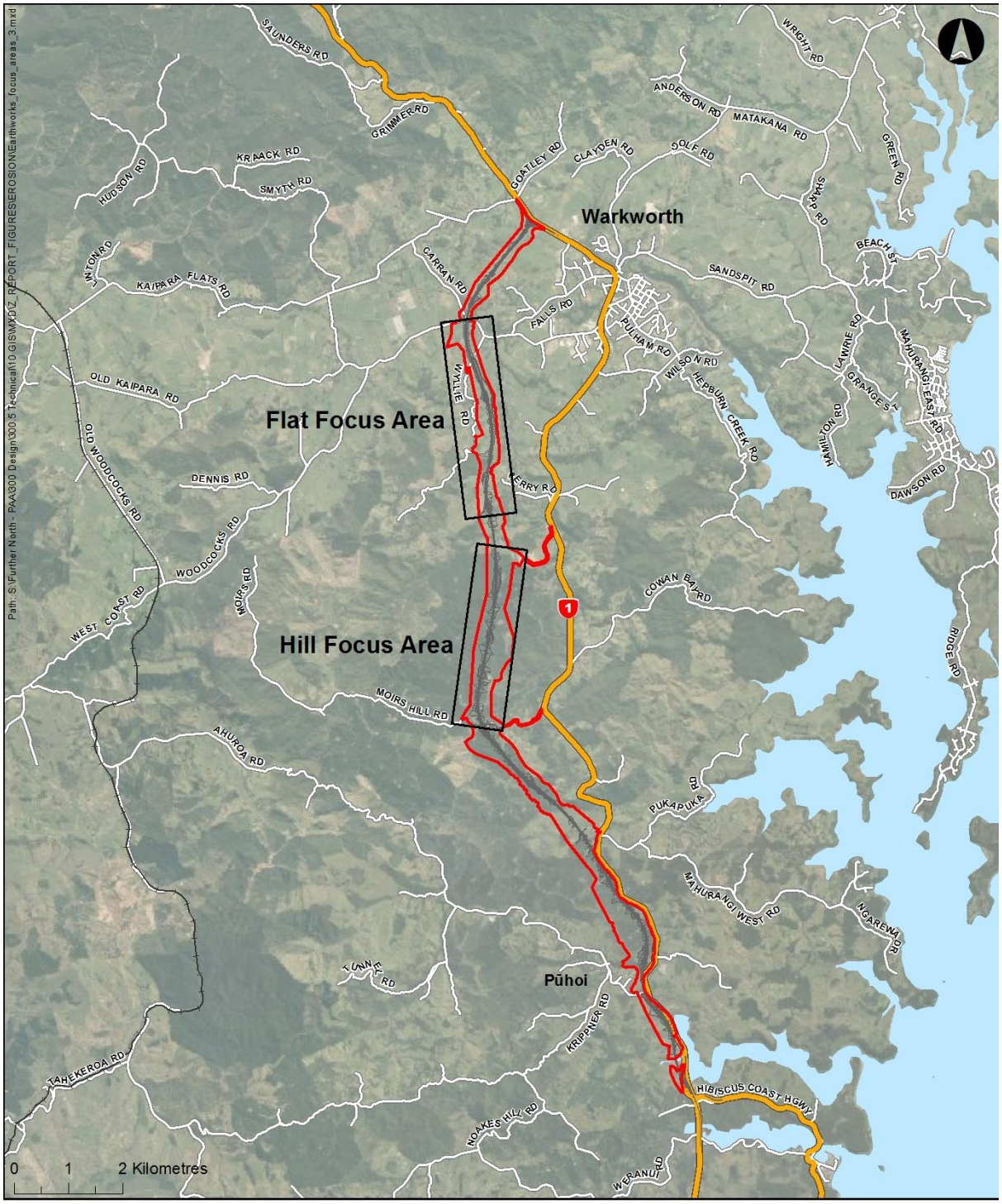
The Project crosses two distinct types of terrain:

- Hill Country – including the prominent landforms of Pūhoi, Schedewys Hill and Moirs Hill; and
- Flat Country – including the relatively flat areas from Perry Road to Warkworth along the Mahurangi River Right Branch.

To assist with the assessment of effects relating to erosion and sedimentation, the Construction Water team selected two Focus Areas in the Moirs Hill Road Sector and the Perry Road Sector to represent the Hill Country and Flat Country terrain types respectively across the Project area. The locations of the Focus Areas are shown in Figure 10-1 below and further details are provided in Section 6.2 of the Construction Water Assessment Report.

Section 6.2 of the Construction Water Assessment Report and the associated assessment of effects (in Section 9 of that report) consider that the soil properties, geology, topography, ground slopes and climate in each of the Focus Areas are representative of those for the remainder of the Project area. The Construction Water team determined the effects for the total Project area by applying appropriate scaling factors to modelled results for these Focus Areas. The Construction Water team also applied learnings from other construction projects, including the NGTR and Long Bay.[82]

[82] Refer to Section 5.4 of the Construction Water Assessment Report for further information on the Long Bay development.



Indicative Alignment
Proposed Designation Boundary
Focus Areas

Figure 10-1: Earthworks Focus Areas

10.3.2 Construction methodology and sequencing

The Construction Water Assessment Report uses the construction methodology developed for the Project (refer to Section 6 of this AEE). This construction methodology includes a mass haul calculation, which includes volumes and areas of earthworks likely to be required. It is a practical approach to achieving the associated bulk earthworks in these locations, and includes the disposal of surplus fill within the designation. Indicative spoil disposal sites are shown on the ESC Drawings 011-025 included in Volume 4.

The Construction Water team calculated sediment yields for a 5 and a 10 year construction scenario to provide options for the construction of the Project based on the recommended open area of earthworks limitations.

10.3.3 Discharge locations

The Construction Water team has developed conceptual Erosion and Sediment Control Plans (ESCPs) for the Focus Areas to demonstrate the ability to install appropriate ESC devices for the Project, and the team has investigated and reviewed the locations of the sediment retention devices as part of the development of the site specific construction erosion and sediment control design. Finalised CESCPs will be developed during the detailed design phase.

From an overview perspective, all construction-related runoff discharges are either to a land environment or to a freshwater system after treatment. Discharge to land is considered by the Construction Water team to be beneficial in that a land-based buffer zone will provide a 'polishing' treatment for the discharged runoff. Where discharges are to freshwater systems, the outlet will be protected with geotextile and riprap material in the immediate vicinity of the outlet to minimise erosion of the stream bank and bed.

There are no specific freshwater environments within the Project area where ecological constraints preclude discharges. There will be no direct discharges from sediment retention devices into the CMA.

10.4 Existing water environment

The Project area is characterised by steep topography with 45% of the earthworks area having over 15 degrees in slope. The geology differs between the Hill Country and the Flat Country, and the dominance of the Pakiri Formation is noted within the Hill Country. While the geology across the Project area highly erodible, the underlying Pakiri Formation will allow the more competent rock to be worked over the winter period.

Both the Pūhoi and Mahurangi River catchments provide a range of ecological, recreational and resource functions and are suitable for a range of uses. They are sensitive to further additions of sediment and nutrients.

The Mahurangi Action Plan recognises sediment deposition as an environmental concern in the Mahurangi Estuary and Harbour, with existing pre-construction sediment deposition from catchment land uses currently impacting upon the estuary.

A more detailed description of the two catchments and the features of the existing environment that influence water management are provided in Section 3 of the Construction Water Assessment Report. Additional information regarding the existing environment in both of the catchments is provided in Sections 11.1 and 12.2 of this AEE, respectively.

10.4.1 Rainfall

Table 10-1 provides an overview of the rainfall data for the Project area. Rainfall in the Mahurangi River catchment typically exceeds that of the Pūhoi River catchment by 10%. This difference is not considered significant from an ESC perspective. All sediment yield modelling used the higher rainfall figures.

Table 10-1: Comparison of 100 year ARI 24hr rainfall depths along the Project route

2013 (current climate)	Pūhoi rainfall (mm)			Mahurangi rainfall (mm)		
ARI (year)	TP108	HIRDS V3	Rain gauge (Orewa)	TP108	HIRDS v3	Rain gauge (max of Warkworth and Mahurangi)
100	280	256	157	310	279	237
10	190	153	122	210	169	166
2	115	101	89	130	113	118

10.4.2 Geomorphology and erosion

Site visits have revealed evidence of existing erosion in the Project area, including mass movement and soil slip. The existing erosion forms part of the sediment yield that currently enters the receiving environments.

10.4.3 Water quality

Water quality sampling was undertaken for dry and wet weather conditions at 11 freshwater sites within the Project area (refer to Figure 8 in the Construction Water Assessment Report for locations). Results were compared with existing Auckland Council water quality monitoring data to develop a broad picture of freshwater quality throughout the Project area.

Overall, the existing Auckland Council data and the Project monitoring data identify that water quality is reasonably good across both freshwater catchments. The data did not indicate significant differences between the Mahurangi and Pūhoi River catchments.

In general, both catchments are characterised by elevated suspended solids and turbidity, which can reduce water clarity. Metals are generally in low concentrations and hydrocarbon concentrations are very low. Nutrients (nitrogen and phosphorous) are occasionally elevated above guideline levels.

Sediment quality is good in both the freshwater and marine environments of the Mahurangi and Pūhoi River catchments. Saline water quality is good in the Mahurangi Estuary with slight elevations of total suspended solids (TSS) and nutrients. No water quality data is available for the Pūhoi Estuary but it is anticipated to also have good water quality as the Project freshwater monitoring data indicates that both catchments are similar in water and sediment quality.

Water quality in the Mahurangi River is suitable for preservation of aquatic ecology values and suitable for stock watering, irrigation and fish farming uses. However, the catchment is sensitive to further increases in sediment and nutrients as these are already elevated and are causing concern in some areas.

10.4.4 Potential issues for construction water management

From a construction water management perspective, the potential environmental issues for the Project are considered to be:

- Changes to water quality – Assessments have been undertaken (refer to Section 6.1.3 of the Freshwater Ecology Assessment Report and Section 4.1 of the Marine Ecology Assessment Report) to identify changes in water quality that may potentially occur as a result of the Project construction. Such changes include the discharge of sediment from earthworks, discharge of other contaminants and the discharge of sediment from stream activities; and
- Changes to ecology and habitat – These changes have been assessed in the Freshwater Ecology Assessment Report and the Marine Ecology Assessment Report, and a summary of key issues and effects for each is presented in Sections 11 and 12 of this AEE. Key potential effects arise from changes to flora and fauna and changes to habitat.

Erosion occurs when the surface of the land is worn away by the action of water, wind or geological processes. Through the erosion process, soil particles are dislodged, generally by rainfall and surface water flow. As rain falls, water droplets concentrate and form small flows. As this flow moves down a slope, the combined energy of the rain droplets and the concentration of flows have the potential to dislodge soil particles from the surface of the land.

Sedimentation occurs when these soil particles are deposited. The amount of sediment generated depends on the erodibility of the soil, the energy created by the intensity of the rain event, the site conditions and the area of bare earth or unstable ground open to rainfall.

10.5 Project ESC

Erosion and sediment control measures will be implemented during the construction phase of the Project to manage the discharge of sediment from the Project and avoid, remedy or mitigate effects on the freshwater and coastal receiving environments.

10.5.1 ESC guidelines

Technical Publication 90 (TP90)[83] provides information on the appropriate use, design and construction of ESC devices and practices. It represents the industry standard and provides the accepted design criteria for ESC measures.

The NZTA has developed an ESC standard for State highway infrastructure. This is a draft and is currently being finalised. The general principles of the standard have been incorporated into the Project ESC approach, which is based on TP90.

10.5.2 ESC principles and design criteria

The ESC for the Project has been described in Section 6 above and will be undertaken and implemented with a hierarchy and priority order as follows:

- Prevention;
- Capture;
- Minimisation; and
- Staging and Sequencing of Works.

Refer to Section 6.6 above for further information regarding the proposed ESC for the Project.

Table 10-2 summarises the principles and key design criteria developed for ESC for the Project (refer to Section 5 of the Construction Water Assessment Report).

Table 10-2: ESC principles and design criteria

Device / methodology	Criteria
Erosion control measures	
Clean water diversions (CWD)	Clean water diversion channels and bunds will be designed to cater for the 20 year ARI rain event.
Construction staging and sequencing	Staging and sequencing are both important non-structural measures and will be implemented within the open area limitations. Details of the staging and sequencing of works will be detailed within the CESCPs.
Contour drains	Contour drains will be designed and implemented in accordance with TP90.
Device location	All ESC devices should be located outside the 20 year ARI flood level unless no other viable alternative exists.
Dirty water diversions (DWD)	Dirty water runoff diversion channels will be sized to cater for the 20 year ARI rain event. Sediment sumps will be installed in all diversion channels
Pipe drop structures / Flumes	Flumes will be used in accordance with TP90 to safely transfer runoff from the top to the bottom of the batter slopes.

[83] Refer to Section 2.2.1 and Appendix A of the Construction Water Assessment Report

Device / methodology	Criteria
Rock check dams	Rock check dams will be designed and implemented in accordance with TP90.
Stabilisation for erosion and dust management purposes	Progressive and rapid stabilisation of disturbed areas using top soil (where necessary) and seed, mulch and geotextiles will be ongoing throughout the Project. Stabilisation will be undertaken with three key purposes: • To achieve the area of open earthwork limitations as specified within consent conditions for the project; • To reduce the area of open earthworks within higher risk locations to assist with a reduction in sediment generation; and • In response to the adaptive monitoring programme to address any potential effects or undesirable monitoring trends.
Stabilised entrance ways	Stabilised entrance ways will be established at all ingress and egress points of the site from a public road network.
Sediment control measures	
Container impoundment systems	Container Impoundment Systems will be implemented as per Drawing ES-155. They will be based a 3% volume criterion applied in relationship to catchment size and as such will apply to smaller catchment areas. Their primary purpose is for the initial earthworks in steep or "difficult" locations prior to the formation of a SRP or DEB structure.
Decanting earth bunds and decant systems	All DEBs established will be based on a volume of 2% of the contributing catchment area. All SRPs and DEBs will be fitted with floating decants. Decants have a mechanism to control (or cease) outflow during pumping activities to these structures.
Flocculation	Flocculation will be applied on all SRPs and DEBs based on an approved chemical treatment management plan and will be applied to all DEBs with a catchment area between 500m^2 and 3,000m^2 and all SRPs. Manual batch dosing will be carried out as required. Flocculant socks will be used as alternative and/or additional measures as required.
Sediment retention ponds	All SRPs will be implemented based a 3% volume criterion applied in relationship to catchment size (ie 300m^3 SRP volume per 10,000 m^2 of contributing catchment). Baffles, decant pulleys and reverse slopes to be installed in all SRPs.
Super silt fences and silt fences	All super silt fences and silt fences will be based upon the design criteria within TP90. SSF fabric will be installed with 200mm of fabric upslope at the base of the trench. In high risk areas, as identified Figure 11 of the Construction Water Assessment Report, if a failure of the primary control measure occurs then the last line of defence, the SSF, will capture and treat any discharges.
Other measures / methodologies	
Construction stage erosion and sediment control Plans (CESCPs)	CESCPs will be submitted prior to commencement of work. CESCPs will likely include: • Contour information; • ESCs; • Chemical treatment design and details;

Device / methodology	Criteria
	• Catchment boundaries; • Location of the Work; • Details of construction methods; • Contingency measures; • Design details; • A programme for managing non-stabilised areas; • The identification staff who will manage ESCs; • The identification of staff who monitor compliance with conditions; • A chain of responsibility for managing environmental issues; • Methods and procedures for decommissioning measures; and Design details for managing the discharge of contaminants.
Decommissioning of devices	Removal of devices will be in accordance with the CESCP.
Non-structural measures	These elements include: • Manually raised decant devices on SRPs and DEBs; • Batch dosing of SRPs and DEBs with chemical flocculant where required; • Proactive monitoring and reporting programme (as per Section 8 of the Construction Water Assessment Report); • Risk identification and management accordingly; • Progressive stabilisation as works progress; and • Weather response.
Pumping activities	Pumping of sediment laden runoff and groundwater during construction will be to SRPs, DEBs to grass buffer zones or to temporary sediment retention devices such as Container Impoundment Systems.
Streamworks	At all practical times these activities, and any associated works within these environments will be undertaken in an offline 'dry' environment. Fish spawning and migration periods will be avoided and managed accordingly.

10.5.3 Integrated management system

An integrated management system will be established by the contractor. This system will ensure that appropriate resources, commitment and expertise are provided for the ESC aspects of the Project from the planning, design and construction phases. The contractor will ensure that relevant key stakeholders are involved in the development of the ESC measures and practices on site and the objectives are communicated to the relevant parties. The integrated management system is a process-based approach which will follow the principles outlined in Section 5 of the Construction Water Assessment Report and will include:

- Education and training of all site staff - all staff working on site, or with site responsibilities, shall undertake a formal site induction which will include an ESC module to ensure familiarisation with the requirements of TP90, the principles of the Draft (and

subsequently final) NZTA Standard and the content of the Construction Water Assessment Report. No person will be permitted to work on the site until they have completed the site induction process;

- Implementation of an adaptive monitoring programme (explained in Section 8 of the Construction Water Assessment Report) to inform the extent of construction activity on site and to influence and reduce the direct effect of construction works on the sediment yield into the receiving environment;
- Development of CESCPs;
- Adoption of a Quality Assurance / Management System to:
  - Provide written records of the management and maintenance programme for ESC devices;
  - Ensure awareness of the reporting procedure in the event of defects being discovered; and
  - Fix defects;
- Proactive and reactive ESC maintenance
  - Proactive maintenance:
    - Undertake regular – daily, weekly and long-range – weather monitoring;
    - Programme construction works and stabilisation works in response to weather forecasts;
    - Remove accumulated sediment from ESC devices and make necessary repairs to ESC devices prior to forecast rain events; and
    - Undertake pre and post rain event inspections of ESC measures.
  - Reactive maintenance
    - Repair any defective or damaged ESC measures following rain events;
    - Record the location of any sediment laden discharges to the receiving environment during a rain event; and
    - Develop a coordinated response plan in the event of unplanned sediment laden discharges to the receiving environment including:
      - Cessation or reduction of work activity in a particular area until accumulated or deposited sediment can be removed and the ESC measures can be repaired or replaced;
      - Remedy the effects of any sediment laden discharges, if required; and
      - Monitor the effects of any sediment laden discharges.

10.5.4 Construction activity management

The overall approach to ESC for the Project includes a number of specific construction water management techniques to address discharges, including sediment, from a number of activities. Activity-specific ESC methodologies have been developed for:

- Vegetation removal;
- Acid sulphate soils (if working in them);
- Stockpile and spoil site establishment;

- Temporary and permanent stream diversions;
- Pumping activities;
- Culvert installation;
- Bridges and viaducts;
- Concrete work;
- Chemical treatment;
- Rip rap placement;
- Stormwater wetland establishment;
- Haul road establishment;
- Monoslope development; and
- Construction yards.

The innovations, devices and measures applied in these methodologies are described in detail in Section 6 of the Construction Water Assessment Report. These measures are based on the conceptual construction methodology and illustrate that the controls and methodologies can be implemented successfully within the Project footprint and proposed designation.

10.6 Sediment modelling

The Construction Water team identifies key erosion control risks as those works within and adjacent to watercourses, steep slopes and spoil site establishment.

Groundwater Loading Effects of Agricultural Management Systems (GLEAMS)[84] modelling has been carried out to assess sediment yields from proposed earthworks activity while also determining the background sediment loads from the existing land use within the proposed earthworks footprint. Note that existing erosion in the Project area due to mass movement and soil slip is not included in the sediment yield calculations.

To provide a comparative analysis to the GLEAMS results, Universal Soil Loss Equation (USLE) calculations (refer to Section 7 of the Construction Water Assessment Report) have also been carried out to determine the construction sediment yields. There is a correlation of the results and a consistent comparative analysis. Based on the conceptual construction programme and associated erosion and sediment control plans development, the mean annual sediment yields have been calculated for the two Focus Areas.

The slope of the existing topography is identified as a key factor in the calculation of sediment yields. The modelling demonstrates that with a 50% reduction in the existing slope angle, (which is considered realistic for many of the proposed earthworks operations within the Project) it is expected that there will be a corresponding 67% reduction in sediment yield.

Through the results of the sediment modelling, other key risks are identified that relate to areas of higher sediment yield, typically within the Hill Country. These higher risk areas will be a specific point of focus and will attract attention from the contractor with rainfall monitoring and forecasting, structural controls and a range of non-structural control measures being implemented during construction.

[84] Excluding Te Muri Beach sub-catchment.

10.6.1 Background sediment loads

Background sediment loads were calculated based on Basin New Zealand modelling for the Mahurangi catchment and Catchment Landuse for Environmental Sustainability model for the Pūhoi catchment. This calculation represents the expected sediment loads from existing catchments. The annual background sediment loads for the Pūhoi Estuary and the Mahurangi Harbour (excluding Te Muri Beach sub-catchment) are 18,311 tonnes and 45,931 tonnes, respectively. These figures do not take into account forestry activity, such as harvesting, which can contribute significantly to sediment yields, producing peak loads and creating major deposition.

10.6.2 GLEAMS modelling

The GLEAMS model was used to estimate construction phase sediment yields based on a number of assumptions, including:

- Soil texture;
- Land cover;
- Slope classes;
- Areas of exposed ground; and
- Sediment yield reduction factors, including the efficiency of sediment control devices, as shown in Table 10-3.

Table 10-3: Sediment control device efficiencies

Sediment control device type	Sediment removal efficiency (%) by return period		
	2 year ARI	10 year ARI	50 year ARI
Super silt fence	80%	65%	50%
Decanting earth bund (DEB) – Chemically Treated	90%	80%	60%
Sediment retention pond (SRP) – Chemically Treated	95%	85%	65%

Comparative analyses of the predicted sediment yields from the Focus Areas (outputs of the GLEAMS model) against the existing sediment loads for the Mahurangi River and Harbour are summarised in Table 10-4 and Table 10-5.

Table 10-4: GLEAMS sediment load results for Focus Areas and the Mahurangi River

5 year conceptual programme	Background load Mahurangi River	FASY plus background load	Percentage increase
Total sediment load (t)	60965	65361	7%
Mean annual load (t)	12193	13072	7%
10 year conceptual programme	**Background load Mahurangi River**	**FASY plus background load**	**Percentage increase**
Total sediment load (t)	121930	128846	6%
Mean annual load (t)	12193	12885	6%

Table 10-5: GLEAMS sediment load results for Focus Areas and the Mahurangi Harbour

5 year conceptual programme	Background load Mahurangi River	FASY plus background load	Percentage increase
Total sediment load (t)	229655	234050	2%
Mean annual load (t)	45931	46810	2%
10 year conceptual programme	**Background load Mahurangi River**	**FASY plus background load**	**Percentage increase**
Total sediment load (t)	459310	466226	1.5%
Mean annual yield (t)	45931	46623	1.5%

For the Pūhoi River, the predicted sediment yields for a five year construction programme are compared with the existing sediment load for the River in Table 10-6.

Table 10-6: GLEAMS sediment load for the Pūhoi River[85]

5 year conceptual programme	Background load Pūhoi River	FASY plus background load	Percentage Increase
Total sediment load (t)	91555	95545	4.4%
Mean annual load (t)	18311	19109	4.4%

Corresponding discharge total suspended solids concentrations have been calculated and are shown in Figure 10-2 to Figure 10-6 below.

[85] Refer to Section 7.3.2 of the Construction Water Assessment Report.

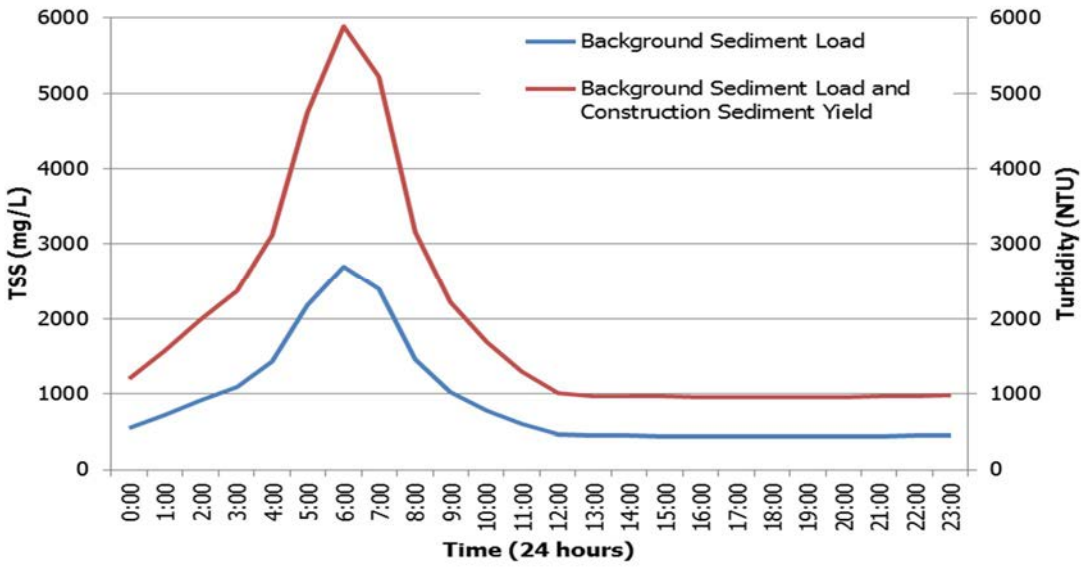


Figure 10-2: AC-FHQ hourly TSS and turbidity concentrations five year construction of a 2 year ARI event

Site AC-FHQ is an upper Mahurangi catchment tributary. The site is likely to receive runoff from most of the Hill Focus Area. At this site, the peak construction activity in the Hill Focus Area is predicted to form approximately 10% of the overall Mahurangi catchment. A large increase in TSS concentrations and turbidity levels relative to background levels is predicted at this site.

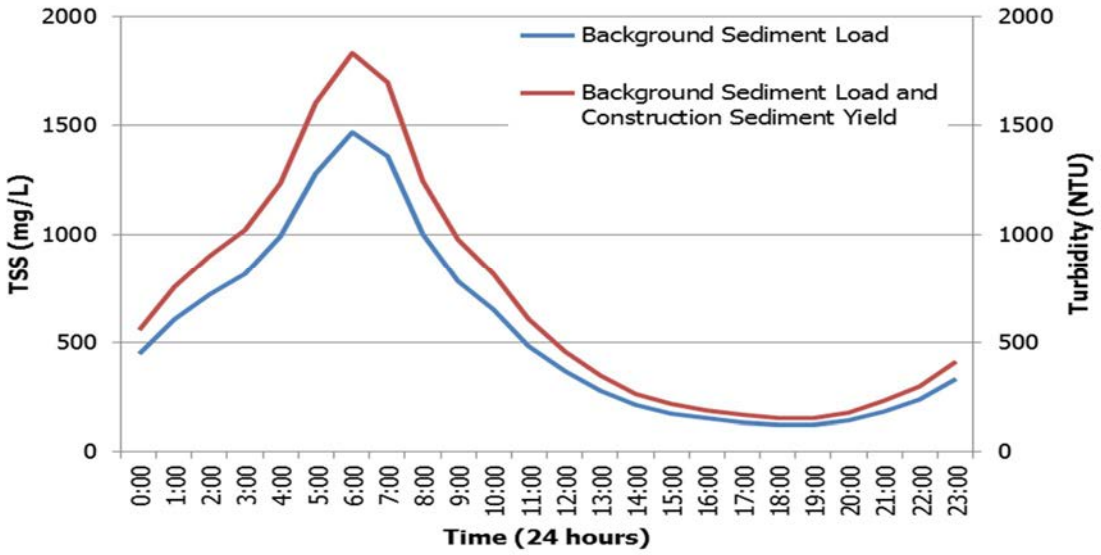


Figure 10-3: MW site hourly TSS and turbidity concentrations five year construction of a 2 year ARI event

Site MW Mahurangi is a mid-Mahurangi catchment tributary and receives flow from both the Mahurangi Left and Right Branches. It is likely to receive runoff from all of the Hill Focus Area and

the majority of the Flat Focus Area. The predicted construction TSS concentrations and turbidity levels in this part of the catchment are a smaller proportion of the background levels.

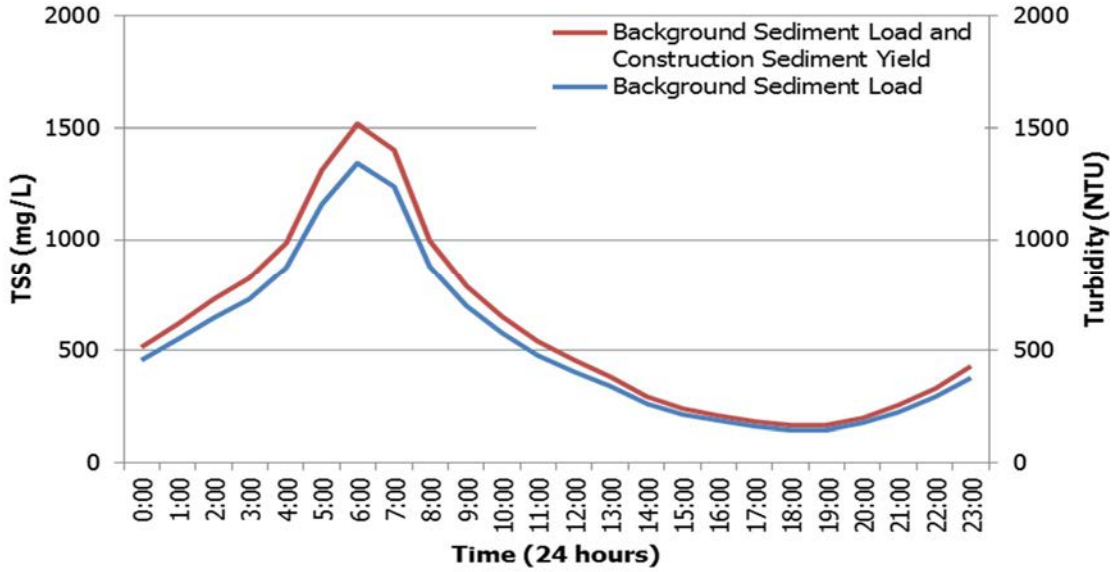


Figure 10-4: Mahurangi mouth site hourly TSS and turbidity concentrations five year construction of a 2 year ARI event

The Mahurangi River mouth is likely to receive the construction runoff from the coincident works in both the Hill and Flat Focus Areas. The predicted construction TSS concentrations and turbidity levels in this part of the catchment are a smaller proportion of the background levels.

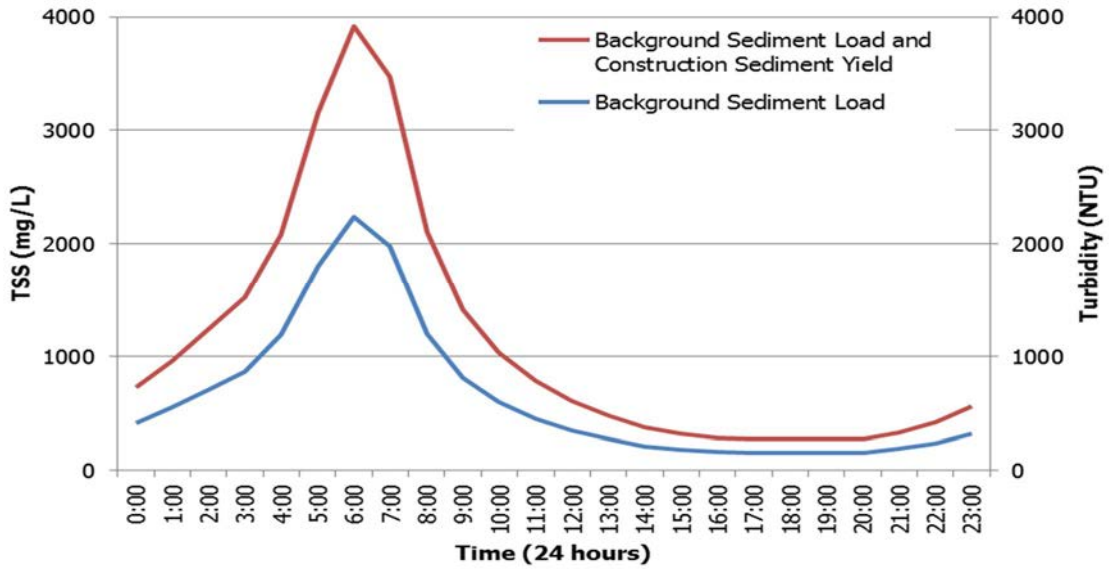


Figure 10-5: P10 site hourly TSS and turbidity concentrations five year construction of a 2 year ARI event

The P10 site is likely to receive the construction runoff from the Hill Focus Area. The predicted sediment yield TSS concentrations and turbidity levels in this part of the catchment are a relatively large proportion of the background loads.

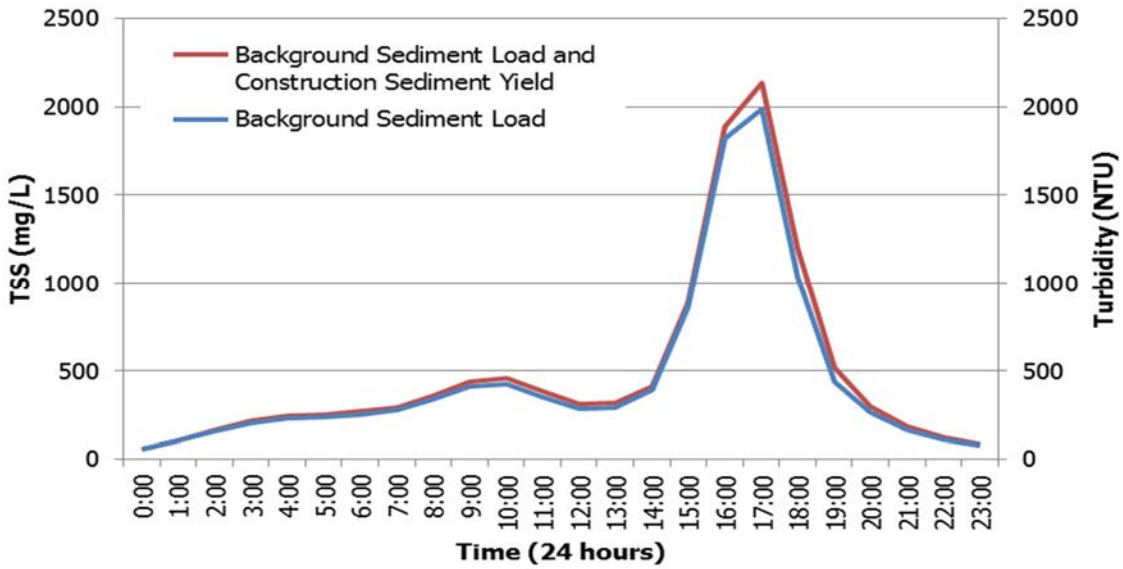


Figure 10-6: Pūhoi mouth site hourly TSS and turbidity concentrations five year construction of a 2 year ARI event

The Pūhoi River mouth is likely to receive construction runoff extrapolated from the Hill Focus Area. Predicted TSS concentrations and turbidity levels in this part of the catchment are a smaller proportion of the background loads.

The effects of increased TSS concentrations are assessed in Sections 5 and 6 of the Freshwater Ecology Assessment Report and Section 4 of the Marine Ecology Assessment Report and summarised in Sections 11 and 12 of this AEE.

10.6.3 Universal Soil Loss Equation

The Construction Water team undertook universal soil loss equation (USLE) calculations to provide a level of confidence and check on the results of the GLEAMS model. The USLE calculations largely adopted the same input parameters used for the GLEAMS model, but use a two year six hour duration storm event instead of an historic 50 year rainfall record to represent normal erosive force and rain intensity. A specific slope length factor, vegetative cover factor and erosion control factor have also been applied.

The USLE calculations are based on the 5 and 10 year construction scenarios for each of the Focus Areas. The comparative sediment yields between the GLEAMS and USLE results are shown in Table 10-7. This comparative assessment provides confidence that the models are an appropriate base for risk assessment and sensitivity analysis for Project construction, and that the calculations can be used to refine ESC measures for the Project.

Table 10-7: Sediment yield estimates from GLEAMS and USLE

5 year construction programme					
Hill Focus Area			Flat Focus Area		
Year	GLEAMS – Focus Area sediment yields	USLE - Focus Area sediment yields	Year	GLEAMS - Focus Area sediment yields	USLE - Focus Area sediment yields
Year 1	563	670	Year 1	472	380
Year 2	853	1171	Year 2	532	483
Year 3	1413	1494	Year 3	533	558
Year 4	1953	1931	Year 4	560	586
Year 5	1598	2067	Year 5	483	662
Total (t of sediment)	6380	7333	Total (t of sediment)	2580	2669
10 year construction programme					
Hill Focus Area			Flat Focus Area		
Year	GLEAMS –Focus Area sediment yields	USLE – Focus Area sediment yields	Year	GLEAMS – Focus Area sediment yields	USLE – Focus Area sediment yields
Year 1	525	648	Year 1	442	348
Year 2	642	980	Year 2	431	470

Year 3	720	997	Year 3	431	399
Year 4	773	979	Year 4	450	630
Year 5	1320	1139	Year 5	456	482
Year 6	1329	1330	Year 6	479	677
Year 7	1384	1950	Year 7	456	512
Year 8	1412	1730	Year 8	483	662
Year 9	1570	1868	Year 9	483	662
Year 10	1777	1868	Year 10	483	662
Total (t of sediment)	11452	13489	Total (t of sediment)	4594	5504

10.7 Sediment and water quality effects during construction

The Construction Water team used the USLE calculations to determine the annual average sediment yield for the Focus Areas over both a 5 year and 10 year construction scenario, and extrapolated them across the wider Project to provide average annual sediment yield for both terrain types, as shown in Table 10-8 and Table 10-9.

Table 10-8: Average annual sediment yield from USLE 5 year scenario

Hills – 5 year construction period	Contributing exposed earthworks area (ha)	Focus Area sediment yield (t)	Flat – 5 year construction period	Contributing area (ha)	Focus Area sediment yield (t)
2016	16.84	670	2016	22.96	380
2017	26.04	1171	2017	31.84	483
2018	44.54	1494	2018	22.19	558
2019	44.18	1931	2019	16.07	586
2020	22.59	2067	2020	NA	NA
Total	154.2	7333	Total	93.06	2007
Average annual sediment yield	47.6 t/ha/year		Average annual sediment yield	21.6 t/ha/year	

Table 10-9: Average annual sediment yield from USLE 10 year scenario

Hills – 10 year construction period	Contributing exposed earthworks area (ha)	Sediment Yield (t)	Flat – 10 year construction period	Contributing area (ha)	Sediment yield (t)
2016	16.84	648	2016	22.96	348
2017	16.84	980	2017	22.96	470
2018	26.04	997	2018	31.84	399
2019	31.79	979	2019	13.08	630
2020	31.79	1139	2020	22.19	482
2021	44.18	1330	2021	16.07	677
2022	12.75	1950	2022	16.07	512
2023	12.75	1730	2023	NA	NA
Total	192.9	9753	Total	145.2	3518
Average annual sediment yield	50.6 t/ha/year		Average annual sediment yield	24.2 t/ha/year	

The Construction Water team then averaged these results across the construction scenarios to provide representative annual sediment yields for both terrain types[86], as follows:

- Hill Country: 49.1 t/ha per year
- Flat Country: 22.9 t/ha per year

An extrapolation of these yields over each of the construction zone earthwork areas, based on the open area of earthworks, is provided in Table 31 of the Construction Water Assessment Report.

The total estimated sediment yield from the Project over a five year earthworks period is approximately 14,075t. Of this total, 6307t are within the Pūhoi River catchment and 7,767t within the Mahurangi River catchment.

GLEAMS and USLE calculations show a relatively low percentage increase in sediment yields for the Project from the background loads. The specific increase from the overall Project on the wider receiving environment based on a mean annual sediment load is shown in Table 10-10.

[86] Refer to Section 7.6 of the Construction Water Assessment Report.

Table 10-10: Mean annual sediment loads in the Mahurangi and Pūhoi Catchments for a 5 year construction programme

Catchment	Background mean annual sediment load (t/year)	Additional mean annual sediment load (t/year)	Increase (%)
Mahurangi River catchment	12193	1553	12.7%
Mahurangi Harbour catchment	45931	1553	3.4%
Pūhoi River catchment	18311	1261	6.9%

It is clear that those works associated with the steep topography of the Project are of higher risk than the Flat areas and need careful and proactive management and monitoring to ensure that the effects will be minor.

10.7.1 Sediment transport and distribution modelling

Coastal process models were developed to model sediment transport and distribution in coastal areas for the purpose of assessing effects. These models and the results of the modelling exercises are summarised in Section 7 of the Construction Water Assessment Report and Section 12 of this AEE.

eCoast developed coastal process models for the Pūhoi and Mahurangi estuaries. The estuary models predict sediment transportation and deposition from each of the catchments to the respective estuarine receiving environments during the 10 year ARI rain event and 50 year ARI rain events, which, while a lower probability, are considered a higher risk than the two year ARI rain event.

Coastal modelling has been used to predict the sediment retained within the estuaries and the quantity of sediment transported into the open sea, beyond the heads of the harbours. The model predicts the change in TSS in the estuary after events and the duration of this change, and provides information on the flushing rate of marine waters within the estuaries. Refer to Section 4.1 of the Marine Ecology Assessment Report for information on sediment distribution to coastal areas.

Further information regarding the transport and deposition of sediment, including volumes and anticipated depths, is provided in Section 7.9 of the Construction Water Assessment Report.

10.7.2 Maximum open areas of earthworks

Based on the sediment yield modelling undertaken for the Project, the Construction Water team considers that the following maximum open areas of earthworks are appropriate:

- Pūhoi River catchment: 41ha

- Mahurangi River catchment (Hill Country): 41 ha
- Mahurangi River catchment (Flat Country): 21.5ha

The maximum open earthworks period for each year will not take place during a full calendar year but only during the summer periods (October to April).

In order to provide the contractor with flexibility during construction, the combinations of maximum open areas across Hill and Flat Country in the Mahurangi River catchment can be changed without affecting the combined sediment yield.

The maximum open areas of earthworks allow the practical completion of the earthworks for the Project construction to be carried out within the 5 year programme, while generating a minor effect on the receiving environment. Section 10 of the Construction Water Assessment Report recommends a limit on the maximum open area of earthworks that reflects the modelled results. An adaptive monitoring programme to monitor the effectiveness of ESC measures implemented on the Project is also proposed that would provide information regarding the actual effects and environmental outcomes associated with earthworks and allow adjustment of the open area limits depending on the monitoring results.

10.7.3 Water quality assessment

The design of the Project, including the water management measures proposed to reduce the effects of discharges of sediment and contaminants during construction, has been considered in the context of the existing water quality environment and is discussed in Section 10.5 of this AEE.

The changes to water quality as a result of construction activities were ascertained using results from the GLEAMS model and a harbour sediment and transport modelling exercise. The changes have been used to assess the effects of Project construction on the existing water quality within the two catchments, particularly in relation to change in water quality, aesthetics and odour, human health and water users.

Section 9 of the Construction Water Assessment Report also considers the potential changes in nutrient loads arising from nutrients bound in sediment entering the watercourses. Experience from similar projects (NGTR and Long Bay) has been used to assess the potential effects of contaminants from other discharges during construction on water quality, including:

- Discharges of flocculants that may affect pH or have a direct effect on water quality;
- Clean water discharges from cut off drains and diversions;
- Dewatering from deeper cut earthworks; and
- Accidental discharges such as spills of fuels, oils, cement etc.

(a) Aesthetics and odour

Oil and grease may be released from the Project in very small amounts due to accidental spills. Any impact associated with such an event would be temporary and managed through the CESCPs so that the effects are minor.

Increases in sediment nitrogen and phosphorus loads are expected to occur in relation to the increase in sediment yields. The receiving environment is not likely to develop nuisance algal growths as a result of these predicted increases.

Effects on aesthetics, including floatable or suspended materials and clarity, and odour will be minor and temporary.

(b) Human health

The increase in stream water nutrient levels during the construction period is not expected to alter the quality of Watercare's Mahurangi River take when compared to New Zealand Drinking Water Standards 2008 (NZDWS) values for nitrite and nitrate. Neither nitrite nor nitrate is currently elevated at the source.

The increase in TSS concentrations, due to the construction of the Project, is likely to increase turbidity levels within the Mahurangi River. The Project sediment retention ponds will attenuate the construction sediment load. Sediment ponds will continue to discharge stormwater for a period of between 24-48 hours after streams have returned to baseflow. The effect of this attenuation on water quality in the lower Mahurangi River is likely to be small, due to the timing of inflows from other parts of the catchment and the relatively small component of the catchment represented by the Project.

In the context of the construction water management techniques to be used within the Project; including the open area limitations, the adaptive monitoring programme and the innovative practices proposed, the Construction Water team consider the effects of the Project on surface water drinking source in the Mahurangi River to be minor to moderate. The increase in sediment loads due to the Project may result in the duration and/or frequency of the closure of the Warkworth water treatment plant. Plant closures have been a relatively frequent occurrence, during which drinking water is supplied form storage or trucked in.

Watercare is currently developing a bore water supply that they propose to come on-line by 2016 and is likely to be the main water supply (refer to Section 9.4.2 of the Construction Water Assessment Report). If the bore is the main source of drinking water during construction, with the surface water as a back-up supply, the effects of the Project on the human drinking water source will be minor.

(c) Water users

After reasonable mixing, the effects of the Project on water quality for stock drinking purposes are expected to be minor. For other water users abstracting water under the permitted activity rules of the ARP:ALW, there may be minor to moderate effects. A potential moderate effect on the Genesis Aquaculture fish farm may occur with increased sediment loads and depositions during rainfall events. However, any such effect would be temporary.

Temporary changes in colour and clarity will have a minor effect on recreational users (swimmers and boats) in the freshwater and marine environments of the Pūhoi and Mahurangi catchments.

10.7.4 Overall water-related effects during construction

The above assessment is based on the effects of construction related discharges and in particular those associated with sediment yields from land disturbing activities, including earthworks.

The potential effects of Project construction on water quality were assessed by the Construction Water team to be moderate only in the case of a 50 year ARI rainfall event. However, the Construction Water team considers that the probability of such an event occurring during the construction period is very low.

The proposed earthworks open area limitations derived from the sediment modelling exercise and the proposed techniques to restrict or control sediment are important to ensure only minor effects are realised. An adaptive monitoring programme will use water quality monitoring to inform any changes to the earthworks open area limitations to ensure that effects are minor.

Subject to the confirmation of specific methodologies for undertaking streamworks and the imposition of proposed conditions, the effects of streamworks are considered to be minor.

Overall, the timing and duration of the works during the construction phase of the Project and the recommended conditions (refer to Section 10.8 below) will effectively avoid, remedy or mitigate any actual or potential water-related effects.

Specific effects on freshwater and marine ecology are assessed in Sections 5 and 6 of the Freshwater Ecology Assessment Report and in Sections 4 and 5 of the Marine Ecology Assessment Report. Summaries of the effects assessed in these reports are provided in Sections 11 and 12 of this AEE, and should be read in conjunction with the assessment of construction water effects.

10.8 Recommendations and mitigation

The following are noted in the Construction Water Assessment Report:

- The Consent Holder shall make all contractor staff aware of and ensure implementation of appropriate construction water management controls including construction and maintenance of these devices, in accordance with TP10 and NZTA draft guidelines;
- GLEAMS and USLE model calculations show a relatively low percentage increase in sediment yields for the Project from the background loads. However it is clear that those works associated with the steep topography of the Project are of higher risk than the Flat areas and need careful and pro-active management and monitoring to ensure that the construction effects are minor.
- A range of ESC measures are proposed for the Project. Where possible, these will be implemented at the same locations as the long-term stormwater structures, and will at all times achieve the requirements of TP90 as a minimum. ESCs will be based on both structural and non-structural measures with an emphasis placed on the non-structural management techniques; and
- The Project's construction-related water management will rely on CESCPs to be submitted to Auckland Council at a later date, before any construction activity takes place, to allow for contractor input and review by the Council.

- An adaptive monitoring programme will be implemented which will allow for ongoing water quality and ecological assessment of the construction programme. Continuous improvement of the construction water methodologies will form an integral part of this monitoring programme.

The adaptive monitoring programme will include meteorological, ecological and water quality monitoring during the construction phase of the Project and will include the following key components:

- Receiving environment visual assessments;
- Weather forecasting;
- On site monitoring of devices;
- Flocculation monitoring;
- Quantitative water quality and flow monitoring; and
- Habitat monitoring.

The results of the adaptive monitoring programme will be used to identify future risks to ecology based on pre-determined trigger levels. These triggers are not effects triggers, but rather act at an earlier stage to identify a point at which investigation, intervention and continuous improvement opportunities are to be considered appropriate. The adaptive monitoring programme will also inform the earthworks open area limitation and associated effects, and may lead to an increase in open earthworks areas over time. However, any such determination will be based on analysis of the water quality outcomes and associated assessment.

I accept that there are proven techniques, derived from the application of TP90, which will manage potential loss of sediment from the Project. Given the experience of the Construction Water team on other projects such as Long Bay and using the adaptive management techniques outlined by that Team, I support these recommendations.

11. Freshwater Ecology

The Freshwater Ecology Assessment Report assesses the environmental effects of the Project on freshwater ecology. Marine ecology and terrestrial ecology are the subjects of separate reports and are summarised in Sections 12 and 14 of this AEE.

The Report discusses in detail the existing freshwater aquatic habitats, biodiversity and current state of the environment monitoring information. The Report also provides survey results and the methodology for assessing effects.

The following is a summary of the issues and potential effects identified in the Freshwater Ecology Assessment Report. This summary and the Report subsequently inform the recommended mitigation contained in Section 28 and will inform the Project conditions.

11.1 Existing environment

The Freshwater Ecology team evaluated the quality of the freshwater habitats along the indicative alignment by reviewing existing information and undertaking assessments of representative habitats in both the Pūhoi and Mahurangi catchments. The Freshwater Ecologists obtained existing information from the New Zealand Freshwater Fisheries Database (NZFFD), Auckland Council database and a range of publications.

Many streams in the Auckland Region periodically experience high sediment loads and consequently sediment has the potential to affect biota of Auckland streams. The turbidity levels recorded in some Auckland streams after heavy rain can be relatively high (>10,000 NTU). High sediment concentrations can also be linked with forestry harvesting activities (refer to Section 5.1.1(d) of the Freshwater Ecology Assessment Report).

The Freshwater Ecology team undertook its assessments of freshwater habitats in two stages. The first stage, which was undertaken over the period October 2010 to May 2011, included proposed crossing locations over six representative permanent streams throughout a representative range of land use types and catchments along the alignment. The Freshwater Ecology team chose these representative sites on the basis that:

- they were permanent watercourses located along the indicative alignment, within the Pūhoi or Mahurangi catchments;
- they were representative of the two principal land use types within these catchments, namely rural and forestry;
- they will be culverted in part by the Project; and
- they were within reaches representative of the overall habitat provided by the watercourse.

The Freshwater Ecologists supplemented these initial assessments by visual assessments of a number of waterways in the vicinity of the proposed culvert locations under low flow (drought) conditions in March/April 2013. The assessments involved the collection of basic water quality and ecological data, the latter including such characteristics as width, depth, substrate types, aquatic plants, macroinvertebrates and fish.

The Freshwater Ecologists also undertook visual assessments at 33 potential culvert and bridge sites, in association with Hōkai Nuku representatives.

A summary of existing aquatic habitats is presented on a catchment basis in the vicinity of identified stream crossings (bridges and culverts) along the indicative alignment. The Freshwater Ecologists identified the representative streams based on physical characteristics and in-situ water quality. The Freshwater Ecologists also recorded macroinvertebrates and fish species and supplemented their data by visual assessments of most of the remaining stream crossing locations.

11.1.1 Assessment protocols

Assessments at each of the final five representative stream sites selected by the Freshwater Ecologists involved the collection of water quality data, a visual assessment of aquatic plants, and sampling of macroinvertebrates and fish. They used the Macroinvertebrate Community Index (MCI), Quantitative Index of Biotic Integrity (QIBI) and Stream Ecological Valuation (SEV) procedures to indicate habitat quality and overall stream health at sites. Specific information regarding the methodologies and criteria for assessing each of these variables is included in Section 3 of the Freshwater Ecology Assessment Report.

11.1.2 Existing aquatic habitats

Permanent and intermittent streams are defined in the Auckland Regional Plan: Air, Land and Water as follows:

> *<u>Intermittent Stream</u>*
>
> *Any stream or part of a stream that is not a Permanent stream*
>
> *<u>Permanent River or Stream</u>*
>
> *Downstream of the uppermost reach of a river or stream which meets either of the following criteria:*
>
> *(a) has continual flow; or*
>
> *(b) has natural pools having a depth at their deepest point of not less than 150 millimetres and a total pool surface area that is 10m2 or more per 100 metres of river or stream bed length.*
>
> *The boundary between Permanent and Intermittent river or stream reaches is the uppermost qualifying pool in the uppermost qualifying reach.*

The aquatic biological data indicates that the quality of freshwater aquatic habitats along the indicative alignment is typical of the Auckland Region and is primarily determined by the land use in the associated catchment.

Four aquatic species, namely a freshwater mussel, freshwater crayfish, inanga, and redfin bully, present in these catchments are in gradual decline nationally. An additional species, the longfin eel, is at risk nationally. These fish species are common throughout the Auckland Region and have been recorded in a wide range of aquatic habitats, including within the Project area.

Table 11-1 and Table 11-2 provide a summary of the permanent and intermittent streams that will be crossed by the Project. A detailed description of freshwater habitat in the Pūhoi and Mahurangi catchments is provided in Section 4 of the Freshwater Ecology Assessment Report. Refer to Figure 4-14 in this AEE for stream locations.

Table 11-1: Summary of permanent watercourses crossed by the Project

Stream	Culvert length	Land use	Existing ecological value
P6a	51	Forest	Good
P7*	81	Forest	Poor
P9 Bridge/Culvert	104	Forest	Good
P10*	N/A	Rural	Fair
P11	N/A	Rural	Fair
P11b	145	Forest	Good
M13d	80	Forest	Good
M15	219	Forest	Good
M16*	N/A	Rural/Forest	Very Good
M18/19*	114	Rural/Forest	Good
M21b	75	Rural	Poor
M22*	104	Rural	Poor
M23	N/A	Rural	Poor
M24	N/A	Rural	Poor
M23a	51	Rural	Poor
M23b	46	Rural	Poor
M23c	61	Rural	Poor
PA900A	N/A	Rural	Poor

* = Streams assessed

Table 11-2: Summary of intermittent watercourses crossed by the Project

Stream	Culvert length	Landuse	Existing ecological value
P2	134	Rural	Poor
P3	218	Rural	Poor

Stream	Culvert length	Landuse	Existing ecological value
P3a	92	Rural	Poor
P5	66	Forest	Poor
P6	40	Forest	Poor
P8	126	Forest	Poor
P9b	65	Forest	Poor
P9a	121	Forest	Poor
P10a	55	Rural	Poor
P11a	99	Forest	Poor
P11f	135	Forest	Poor
P11g	96	Forest	Poor
P12	228	Forest	Poor
M13	129	Forest	Poor
M13a	101	Forest	Poor
M13b	96	Forest	Poor
M15a	67	Forest	Poor
M19b	57	Rural/Forest	Poor
M19c	161	Rural	Poor
M21a	126	Rural	Poor
M21c	78	Rural	Poor
M21d	109	Rural	Poor
M21e	N/A	Rural	Poor
M23d	61	Rural	Poor
Pa100A	29	Rural	Poor
Pa200A	27	Rural	Poor
PA500A	15	Rural	Poor
SH1700	69	Rural	Poor

11.1.3 Pūhoi River and tributaries

The overall quality of the intermittent streams in the Pūhoi catchment is characterised by poor quality habitat, low banks with poorly defined flow paths, generally soft substrate, and very limited aquatic habitat suitable for aquatic plants, macroinvertebrates and fish. In the case of the intermittent streams in the lower Pūhoi River catchment, these streams also had little riparian vegetation, which resulted in any open water areas being subject to solar radiation with consequential heating. While those streams in the forestry area were well shaded by the pine forest, they contained little free-standing water and thus very limited aquatic habitat available for colonization by instream organisms such as macroinvertebrates and fish. The proximity of the intermittent streams in the southern part of the Pūhoi River Catchment in particular, to the Hikauae Creek, indicates that under flowing conditions some migrating fish species (assuming no significant obstacles are present) may be able to access these streams.

The habitat quality of the two representative permanent streams in the Pūhoi catchment based on the MCI, varied between poor and fair (MCI scores of 75 and 96 respectively). The limited physical habitat present in P7 (refer to Figure 4-14) combined with the downstream falls that limited fish species able to utilise this tributary to one species (banded kokopu (not threatened) is a recognised "climbing" fish), resulted in a poor quality habitat in this tributary. Although the other tributary, P10 (refer to Figure 4-14) a tributary of the Hikauae Creek, is largely in a rural catchment and contains a soft substrate (unsuitable for a number of macroinvertebrate species) the quality of this habitat was fair. This was due to the presence of aquatic weed, which provides habitat suitable for some species of macroinvertebrates, and also the linkage of this tributary with the larger Hikauae Creek. The Freshwater Ecology team assessed water quality as being well oxygenated and cool (refer to Section 4 of the Freshwater Ecology Assessment Report.

11.1.4 Mahurangi Right Branch and tributaries

The Freshwater Ecology team characterised the intermittent streams located within the pine forest, in the southern part of this catchment, as having poorly defined flow paths and very limited aquatic habitat suitable for aquatic plants, macroinvertebrates and fish. The flow paths of most of these streams were covered with pine needles and associated organic litter from the pine forest in which they were located. In the case of the more northern intermittent streams, that were located in pasture, while many of these streams had well defined flow paths they had limited riparian cover (comprising grasses) and almost stagnant water under low flow conditions.

The Freshwater Ecologists assessed the habitat quality of the three representative permanent streams based on the MCI scores. The scores varied from poor (M22) to excellent (M16), with MCI scores of 52 and 123 respectively. Refer to Figure 4-14 and Table 11-1and Table 11-2 in this AEE for locations and status, and Section 3 of the Freshwater Ecology Assessment Report for further detail regarding stream evaluations. The lower habitat quality recorded by the Freshwater Ecologists for M22 was due to the influence of the development of the catchment of this stream for agriculture. The catchment use of M22 was also reflected in the SEV scores of 0.84 (M16 - native forest), 0.77 (M18/19 - rural/exotic forest) and 0.54 (M22 - rural catchment).

With respect to the other two streams (M16 and M18/19), which are located in catchments developed for agriculture/forestry and contain remnants of native forest, the qualities of these habitats were good (M18/19) and excellent (M16).

The Freshwater Ecology team found moderate diversity of macroinvertebrates in the forested streams. The rural stream (M22) contained a much lower diversity of macroinvertebrates, and all identified were species tolerant of degraded habitat conditions.

Section 4 of the Freshwater Ecology Assessment Report contains a complete summary of findings on stream habitat and instream ecology.

11.2 Construction effects on freshwater ecology

The Project construction activities most likely to adversely affect freshwater ecology are sedimentation and construction stormwater discharges which can affect habitat, water quality or instream fauna. Cut and fill activities and the disposal of spoil and fill during construction will result in the loss of some freshwater aquatic habitat within the Project area.

Construction water management effects are discussed in Section 10 of this AEE.

11.2.1 Sedimentation

Under low flow conditions the water of the representative streams is generally clear, cool, well oxygenated, with a slightly acidic pH and low concentrations of TSS and nutrients (refer Section 6.2.2 of the Freshwater Ecology Assessment Report). Under elevated flow conditions however the water becomes turbid and the concentrations of nutrients increase. Such changes are typical of streams in the Auckland area.

TSS is the principal contaminant of concern for freshwater ecology.

The Construction Water Assessment Report indicates that the load of sediment that will be discharged from the Project will increase by 5% and 11% respectively for the Mahurangi and Pūhoi catchments, and that much of this sediment will be re-worked and transported to the estuaries.

Section 7 of the Construction Water Assessment Report states that sediment entering the freshwater catchment will change as the Project progresses, with an increase in sediment yields above those generated in the existing catchment anticipated during rainfall events. However, the predicted sediment loads in the rivers during construction could also occur during a rainfall event within the existing catchment. The predicted sediment loads for 2, 10 and 50 year rainfall events, including the sediment yields from the Project, would be equivalent to loads generated during slightly less frequent and less likely events in the background case.

Section 7 of the Construction Water Assessment Report provides details on stream sediment transport and deposition in relation to background loads and the construction of the Project.

The accumulation of fine sediment on stream beds may reduce the abundance and diversity of macroinvertebrates by increasing drift, smothering and abrasion of the macroinvertebrates themselves and their periphyton (algae) food supply. Smothering and abrasion of periphyton from

hard-substrate by sediment erosion is anticipated to be very minor, as few of the streams in the Project area contain hard-substrate and discharges will largely occur in lower sections of these streams. Nutrient concentrations are predicted to increase only marginally due to stormwater discharges and will have little effect on the periphyton of the receiving streams. Effects of increased nutrient concentrations on water for the Warkworth municipal potable supply are discussed in Section 10.7.3 of this AEE.

The structure of macroinvertebrate populations may be altered as sensitive species are replaced by species more tolerant of higher TSS concentrations. In this instance most of the permanent streams examined are colonised by macroinvertebrates that are able to tolerate elevated TSS concentrations, the discharge of treated stormwater from construction activities will have a minor effect on the macroinvertebrate populations in streams within the Project area.

Increased turbidity has the potential to impact on feeding and upstream migration rates in juvenile banded kokopu, and to a lesser extent inanga and common bullies. Turbidity can also increase avoidance behaviour and cause survival rates to decline in some species, though a number of New Zealand's freshwater fish have been found to be largely unaffected by sub-lethal turbidity levels[87]. In this instance, the dominant fish species resident in the streams within the Project area are tolerant of high TSS concentrations for short periods of time.

While the feeding and migration of some juvenile fish species (eg banded kokopu) may be affected by relatively low levels of turbidity (NTU>25), adults of this species along with redfin bullies are able to tolerate very high levels of turbidity, up to 40,000mg/L.

11.2.2 Habitat loss

Cut and fill activities will occur along the alignment within both the Pūhoi and Mahurangi catchments. Construction of fill embankments and disposal of excess spoil at a number of locations will result in the infilling of valleys and diversions of existing watercourses. These stream diversions will result in the formation of new watercourses within those valleys. However, there will be an overall loss of stream habitat – albeit of poor quality and limited ecological value – along the alignment.

Effects of fill associated with the installation of culverts on water flow within the streams will be short term and flushed downstream, and the overall effects on water quality will be minor. Water quality will be unaffected once diversions have stabilised and the associated riparian planting is developed. Following the completion and stabilisation of streamworks, the operation of culverts will not affect the water quality of streams.

11.3 Operational effects on freshwater ecology

Post-construction, loss of habitat through culverting and stormwater treatment and discharges from the operation of the motorway may also have adverse effects on the water quality and thus the ecological health of watercourses within the Project area. Fish passage may potentially be disrupted by the construction of culverts and stream diversions.

[87] Refer to Section 5.1.1 of the Freshwater Ecology Assessment Report.

Effects relating to operational water are discussed in Section 21 of this AEE.

11.3.1 Culverting

The indicative alignment for the Project proposes seven large viaducts and five bridges, of which nine are required because of stream / river crossings. The Project also proposes 40 culverts with three of the culverts being concrete arches.

Bridge structures and arch culverts are proposed for crossing watercourses with high quality habitat, including the Kauri Eco Viaduct, which avoids a stand of mature kauri in the Perry Road Sector and arch culverts at Sites P9, M15 and M22 (refer to Figure 4–14 for freshwater sites). The structures are intended to be constructed so that no part of the bridge will be located within watercourse. Concrete culverts are proposed where the streams have little or no ecological value. Refer to Table 11-1and Table 11-2 for a summary of the ecological status and type of crossing proposed at each watercourse and Tables 11 and 12 in the Freshwater Ecology Assessment Report, which provide a summary of effects on intermittent and permanent streams.

While in most cases culverts will be placed in the existing stream bed, some culverts will be associated with diversions of parts of streams. Overall, this will result in the change to approximately 1,788m of permanent stream habitat (905m in the Pūhoi catchment and 883m in the Mahurangi catchment) and 7,151m of intermittent stream habitat (3,388m in the Pūhoi catchment and 3,763m in the Mahurangi catchment). Refer to Sections 21.1 and 21.5 of this AEE for further details of stream diversions.

The principal effect of culverts on streams is a reduction in the amount of light that is able to reach the streambed and sustain the primary productivity on which the stream ecosystem is based, thus reducing the productivity of the section of stream in which the culvert is located. However, the presence of water within the culvert means that section will to continue to be an integral component of the overall stream system and enable the stream to function as an integrated continuum. Design measures have been incorporated to minimise the effects of culverts on streams crossed by the indicative alignment.

Adverse effects associated with the permanent loss of freshwater aquatic habitat will be mitigated through riparian planting and enhancement, as discussed further in Section 28 of this AEE.

11.3.2 Operational stormwater discharges

The treatment and discharge of stormwater from motorway surfaces has the potential to contain elevated concentrations of sediment, trace metals and total hydrocarbons. All of these contaminants have the potential to affect freshwater aquatic organisms.

The existing water quality of streams within the Project area is generally good, with contaminant levels well below the ecological trigger values. A small increase in contaminant levels is anticipated at all sites due to the discharge of motorway runoff. Operational stormwater treatment proposed for the Project will keep contaminant concentrations within the Australia and New Zealand Environment and Conservation Council (ANZECC) guidelines for freshwater quality. Refer to Section

8 of the Operational Water Assessment Report for further details regarding the proposed stormwater treatment by constructed wetlands.

11.3.3 Fish passage

As indicated on Drawings FE-101, 40 culverts are proposed for the Project. Of the 40 culverts, 12 will be located within existing permanent streams used by diadromous fish species that migrate upstream and downstream between fresh and saltwater environments. Six of the indigenous species recorded in the Pūhoi and Mahurangi catchments are diadromous, namely banded kokopu, shortfin and longfin eel, common bully, inanga and redfin bully.

Culvert designs will incorporate features such as baffles and weirs to facilitate the upstream/downstream passage of climbing and swimming fish species in all but two permanent streams where fish passage is required. The NZTA's Fish Passage Guidance for State Highways[88] has been considered in the design of culverts. Drop structures are required at the upstream end at Sites M23a and M23b and will create barriers to fish passage in these streams (refer to Table 11-1 and Table 11-2 for details of sites where culverts are proposed and to Figure 4-14 for the location of these structures). Table 12 in the Freshwater Ecology Assessment Report indicates that these streams have poor ecological values in terms of water quality, habitat, water flow and fish passage, and that the overall effect of the Project on these streams would be minor. As a result, the effects of the Project on fish passage will be minor.

In addition to this assessment, the Freshwater Ecology Assessment Report recommends that fish transfers are undertaken prior to any streamworks occurring.

A description of the fish passage measures to be incorporated into culverts is provided in Sections 3 and 7 of the Operational Water Assessment Report.

11.4 Overall effects on freshwater ecology

The actual and potential effects of the Project on freshwater ecology relate to sedimentation of watercourses, loss of habitat through culverting of streams and disposal of fill, disruption to fish passage, and effects of contaminant concentrations from construction and operational stormwater discharges. Much of the aquatic habitat within the Project area is degraded and many streams possess a very limited diversity of aquatic fauna.

Effects associated with the sedimentation of waterways during construction will for the most part be temporary. Increased sediment concentrations are unlikely to affect fish populations as the dominant species present in the Project area are tolerant of such effects for short periods of time. Such increases are predicted to occur during large rainfall events, after which TSS levels are predicted to reduce as sediment is progressively flushed downstream by flow. The methods and controls proposed for managing water-related effects during construction seek to mitigate the potential effects on the freshwater environment in such an event (refer to Section 10.5 of this AEE).

[88] Refer Section 5.3 of the Operation Water Assessment report.

The potential disruption to fish passage will largely be avoided through incorporation of measures to facilitate upstream and downstream movement in culvert design (aside from sites M23a and M23b where drop structures are required).

Installation of permanent stormwater treatment ponds will ensure that concentrations of contaminants will remain significantly less than ANZECC guideline levels and will have a minor effect on the habitat quality of streams within the Project area. The contaminants tend to partition (sorb) to particulates, which are effectively treated by the proposed wetlands designed to capture all runoff from the motorway road surface.

It is recognised that culverts will significantly alter the aquatic habitat where they occur. However, the design of the culverts has kept impacts to a minimum and riparian planting and enhancement of aquatic habitat within streams throughout the Project will assist in mitigating the effects of habitat loss. The majority of the streams crossed by the indicative alignment are poor in terms of riparian cover and ecological value, so the planting associated with the Project will significantly improve the habitat. In addition to these measures, a total of approximately 237ha of forestry and 205ha of farmland within the proposed designation will potentially be retired from productive use, reducing long-term sedimentation generation from that area of land.

11.5 Recommendations and mitigation

The Project will cross a number of intermittent and permanent streams typical of those of the Auckland Region. These streams contain very little aquatic fauna. However, they do contain four fish species that are in gradual decline on a national level, but are common in the Auckland region.

The principal potential effects of the Project on the freshwater habitats are a reduction in water quality as a result of construction and stormwater discharges, a loss of aquatic habitat as a result of culverting, and disruption to fish passage.

The effects of these activities will be minor as:

- Wetland treatment of the construction stormwater to a minimum of 75% TSS will ensure that the quality of the stormwater discharged, as a result of increased TSS, will be reduced for a short period and progressively flushed through by stream flow and can be tolerated by the resident fish species;
- The quality of discharges from operational stormwater ponds and wetlands will meet the ANZECC guidelines for the protection of freshwater aquatic life;
- Riparian planting will mitigate effects of habitat loss by culverting and enhance riparian areas and stream habitats within the proposed designation; and
- Fish passage will be provided through culverts in all but two permanent streams and in intermittent streams where adequate upstream habitat is available.

The Freshwater Ecology Assessment Report recommends, at Section 8, that site-specific aquatic habitat assessments should be undertaken in the permanent streams that will be culverted to determine whether the stream is permanent and that the culvert design is appropriate. This would establish a baseline against which any habitat changes could be assessed.

Fish species within existing streams should be captured and relocated prior to construction using standard relocation practices. I support these recommendations.

The Freshwater Ecology team's recommendations, including planting, should be undertaken at a level commensurate with the amount of stream habitat lost through culverting, leaving the stream and aquatic environment no worse off. In those areas where there is poor quality instream habitat there may be overall improvements. I support these recommendations and note that they are "commensurate with habitat lost" measures, which do not necessarily reflect the length of stream. There may be better benefits realised by restoring a shorter length of stream to a higher standard than currently exists.

The mitigation measures and conditions proposed for the Project (refer to Section 28 of this AEE and Sections 7 and 8 of the Freshwater Ecology Assessment Report) will provide opportunities to enhance the freshwater habitat within the proposed designation. I support the Freshwater Ecology team's recommendation that monitoring and assessment following significant rainfall events (ie 1 in 50 year event) should be undertaken to assess any significant impacts on freshwater environments and appropriate remedial measures implemented.

12. Marine Ecology

A Marine Ecology Assessment Report has been prepared for the Project. That Report provides an assessment of environmental effects on marine and coastal ecology within the Project area and the downstream coastal receiving environments. Freshwater and terrestrial ecology are the subjects of separate reports, and are summarised in Sections 11 and 14 of this AEE, respectively.

The Project crosses two catchment areas that discharge into either the Pūhoi Estuary or the Mahurangi Harbour, and ultimately into the Hauraki Gulf. The Project will directly affect the CMA at Okahu Inlet, where the Okahu Viaduct passes over the upper extent of the Pūhoi Estuary. The indicative alignment will cross numerous watercourses that ultimately discharge into both coastal areas. The Project therefore has potential to affect the ecological values of the coastal receiving environments.

The following is a summary of the issues and potential effects identified in the Marine Ecology Assessment Report, as identified through desktop analysis and sediment sampling and ecological surveys undertaken for the Project. This summary and the Report subsequently inform the recommended mitigation contained in Section 28 and will inform the Project conditions.

12.1 Coastal processes

The coastal environment is dynamic and complex. Sedimentation patterns are highly dependent on a wide range of environmental factors. An investigation into the influence of environmental and construction variables on a range of scenarios has been undertaken to obtain an understanding of the potential impacts associated with the construction and operation of the Project.

The Coastal Processes Modelling Report (as discussed in detail in Section 2.3 of the Marine Ecology Assessment Report) documents the investigation undertaken to assess the likely locations and magnitude of changes in sediment deposition depths and TSS concentrations in the Mahurangi Harbour and Pūhoi Estuary environments as a result of rainfall coinciding with open earthworks. The Report provides a foundation for the assessment of the severity and duration of additional sediment generated by the Project on the marine ecology, as covered in the Marine Ecology Assessment Report at Section 4.1. The Report has also been used to help in the assessment of the potential impacts on navigation, contact recreation and amenity qualities in these areas.

12.2 Marine ecology and environment

Specific areas within both the Pūhoi Estuary and the Mahurangi Harbour are zoned as CPAs 1 and 2 (refer to Figure 4-11). These areas are considered significant for their ecological values, as described in Sections 4.2.6 and 4.3.2 of this AEE. Both the Pūhoi Estuary and the Mahurangi Harbour are popular for recreational use. The latter also contains a number of commercial oyster farms.

The Marine Ecology Assessment Report used empirical literature and field survey results to determine the marine ecological values of the existing environment in the Pūhoi Estuary and Mahurangi Harbour. The Marine Ecology team identified values as including

- Estuarine vegetation
- Water and sediment quality
- Benthic invertebrate community species diversity and richness
- Fish
- Wading birds

Overall the Marine Ecology team assessed the Mahurangi Harbour as having moderate to high marine ecological values in the middle and lower reaches, and low to moderate marine ecological values in the upper reaches.

The team considered the marine ecological values of the main body of the Pūhoi Estuary to be moderate in the middle to lower reaches, and low in the upper reaches. Ecological values within the Okahu Inlet were assessed as moderate.

An interpretation of baseline monitoring results is provided in Section 3 of the Marine Ecology Assessment Report.

The assessment uses the criteria shown in Table 12-1 for assessing the magnitude of ecological impacts.

Table 12-1: Criteria for describing impact magnitude[89]

Magnitude	Description
Very High	Total loss or very major alteration to key elements/ features of the baseline conditions such that the post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether.
High	Major loss or major alteration to key elements/ features of the baseline (pre-development) conditions such that post development character/ composition/ attributes will be fundamentally changed.
Moderate	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition/attributes of baseline will be partially changed.
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of baseline condition will be similar to pre-development circumstances/patterns.
Negligible	Very slight change from baseline condition. Change barely distinguishable, approximating to the “no change” situation.

The Marine Ecology team assessed the significance of ecological effects using ecological value and impact magnitude, as shown in Table 12-2.

[89] Refer Marine Ecology Assessment Report Section 2.4

Table 12-2: Matrix for determining the significance of ecological impacts

SIGNIFICANCE		Ecological &/or Conservation Value			
		Very High	High	Medium	Low
Magnitude	Very High	Very High	Very High	High	Moderate
	High	Very High	Very High	Moderate	Low
	Moderate	Very High	High	Low	Very Low
	Low	Moderate	Moderate	Low	Very low
	Negligible	Low	Low	Very Low	Very Low

12.2.1 Construction effects

Construction of the Project has the potential to adversely affect marine ecological values through:

- The discharge of runoff from open earthworks areas to marine environments;
- Permanent habitat loss;
- Temporary habitat loss; and
- Temporary habitat disturbance.

Sediment generated from open earthworks areas during rainfall events will be treated and then discharged to the Mahurangi River and Pūhoi Estuary. The concentration of TSS and area and depth of deposited sediment under the 10 year and 50 year rainfall event with both calm and east-north-east (ENE) wind conditions have been modelled and mapped for 5 year and 10 year construction scenarios.

TSS concentrations will reduce significantly below effects thresholds within approximately three days in all scenarios modelled within both the Mahurangi Harbour and the Pūhoi Estuary. The Marine Ecology team conclude that the effect of suspended sediments on benthic invertebrates including farmed oysters, saltmarsh, seagrass and marine/estuarine habitat values will be negligible.

Deposition of sediment in both the Mahurangi Harbour and the Pūhoi Estuary in a 10 year rainfall event results in a relatively small increase in the area of the harbour predicted to receive sediment. The Marine Ecology team considers 10 year events to have adverse effects of low to very low significance in terms of sedimentation.

In the 50 year rainfall event in the Mahurangi Harbour, adverse effects on marine ecological values of moderate significance may occur in the 5 year construction scenario, compared to low significance in the 10 year construction scenario. In the 5 year construction scenario, the area receiving >5-10mm increases from an existing baseline of approximately 90ha to 110ha; the area receiving >10mm increases from an existing baseline of approximately 40ha to around 44ha. In

both cases, sediment is primarily deposited in the upper reaches of the Harbour, ie upstream of Hamilton's Landing.

In the Pūhoi Estuary, deposition of Project-related sediment during a 50 year rainfall event in the 5 year construction scenario results in a diffuse pattern of deposition throughout the extent of the estuary. The Marine Ecology team assesses deposition as potentially causing adverse effects on marine ecological values of moderate significance.

The Marine Ecology team considers permanent and temporary habitat loss, in addition to temporary habitat disturbance associated with the construction of fourteen piers (seven pairs) within Okahu Creek, to have adverse effects of low to very low significance due to the small areas involved and/or the temporary nature of the effect. Approximately 70m^2 of intertidal habitat will be lost through the construction and occupation of concrete pad foundations for the Okahu Viaduct, which represents 0.0004% of the intertidal habitat within the Pūhoi Estuary. The area involved is negligible in the wider context of the estuary and the Marine Ecology team considers the impact to be of low significance.

Temporary habitat loss during construction will be approximately 2,000m^2, which constitutes 0.13% of the intertidal habitat within the Pūhoi Estuary. The Marine Ecology team recommend that adult mud snails within the construction area are collected and relocated outside of the works footprint prior to the commencement of works. The Marine Ecology team consider the impacts of temporary habitat loss associated with the Project to be low as affected areas will be restored by biological processes over a period of years once temporary works are removed.

Temporary habitat disturbance through removal of coastal and terrestrial vegetation at the mouth of the Okahu Inlet will be negligible. Disturbance of marine organisms and wading birds from construction of the Okahu Viaduct (eg noise, vibration and movement) will be very low.

12.2.2 Operational effects

Constructed wetlands will primarily be used to treat operational phase stormwater prior to discharge to aquatic environments. On average, stormwater treatment wetlands will remove 75% of suspended solids and associated contaminants. Operational phase stormwater will all ultimately discharge to the Pūhoi River and the Mahurangi River. It is anticipated that any residual sediment and associated contaminants will largely be distributed within the upper estuary and upper harbour areas due to the low energy depositional characteristics of these waterways.

The contaminant load model calculations indicate that of the remaining common stormwater contaminants in the treated discharges, the greatest percentage increase (12%) above baseline concentrations will be in zinc discharged to the Pūhoi Estuary, which equates to approximately 4kg/year). The proportion of the increased zinc load likely to be retained within the Pūhoi Estuary will be redistributed and diluted by the physical and biological processes within the estuary. As such, the Marine team considers the potential adverse effects of increased zinc load on the marine ecological values present within the Pūhoi Estuary to be minor.

No significant increases in contaminants from operational phase discharges to the Mahurangi Harbour are anticipated and the Marine team considers any potential adverse effects on marine

ecological values to be negligible. However, there is the potential for these discharges to add to the long- term accumulation of common stormwater contaminants within marine sediments in both the Mahurangi Harbour and Pūhoi Estuary.

12.3 Overall effects within the coastal environment

Adverse effects on marine ecological values may occur from the discharge of construction phase sediment, construction of piers within the CMA and the discharge of stormwater from the motorway surfaces.

Smaller rainfall events resulting in increased sedimentation, permanent and temporary loss of benthic habitat, temporary disturbance of benthic habitat and the discharge of operational phase stormwater have been assessed as having adverse effects on marine ecological values of low to very low significance.

The greatest risk to marine ecological values within both the Pūhoi Estuary and the Mahurangi Harbour is the occurrence of a large (50 year ARI) rainfall event during peak open earthworks. The Marine Ecology team predicts effects on marine receiving environments of such an event to be of moderate significance in the upper parts of the Mahurangi Harbour and in the middle to lower reaches of the Pūhoi Estuary.

The contribution of the Project to the long-term sedimentation of the Mahurangi Harbour and Pūhoi Estuary is a cumulative effect, but the Marine Ecology team assesses it as having low significance. The Marine Ecology team recommends both routine and triggered monitoring of benthic invertebrates and sediment quality. I support this as prudent practice to ensure that the potential effects of the Project can be quantified.

If a large rainfall event, such as the modelled 50 year event, occurs and the monitoring indicates that the effects of sediment generated are unacceptable, a mitigation programme will be implemented. I support the Marine Ecology team's recommendation that mitigation measures be developed in consultation with the appropriate stakeholders, which reflect existing strategies and plans for improvement of the ecological values of the Mahurangi Harbour and Pūhoi Estuary. It is important that the offset mitigation proposed has direct benefit to the marine environment affected. Offset mitigation could include the treatment of other discharges entering the marine environment, revegetation of coastal margins, weed and pest control or the retirement of steep land from grazing.

13. Construction traffic

The Construction Traffic Assessment Report provides an assessment of the effects on the local and regional transport network in relation to the construction of the Project.

The Report discusses the relevant performance standards and specifications in relation to the management of construction traffic for the Project. The Transport team assessed the construction traffic effects of the Project by identifying where construction activities (physical works and construction related vehicle movements) would potentially impact on users of the transport network. The Transport team then considered these activities in relation to their impact on performance and safety of the network.

The following is a summary of the key issues and potential effects identified in the Construction Traffic Assessment Report. This summary and the Report subsequently inform the recommended mitigation contained in Section 28 and will inform the Project conditions.

13.1 Existing traffic environment

The SH1 corridor from Pūhoi to Warkworth is primarily characterised by rolling or steep terrain with some particularly low speed horizontal curves and steep grades. The route is primarily a single carriageway with some passing lanes. The majority of the route has a posted speed limit of 100kph. Warkworth experiences significant congestion during holiday periods and also during weekday evening commuter peak and on weekends.

The 2012 AADT volume is approximately 17,400 vpd for the Pūhoi to Warkworth section of SH1. SH1 carries high volumes of freight traffic, with up to 7%[90] of traffic being HCVs along the route between Pūhoi and Warkworth.

The section of SH1 between the NGTR and Warkworth and the NGTR has a poor crash history. There is an average of 13 injury crashes per year on SH1 between Pūhoi and the proposed northern connection with the Project.

13.2 Assessment methodology

The Transport team has assessed the nature and scale of effects that the construction of the Project will have on the transport network.

The approach used by the Transport team was to identify:

- Locations where construction operations would directly affect the existing roading network, ie where temporary traffic management measures would need to be put in place;
- Construction access points required for staff, equipment and material; and
- The number of vehicle movements associated with construction of the Project, their origins and destinations.

[90] Refer Construction Traffic Assessment Report Section 1.7

The Transport team considered the methods that the NZTA would typically use to manage construction traffic, and then assessed:

- The effects of traffic management measures; and
- The effect of construction traffic moving through the transport network for a typical construction.

13.2.1 Construction Traffic Management Plan

The NZTA will develop a Construction Traffic Management Plan (CTMP) as part of the outline plan of work (OPW) process for the Project. The NZTA will produce Site Specific Traffic Management Plans (SSTMPs) for each activity in accordance with COPTTM, to demonstrate to the Auckland Council and Auckland Transport (as the local Road Controlling Authority) that the effects of the construction activity on the transport network will comply with designation conditions, and will minimise disruption wherever practicable. The Transport team has factored in the development of the CTMP and the SSTMPs into the assessment of the construction traffic effects of the Project.

The CTMP will incorporate the following objectives for the delivery of Temporary Traffic Management (TTM) during the construction of the Project:

1) Provide TTM complying fully with the COPTTM wherever practicable. Non-compliance will be addressed through Engineering Exception Decisions signed off by the implementation team and the relevant RCA.
2) Focus on current best industry standards with regard to TTM and safety.
3) Minimise disruption on the State highway and local roads wherever practicable.
4) Maintain existing flows and travel times on State highway and local roads adjacent to the work site where practicable.
5) Minimise the impact of works on pedestrians and cyclists wherever practicable.
6) Minimise the effects of construction traffic on local roads used for access wherever practicable.
7) Minimise the impact of construction parking wherever practicable.
8) Develop SSTMPs having consideration for key stakeholders ie (mainly local residents and Auckland Transport, but also the wider travelling public).
9) Identify all issues and have a planned SSTMP approved at least five days before implementation is required, in consultation with the applicable RCA and the NZTA's network management consultant.
10) Provide effective communication to affected parties and the travelling public.
11) Implement TTM that provides stakeholders with exceptional service in terms of functionality and clarity of direction of travel through roadwork sites.

These objectives can be achieved through the implementation of the CTMP and associated SSTMPs to ensure the overall effects of construction will be minor.

13.3 Temporary traffic management effects and mitigation

The Transport team has assessed the effect of construction activities by considering the location and scale of construction activities and associated TTM measures on the existing network. The

Transport team used a qualitative assessment to determine the likely level of impact from the activities. This assessment was based on the team's experience and understanding of capacity reductions and delays caused by traffic management activities.

The Transport team also assessed the potential for alternative routes to be used as detour routes if roads were to be closed for a given time. As part of developing the CTMP and associated SSTMPs, the contractor will consider the suitability of detour routes where short-term road closures are considered necessary to facilitate construction works.

The key locations where construction activities are likely to affect operating conditions on existing road networks are:

- SH1 at the southern tie-in;
- Pūhoi Interchange – SH1 and Pūhoi Road;
- SH1 at Hungry Creek;
- Moirs Hill Road;
- Wyllie Road;
- Woodcocks Road / Carran Road;
- SH1 at the northern tie-in; and
- Construction site access directly to SH1.

13.3.1 Southern tie-in

Construction activities in this area will focus on the integration of the existing Hibiscus Coast Highway and SH1 alignments with the Project.

The works are likely to require speed and lane width restrictions, and potentially the use of the opposing carriageway near to the tunnel portals. There may be some minor temporary loss of road capacity over the duration of TTM operations but a single lane of traffic will be maintained in each direction with the main impact being a reduction in speed limit.

The Transport team recommends that the NZTA schedule works that significantly reduce capacity outside of peak holiday periods and develop an extensive communication campaign in advance of significant works components to inform motorists of road layout changes and potential delays.

The Transport team considers that construction activities can be undertaken and managed so that the effects on SH1 are minor.

13.3.2 Pūhoi Interchange – SH1 and Pūhoi Road

Works in this area will involve the construction of the Pūhoi Interchange and Viaduct. The construction of the south-facing ramps will largely be undertaken outside the existing SH1. Shoulder closures over an 18 month period covering two construction seasons will be required to facilitate the tie-in of the ramps to the existing SH1 alignment and Pūhoi Road.

Some works will require operations in or over existing traffic lanes, such as the installation of bridge beams. To facilitate this, closures of Pūhoi Road may be required for short durations. These

closures will generally be scheduled to occur at night or during other periods of low demand, with cessation of works if delays are excessive, queues extend to SH1 or emergency access is required.

Traffic counts of the peak periods undertaken by the Transport team on Tuesday 21 May 2013 indicate that even during the peak periods, the maximum hourly two-way volume on Pūhoi Road is approximately 170vph. This volume is less than three vehicles per minute on average. Due to low volumes of traffic on Pūhoi Road, construction works and associated TTM are unlikely to greatly affect traffic.

NZTA will manage traffic at the SH1 / Pūhoi Road intersection to minimise disruption and delays. The Transport team recommends extensive communication campaigns in advance of significant works to assist motorists to make informed decisions regarding trip planning.

13.3.3 Hungry Creek

The indicative alignment passes close to the existing SH1 at two locations around Hungry Creek. Works in this area will include earthworks, retaining wall construction and construction of the Watson Road underpass.

These works will likely require shoulder closures, temporary speed restrictions and may potentially necessitate the closure of the southbound overtaking lane to facilitate site access over a 30 month period.

The Transport team considers that the closure of the overtaking lane is unlikely to have a significant impact on either the capacity or operating conditions on the existing SH1 and concludes that construction activities can be undertaken and managed so that effects are minor in this location.

13.3.4 Moirs Hill Road

The Design team has identified Moirs Hill Road as a critical access point for construction activities between the Schedewys Hill Viaduct and Perry Road Viaduct. Moirs Hill Road is an unsealed road serving several rural-residential properties. It is narrow, winding and extends through challenging topography. The initial section is too narrow for one vehicle to pass another and extends between a steep embankment on one side and a steep drop on the other.

The proposed designation boundary allows for the reconstruction of Moirs Hill Road from SH1 to the alignment to allow two truck and trailer units to be able to pass. Such works will be undertaken if determined necessary as part of the detailed construction methodology. Reconstruction works would likely require alternating flow under stop/go or portable traffic signals, for an estimated works period of six months.

Moirs Hill Road will be widened and realigned near to the new motorway to enable the construction of the Moirs Hill underpass. These realignment works will occur off-line. Where it connects to the existing Moirs Hill Road alignment, works are likely to require temporary diversions or alternating flow operations.

The Transport team undertook surveys of Moirs Hill Road in the AM and PM peaks on Tuesday 21 May 2013. The maximum number of vehicles using Moirs Hill road (2-way) over any one hour (8:00am to 9:00am) was 27 vehicles with no observed trucks and two bus movements. Given the traffic volumes on Moirs Hill Road are very low, the Transport team considers that the construction activities can be undertaken and managed to have only minor effects.

13.3.5 Wyllie Road

Wyllie Road is a no-exit unsealed road that services approximately 40 properties. Wyllie Road may potentially be impacted on by works undertaken to facilitate construction of embankments and a bridge structure, and works to widen Wyllie Road and allow for two-way operation and pedestrian access under the bridge.

The Transport team anticipates that construction works in this location will necessitate shoulder closures and alternating flow under stop/go control over a 12 month period. The team recommends that access be maintained at all times throughout construction of the Project as there is no feasible alternative access.

Some works will require operations in or over existing traffic lanes, such as the installation of bridge beams. To facilitate this, closures of Wyllie Road may be required for short durations. The Transport team recommends that these closures generally be scheduled to occur at night or during other periods of low demand, and that works should cease if delays are excessive, or emergency access is required.

Due to the very low traffic volumes on Wyllie Road, the Transport team considers that the construction activities can be undertaken and managed so that effects are minor.

13.3.6 Woodcocks Road / Carran Road

As part of the Project works, Woodcocks Road will be realigned to provide better sight distance under the RoNS carriageway, and the intersection with Carran Road will be reconstructed. Shoulder closures and alternating flow under stop/go control will be required to facilitate construction, as required over a six month period.

The Transport team observed stop/go operations on Woodcocks Road as part of a road reconstruction project on 14 May 2013 and concluded that these operations were appropriately managed so that delays were acceptable.

Construction activities relating to the construction of the Woodcocks Road Viaduct and widening of Woodcocks Road where it passes beneath the Viaduct will largely occur offline.

Some works will require operations in or over existing traffic lanes, such as the installation of bridge beams. To facilitate this, closures of Woodcocks Road may be required for short durations. The Transport team recommends that these closures generally be scheduled to occur at night or during other periods of low demand, and that works should cease if delays are excessive, or emergency access is required.

With the availability of Carran Road as a possible detour route, the NZTA may have some flexibility in managing the works in this area so as to accelerate launching of the viaduct sections.

Given the AADT on this section of Woodcocks Road of 2,500 vpd and the availability of Carran Road as a detour route, the Transport team considers that the Project construction activities can be undertaken with effects that are minor.

13.3.7 Northern tie-in

The majority of works associated with the construction of the tie-in of the new motorway with the existing SH1 will be undertaken offline. Temporary roads will need to be constructed and contra-flow operations implemented to minimise delays to road users over an 18 month construction period. is The Transport team anticipates that the northbound passing lane on the existing SH1 will be closed for six months to facilitate site access and the construction of the tie-in to the indicative alignment.

Two-way operation will be maintained during the construction period with lane and shoulder narrowing as necessary. Speed restrictions may lead to some minor reduction in capacity and minor increase in delays. The Transport team recommends SSTMPs be developed for this section of the Project to minimise impacts and mitigate effects associated with TTM.

The Transport team considers that the construction activities can be undertaken and managed so that the effects on SH1 are minor.

13.3.8 Conclusion – temporary traffic management

The Transport team considers that the effects of the temporary traffic management activities can be effectively managed to minimise disruption through the implementation of CTMPs and SSTMPs.

13.4 Construction traffic volumes

The Design team has estimated potential traffic volumes travelling to and from offsite locations (eg from sources of materials and products) using the location of construction zones and programme provided in the construction methodology and detailed in Section 6 of this AEE. These volumes were developed by an experienced construction engineer based on the number of staff required at each site and the volume of construction equipment and materials required to construct the project.

The preliminary construction methodology is based on all of the earthworks being contained within the proposed designation. Therefore, there will be no vehicle movements associated with hauling surplus material off-site along SH1 or the existing local roads. Use of internal haul roads in this manner is consistent with the methodology set out in the indicative construction programme.

The Transport team has used these estimated traffic volumes to assess the effects of construction traffic on the existing road network.

The Transport team used these traffic volumes (and an assessment of whether the origin or destination of the movements to the north or the south of the site), to develop turning movements

at the point where construction traffic accesses the public road network (as shown in Drawings CT-101 and CT-102).

There will be some variation in the number of vehicle movements into and out of a site throughout the duration of construction. During some periods a site access may not be in use as construction has not started (or has been completed) or there is limited activity taking place. During critical periods, there may be increased activity. For example, there may be a larger number of trucks into and out of a bridge staging site as beams are being transported to site for launching or while pant is being delivered to site.

The number of vehicle movements on a 'typical' day represents the number of movements that would be expected to access a site on an average day when it was operating. The 'peak' day represents the number of movements on a day when the site is in peak operation over a much shorter duration.

The Transport team used the peak volumes to assess the performance of individual accesses during their peak usage. The cumulative typical traffic volumes from all sites were used to assess the performance of the network assuming every site is operating at the same time.

The final construction methodology is not confirmed at this stage and is subject to change following the appointment of a contractor. However, the Transport team considers that the Construction Traffic Assessment Report takes a conservative approach to developing the traffic volumes for the following reasons:

- The Transport team assumed that peak hour traffic volumes were 10% of the total assessed daily construction traffic volumes. However, shifts are likely to be 12 hours and construction traffic would be likely to be spread relatively evenly over this period. This assumption means that volumes in the assessment are likely to be more peaked than would be observed in reality;
- Many of the light vehicle movements are likely to take place at the start and end of shifts (nominally 7am and 7pm). These will not coincide with the peak traffic volumes on the adjacent roads;
- The Transport team identified a range of vehicle movements. The maximum of these ranges has been added cumulatively and used in the assessment. It is unlikely that the maximum of all these ranges would all occur at the same time. As a result, this approach is likely to significantly overstate the number of movements that could be expected;
- For simplicity, the Transport team assumed that all trips are destined for a location north or south of the Project extents. In practice some of the movements will be from one site to another. For example, a trip taking precast bridge units from the precast yard to sites 7 or 8 will only travel from Warkworth to Moirs Hill Road rather than all the way south; and
- The development of the CTMP for the Project will enable the NZTA and its contractors to fully programme their activities to maximise the efficiency of their operations by avoiding congested periods, and minimising the effects of their activities on the existing road network.

The Transport team has estimated the cumulative increase in traffic volumes on sections of the existing SH1 for a typical working day during construction. Table 13-1 shows the projected increase in traffic on the existing SH1 attributable to the construction of the Project.

Table 13-1: Cumulative traffic increase on SH1 in each direction during construction

Section of SH1	Cumulative traffic increase (vpd)*
South of Johnstone's Hill	410-1020
Pūhoi Road to Hungry Creek	320-870
Hungry Creek to Schedewys Hill	290-810
Schedewys Hill to Moirs Hill Road	270-770
Moirs Hill Road to Perry Road	210-670
Perry Road to Woodcocks Road	170-700
Woodcocks Road to northern tie-in	90-540
North of northern tie-in	80-520

* Note that figures relate to a typical day with all sites operating

13.5 Construction traffic effects

The Transport team assessed the effects of construction traffic on the wider network by using the cumulative typical day traffic volumes, assuming every site is operating at the same time. This approach is considered conservative as all sites will not be operating at the upper end of the typical day volumes at the same time. In fact it is unlikely that all sites will be operating at the same time at all. Cumulative peak day volumes have not been assessed as all sites will not be operating at their peaks at the same time.

13.5.1 Effects of construction traffic on SH1

The Transport team assessed the effects of construction traffic on the existing SH1 by determining the spare capacity on SH1 to accommodate the expected construction traffic volumes.

The Transport team obtained existing traffic flow profiles from the NZTA's permanent traffic count site south of McKinney's Road and added 4% per annum traffic growth (consistent with that observed over the last 5 years) to these profiles to develop a baseline 2016 profile.

The traffic profiles calculated in the Construction Traffic Assessment Report demonstrate that, with the inclusion of the forecast construction traffic volumes, the peak traffic volume is likely to be in the order of 1,000vph per direction against the nominal capacity of 1,300vph per direction. These traffic volumes indicate that even with the additional construction traffic, SH1 will be operating within its capacity with minimal impact on delays. The Transport team considers that even if a very

worst case assumption was used where all the sites were operating concurrently at their peak traffic volumes, there would still be additional capacity available on SH1.

There will be a large number of additional heavy vehicle movements on SH1 as a result of the additional construction traffic. For example the number of construction related HCVs forecast to be on SH1 south of Pūhoi Road is approximately 420vpd. If this number of additional HCVs were included onto SH1 at the moment, this would have the effect of increasing the HCV proportion from approximately 7% to 9%. The Transport team does not consider that this level of additional HCVs would have a significant effect on the operation of SH1. However, there will be some larger or oversized loads as part of the construction traffic which would need to be scheduled to avoid peak traffic periods.

The exceptions to spare capacity on SH1 being available are the peak periods of Friday afternoon (northbound), Saturday morning (northbound) and Sunday afternoon (southbound). During these periods, traffic volumes on SH1 will reach or exceed the nominal capacity of SH1. As the volumes approach capacity of SH1, congestion will increase and travel times will increase. The Transport team recommends that as part of the CTMP, the NZTA will need to monitor delays on SH1. If significant delays are observed NZTA will need to consider restricting construction movements during these peak periods to ensure that delays to general traffic (and their construction traffic) are maintained at a manageable level.

The Transport team expects the increase in vehicle movements through the Warkworth Township north of Woodcocks Road (including the signalised intersections) as a result of the Project to range from 10-55 vph on a typical day. To put this in context through Warkworth, this would equal a maximum of 2 vehicles per traffic signal cycle in each direction (based on a 120 second traffic signal cycle). The Transport team recommends that the NZTA give consideration to scheduling (through the CTMP) Project construction vehicle movements to avoid the peak periods if delays are observed to increase to unmanageable levels.

The Transport team considers that the effects of the traffic generated by the construction activities are likely to be minor based on the capacity of SH1 to accommodate additional traffic for most of the week during the earthworks season. The CTMP will allow the NZTA to manage the construction traffic movements to minimise the impact on the travelling public and maximise the efficiency of the construction operations.

13.5.2 Effects on local roads

The Transport team assesses that the effects of cumulative construction traffic on the majority of local roads will be minor. However, there are two locations where the construction traffic volumes are likely to be highest. These locations are:

- Moirs Hill Road; and
- Woodcocks Road /Wyllie Road.

(a) Moirs Hill Road

Moirs Hill Road has been identified as a critical access route for construction activities between the Schedewys Viaduct and Perry Road bridges. The forecast construction traffic volumes range from 200vpd to 840vpd, which represent a low range for a typical day and a high range for a peak day, respectively. The Transport team considers these volumes to be relatively low, representing less than 1.5 additional light or heavy vehicle movements per minute on average. However, as Moirs Hill Road is very lightly trafficked (with the highest observed peak hour two-way traffic volumes in the order of 30vph) the relative increase will be noticeable.

The proposed designation boundary has been extended to allow for the reconstruction of Moirs Hill Road from SH1 to the indicative alignment if deemed necessary. These works will remove potential conflict of passing traffic in the one-way area near SH1 and allow two truck-and-trailer units to pass each other. As such, Moirs Hill Road will be relatively unaffected by construction traffic in terms of capacity. The Transport team considers that with these improvements in place, the effect of construction traffic in relation to the operation of Moirs Hill Road will be minor.

(b) Woodcocks Road / Wyllie Road

The construction activities at sites in the vicinity of Woodcocks and Wyllie Roads will generate traffic that will use Woodcocks Road south of the Carran Road intersection. The Transport team expected these sites to generate between 200-1240vpd, which represents a low range for a typical day and a high range for a peak day, respectively. This indicates peak hour 2-way traffic volumes of 20-124vph (each way). These volumes are equivalent to approximately one vehicle per minute in each direction. The Transport team does not expect these volumes to have a significant effect on the operation of Woodcocks Road. However, potential conflicts and pedestrian safety risk may increase in the vicinity of Mahurangi College.

To avoid this potential effect, the Transport team recommends that works be scheduled (through the CTMP/SSTMP) so that heavy vehicle movements do not use Woodcocks Road during the start and end of the school day when large numbers of students are expected to be crossing Woodcocks Road. The use of the alternative route via Carran Road and Kaipara Flats Road may also be desirable during these periods. The NZTA will need to ensure detailed safety briefings are given to all truck drivers during project inductions and as part of regular 'Tool Kit' sessions to highlight the hazards through this area with consideration given to reducing their speed to 30-40kph on the approach to the school as this will have little impact on delays to construction traffic.

Additional construction traffic will use the Woodcocks Road / Wyllie Road intersection, which is currently controlled by give way to give priority to Woodcocks Road. Given the low background traffic volumes on both of these roads, the intersection is expected to work within its capacity, even with the additional construction traffic. Through traffic on Woodcocks Road would not be affected. The worst performing movement at the intersection would be the right turn out of Wyllie Road into Woodcocks Road, which is forecast to operate with average delays in the order of 15 – 19 seconds evening with peak day construction traffic volumes. The Transport team considers this effect to be a minor due to the low volumes of traffic using Wyllie Road.

Although volumes across the one-way bridge on Woodcocks Road will increase as a result of additional construction traffic, the Transport team considers the bridge will continue to operate well within its capacity in a peak hour with peak day construction traffic included. Average delays of less than 15 seconds are forecast even with the additional construction traffic included. Given the relatively low volumes of general traffic on Woodcocks Road, the Transport team considers construction traffic to have a minor impact on the performance of the one-way bridge.

The Transport team expects the maximum increase in vehicle movements associated with construction traffic at the SH1 / Woodcocks Road intersection to be in the order of two additional vehicle movements to and from Woodcocks Road per traffic signal cycle (based on a 120 second traffic signal cycle). The Transport team considers that this level of additional traffic can be accommodated by the traffic signals with only minor delays for other vehicles and that signals will operate at the same level of service as present with around 25 seconds of average delay.

The Transport team concludes that with the inclusion of appropriate safety measures into the CTMP (including careful planning to avoid/mitigate the potential for safety-related concerns associated with the peak pedestrian activity in the vicinity of the school), construction traffic effects on local roads can be managed so that they are minor.

13.5.3 Effects of construction accesses onto local roads and SH1

The Construction Traffic Assessment Report provides an assessment of proposed construction accesses onto local roads and SH1 and highlights the standards and potential issues associated with the establishment of unsignalised intersections. The Transport team selected access locations in order to provide adequate sight distances and deceleration zones along SH1. Options for potential improvements that would be considered as part of a CTMP are suggested in order to mitigate the potential effects of construction activities on the existing road network.

(a) Local roads

Access from the construction sites to local roads can be provided safely given the expected operating speeds and generally low traffic volumes on these roads, as follows:

- Sites 7 and 8 access onto Moirs Hill Road, which will provide sufficient additional capacity using a simple give way controlled access. Minimal delay to either local or construction traffic is expected.
- Sites 11 and 12 access onto Wyllie Road, which will provide sufficient additional capacity using a simple give way controlled access. Minimal delay to either local or construction traffic is expected.
- Site 13 access onto Woodcocks Road north of Carran Road. Analysis of a peak hour indicates that a give way controlled access will operate within its capacity, with no delays for through traffic and an average delay for the right turn out of the access itself of approximately 15 seconds.

It is considered that all access intersections would be sealed and constructed to allow for HCVs to turn and access sites without encroaching onto opposing lanes or verges. Some localised widening

around access may be required but should be able to be accommodated within the road reserve or the proposed designation. No specific additional treatment is required for accesses.

It is considered that construction vehicle movements onto and from local roads at site accesses can be managed so that effects are negligible.

(b) SH1

The Transport team concludes that access from the construction sites to SH1 can be provided safely given the expected operating speed of SH1 in these locations.

The Transport team recommends that for the expected volumes of traffic, all construction site accesses to SH1 should be designed to provide space for left-turning and right-turning vehicles to pull clear of through traffic. The following treatments should be implemented to mitigate effects of delays at intersections of site accesses and SH1 and to provide for their safe use by HCVs:

- Right turn and left turn bays for traffic leaving SH1; and
- Acceleration lanes for traffic turning right on to SH1.

The Transport team considers that there is sufficient space within the existing designation for SH1 to allow for these treatments.

The Transport team analysed potential delays at these intersections assuming these treatments are provided at each site access intersection with SH1. The results indicate that access into and out of sites onto SH1 are expected to operate at acceptable levels of service throughout a typical day and during peak days across a range of traffic volumes on SH1.

The intersection where the Transport team forecasts the most delay is at Moirs Hill Road, where average delays for right turning traffic into SH1 may increase from around 40 seconds to around 270 seconds on a peak day at the upper end of the range, assuming 1,100vph on SH1. General traffic making these movements will also be held up during these periods. However, the upper range of peak traffic for both sites 7 and 8 and these high volumes on SH1 are unlikely to coincide for long periods of time during construction. Where traffic volumes on SH1 increase above 1,100vph (Friday evenings, Saturday mornings and Sunday afternoons), delays at site access intersections should be monitored and managed as part of the CTMP.

The Transport team considers that any delay and safety issues for construction accesses onto SH1 can be adequately addressed through the CTMP.

13.6 Pedestrian and cycle effects

Given the large distances between centres, there is limited opportunity for walking or commuter cycling between centres. There is the potential for a small number of pedestrian movements between Pūhoi and SH1 along Pūhoi Road to access the Inter City bus services. No roads that form part of the Auckland Regional Cycle Network are within the vicinity of the Project construction works. However, recreational cyclists do use the existing SH1. On SH1 through Warkworth, there are existing on-road facilities.

There will be some additional traffic on SH1 which could increase the exposure of pedestrians and cyclists to additional conflicts. However, given the relatively low proportion that construction traffic will make up of general traffic, the Transport team does not consider potential conflicts to be an issue.

The Transport team recommends that particular consideration should be given to scheduling work so that HCVs do not use Woodcocks Road at the start and end of the school day, and that safety briefings be provided for all HCV drivers, as mentioned above in Section 13.5.2. Carran Road and Kaipara Flats Road could be used as an alternative route for construction traffic at these times. The Transport team also recommends that due consideration be given in the development of the CTMP and SSTMPs to the safe passage of pedestrians and cyclists through areas controlled by temporary traffic management and routes used by construction traffic.

The Transport team considers that the effects of construction activities on pedestrians and cyclists can be managed so that they are no more than minor.

13.7 Passenger transport effects

A small number of regular passenger transport services and a larger number of tourist shuttle services operate along the route. These bus and shuttle services utilise the existing SH1 and are subject to the same road performance conditions as general and freight traffic.

Regular passenger transport services allow pre-booked passengers to board and alight on SH1 at the Pūhoi turn off. The Transport team recommends that the NZTA consider providing a suitable location for a set-down area for buses to allow for passengers to safely board and alight and depart at Pūhoi.

The schools in Warkworth are well served by school buses using Woodcocks Road and Hill Street. Bus boarding and alighting takes place on Mahurangi College grounds and not on Woodcocks Road; accordingly, the Transport team does not anticipate any effects in this location due to construction traffic. Moirs Hill Road is also a school bus route.

Provided that access is maintained for these routes, the Transport team expects that effects on passenger transport during construction will be minor.

13.8 Overall assessment of effects

The Construction Traffic Assessment Report (refer to Volume 3, Part 1) concludes that the effects of construction activities and construction traffic movements for the Project can be managed effectively through the development of a CTMP and SSTMPs as part of the OPW process.

There is flexibility available for the contractor to programme traffic movements and select routes in Warkworth to mitigate potential effects on the existing road network. Flexibility also exists in the staging of the northern and southern tie-ins to ensure that traffic is effectively managed through the construction period. The existing SH1 is expected to have sufficient spare capacity to accommodate additional construction traffic during most periods.

Effects on passenger transport are expected to be negligible and effects on pedestrians and cyclist are expected to be minor.

In general the effects outlined in this assessment are able to be mitigated acceptably provided a CTMP is developed and followed in line with normal NZTA practices.

13.9 Recommendations and mitigation

The Report makes the following recommendations for measures to avoid, remedy or mitigate potential adverse effects:

- Staging of works at the northern and southern tie-ins should be communicated to the wider public to provide the opportunity to alter times of travel if needed;
- Dedicated acceleration lanes, right turn bays, and closure of passing lanes is likely to be required to facilitate access onto SH1 form the construction sites to ensure that construction movements can be made safely without significantly increasing delays to other road users. There is sufficient space on SH1 to provide for this;
- Access to Pūhoi Road, Moirs Hill Road and Wyllie Road will need to be maintained at all times as there are no feasible alternative routes. Short term closures or stop/go operations can be maintained on these roads without causing significant delays;
- Consideration will need to be given to providing a suitable location as a set-down area for buses to allow for passengers to board and alight and access Pūhoi;
- Construction traffic movements should be programmed outside of peak times of activity in the vicinity of Mahurangi College; and
- Management plans should be put in place to ensure that all issues can be managed to minimise disruption for road users.

With these recommendations and the development of a CTMP, the Transport team and I consider that the Project's construction traffic effects can be appropriately mitigated.

14. Terrestrial ecology

The Terrestrial Ecology Assessment Report provides a comprehensive assessment of the terrestrial ecological values along the indicative alignment and within the proposed designation.

The Terrestrial Ecology Assessment Report identifies, describes and maps these values and assesses the potential or known effects of the Project, both during construction and operation. The Report also presents recommendations for mitigation and management to inform the development of conditions to minimise or avoid potential and known effects.

A detailed description of the existing terrestrial environment in the Project area and the methodology used for assessing effects are provided in the Terrestrial Ecology Assessment Report. The following is a summary of the issues and potential effects identified in the Report. This summary and the Report subsequently inform the recommended mitigation contained in Section 28 and will inform the Project conditions.

14.1 Methodology

The Terrestrial Ecology team undertook desktop investigations, literature reviews and visual site assessments to identify constraints and potential issues during initial scoping assessment phases of the Project within the proposed designation boundary. Adjustments to the alignment occurred during that assessment process, which further reduce the Project's ecological impact by avoiding ecologically valuable sites. These sites include Pohuehue Scenic Reserve, three sites of high ecological value at Sites 13, 14 and 15B, an area of native mistletoe at Schedewys Hill and an area of native forest containing an uncommon species of native orchid. Refer to Figure 4-12 and Figure 4-13 for the location of assessed terrestrial and wetland sites.

The Terrestrial Ecology team assessed areas of significant vegetation, flora, wetlands and protected wildlife by:

- Identifying both native forest and wetland sites within the Project area from aerial imagery using GIS and desktop research;
- Assessing sites using a walked transect method; and
- Recording canopy and understorey species at forested sites and key wetland species in wetland sites.

The Terrestrial Ecology team used specific survey methodologies for vegetation and flora, and for fauna, namely land snails, Hochstetter's frogs, reptiles, birds and bats. Field surveys included:

- Targeted or opportunistic snail searches at all terrestrial sites accessed. Surveys focussed on areas of leaf litter habitat preferred by land snails.
- Stream searches for Hochstetter's frogs in areas where potential frog habitat was identified.
- Visual searches of all identified sites to determine their potential to support native lizards. The specialists placed artificial lizard retreats throughout sites identified as potential habitat. Nocturnal visual encounter surveys and manual habitat searches were also undertaken.

- Observations of all native bird species using various habitats within the Project area during all terrestrial site visits (daytime and night time); and
- Acoustic Bat Monitors (ABMs) to detect long-tailed bats by recording ultrasound calls, created by bats navigating and feeding. The ABMs were recorded from sunset to sunrise at 25 locations for 5-17 consecutive nights.

Further details of the methodologies used for each and the locations where terrestrial and wetland site surveys were undertaken are provided in Section 3 of the Terrestrial Ecology Assessment Report.

14.2 Existing environment and survey results

The existing environment within the Project area, as it relates to terrestrial flora and fauna, is largely characterised by pine plantation. Forestry areas are present in the Hungry Creek, Schedewys Hill and Moirs Hill Road Sectors. Other land cover includes managed pasture and several smaller fragments of native secondary forest and scrub.

Within the proposed designation there is some 40ha of native vegetation of all classes, of which approximately 8.5 ha falls within the indicative alignment. There are few areas of mature forest within the alignment and wetlands are generally small and degraded through grazing by livestock.

Of the native vegetation that falls within the indicative alignment, an area of mature native forest between Wyllie Road and Perry Road (Site 15A) has the highest ecological value within the Project area for both flora and fauna diversity. Other areas of high ecological value within the proposed designation are avoided by the indicative alignment.

The Terrestrial Ecology team found that pine plantations provide habitat for threatened long-tailed bats, and At Risk[91] North Island fernbird and New Zealand pipit. Other native fauna were associated with smaller fragments of native vegetation, particularly land snail and lizard populations. No native frogs were found within the Project area.

The presence and values of each type of flora and fauna surveyed within the Project area are summarised below. More detailed descriptions are provided in Section 4 of the Terrestrial Ecology Assessment Report.

14.2.1 Native forest

Native vegetation and flora is present at a number of locations within the Project area (refer to Figure 4-12 for locations of terrestrial sites). Overall, the Terrestrial Ecology team considered the botanical values of most of the sites surveyed to be low to moderate, with the exception of Sites 10, 12, 13, 14, 15 (A and B) (refer Figure 4-12).

Site 10 contains totara trees that host a species of mistletoe which is classified as Regionally Critical. Site 12 contains a native taraire orchid which is Naturally Uncommon.

[91] Terrestrial Ecology Assessment report Section 5.1.2

Sites 13 and 14 contain good quality native forest and are considered by the Terrestrial Ecology team to have high and moderate–high botanical values, respectively.

Site 15A contains old secondary forest including dense kauri forest in early maturity and riparian podocarp forest along the stream banks. Of note are a mature tree and a number of seedlings of kawaka, which is classified as Naturally Uncommon[92]. A detailed description of the vegetation and ecological values of this site is provided Section 4 of the Terrestrial Ecology Assessment Report.

Site 15B comprises good quality old-growth broad-leaved podocarp forest with a mature canopy, a diverse and well-developed understorey, and a range of vines and epiphytes. Some large old puriri trees are present.

The presence of the native grass short-hair plume *Dichelachne inaequiglumis* near the intersection of Pūhoi Road with SH1 at Site 5 is also of note. This species is classified as Naturally Uncommon[91].

14.2.2 Wetland vegetation

The saline wetland at Okahu Inlet is the largest of 13 small wetlands identified within the Project area, the majority of which are located within open pasture. Refer to Figure 4-13 for locations of assessed wetland vegetation sites.

Wetlands 10, 11 and 12 are fenced and have been subject to restoration planting within the last seven years, but contain a restricted range of vegetation. Wetland 6 is an artificially dammed pond. Overall, the botanical values of all wetland sites are low.

14.2.3 Land snails

During field surveys, the Terrestrial Ecology team identified two Rhytid snails (*A. dunniae)* at Site [redacted] Both snails were located approximately 25m from the existing edge of the larger forest fragment, within leaf litter debris dams alongside rotting logs.

Locals have reported the larger kauri snail, *Paraphanta busbyi busbyi,* to be present at Site [redacted] located at the [redacted] However, the Terrestrial Ecology team did not undertake a formal search at [redacted] as the indicative alignment has been shifted to avoid the site.

14.2.4 Hochstetter's frogs

DoC's Amphibian and Reptile Distribution Scheme (ARDS) database contains records of Hochstetter's frogs from within some areas of pine plantation north of Warkworth, outside the Project area[93]. The only records of native frogs between Pūhoi and Warkworth are outside the Project area, including frogs from two areas of native broadleaf forest at Moirs Hill.

The Terrestrial Ecology team identified 31 streams within the Project area that could contain potential Hochstetter's frog habitat. The Terrestrial Ecology team's field surveys revealed that most

[92] Terrestrial Ecology Assessment Report Section 4.1.2

[93] ibid 4.3.

of the streams identified did not contain suitable habitat for native frogs. Those streams were either completely dry during the period when assessments were undertaken or were severely degraded due to activity by feral pigs. Seven streams did provide potential habitat for frogs, although those areas of potential habitat were typically restricted to small, isolated waterfalls.

No native frogs were found during searches within the Project area. As such, the Terrestrial Ecology team did not consider effects on Hochstetter's frogs further.

14.2.5 Reptiles

The Terrestrial Ecology team's desktop investigations revealed two large areas of pine plantation and several smaller areas of native forest and scrubland that could be potential reptile habitats. The DoC's ARDS database listed previous records of copper skink, ornate skink, forest gecko, Auckland green gecko and Pacific gecko within 3 km of the Project area.

During field investigations the Terrestrial Ecology team identified copper skinks at Sites [redacted] (refer to Figure 4-12), which they consider to represent populations in these locations. Forest geckos were identified at Sites [redacted] (refer to Figure 4-12).

Most sites dominated by native vegetation had few searchable materials, aside from leaf litter. Pine plantations provided ample searchable material and potential habitat along the edge of the pine and in clearings. However, no native lizards were identified by the Terrestrial Ecology team in the pine plantation areas.

14.2.6 Birds

Literature searches of terrestrial birds recorded from the wider area indicated that the use of the indicative alignment by At Risk or Threatened species is likely to be limited and intermittent[94]. The areas of the alignment likely to be used by these species consist of grazed pasture, young pines and cutover pine plantation.

A total of 38 terrestrial species have been recorded in the wider area surrounding the Project[94]. Those species consist of 16 endemic and native species, and 22 introduced species. Of those, the North Island kaka is considered Threatened while the NZ pipit and red-crowned parakeet are considered to be At Risk.

Kaka and parakeet are likely to be intermittent visitors to both the pine plantation and groves of remnant native vegetation within the Project area at times, though from the Terrestrial Ecology teamdid not record any during their field surveys. They recorded a single NZ pipit during field surveys at a clearing in the pine plantation at Site 12. Pipit are likely to be more prevalent in more open habitat types along the coastal strip to the east between Pūhoi and Warkworth.

Results of the bird species recorded during field assessments are provided in Table 14-1 below.

[94] Refer to Section 4.5.1 of the Terrestrial Ecology Assessment Report

Common name	Scientific name	Site																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	33
Fantail	*Rhipidura fuliginosa placabilis*		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Grey warbler	*Gerygone igata*		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Silvereye	*Zosterops lateralis lateralis*		✓	✓	✓	✓			✓	✓			✓	✓	✓	✓	✓	✓
NI tomtit	*Petroica macrocephala toitoi*											✓	✓					
NI pipit *	*Anthus novaeseelandiae novaeseelandiae*												✓					
Tui	*Prosthemadera novaeseelandiae novaeseelandiae*		✓		✓				✓					✓	✓	✓	✓	✓
Bellbird x	*Anthornis melanura melanura*												✓					
Kereru	*Hemiphaga novaeseelandiae*						✓		✓					✓	✓	✓	✓	
Morepork	*Ninox novaeseelandiae novaeseelandiae*						✓		✓						✓	✓		
Harrier	*Circus approximans*		✓	✓	✓	✓		✓		✓	✓			✓	✓	✓	✓	✓
Shining cuckoo	*Chrysococcyx lucidus lucidus*					✓	✓		✓				✓	✓	✓	✓		
Kingfisher	*Todiramphus sanctus vagans*		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Welcome swallow	*Hirundo tahitica neoxena*		✓	✓	✓	✓					✓				✓		✓	
Spur-winged plover	*Vanellus miles novaehollandiae*										✓				✓	✓	✓	✓
Pukeko	*Porphyrio melanotus*		✓	✓	✓	✓								✓			✓	

Common name	Scientific name	Site																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	33
Paradise shelduck	*Tardorna variegata*		✓													✓	✓	✓
White faced heron	*Ardea novaehollandiae*		✓		✓						✓							
Pied shag *** x	*Phalacrocorax varius varius*					✓							✓					
Banded rail **	*Gallirallus philipensis assimilus*		✓															
NI fernbird *	*Bowdleria punctata vealeae*							✓										

Threat Classification (Miskelly *et al.* 2008)

* At Risk-declining

** At Risk-naturally uncommon

*** Threatened-Nationally vulnerable

x Species observed at 101 Moir Hill Road (G. Tewsley, 25.11.2010)

Table 14-1: Native terrestrial bird species recorded

Three of the wetland species identified by the Terrestrial Ecology team in the relevant literature as occurring in the wider area are considered to be At Risk in New Zealand, namely marsh crake, spotless crake and fernbird.[95] The Terrestrial Ecology Team did not identify crakes from field surveys.

They did observe fernbird at Site 7 at the southern end of the pine plantation, and in regenerating scrub along the ridgeline at Cook Road.

A total of 22 aquatic species have been recorded in the wider area.[94] Five of these species are classified as Threatened, including Caspian tern, grey duck, NZ dabchick, pied shag and red-billed gull. Six are At Risk and the remaining species are Not Threatened.

The most common aquatic and estuarine birds that the Terrestrial Ecology team surveyed along the route were mallards. They recorded pied shags roosting on a dead tree upstream of the SH1 bridge at the Pūhoi intersection (Site 5). The most notable record was of banded rail in the Okahu Inlet habitat, where one individual was observed crossing Billing Road. Footprints were common in the lower half of the Okahu Inlet channel east of the alignment. Despite banded rail not being previously recorded in that area, given the habitat type available, banded rail are expected by the Terrestrial Ecology team to be frequent throughout the Pūhoi River estuarine area.

14.2.7 Bats

Some habitats within the Auckland Region are known to support populations of the threatened long-tailed bat *Chalinolobus tuberculatus*. Historic records indicate that long-tailed bats have occurred around the southern Kaipara Harbour. There is one 1984 record from a bush patch on Wyllie Road within the Project Area.[96] Long-tailed bats were recently recorded north of Auckland at Riverhead Forest and near Pūhoi.[97]

Surveys undertaken by the Project terrestrial ecology team using Automatic Bat Monitoring boxes (ABMs). Long-tailed bats were detected by them at eight locations from Schedewys Hill to the southern portion of the Perry Road Sector. Habitat in these Sectors comprised several hundred hectares of medium-sized plantation pine and several smaller remnants of native forest.

14.3 Effects on terrestrial ecology

The effects of the Project on terrestrial ecology relate to direct and indirect loss of vegetation, food sources and habitat for a range of terrestrial fauna, including land snails, reptiles, birds and long-tailed bats.

14.3.1 Native vegetation and flora

The actual and potential effects of the Project on vegetation and flora are as follows:

- Site 3: Approximately 0.5ha on the western edge of the area will be affected by cut and fill. The vegetation in this part of the stand has generally low botanical values. The

[95] ibid 4.5.2

[96] ibid 4.6

[97] ibid 4.6

vegetation affected by the indicative alignment is not significant. Edge effects will be negligible and any minor changes to the surface hydrology will not affect the rest of the vegetation. The Okahu Creek Scenic Reserve which lies within the proposed designation will remain unaffected except for the possible loss of up to 150m² in the extreme north western corner where the vegetation is similar to that described in Section 14.2.1 above.

- Site 4: Approximately 0.2ha on the edge of the ridge spur will be lost to fill activities. The botanical values in this part of the stand are generally low apart from several medium sized kauri trees that may be lost. A very small area at the edge of the secondary kauri forest will be affected. The main kauri stand is further up the ridge and will not be significantly affected either by edge effects or any minor hydrological change brought about by the fill batter.

- Site 5: Native vegetation under the bridges in this location may potentially be trimmed to reduce its height and it will also be subject to a rain shadow effect given the low height of the bridges and their width. Because of the north-south orientation of the carriageway the amount of vegetation underneath that is in total shade will be minimised. The effects on the vegetation at Site 5 will be minor, provided that the short-hair plume grass is removed and conserved for restoration planting, as the total area affected is only expected to be approximately 900m².

- Site 6: Only about half of the dozen or so larger totara trees at this site will be affected by construction and cut and fill activities. Effects on vegetation at this site are considered by the Terrestrial Ecology team to be minor and vegetation at the nearby Pūhoi Pioneers Memorial Park will not be directly affected by the construction activities.

- Site 8: Effects on vegetation at this site are expected by the Terrestrial Ecology team to be negligible. The potential loss of one or two of the large puriri trees scattered throughout this site would create a minor effect. However, it is unlikely that all of these trees would be lost as they are quite widely scattered.

- Site 10A: A large totara tree which is host to at least 12 green mistletoe plants and another small tree with two plants will be avoided by a construction access track planned for this area. The species is classed as Regionally Critical as there are a limited number of small populations within the Auckland Region. There will be no effects on the mistletoe at this site.

- Site 13: The alignment passes to the west of this site. Therefore, any effects in this location are likely to be negligible. A construction access track planned for this area has been designed to avoid a small area of native forest that is known to contain taraire orchid (*Danhatchia australis*).

- Sites 14A and 14B: Only parts of these sites are inside the Project area and the indicative alignment itself avoids them, passing to the west on a viaduct structure. These sites are unlikely to be affected by road construction.

- Site 15A: A total of approximately 1.6ha (6.6%) of the forest will be lost to the indicative alignment and associated cut and fill at this site.

Approximately 0.4 ha of the kauri forest on the lower part of the ridge will be affected by the construction of the viaduct and some minor cuts on the north eastern edge of the forest around the viaduct abutment. Diversion of the Mahurangi River Right Branch will affect the south eastern edge of the forest block which is riparian forest.

Although the kauri forest here is secondary forest it is of significant age and maturity. The Terrestrial Ecology team did not see kauri of similar size and density to those found within the Project area in other parts of the same forest remnant where broad-leaved species such as taraire, puriri and rewarewa are dominant, nor at other locations along Wyllie Road. They also saw no signs of kauri dieback disease in any of the kauri in the general area.

Most of the best quality kauri forest at Site 15A occupies the lower slopes of a southeast sloping ridge on the north-eastern edge of the forest patch. The indicative alignment passes to the east of this area and will avoid the bulk of the stand. Kauri are sensitive to soil moisture, and although they generally occupy ridge crests and other well-drained sites, they are shallow-rooted and may be potentially more susceptible to drought if the cut exerts a drainage effect on the ridge above. However, the scale of the cut planned in the vicinity of the northern abutment of the viaduct will not result in significant drainage effects.

Kawaka (Naturally Uncommon) seedlings were observed within Site 15A and mature kawaka trees are present in the Woodcocks Kawaka Park Scenic Reserve only 4km away. The indicative alignment avoids this tree, although some seedlings may be located within the alignment's path.

Vegetation located underneath the viaduct will, as a minimum, be trimmed to reduce its height and in reality will probably be lost to the construction zone. Kauri and some podocarps such as rimu will not tolerate trimming and will be lost. Since the viaduct is located at the base of a long ridge and valley system this vegetation may not be unduly affected by rain shadow effects because surface water will tend to flow under the viaduct from the land above.

There will be some edge effects since new forest edges will be created on each side of the road, along the cut face associated with the viaduct and abutment on the western side and with the stream diversion. However, these effects will be minimal as the indicative alignment passes along the eastern edge of the main forest block, which will currently be subject to some edge effects.

The key effects of the Project on the botanical values of site 15A are:

- Loss of an area of approximately 0.44ha of kauri forest estimated to be 75-100 years old, containing some trees of medium size;
- Loss of a total area of 1.6ha of mature secondary forest;
- Potential for weed invasion along the newly created forest edges; and
- The potential for kauri dieback disease to be introduced to and/or invade the site.

Although these effects are significant for this site, the Terrestrial Ecology team considers that the effects can be adequately mitigated and compensated for through the implementation of the recommended mitigation measures and replacement planting. Refer to Section 6.1.2 of the Terrestrial Ecology Assessment Report for specific recommendations for managing effects at Site 15A and other forest sites.

- Site15B: Significant effects on this forest have been avoided during the development of the Project indicative alignment. The forest will be conserved intact and mature native trees including large, old puriri trees will be preserved.

- Site 16: The indicative alignment passes over only a small area of native forest conservatively estimated to be no more than 0.3ha. Trees under the bridge structure located in this site will have their height reduced to less than 6m and rain shadow effects from the bridge above will affect the vegetation underneath. However, the amount of vegetation underneath that is in total shade will be minimised due to the north-south orientation of the bridge. A small area may be required for the construction of a bridge pylon, although this is more likely to be placed in the adjacent pasture or an area of exotic trees.

  The indicative alignment lands just to the north of this site and a small cut on the western side may affect a few trees on the edge of the site. The effects at this site are anticipated by the Team to be less than minor since only a small proportion of the riparian forest is expected to be affected with the result that only a few trees will be lost, most of which are expected to be second growth totara trees.

- Site 33: The Terrestrial Ecology team considers the loss of 1.5ha of common vegetation at this site to constitute a negligible effect given the low diversity and botanical values.

14.3.2 Wetland vegetation and flora

There will be some temporary disturbance among the saline vegetation on the northern edge of the Okahu Inlet estuarine area during construction. The construction of bridge piers and a temporary access road will result in the loss of mangroves and other saltmarsh vegetation. The saline vegetation at the construction site on the north shore of the estuary is sparse because the area is shaded by several large old pine trees. Loss of saline vegetation will be minimal and effects at this site will be negligible.

Wetland 2 (refer to Figure 4-13) will be partially lost and it may lose all or part of its water source. It is in any case very small and its botanical values are low due to stock grazing and weed impacts.

Wetlands 3, 4, 6, 10 and 12 will be lost. Wetlands 3, 4 and 6 are all small with low botanical values and their loss will have negligible effects on wetland values in the Pūhoi catchment. Wetlands 10 and 12 are wetland restoration plantings of recent origin. Their botanical values are low. Wetland 12 is protected by a QEII Open Space Covenant.

Wetland 9 may be affected by minor changes in hydrology, along with Wetland 11, which will have some works occurring in the uppermost part. Most of Wetland 11 is outside the indicative

alignment. Overall, the Project will have negligible effect on the wetland values of the Pūhoi and Mahurangi catchments.

Wetlands 7, 8 and 13 will not be affected by the Project. However, they lie within the proposed designation area and may provide opportunities for restoration to mitigate for other vegetation and habitat loss effects of the Project.

14.3.3 Terrestrial fauna

(a) Effects on native land snails

The clearance of vegetation and habitat features may result in significant adverse effects to native land snails in the small area of native forest affected by the Project at Site [redacted] Removal of forest floor substrate may cause desiccation and mortality to resident snails and their invertebrate food source. The potential displacement of some snails into remaining areas of the forest fragment may result in failed attempts to re-establish due to competitive exclusion by resident wildlife communities already present in those areas.

The habitat types of the Rhytid snail (*A. dunniae*) are particularly vulnerable to edge effects, including increased light, wind and temperature levels. These effects could adversely change the microclimates that the Rhytid snails require, having a significant desiccating impact on Rhytid snail habitat. Invasion of fragment edges by weed plants could also significantly alter the microclimates and food sources that the snails rely on. Recommendations for reducing the impacts of new forest edges are included in Section 14.4 of this AEE.

(b) Effects on reptiles

The effects of the Project on copper skinks and forest geckos relate to habitat clearance, disturbance effects and proximity to the new road.

The clearance of vegetation and habitat features during construction and pre-works activities would result in significant, direct adverse effects to native lizard populations at Sites [redacted] Removal of debris and shelter structures, via dragging or rolling and burying shelter structures under soil, may cause injury or mortality to resident reptile communities at those sites. The consequent displacement of lizards into surrounding areas may result in failed attempts by lizards to establish, due to competitive exclusion by resident wildlife communities already present in adjacent habitat.

The potential effects of habitat clearance on reptiles at sites within the Project area are summarised in Table 14-2.

Table 14-2: Potential effects of habitat clearance on reptiles

Site	Issue	Potential scale of effect	Explanation
■	Copper skink population	Low	Copper skink population – small area affected
■	Forest gecko population	Moderate	Forest geckos At Risk, small area affected
■	Copper skink and forest gecko populations	High	Two species present including At Risk forest geckos. Large area affected.
■	Copper skink population	Low	Site avoided by indicative alignment
■	Forest gecko	Moderate	Forest geckos At Risk, small area of habitat affected.

The Terrestrial Ecology team does not consider potential effects associated with dust to be an issue during construction or operation of the Project. Noise and vibration are likely to be short-term, non-lethal stressors to any lizards in adjacent habitat, and are not considered by the specialists as significant for either Project construction or operation.

14.3.4 Effects on birds

The Project will result in a loss of terrestrial and freshwater habitat for birds. Potential adverse effects on avifauna include:

- the clearance of isolated food trees;
- clearance of areas of vegetation used for feeding, roosting and nesting;
- direct mortality of eggs and chicks if clearance occurs during the breeding season;
- habitat reduction and further fragmentation;
- general disturbance effects such as light and noise;
- further edge effects together with sediment discharges during the construction phase; and
- stormwater discharges during the operational phase.

The most affected avifauna consists of common native and introduced species, which will experience minor effects. However, on a cumulative basis there will be a significant loss of vegetation that provides feeding and nesting habitat, including significant native food trees. Such losses will occur particularly at Sites 8 and 15 where kereru were identified by the Terrestrial Ecology team within the proposed designation. Some birds, including kereru, will commute long distances to exploit productive food trees. Therefore, the route has the potential to affect birds well beyond the Project area. Approximately 8.5ha of native vegetation will be cleared, which may have a significant effect on (mostly common) native birds with respect to feeding and nesting habitat.

Effects of loss of feeding and roosting habitat on widespread species such as welcome swallow and pukeko, which are known to use wetlands, are considered by the Terrestrial Ecology team to be minor.

Estuarine areas where the Team recorded aquatic birds will be traversed via viaducts. Therefore, they anticipate that the effects on aquatic birds will be minor.

Culverting will create a reduction in stream habitat that will impact locally upon common and widespread birds such as pukeko, mallard and kingfisher. The Terrestrial Ecology team considers that effects on these species are minor due to the prevalence and distribution of these bird species.

14.3.5 Effects on bats

For Nationally Vulnerable long-tailed bats, the construction and operation of the Project could cause direct mortality, loss of habitat, and creation of an impassable barrier due to noise and lighting associated with the operation of the motorway, preventing access to resources on the other side of the road. These effects may change in scale, depending on the time of year when construction is undertaken.

Direct mortality through habitat clearance may have significant effects on long-tailed bat populations by crushing individuals during tree felling, causing lethal levels of stress, or forcing them out of roosts and exposing them to predators. Felling of roost trees could be particularly significant if a large proportion of a colony is killed. These effects would be greatest between November and mid-February, when females are pregnant or when communal roosts contain non-flying juveniles. Bats are also highly vulnerable during the period from June through to the end of August, when their physiological activity reduces.

Bat habitats within pine plantations are likely to change over time as pines mature and are felled during normal harvest practices. Colonies will move into areas as they become suitable. Depending on construction timeframes, the location of communal roosts and distribution of bats within the Project area may change, and the areas where bats were detected will mature enough to support roosting populations.

The removal of habitat for construction will result in some loss of commuting, foraging, and roosting areas. Overall, the Team considers that the loss of habitat within the Project Area will have a minor effect on long-tailed bats because the construction and operation of the Project will affect only a small proportion of the pine plantation in the area. At the time of the Team's survey in 2009 none of the pines within the proposed designation were considered by the Team to be suitable for communal roosting, though this may change with plantation maturity and Project construction timing. Long-tailed bat populations occur in other areas of plantation forest in the North Island[98] and would have survived through or recolonised those areas following multiple harvest rotations.

Noise and light pollution (vehicle, construction and limited motorway lighting) from the construction and operation of the Project may also affect adjacent habitats. However, extensive planting of native vegetation and retention and protection of large pines within the proposed designation boundary would reduce this effect during operation and in the long-term.

Long-tailed bats have been observed foraging over streetlights[99], so it is possible that the lit sections of the motorway would create foraging habitats for them. Recent studies have also

[98] ibid Section 5.6.2

[99] ibid 5.6.2

recorded bats moving along and over well-lit road corridors[100]. The motorway will remain unlit except at the Pūhoi Interchange and northern tie-in, so the potential effects of lighting, both in reducing habitat and creating an impassable barrier, are largely avoided and otherwise considered by the Terrestrial Ecology team to be minor.

14.3.6 Summary of effects

The proposed designation contains some 40ha of native forest vegetation of which approximately 8.5ha lies within the indicative alignment.

The effects of the Project on vegetation include:

- direct loss, edge effects;
- changes in soil moisture related to surface hydrological changes may affect some wetland sites;
- shading and rain shadow effects of bridges and viaducts; and
- excess dust deposition and reduction in the height of vegetation under bridges and viaducts.

The Terrestrial Ecology team assess the overall effects of the Project on native vegetation to be minor except for those at Site 15A where the effect on mature secondary forest is considered to be significant. The Terrestrial Ecology team considers that these effects can be adequately mitigated and compensated for as described in Section 6 of the Terrestrial Ecology Assessment Report.

Wetlands are generally small with low botanical values. Although five such sites will be lost, the overall effects are considered by the Team to be minor. Some wetlands within the proposed designation are suitable for restoration as part of the overall mitigation planting plan. Such restoration would lead to benefits through enhancing the ecological functioning of the existing wetlands.

Clearance of vegetation would result in the loss of habitat for terrestrial fauna. The Terrestrial Ecology team considers that the Project will have potentially significant effects on the presence of At Risk native land snails (*A. dunniae*), two species of native lizard, At Risk fernbirds and Nationally Vulnerable long-tailed bats.[101]

For most species, these effects are greatest at the vegetation clearance phase. For long-tailed bats and common birds, the Terrestrial Ecology team considers the effects of the Project to be longer-term as well, particularly as replanted vegetation will take time to mature to provide feeding and roosting habitat.

Overall, the Terrestrial Ecology team considered that the species-specific recommendations will adequately minimise and mitigate the construction and operational effects of the Project. The Project affords the opportunity to plant areas of higher quality native vegetation for landscaping purposes within the designation. Wetland planting with native species will also be undertaken for the permanent stormwater treatment devices (wetlands and stream diversions). This would greatly

[100] ibid 5.6.2

[101] ibid Section 5

exceed the area of native vegetation that will be lost and plantings would also increase habitat connectivity in the long-term, which would benefit all terrestrial fauna.

14.4 Recommendations and mitigation

Section 6 of the Terrestrial Ecology Assessment Report provides a number of recommendations to avoid, remedy and mitigate effects on vegetation, flora and fauna. These recommendations are set out below.

With respect to vegetation and flora, the Terrestrial Ecology team's recommendations include protocols regarding sourcing of plants, management of kauri die back disease, protection of remnant vegetation, dust suppression measures in certain areas, mitigation replanting and additional site-specific recommendations. The method for replacement planting of key forest canopy species such as kauri that will be lost through vegetation clearance is included in Appendix C of the Terrestrial Ecology Assessment Report. The method involves a calculation of the lost area of trees and their growth rates to determine the number of replacement trees required to be planted. The calculation aims to achieve full replacement of the lost canopy trees within 20 years, and the terrestrial specialists predict significant biodiversity benefits from the replanting over the longer term.

It is my opinion that the loss of vegetation from Site 15A should first be mitigated through stream riparian restoration and wider planting initiatives. My concern with the calculation proposed by the Terrestrial Ecology team is firstly in relation to the significance of the loss. I accept that the removal of the kauri and 1.6 ha of native forest is assessed by the Team as being significant. However the loss of the kauri from the Rodney Ecological District is assessed as being 0.07%, which in my opinion is not significant. Secondly, in my opinion, the application of a basal area calculation may end up misrepresenting the overall effect, and needs to be considered in the wider context of the landscaping and riparian restoration. It is my opinion that these plantings need to be integrated into the ULDF to avoid the kauri and other mitigation planting appearing unnatural in the environment.

With regard to wetland vegetation, Wetlands 7, 8 and 9 (refer to the Terrestrial Ecology Assessment Report for locations) may present opportunities for restoration planting as they are wholly or partially within the proposed designation.

Incidental deposition of spoil and spill of silt into wetlands outside the alignment should be avoided, as should the introduction of exotic weeds into wetland environments. I support the recommendations relating to management and restoration of Wetlands 7, 8 and 9.

With respect to fauna, land snails (*A. dunniae*) and their leaf litter habitat should be relocated to an area of suitable habitat inside the designation if possible.

Relocation of copper skinks and forest geckos to protected, suitable habitat is also recommended by the Terrestrial Ecology team. Recommended procedures for the capture and relocation of these species are included in Section 6 of the Terrestrial Ecology Assessment Report and reflect standard best practice.

Replanting throughout the Project area should include native fruit trees and species that provide nesting habitat for native forest birds. Suitable species include puriri, kahikatea, taraire, totara, karaka and rimu. Mitigation planting should be undertaken on a functional, ecological basis and I recommend that this be fully incorporated into the ULDF to ensure that the overall integration of such species with the wider landscaping proposals. It is also recommended by the Terrestrial Ecology team that replanted areas be removed from the carriageway as far as practicable within the Project area to reduce the risk of mortality to birds as a result of collision with vehicles.

Clearance of native vegetation should be undertaken outside the bird breeding season (September through to the end of December) to avoid direct mortality of eggs and chicks.

The measures recommended by the Terrestrial Ecology team are practical, on site, methods to avoid potential demise of snails, lizards and bird species. I support them and recommend a condition to ensure site clearance is undertaken immediately prior to works commencing.

The Terrestrial Ecology Assessment Report also recommends that fernbirds be relocated to protected habitat in accordance with the requirements of a Wildlife Act translocation authority.

The Report also recommends a number of measures to manage potential effects on long-tailed bats during construction. Recommendations for managing effects on bats include:

- A Bat Management Plan should be prepared prior to construction, to reassess habitat use by bats closer to construction time. The Plan should determine appropriate measures to avoid or minimise effects on bats with respect to their habitat use at the time.
- Native vegetation that may provide quality roosting habitat for bats at Sites 13, 14 and 15 should be avoided where practicable;
- Where vegetation is of a size to support roosting clearance of vegetation from Hungry Creek to the southern part of the Perry Road Sector should be undertaken during September and October and/or from mid-February to May to minimise the risk of direct mortality to bats;
- Areas of large pine trees within plantation habitats should be retained on each side of the alignment and outside of cut and fill areas, to provide roosting and foraging habitat.

In addition to these recommendations, the Project offers potential opportunities to enhance roosting and foraging habitats for bats in the long-term and I support the integrating of these species into the ULDF.

15. Construction noise

A Construction Noise Assessment Report has been prepared for the Project, which provides an assessment of noise effects relating to the construction phase of the Project. The Report does not include an assessment of operational noise effects, which are addressed in a separate report and summarised in Section 24 of this AEE.

A detailed description of the assessment criteria and methodology, and options for managing and mitigating construction noise effects is provided in the Construction Noise Assessment Report. The following is a summary of the issues and potential effects identified in that Report.

This summary and the Report subsequently inform the recommended mitigation contained in Section 28 and will inform the Project conditions.

15.1 Noise assessment criteria

New Zealand Standard NZS 6803:1999 “Acoustics – Construction Noise” is the most commonly used standard and is considered by the Noise team to be the most appropriate standard on which to base an assessment of construction noise effects for this Project. The Noise team reviewed all relevant documentation, including the Standard, the District Plan and ARP:C provisions in relation to construction noise. Both the District Plan and the ARP:C references a version of the Standard.

Application of NZS 6803:1999 will achieve equitable treatment of all affected parties and enables a reasonable balance between appropriate noise criteria and the need to progress construction. Where full compliance with the criteria is not practicable, alternative measures are to be employed to deal with the potential exceedance.

The Noise team recommends appropriate criteria for general construction noise and noise from blasting, based on the Standard.

The recommended noise criteria of NZS 6803:1999 are summarised in Table 15-1 and Table 15-2. Because construction will exceed 20 weeks’ duration, the Noise team considers the “long-term duration” criteria to be most appropriate for this Project, in accordance with Section 7.2.1 of NZS 6803:1999.

Table 15-1: Recommended upper limits for construction noise received in residential zones and dwellings in rural areas[102]

Time of week	Time period	Long-term duration	
		dB $L_{Aeq(T)}$*	dB L_{Amax}
Weekdays	0630-0730	55	75
	0730-1800	70	85
	1800-2000	65	80
	2000-0630	45	75
Saturdays	0630-0730	45	75
	0730-1800	70	85
	1800-2000	45	75
	2000-0630	45	75
Sundays and Public Holidays	0630-0730	45	75
	0730-1800	55	85
	1800-2000	45	75
	2000-0630	45	75

Note: shading shows the low noise times in accordance with NZS 6803:1999.

Table 15-2: Recommended upper limits for construction noise received in industrial or commercial areas for all days of the year[103]

Time period	Long-term duration
All days of the year	$L_{Aeq(T)}$ *
0730-1800	70
1800-0730	75

* T means a representative assessment duration between 10 and 60 minutes.

For residential areas and rural dwellings, the Standard allows higher noise criteria during daytime hours so that construction activity can take place. For Sundays and Public holidays, lower noise

[102] Refer to Section 3.1 of the Construction Noise Assessment Report

[103] ibid

criteria are set to provide days of rest from construction noise. Similarly, night-time criteria are low and only allow very quiet operations to be carried out.

For commercial and industrial areas, less stringent noise criteria are set out during night-time when it is less likely that persons or business activities would be affected by construction noise. In addition, criteria for daytime and night-time are consistently high, seven days per week, as businesses are less noise sensitive than residences.

The Standard does not anticipate that full compliance will necessarily be achieved at all times and at all receivers. It focuses on the implementation of the best practicable option (BPO) for construction noise management and mitigation rather than requiring that the criteria be achieved.

15.1.1 Blasting noise

Noise from explosives is normally described as 'airblast' or blasting noise. Blasting noise is the pressure wave that radiates out from the blasting area, caused by ground vibration, air movement around the rock face being blasted and air pressure venting from the holes that are drilled in the face. There is often sub-audible, low-frequency noise associated with blasting, which can result in the rattling of structures even when the blast is not clearly audible outdoors.

Blasting noise can cause annoyance or discomfort at low levels, and potentially damage structures or result in personal injury at very high levels. The NZS 6803 limit of 120dBC (refer to glossary at Appendix B of this AEE) is a human comfort noise limit related to annoyance and therefore a conservative limit at which no building damage will occur.

15.2 Existing environment

The ambient noise environment in the vicinity of most of the Project is relatively low due to the absence of major local roads and industry. Exceptions are the northern and southern connections of the Project with the existing SH1, where traffic on SH1 affects ambient noise levels at Pūhoi and Warkworth. Measured noise levels ranged from 40dB L_{Aeq} in rural areas to 73dB L_{Aeq} adjacent to SH1. Noise levels at the lower end represent positions away from the existing roading network, and levels at the higher end represent positions close to the existing SH1.

15.3 Assessment methodology

The Noise team's assessment methodology for determining construction noise effects takes into account issues such as:

- Duration and variability of construction activities, eg through staging and equipment moving along the alignment;
- Change in noise level. For construction, typically the change in noise level is greater than would be acceptable for ongoing operational noise;
- Potential adverse effects, which need to be balanced against development needs; and
- Potential for exceedance of construction noise criteria and what this means in the context of temporary activities.

The Construction Noise assessment is based on a construction methodology (refer to Section 6 of this AEE) developed to provide a feasible scenario under which the Project could be constructed. Details regarding staging, duration of works and construction activities are therefore indicative only and are subject to change following the appointment of a construction contractor.

15.4 Actual and potential noise effects

In terms of the RMA, noise effects can be described in relation to the potential noise level change that will be experienced by a person. Using the noise level change as the primary basis of an effects assessment is especially appropriate for ongoing noise such as traffic or industrial activities.

Construction is inherently noisy and generally results in a large noise level increase over existing levels, but for limited periods[104]. This increase in noise level occurs particularly for existing low noise environments, where construction would introduce not only a new noise source, but may be the dominant noise source for the duration of construction.

The ambient noise levels in proximity to the indicative alignment are generally low. Therefore, even when achieving compliance with the daytime construction noise criteria of NZS 6803, there will be a significant increase in overall noise level during the construction phase. This increase is an expected and inevitable result of large construction projects in the vicinity of receivers, and is anticipated by the Standard.

15.4.1 Construction noise predictions

There are few dwellings in close proximity to the Project and these are mainly concentrated in and around Pūhoi and in the rural/residential area to the west of Warkworth. Table 15-3 summarises the key construction noise issues related to the potential construction activities that may occur in specific locations within the Project area.

Table 15-3: Key construction noise issues

Sector	Noise generating activities	Closest receiver areas
Pūhoi Sector	• Significant earthworks • Rock breaking and blasting • Viaduct construction at Billings Road and Pūhoi Road • Road construction and sealing • Construction staging areas near Okahu Creek Viaduct and Pūhoi River Viaduct • Ramp construction works south of Pūhoi • Spoil areas	Billings Road, Pūhoi Close, Pūhoi Road, SH1

[104] Note that although the construction programme could be 5 years, localised noise effects will be of much shorter duration.

Sector	Noise generating activities	Closest receiver areas
Hungry Creek Sector	• Significant earthworks • Rock breaking and blasting • Viaduct construction at Hikauae and Schedewys Hill • Road construction and sealing • Construction yards and construction staging area near Schedewys Hill Viaduct • Spoil areas	Pūhoi Close, SH1
Schedewys Hill Sector	• Earthworks • Rock breaking and blasting • Moirs Hill Road realignment • Road construction and sealing • Construction yards • Spoil areas	Moirs Hill Road
Moirs Hill Road Sector	• Significant earthworks • Rock breaking and blasting • Road construction and sealing • Construction yards • Spoil areas	n/a
Perry Road Sector	• Significant earthworks • Rock breaking and blasting • Viaduct construction at Perry Road • Wyllie Road alternate property access • Road construction and sealing • Construction yards and construction staging areas near Perry Road Viaduct and Mahurangi River Viaduct • Possible precast yard at Woodcocks Road • Spoil areas	Perry Road, Wyllie Road, Woodcocks Road
Carran Road Sector	• Significant earthworks • Viaduct construction at Woodcocks Road • Roundabout construction at Warkworth • Road construction and sealing • Construction yard • Spoil areas	Carran Road, Woodcocks Road, Viv Davie-Martin Drive, SH1

A list of likely equipment was compiled based on previous experience with other large roading projects throughout New Zealand. The Noise team used this list to predict construction noise levels and identify areas within the Project area where noise criteria may be exceeded. Activity sound power levels and compliance distances for specific construction activities are provided in Table 5 of the Construction Noise Assessment Report.

The predicted noise levels are conservative and do not take into account any topographical shielding. Therefore, the predicted noise levels and compliance distances are applicable to a worst case scenario.

The Noise team identified several receivers in proximity to the alignment where the noise criteria may be exceeded using the activity sound power levels and compliance distances. These locations may receive noise levels above the daytime noise criteria, generated as a result of bulk earthworks, ground improvement, entrainment or detention pond excavation, haul roads, spoil disposal and blasting activities. The areas of potential noise criteria exceedance of anticipated construction activities along the indicative alignment are shown in Drawings CN-101 to CN-117.

Table 15-4 shows the risk of exceeding the daytime noise criteria at receivers close in proximity to the Project.

Table 15-4: Risk of exceeding daytime noise criteria (70 dB L_{Aeq})

Activity	Activity Sound Power Level	Risk distances	Sector	Potential addresses (depending on alignment within designation)
Bulk earthworks Ground improvement Retainment pond excavation Haul road Spoil disposal	118	High: <65m Medium: 65 – 90m Low: >90m	Pūhoi Sector Schedewys Hill Sector Perry Road Sector Carran Road Sector	M: 24, 26 Billings Road, 466 SH1 M: 187 Moirs Hill Road M: 70, 75, 161, 217, 221 Wyllie Road M: 63, 102, 104 SH1
Rock breaking	120	High: <75m Medium: 75 – 110m Low: >110m	N/A	L: No receivers within 110m of breaking
Piling / foundations	110	High: <30m Medium: 30 – 40m Low: >40m	N/A	L: No receivers within 40m of works
Viaduct construction	110	High: <30m Medium: 30 – 40m Low: >40m	N/A	L: No receivers within 40m of works
Pavement construction	110	High: <30m Medium: 30 – 40m Low: >40m	N/A	L: No receivers within 40m of works

Activity	Activity Sound Power Level	Risk distances	Sector	Potential addresses (depending on alignment within designation)
Staging area / Construction yard	100	High: <10m Medium: 10 – 30m Low: >30m	N/A	L: No receivers within 30m of sites
Pre-cast yard	112	High: <50m Medium: 50 – 70m Low: >70m	N/A	L: No receivers within 50m of site
Blasting	12 kg charge weight assumed	High: <160m Medium: 160 – 200m Low: >200m	Hungry Creek Sector Schedewys Hill Sector Perry Road Sector	H: 20 Pūhoi Close M: 446 SH1; 5, 6 Hungry Creek Road M: 187 Moirs Hill Road M: 83, 97 Perry Road; 221 Wyllie Road

Note: this table also includes dwellings that may potentially be affected should the alignment move a likely distance towards the designation boundary.

Noise level predictions for all Sectors indicate that construction activities can be undertaken in compliance with the relevant daytime noise criteria outlined in NZS 6803; provided that appropriate mitigation and management measures are implemented (refer to Section 28 of this AEE). Mitigation measures may include using a lower charge weight for blasting in the vicinity of Pūhoi Village, where blasting noise could otherwise exceed the criteria.

A summary of construction noise for each Sector is included in Section 6 of the Construction Noise Assessment Report.

15.4.2 Night-time construction

Generally, Project construction activities will occur during daytime only, particularly in areas where receivers are located. However, some construction works may be undertaken during night-time.

Preparatory work may be undertaken in the construction yards and staging areas at night. These yards and areas do not contain particularly noisy operations, so the night-time construction noise criteria can be complied with (without mitigation) at dwellings that are 140m or more from the relevant yard. If yards are closer than 140m to a dwelling (eg in Billings Road and some dwellings at SH1), mitigation may involve solid site hoardings and placement of activities in the yard as far as possible from dwellings during night works.

Construction of the tie-ins with the existing SH1 at the southern and northern ends of the Project may also require night-time works so as to avoid disruption to traffic on SH1. Such works will be communicated with the potentially affected residents in the vicinity and mitigation implemented as required and practicable.

15.4.3 Construction traffic

Construction traffic will use the alignment as a haul road throughout construction, and this has been assessed as part of the earthworks activities. However, construction traffic will need to enter the alignment at various points along the alignment. Upgrades of existing roads and new access roads will need to be constructed, connecting the Project with the local road network and SH1. Particularly the construction yards will require access for materials to be delivered and stored at the yards before being distributed along the Project.

Most construction traffic cannot be distinguished from general traffic (eg freight, logging trucks). Therefore, the potential change in noise level from the inclusion of construction traffic on public roads is described in the Construction Noise Assessment Report and below, rather than the construction traffic per se.

The character and level of noise as a result of construction traffic will remain the same as existing noise levels for receivers in proximity to access routes for indicative staging areas, project offices and construction yards. The exceptions to this assessment are receivers near to access routes for indicative construction yards 7 and 8. Access to these yards would be via Moirs Hill Road.

Access to construction yard 7 would be immediately alongside two dwellings (99 and 101 Moirs Hill Road). The Noise team recommends that solid site hoardings of 2m height are erected between the access road and dwellings to reduce noise events of individual trucks.

Individual truck movements would be audible at 187 Moirs Hill Road, which is approximately 100m from the access to construction yard 8. However, the small increase in noise over existing levels is well within acceptable noise criteria.

A summary of construction traffic noise predictions for each of the construction yard accesses is provided in Section 6.9 of the Construction Noise Assessment Report. Overall, construction traffic effects relating to noise will be negligible to minor.

15.5 Overall construction noise effects

In general, construction activities can be undertaken in compliance with the daytime construction noise criteria without the need to implement mitigation measures beyond best practice general mitigation. Where night-time construction is required, mitigation such as scheduling, solid site hoardings, enclosure or similar common mitigation is predicted to generally achieve compliance with the relevant criteria. Such measures should be supported by early and on-going consultation with potentially affected communities.

Blasting will need to be undertaken at several sites along the alignment. While generally blasting can be undertaken in compliance with the relevant noise limit, there is one dwelling at 20 Pūhoi Close where the noise limit may be exceeded with the use of 12 kg blast charges. For this dwelling, we recommend that the blast charge is reduced to achieve lower noise levels. As general best practice, we recommend a regime of notification of residents and warning sirens prior to blasts and that no blasting is undertaken at night-time.

The Noise team evaluated anticipated construction traffic along the alignment, predicted construction traffic noise levels and assessed potential noise effects. Generally, before entering the designation, trucks will use existing roads such as SH1 and Woodcocks Road to reach the construction yard access roads. These roads carry comparatively large numbers of traffic, including trucks, each day. Construction trucks will be of the same character and at a lower level than existing traffic noise. Therefore, construction traffic noise effects will be negligible to minor.

15.5.1 Recommendations and mitigation

Even when complying with the construction noise criteria, noise levels will increase significantly for many of the affected dwellings, compared with the existing noise levels and will be evident to residents. The recommended noise criteria achieve a balance between the need for development to be progressed while avoiding adverse health and annoyance effects on residents.

We recommend the adoption of general noise management and mitigation measures throughout construction, such as considerate operating procedures on and off-site and appropriate communication with affected residents. Examples of on-site measures include training of personnel, maintenance of equipment, noise barriers and enclosures and considerate behaviour and use of equipment. Examples of off-site measures include public liaison and communication, temporary barriers, offers of resident relocation and noise level monitoring. In addition, targeted mitigation such as individual engagement with residents should be undertaken for ‘at risk’ receivers.

Any potential exceedances of the recommended criteria can be managed and mitigated through a Construction Noise and Vibration Management Plan (CNVMP), which would be developed during the OPW process (refer Section 1.9 above). The CNVMP would be formulated by the contractor following the detailed design phase to identify at risk receivers and mitigation proposed specifically for them. A CNVMP has the advantage of being a flexible tool that can be adjusted as construction progresses. Therefore, we considered it is the most appropriate instrument to respond in a proactive manner to any potential construction noise issue.

I consider it is appropriate that the designation conditions should include the Noise team’s recommended noise performance criteria and the requirement for a CNVMP to be produced prior to, and implemented and updated throughout, construction.

16. Heritage

A Heritage Assessment Report has been prepared for the Project. The Report provides an assessment of effects on historic heritage relating to the Project. It does not include an assessment of effects on cultural values, which is the subject of a separate report and is summarised in Section 25 of this AEE.

The historical context for the Project area and a detailed description of the archaeological and heritage sites identified are provided in the Heritage Assessment Report. The following is a summary of the issues and potential effects identified in the Heritage Assessment Report.

This summary and the Report subsequently inform the recommended mitigation contained in Section 28 and will inform the Project conditions.

16.1 Heritage sites

The heritage sites are identified in Section 4.1.10 above and are shown on Figure 4-4 and in each Sector on Figure 4-5 to 4-10.

16.1.1 Pūhoi Sector

There are 14 previously recorded heritage sites and one additional site recorded during field surveys for the Project within or close to the proposed designation boundary within the Pūhoi Sector. Of these, seven fall within the designation boundary and comprise three historic structures and four archaeological sites.

At the southern end of the Sector, in the Stanaway property, three sites are recorded within the designation boundary: Titford Cottage (CHI 16252), Titford House (CHI 16248) and Te Pā o Te Hēmara Tauhia (CHI 12063 = NZAA R10/921). These buildings and pā site overlook the existing route of SH1 just to the north of the Johnstone's Hill tunnels, within Pt Lot 1 DP 55676. These sites were not accessible for inspection prior to the writing of the Heritage Assessment Report.

The indicative alignment passes through the Cottage, while Titford House is located further to the north at approximately 50m from the centreline of the alignment. Titford Cottage was probably built around 1902, and Titford House was built between 1918 and 1920.

Te Pā o Te Hēmara Tauhia is a pā site situated on the end of a ridge overlooking the river, partly destroyed where cut through by SH1. A number of 19th and 20th century developments on the site have also modified its condition. Several midden scatters, some extensive, have been reported around the pā, particularly to the west and south of the main defences. The pā itself is located outside the indicative alignment, but associated midden may be present within it.

Two archaeological sites (CHI 15857 = R10/1106 and CHI 15872 = R10/1107), both primarily consisting of shell midden and a platform, have been recorded on ridges located approximately 600m north of Te Pā o Te Hēmara Tauhia. Both sites are located within Part Section 3 Block III Waiwera SD, although R09/1106 extends east onto Section 65 Block III Waiwera SD, partly within the indicative alignment.

Site R10/1106 is located approximately 80m west of SH1 and consists of a 35m x 5m platform around which four midden deposits have been recorded.

Site R10/1107 is located approximately 200m west of SH1 and consists of a 15m x 8m platform with midden spread around its front scarp. Descending from the platform to the watercourse below is a historic period log skid that has been recorded as part of the same site.

An unnamed historic building (CHI 16249) is recorded near the existing highway at Pūhoi within Part Okahu Block. It is described in the CHI database as a corner bay villa with a corrugated iron roof, built for a member of the Schollum family. No date for its construction is given in the database, but the family was one of the pioneering families at Pūhoi. Initial historic research by the Heritage team has suggested a tentative date of 1906 for the construction of this building. Research indicates that other archaeological remains relating to earlier occupation may still be preserved on the property, though inspection and probing during field surveys found no archaeological features.

Photo 16-1: CHI Heritage Site 16249: the Schollum villa

During site surveys for the Project, the Heritage team and Hōkai Nuku identified a previously unrecorded pā site and it has since been recorded on the NZAA database as R10/1369. This site is located to the south of R10/1107, close to Billing Road on the Straka property. It overlooks the Pūhoi Estuary and Te Pā o Te Hēmara Tauhia to the south and the Estuary to the east. The main remnant features of the pā are a 17m long transverse ditch, another wider remnant ditch, a platform, a natural terrace and possible pit features. A small midden deposit was observed on the

western side of the pa and probed to establish its size. The midden is eroding out of the side of the east–west running ditch, and has a diameter of approximately 1.5m. The midden is highly fragmented and in poor condition, with its greatest thickness being 3cm. Further to the west of the pā, behind the Straka house, is another smaller area that appears to be part of the natural terrace and to the north of this a flat area with many mature puriri trees. It is likely that these areas were also used for settlement and/or horticulture, although no pits or other features were observed on the surface.

The previously identified and recorded site Te Pā o Te Hēmara Tauhia and the rediscovered pā site are collectively referred to by Hōkai Nuku as Ngā Pā o Te Hēmara Tauhia.

Refer to Figure 4-5 for the location of heritage sites within the Pūhoi Sector.

16.1.2 Hungry Creek Sector

There are no recorded heritage sites in this Sector. A field survey of the Fernbrook Farm property alongside the existing SH1 in this sector did not identify any archaeological features or deposits. Structures in this Sector are of early to mid-20th century construction.

16.1.3 Schedewys Sector and Moirs Hill Sector

There are no archaeological sites recorded in these Sectors. Field surveys were not undertaken due to the rugged topography largely forested in pine, with overall low potential for archaeological sites.

16.1.4 Perry Road Sector

There are seven related recorded heritage sites within the Perry Road Sector, all of which are 'reported' historic sites recorded on the basis of historical evidence rather than field survey. All of these sites are remnant historic structures relating to the US military camps established in the countryside west of Warkworth during World War II.

- Falls Camp H1 (CHI 17004);
- Gubbs Camp K1 (CHI 16997);
- Gubbs Camp K2 (CHI 16998);
- Gubbs Camp K3 (CHI 16999);
- Gubbs Camp K4, K5 and K6 (CHI 17000);
- Wylies[105] Road Camps D2 and E (CHI 17006);and
- Wylies Road Camps F and G (CHI 17007).

The majority of the camps are outside the proposed designation. The exceptions are Wylies[106] Road Camps E, F and G.

[105] We note that historically the name of the camps was spelled with one L (Wylies Road), whereas the road today is spelled with two (Wyllie Road).

[106] Wylies not Wyllie as it is the historical name of the camp.

Photo 16-2: US military camp huts

Refer to Figure 4.9 for the location of heritage sites within the Perry Road Sector.

16.1.5 Carran Road Sector

An additional US military camp site is located within the Carran Road Sector. Carran Road Camp H2 (CHI 17005) is located approximately 200m to the west of the indicative alignment. Part of CHI 17006 (Wylies Road Camp D1) also extends into this Sector from the Perry Road Sector. These sites are outside the proposed designation.

Refer to Figure 4-10 for location of heritage sites within the Carran Road Sector.

16.1.6 Heritage significance

The Heritage team considers the overall heritage significance of Te Pā o Te Hēmara Tauhia (CHI 12063 = NZAA R10/921) to be high, despite the removal of approximately 50% of the pā during the construction of the existing SH1. The recently rediscovered pā R10/1369 is considered to have high archaeological value and significance due to its contextual value and information potential. The two midden sites within the Pūhoi Sector are of low to moderate archaeological significance.

The early 20th century age of the three heritage buildings and their association with early settler families in the Pūhoi area give them moderate heritage significance. However, a full heritage assessment would be required to accurately determine their historical and architectural

significance, and these sites were not accessible to the Heritage team during the preparation of the Heritage Assessment Report. The archaeological sites collectively form part of an archaeological landscape of moderate significance surrounding the Pūhoi River and Estuary relating to Māori occupation. The sites must also be seen as part of the significant wider heritage landscape of Pūhoi Village and its surrounds, which includes sites and heritage structures relating to both Māori and early European occupation.

The US military camps in the Perry Road and Carran Road Sectors are of some historical significance but have low physical heritage value. Little evidence of the camps is apparent today, but remnant concrete foundations and other features are still present in some areas. Being of 20th century date, they do not meet the definition of an archaeological site under the HPA 1993. They do meet the definition of historic heritage in the RMA, but have not been scheduled for protection on the basis of their heritage values.

The camp sites collectively form a group of historically related land areas, but as there are few visible remains representing their history, they have no significant heritage landscape value.

16.2 Actual and potential historic heritage effects

The identified heritage sites are located within two distinct clusters. The first of these clusters is situated around Pūhoi Village in the Pūhoi Sector, where both pre- and post-contact Māori and early Europeans settled and left a material impact upon the landscape. The second cluster is along the right branch of the Mahurangi River, where a number of military camps dating from World War II are found.

Research and field surveys have confirmed that nine of the known heritage sites in or near the Project area fall within the designation boundary: three historic houses, two pa and two midden sites in the Pūhoi Sector; and two US military camp sites in the Perry Road Sector. Adverse effects on known historic heritage sites will be confined to the Pūhoi and Perry Road Sectors, in which these nine sites are located.

16.2.1 Pūhoi Sector

Of the seven heritage sites within the Pūhoi Sector, three are avoided and four affected by the indicative construction footprint within the proposed designation.

The Project is unlikely to affect the previously known extent of Te Pā o Te Hēmara Tauhia, and Titford House. These sites are on the periphery of the indicative alignment and can probably be avoided. However, it is possible that extensive middens recorded around Te Pā o Te Hēmara Tauhia may be disturbed by piling for the Okahu Creek Viaduct. In any event, both heritage sites will be adversely affected from a visual perspective and by impacts on the setting/surrounds of the site, and will be hemmed in between the new road on the west and the existing SH1 on the east.

Titford Cottage will be directly affected by the Viaduct and will be destroyed. Effects could be mitigated by preserving a detailed record of the Cottage, or by relocating it, subject to further assessment of its heritage values and condition.

Based on the indicative construction footprint, the two midden/platform sites within the Pūhoi Sector will likely be destroyed or modified. R10/1106 will be completely destroyed by the planned cut. The lower portion of the log skid of R10/1107 will be destroyed, with the midden remaining unaffected. Investigations to recover information about the history of the area before construction commences would mitigate the loss of these sites.

The indicative alignment has been redesigned to avoid the recently rediscovered pa R10/1369. A retaining wall will be constructed to the immediate east of the pā, which will protect the lower terrace. The adverse visual effects on the pā created by the nearby motorway could be mitigated by incorporating interpretation on retaining wall panels and creating walking access to the area (subject to consultation with Hōkai Nuku).

The other affected site is an unnamed historic building (CHI 16249) associated with the Schollum family. The house falls within the proposed designation and lies on the periphery of the indicative alignment. However, associated works run much closer to the building with areas of fill abutting the northeast corner of the house. The house itself would be affected, and associated subsurface archaeological deposits relating to the house or earlier occupation of the property may be exposed during works. However, even if the house could be avoided the proximity of the new road would result in adverse visual effects on and from the heritage building and adverse effects on its surrounds. Because this is a timber house, relocation further from the alignment would be feasible to mitigate the adverse effects.

16.2.2 Perry Road Sector

The Heritage team considers that the effects of the Project on historic heritage in this Sector will be less than minor, as the World War II camp sites are of low heritage value, have little remnant physical features and only parts of some of the camps will be affected by the Project. Recording of any remaining camp features would be appropriate as mitigation for adverse effects.

16.2.3 Unrecorded archaeological sites

In any area where archaeological sites have been recorded in the general vicinity, it is possible that unrecorded subsurface remains may be exposed during earthworks. Appropriate provision for the possibility should be made through the implementation of the NZTA Accidental Discovery Protocols.

There is little potential for unrecorded archaeological remains over most of the Project route apart from near the recorded archaeological sites and heritage buildings in the Pūhoi Sector, and in particular in the vicinity of Ngā Pā o Te Hēmara Tauhia.

16.3 Overall effects, recommendations and mitigation

Effects on the most significant heritage sites within the Project area, Ngā Pā o Te Hēmara Tauhia, are largely avoided by the indicative alignment – in the case of the newly discovered pā – through amendments to the position and design of that alignment.

Other archaeological sites within the Pūhoi Sector will be adversely affected, one completely and the other to a limited extent. The effects on these can be mitigated through archaeological recording and investigation to recover information relating to the history of the area.

Effects on Titford Cottage and the Schollum villa can be mitigated through detailed recording and potentially through relocation of the structures, which would require further assessment.

The Heritage team considers the effects on historic heritage within the Perry Road Sector to be less than minor due to the low heritage value of the sites and lack of any significant heritage landscape value.

Overall, the adverse effects of the Project on heritage values are moderate and can be appropriately mitigated through investigation and recording, and potential relocations of affected heritage buildings (pending investigation and determination of their values, and assessment of relocation potential).

The provision of public access to sites that were previously inaccessible and information on the history of the area and its heritage sites will be a positive effect of the Project, as will ongoing future management of Ngā Pā o Te Hēmara Tauhia in partnership with Hōkai Nuku.

I support the recommendations above as being an appropriate mitigation for the Project's potential effects on heritage sites.

17. Vibration

A Vibration Assessment Report has been prepared for the Project, which provides an assessment of vibration effects on receivers along the indicative alignment in relation to the construction phase of the Project. The Report also comments on potential vibration effects generated by traffic once the motorway is operational.

An analysis of relevant performance standards, predicted vibration levels and risk assessment, and options for managing and mitigating vibration effects is provided in the Vibration Assessment Report. The following is a summary of the issues and potential effects identified in the Report.

This summary and the Report subsequently inform the recommended mitigation contained in Section 28 and will inform the Project conditions.

17.1 Project criteria and vibration performance standards

To assess and measure vibration levels for the Project, the Vibration team used Project criteria similar to those adopted for other, already consented RoNS, as follows:

Construction vibration:

- The NZTA State Highway Construction and Maintenance Noise and Vibration Guide[107] (the NZTA Guide); and
- Table 2 from German Standard DIN 4150-3:1999 *Structural Vibration – Effects of Vibration on Structures* for effects of vibration on buried pipes.

Traffic vibration:

- Norwegian Standard NS 8176.E:2005 *Vibration and Shock – Measurement of vibration in buildings from land-based transport and guidance to evaluation of its effects on human beings*.

17.1.1 NZTA Guide

The NZTA Guide uses two international vibration standards, German Standard DIN 4150-3:1999 and British Standard BS 5228-2:2009 *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration*. These two standards are commonly adopted for large infrastructure projects in New Zealand.

Figure 17-1 outlines the construction vibration criteria applied under the NZTA Guide. The term 'receiver' has been used in place of PPF (protected premises and facilities)[108] in this AEE and the Vibration Assessment Report.

[107] Refer Vibration Assessment Report Section 2.2

[108] The NZ Road Noise Standard NZS 6806:2010 defines PPFs as: dwellings, educational facilities and play grounds within 20 metres of educatonal facilities, boarding houses, homes for the elderly and retirement villages, marae, hospitals that contain in-house patient facilities and temporary accommodation (eg motels and hotels) in residential zones. For the purposes of the assessment of vibration playgrounds would not be considered to be sensitive receivers, and motels and hotels outside residential zones (such as the Hungry Creek Bed and Breakfast) would.

Criteria

On the basis of the standards discussed above, the criteria in table 2.3 can be used to manage the effects of construction vibration and airblast[23]. These are structured as part of a process whereby construction should be managed to comply with the Category A criteria. If measured or predicted vibration and airblast levels exceed the Category A criteria then a suitably qualified expert should be engaged to assess and manage construction vibration and airblast to comply with the Category A criteria as far as practicable (see figure 2.5). If the construction vibration exceeds the Category B criteria then construction activity shall only proceed if there is appropriate monitoring of vibration levels and effects on those buildings at risk of exceeding the Category B criteria, by suitably qualified experts.

TABLE 2.3 | Construction vibration criteria

Receiver	Location	Details	Category A	Category B
Occupied PPFs	Inside the building	Night-time 2000h - 0630h	0.3mm/s ppv	1mm/s ppv
		Daytime 0630h - 2000h	1mm/s ppv	5mm/s ppv
		Blasting – vibration	5mm/s ppv	10mm/s ppv
	Free-field	Blasting – airblast	120dB L_{Zpeak}	-
Other occupied buildings	Inside the building	Daytime 0630h - 2000h	2mm/s ppv	5mm/s ppv
All other buildings	Building Foundation	Vibration - transient (including blasting)	5mm/s ppv	BS 5228-2 Table B.2
		Vibration - continuous		BS 5228-2 50% of Table B.2 values
	Free-field	Airblast	-	133dB L_{Zpeak}

TABLE 2.4 | Table B.2 from BS 5228-2

Type of building	Peak component velocity in frequency range of predominant pulse	
	4 to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s	50 mm/s
Unreinforced or light framed structures Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Additional criteria should be used in the case of historic, vibration-sensitive or multi-storey buildings. Advice on such buildings is given in BS 5228-2[07] and DIN 4150-3[18]. Similarly, if there is history of foundation settlement, then expert geotechnical advice should be sought regarding specific vibration criteria.

Figure 17-1: NZTA Guide construction vibration criteria[109]

[109] Refer Vibration Assessment Report Section 2.2

The NZTA Guide incorporates both perception and damage thresholds, and applies them in such a way that annoyance is considered in the first instance, but in areas of high-vibration construction, building condition is the bottom line. A discussion regarding the application of these criteria is provided in Section 2 of the Vibration Assessment Report.

17.1.2 DIN 4150-3:1999 – Effects on buried pipework

The German Standard DIN 4150-3:1999 primarily addresses building damage but it also contains guidance values for vibration effects on buried pipework. This Standard is needed to assess the effects of vibration on the Vector Limited High Pressure Gas transmission line connection to Warkworth near the Wyllie Road overpass. The guideline values set out in the Standard are shown in Table 17-1. As the pipe is steel the 100mm/s criterion is appropriate.

Table 17-1: Guideline values for vibration effects on buried pipework (DIN 4150-3:1999)

Pipe material	Guideline values for PPV measured on the pipe (mm/s)
Steel (including welded pipes)	100
Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80
Masonry, plastic	50

17.1.3 Norwegian Standard NS 8176.E:2005

The Norwegian Standard NS 8176.E:2005 specifically addresses transportation vibration. The Standard's criteria (shown in Table 17-2), are based on studies of vibration annoyance in residences, and it provides guideline values for four vibration 'classes'. The appropriate class for this Project is 'Class C', which is the "recommended limit value... in connection with the planning and building of new transport infrastructures". Section B.3.3 of the Standard states that, at this level of vibration, "about 15% of the affected persons in Class C dwellings can be expected to be disturbed by vibration" and this is deemed by the Standard to be acceptable.[110]

Table 17-2: Human response criteria for transport sources in NS 8176.E:2005

Type of vibration value	Class A	Class B	Class C	Class D
Statistical maximum value for weighted velocity, $v_{w,95}$ (mm/s)*	0.1	0.15	0.3	0.6

* $v_{w,95}$ = value exceeded for 5% of events (equivalent to L_{05} centile level in noise terminology)

Compliance with these criteria would also ensure ready compliance with the building damage criteria in DIN 4150-3:1999.

[110] ibid Section 2.3

17.2 Existing environment

The existing environment in the Project area is predominantly rural with small pockets of residences around the Pūhoi and Wyllie Road areas. In lieu of ambient vibration monitoring, and to ensure a conservative assessment, it is assumed the existing vibration environment at these residences is below the threshold of human perception.

From a vibration point of view, the existing geological ground types (as informed by the Further North Alliance geotechnical engineering team) would be roughly classified as competent to hard, (refer to Section 3.2 Vibration Assessment Report) and there would be less attenuation with distance than in softer ground.

17.3 Construction vibration

Heavy construction activities generate vibration levels that can impact on buildings, building occupants and structures. Blasting has the potential to cause the highest vibration levels.

17.3.1 Predicted vibration levels

The construction methodology in Section 6 of this AEE has informed the following list of vibration-inducing equipment that may be used for the construction of the Project:

- Blasting;
- Piling (bored piles with castings vibrated in using a vibro-hammer);
- Bulldozer;
- Vibratory roller; and
- Rockbreaker (excavator mounted).

Vibration levels have been predicted for these sources using the standard prediction model for vibration propagation with distance, with the exception of blasting, for which a blasting-specific model has been used. Refer to Section 4.4 of the Vibration Assessment Report for further information on the methodology used to predict vibration levels for various activities associated with construction of the Project.

The predicted vibration radii for high-vibration sources to comply with the 'Category A' Project criteria are shown in Table 17-3 below. These vibration radii (for sources other than blasting) are predictions based on regression analysis of previous measurements, and monitoring will need to be undertaken on-site to ensure they are accurate.

Table 17-3: High vibration sources and their vibration radii (predicted)

Source	Project criterion Category A (PPV)	Vibration radius (m)
Blasting (12.5kg blast weight assumed)	5 mm/s	80
Vibro-hammer piling rig	1 mm/s	120
Bulldozer	1 mm/s	110

Source	Project criterion Category A (PPV)	Vibration radius (m)
Vibratory Roller	1 mm/s	90
Rockbreaker	1 mm/s	30

17.3.2 Effects of construction vibration on receivers

The Vibration team has assessed construction vibration effects on receivers that lie inside the vibration radii noted in Table 17-3. The results of the construction vibration assessment are shown in Table 17-4 below. The locations listed in the table are potential vibration hotspots where the Category A (annoyance) criteria may be exceeded. In these locations, a suitably qualified expert would be required to assess and manage construction effects for these receivers.

Table 17-4: Potential vibration hotspots - receivers within the predicted vibration radii

Receiver	Construction activity	Vibration radius (m)	Approximate distance from construction activity to receiver (m)
Pūhoi Sector			
3 Fowler Access Road	Vibratory roller	90	75
5 Fowler Access Road	Vibratory roller	90	40
20 Fowler Access Road	Vibratory roller	90	35
466 SH1, Pūhoi	Vibratory roller	90	30
Hungry Creek Sector			
20 Pūhoi Close	Bulldozer	110	105
682 SH1, Pūhoi	Bulldozer	110	85
Schedewys Hill Sector			
101 Moirs Hill Road	Bulldozer Vibratory roller	110 90	75 75
187 Moirs Hill Road	Bulldozer	110	75
Perry Road Sector			
75 Wyllie Road	Bulldozer	110	105
371 Woodcocks Road	Bulldozer Vibratory roller	110 90	105 60
372 Woodcocks Road	Piling Vibratory Roller	120 90	120 50

Receiver	Construction activity	Vibration radius (m)	Approximate distance from construction activity to receiver (m)
Carran Road Sector			
141 Carran Road	Bulldozer	110	105
62 SH1, Warkworth	Bulldozer	110	70
102 SH1, Warkworth	Bulldozer	110	95
104 SH1, Warkworth	Bulldozer Vibratory Roller	110 90	45 50

Overall, the Vibration team predicts that compliance with the Category B criteria (refer to Figure 17-1) can be achieved for all receivers.

In the event, at confirmation of detailed design, that construction is predicted to exceed the Category B criteria, pre-construction building condition surveys and monitoring are recommended.

17.3.3 Construction traffic vibration

The Project alignment will be the primary haul road, but new access roads will need to be constructed to connect the alignment with the local road network during Project construction and SH1, ie Moirs Hill Road, a new access road commencing 500m south of Perry Road, Wyllie Road and Woodcocks Road.

The character of road trucks used for the Project will be the same as Heavy Commercial Vehicles (HCVs) (eg forestry trucks) that can travel along local roads by right. On SH1, and to a lesser extent Woodcocks Road, the number of construction trucks will generally be small compared to the number of HCVs that currently travel on those roads. The Vibration team assessed traffic vibration risk by reviewing data of HCVs travelling on existing roads with a range of surface conditions. Assessing this data against the Project traffic vibration criterion indicates that compliance can be achieved at 25m, even for roads in a dilapidated state.

Vibration levels will not be high enough to cause building damage. As such, no vibration effects relating to construction traffic on local roads are anticipated.

17.4 Operational Traffic vibration

When the Project is completed, the only likely source of vibration will be HCVs that use the new motorway. Whether a heavy vehicle generates vibration is entirely dependent on the state of the road surface, and effects can be avoided altogether if the pavement is kept smooth and free of bumps or dips. Vibration issues most commonly arise when road surface repairs, particularly backfilled trenches, are carried out poorly.

With the implementation of the NZTA's policies regarding road maintenance,[111] it is unlikely that the motorway road surface will degrade significantly. Furthermore, for a well maintained surface, traffic vibration is expected to be less than 0.05 mm/s at the closest dwelling (4 Wyllie Road), and the levels at all other receivers along the route will be even less.

As such, the effects are predicted to be negligible for all receivers. However, if the road surface does degrade, the effects would still only be minor provided that compliance with the Project traffic vibration criterion is maintained.

17.5 Overall vibration effects

The Vibration team assessed potential vibration effects of the Project on receivers along the route by applying relevant performance standards as Project criteria to ensure acceptable outcomes.

The Category A (annoyance) criteria will likely be exceeded at 15 receivers (as noted in Table 17-4). The Vibration team predicts that compliance with the Category B (building damage) Project construction criteria can be achieved for all receivers, so the risk of building damage is low.

The Vibration team considers a CNVMP should be prepared, which contains the Project criteria and provides detail for a methodology for proactively avoiding, or responding to, any issues that may arise during construction. In the event of changes to the construction design that result in exceedance of the Category B criteria, pre-construction, the Vibration team recommends building condition surveys and monitoring be carried out in accordance with the CNVMP.

I consider designation conditions that require compliance with the Project construction criteria and development of a CNVMP as part of the OPW to be appropriate.

With the management and mitigation measures recommended (refer to Section 17.6 below), it is predicted that Project construction activities will comply with the Project criteria for all receivers, and the effects will be minor.

17.6 Recommendations and mitigation

The measures for mitigating and managing construction vibration effects include:

- Liaison with affected parties;
- Monitoring of vibration levels and building condition and post-completion remediation if necessary;
- Using low-vibration techniques and managing the timing of activities where practicable; and
- Reducing the charge weight used in blasting.

I recommend that the CNVMP should include the following vibration management content:

- The Project criteria for construction vibration;
- A list of high-vibration sources to be used;

[111] ibid Section 5

- Hours of operation, including times and days when high-vibration sources would be used, and where;
- Requirements for vibration monitoring of high-vibration sources prior to construction or during their first use;
- Requirements for building condition surveys of identified receivers prior to construction works, and during the works if required, with remediation if required;
- Roles and responsibilities of personnel on site;
- Construction operator training procedures;
- Construction vibration monitoring and reporting requirements;
- Details of the blasting contractor's programme, proposed charge weights and monitoring locations;
- Mitigation options, including alternative strategies in the event Project criteria cannot be achieved;
- Methods for receiving and handling complaints about construction vibration, including setting up a hotline number;
- Procedure for managing vibration damage; and
- Communication protocols and procedures, especially in relation to blasting.

18. Air

The Project Air quality team prepared an Air Quality Assessment Report for the Project, which is included in Volume 3 (Part 1). The Report provides an assessment of air quality effects associated with the construction and operation of the Project. The Report considers the impacts of vehicle emissions and effects of road construction on nearby residential receptors, and recommends mitigation measures where effects are potentially significant.

A detailed description of the existing air quality environment in the Project area and the assessment framework and methodology used are provided in the Air Quality Assessment Report. The following is a summary of the issues and potential effects identified in the Report.

This summary and the Report subsequently inform the recommended mitigation contained in Section 28 and will inform the Project conditions.

18.1 Existing air quality environment

The Project area is largely rural in nature with farming and forestry activities predominating. The Air quality team assessed the background ambient air quality along the alignment assuming air quality will be better than that measured in the Warkworth and Auckland urban areas, ie without the peak concentrations of air contaminants observed in urban areas. The reviewed data indicates background concentrations in the Project area will be better than those shown in Table 18-1:

Table 18-1: Background contaminant concentrations for urban areas

Contaminant	Background concentrations
Particulate matter smaller than ten microns (PM_{10})	<20 µg/m^3 24-hour average
Particulate matter smaller than 2.5 microns ($PM_{2.5}$)	<10 µg/m^3 24-hour average
Carbon monoxide (CO)	<1 mg/m^3 1-hour average
Nitrogen dioxide (NO_2)	<20 µg/m^3 annual average

There is a relatively low density of residential use in the vicinity of the Project throughout many of the Sectors, although there are some dwellings that will be relatively close to construction activities and the alignment once operational. Dwellings within the designation boundary will be purchased by the NZTA. Therefore, these dwellings have not been considered as potentially affected in the Air Quality Assessment Report.

The Project area environment is characterised by:

- Hilly terrain requiring a series of cuts and fills for road construction;
- All Sectors other than the Moirs Hill Road Sector have residences within 200 m of the designation boundary and are therefore considered potentially sensitive to the construction and operational air quality effects of the Project;
- Prevailing winds are from the west to south-west sector, with winds above 5 m per second likely around 30% of the time. Strong winds are predominantly from that direction; and

- Strong winds over 10 m per second are likely to be infrequent at around 2% of the time.

Further information regarding topography and meteorological conditions within the Project area and the relationship of these factors to ambient air quality is provided in the Air Quality Assessment Report.

18.1.1 Sensitive receptors

Highly sensitive air pollution land uses (HSAPLUs) include residential houses, hospitals, early childhood centres and schools[112]. Table 18-2 below indicates the number of residences within 200m of the indicative alignment, for assessing operational effects, and within 200m of the construction area, for assessing construction effects (refer to the C series drawings in the Drawing Set in Volume 4).

Genesis Aquaculture, a commercial fish farm, is located near the Perry Road Sector of the Project and has the potential to be sensitive to the effects from the construction and operation of the motorway.

Figure 18-1: Location of Genesis Aquaculture in relation to the indicative alignment and proposed designation

Genesis Aquaculture is located within 50m of the Kauri Eco Viaduct, 60m east of the earthworks, and the closest pond is approximately 15m from the designation boundary, as shown in Figure 18-1. The Freshwater Ecology Assessment Report assesses the potential for the fish farming operation to be affected by air discharges. That report concludes that the fish currently in the ponds are not sensitive to suspended solids in the pond as may result from dust deposition during construction.

[112] Refer Section 3.1 of the Air Quality Assessment Report.

The low level of predicted impact on ambient air quality relative to ambient air guidelines and standards (and being below significance criteria other than at one HSAPLU), the effects from the road operation will be less than minor. Accordingly, the Air quality team assessed the fish farm as not a highly sensitive receptor.

The Terrestrial Ecology Assessment Report raised the potential issue of dust effects, particularly on the native flora and fauna within close proximity to the construction areas. The report generally considers the effects are of a temporary nature but it is apparent that some species and/or locations may be particularly sensitive to dust. Specific areas where a higher level of dust management is recommended are to be incorporated in the management plan.

Table 18-2: Sensitive receptors near the Project alignment and construction areas

Sector	Number of residences within 200 metres of designation boundary	Distance of nearest residence to designation boundary (m)	Distance of nearest residence to current alignment (m)	Distance of nearest residence to earthworks (m)
Pūhoi Sector	24	31	117	50
Hungry Creek Sector	9[113]	50	187	118
Schedewys Hill Sector	8	17	184	142
Moirs Hill Road Sector	0	n/a	n/a	n/a
Perry Road Sector	18	7	140	125
Carran Road Sector	17	31	130	124

Table 18-3 shows the number of dwellings within 200m of the designation boundary at access roads for construction yards (refer to Section 6 of this AEE for locations of indicative construction yards).

Table 18-3: Houses within 200m of the designation boundary at access roads

Yard access road number	Number of residences within 200 m the Designation Boundary	Distance of nearest residence to access road (m)
1, 2 and 3	2 (east of alignment)	80
4	3 (east of alignment)	90
6a and 6b	2 (east of alignment)	120

[113] Note that a house is currently under construction in the vicinity of the proposed designation in this Sector.

Yard access road number	Number of residences within 200 m the Designation Boundary	Distance of nearest residence to access road (m)
7 (via Moirs Hill Road)	8 (east of alignment)	17
8 (via Moirs Hill Road)	5 (west of alignment)	120
9 and 10	5	53
11 and 12 (via Wyllie Road)	3 (east of alignment)	120
11 and 12 (Wyllie Road)	1 (east of alignment)	35

18.1.2 Topography and meteorology

The topography of the Project area is predominantly hill country. Much of the Project area has slopes between 20% and 60% and some areas have slopes in excess of 60% (refer to Drawings ES-101 – ES-117 in Volume 4). Elevations through the Project area range from near sea level to 360m.

Wind speed and direction and rainfall are key determinants for the potential for impacts to occur from emissions during road construction and operation. Winds above 5 m per second will start to give rise to airborne dust from exposed surfaces, particularly after extended periods without rainfall. High wind speeds above 10m per second have the most potential for excessive dust if winds are blowing towards the direction of sensitive receptors.

Light winds will have the effect of limiting dispersion of traffic discharges, resulting in higher concentrations of contaminants near the road. Strong winds result in greater dispersion of traffic emissions and lower concentrations. Strong winds during construction, will, however, result in a higher rate of dust entrainment and so have the potential to cause greater effects from dust during the construction phase of the Project.

Meteorological monitoring indicates that the winds for the main earthworks season are similar to those for the whole year, with strong winds occurring predominantly from a westerly direction. The predominant wind directions are from the west and south-west.

18.2 Assessment methodology and framework

The Air quality team considered both the operational and construction effects of the Project on air quality. The assessment methods they used are based on national guidance from both the NZTA and the Ministry for the Environment. For the operational assessment the Air quality team used a tool specifically developed by the NZTA to output conservative estimates of the potential effects on air quality for indicator contaminants ie NZTA's Tier 2 Screening Tool.

The Air quality team assessment of construction effects has been informed by the construction methodology as outlined in Section 6 of this AEE.

Construction dust effects were assessed by considering the Project location and the separation of the construction areas to HSAPLUs along the route, and the nature and extent of the construction

activities. Those activities within 200m of the construction area were considered by the Air quality team as being possibly affected by construction dust. The Air quality team recommend mitigation measures to ensure that any identified significant adverse effects are avoided.

The Air quality team considered the potential effects of the Project by assessing the 'with the Project' and the 'without the Project' scenario on SH1. To do this the Project Transportation and Traffic team used emission factors for indicator contaminants developed using the Vehicle Emissions Prediction Model (VEPM), Version 5.1. These factors were integrated with the SATURN[114] traffic model to develop estimates of the mass emission of contaminants for comparing the effect on the road network if the Project did not proceed.

18.2.1 Assessment criteria

For operational effects, the air quality specialists took relevant assessment criteria from a range of sources, including ambient air quality standards and guidelines set nationally for managing air quality and threshold criteria to evaluate the level of risk to air quality resulting from land transport projects.

The NZTA draft *Guide to Assessing Air Quality Effects for State Highway Asset Improvement Projects* promotes a three-tiered assessment approach as follows:

- Tier 1: Risk assessment
- Tier 2: Screening assessment
- Tier 3: Detailed assessment

The Tier 1 risk assessment dictates the level of detail required in the assessment (ie whether a Tier 2 screening assessment or a Tier 3 detailed assessment is required) according to the risk. The NZTA has developed a document *Checklist and Risk Assessment for Tier 1 Air Quality Social and Environmental Screening (SES)* which considers the existing air quality in the Project area, likely exposure to potential discharges from the Project, and the level of emissions based on predicted AADT. The Air quality team completed the checklist for the Pūhoi to Wellsford RoNS and determined them to be low risk in terms of existing air quality, medium risk in terms of emissions based on AADT and high risk for exposure. They determined overall risk for the Project to be medium.

The NZTA has also developed a web-based screening tool to assist with implementing the recommended approaches in the NZTA Guide. A Tier 2 assessment is a quantitative screening assessment to determine whether a project is likely to exceed threshold criteria in terms of contaminant emissions from vehicle traffic. The screening tool predicts the maximum ground level concentration (MGLC) of PM_{10}, $PM_{2.5}$ and NO_2 at the nearest HSAPLU based on AADT, fleet composition and average speed.

Using the Screening Tool, the NO_2 threshold criteria is predicted to be exceeded at one HSAPLUs at 466 SH1 for the new road, although the Project is slightly lower than the without Project scenario.

[114] Refer Section 2.2 of the Transportation and Traffic Assessment Report.

The criteria used to evaluate operational phase effects relevant to a Tier 2 assessment are:

- NO_2 guideline of 40µg/m³ annual average (WHO), threshold criteria 2 µg/m³
- PM_{10} standard of 50µg/m³ 24 hour average (NESAQ), threshold criteria 2.5 µg/m³
- $PM_{2.5}$ guideline of 25µg/m³ 24 hour average (ARAQT), threshold criteria 1.25 µg/m³

For construction effects relating to dust, the criterion for assessment is for "no objectionable or offensive effects from dust". The assessment criterion is necessarily subjective but is in line with the MfE's *Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions* and relevant provisions of the ARP:ALW.

18.2.2 Traffic modelling and vehicle emission estimation

Sections 2.2 and 3 of the Transportation and Traffic Assessment Report summarise the traffic modelling undertaken for this Project, the outputs of which were interpolated by the Air quality team to obtain data for the air quality assessment. They used the opening and design year for the assessment (2021 and 2031).

The Air quality team used the base data relating to traffic for the assessment as follows:

- A projected AADT for the Project for 2031 of 21,500 vpd south of the Pūhoi ramps and 15,140 vpd north of the Pūhoi ramps; and
- The projected percentage of HCVs was 13% of the fleet operating on the Project alignment.

The Air quality team used the VEPM Version 5.1 to estimate mass emissions of contaminants emissions for the assessment of network effects. By default, the VEPM was also used for the Tier 2 screening assessment for the Project because that model is incorporated into the NZTA Tier 2 screening tool applied to the operational effects assessment.

18.3 Construction air quality effects

The potential effects of dust from construction are dependent on multiple variables including wind direction and strength, rainfall, the distance from the earthworks activity to potentially affected properties, the size and scale of earthworks and other activities, the number of vehicle movements and the nature of the surface material, including moisture content.

The construction phase of the Project has the potential to generate dust particularly from earthworks, topsoil removal and spreading, cut and fill operations, and other activities involved in road construction such as access roads for construction yards and mobile crushing and blasting.

18.3.1 Mobile rock crushing plant

The rock crushing plant will have a capacity of up to 300tph and accordingly requires a resource consent for discharge to air. Dust will potentially be generated from the size reduction operation and the conveying of crushed materials. The potential for dust emissions will largely depend on the moisture content of the materials and the amount of fines present.

18.3.2 Effects on receptors

The primary air quality effects resulting from construction is the potential for excessive dust deposits causing soiling of property and potentially contaminating roof water supplies. Excessive dust deposition can cause stress-related conditions for some residents. Dust can have effects on visibility, although this is typically near the source and does not pose an adverse effect beyond the immediate vicinity of the site.

The assessment criterion for dust from the MfE Dust Guide and ARP:ALW relate to “no objectionable or offensive effects from dust beyond the boundary”. The means of determining whether dust is offensive or objectionable to the extent that there is an adverse effect relates to the Frequency, Intensity, Duration, Offensiveness and Location factors.

The effects of dust from construction at HSAPLUs will be greatest immediately downwind under strong wind and dry conditions. The meteorology of the Project area indicates that strong winds are predominantly from the west, which would cause increased risk of dust deposition to residences to the east of the corridor.

The nearest HSAPLU to the proposed earthworks is 50m distant and located at 466 SH1 (refer to Drawings C101 –C117 in Volume 4), the same nearest receptor as for operational effects. Activities close to this HSAPLU include:

- Earthworks associated with the construction of the southbound and northbound Pūhoi ramps, and the alignment itself;
- An area of possible blasting to the south;
- Construction traffic on Yard access roads 1, 2 and 3 (around 540 two way vehicle movements per day at peak); and
- The operation of construction yard 2 and bridge staging area 3.

The residence at 466 SH1 is to the east of the alignment and is therefore, subject to potentially significant adverse effects of dust from the prevailing winds and the strongest winds, those greater than 10 m per second. The next closest HSAPLU is the Hungry Creek Arts School, 90m from the road works, and the remaining HSAPLUs are more than 100 m distant from construction areas and are less likely to be significantly affected by dust deposition, particularly given the application of good practice management discussed in Section 18.5 of this AEE.

The nearest residence to the edge of any blasting areas is number 20 Pūhoi Close, which about 150m away. This blasting location is also the nearest potential site to any HSAPLU where the mobile crushing plant could be operated.

There is the potential for dust to be generated from the mobile crusher, which incorporates size reduction and conveying of crushed materials. The Air quality team recommend industry standard dust control measures for the rock crusher to avoid excessive dust discharges. Dust control systems may include watering systems for dust suppression and/or enclosure and extraction to specific air pollution control systems for particulate matter removal, such as to a water scrubber or baghouse filtration system.

There are two houses (99 and 101 Moirs Hill Road) located less than 20m from yard access road 7 (off Moirs Hill Road), that will have up to 160 HCV movements each way per day for an estimated construction period of 4.5 years (Drawing C-107). One other HSAPLU located at 12 Wyllie Road (Drawing C-115in Volume 4), which provides access to yards 11 and 12 is located about 35m from the roadway. Peak construction traffic is around 400 two-way vehicle movements per day for a construction period of 4.5 years. The Air quality team assess dust from construction traffic for these three properties as potentially significant, and mitigation is required. This mitigation is likely to be in the form of chip seal along the upgraded section of Moirs Hill Road and potentially of a section of Wyllie Road.

Susceptibility to effects of dust from road construction will decrease with distance from the road works. Properties with a separation distance of more than 200m will experience no more than minor impacts, even without mitigation measures for dust management.

Construction dust effects have the potential to impact on the Genesis Aquaculture facility from dust deposition into fish ponds some 60m from the construction area. The Freshwater Ecology Assessment report concludes that the fish are not sensitive to dust deposition into fish ponds some 60m down the prevailing wind direction from the construction area. However, due to the proximity of the fish ponds to the construction area, dust nuisance may still be a concern for the fish farm operation. Mitigation, such as wind protection fencing, may be appropriate for earthworks activities upwind of the ponds.

The Terrestrial Ecology Assessment Report raises the potential issue of dust effects, particularly on the native vegetation and some fauna within close proximity to the construction areas. The Terrestrial Ecology report considers the effects are generally of a temporary nature and generally manageable through dust suppression measures to mitigate effect. Particularly sensitive areas of flora and fauna have been identified in the Terrestrial Ecology Assessment Report and these areas will be identified in the management plan as areas where additional measures such as wind protection fencing may also be appropriate.

Further recommended mitigation measures and the development of a management plan are discussed in Section 18.5 of this AEE.

18.4 Operational air quality effects

As recommended in the MfE Transport Guide, the indicator contaminants for transport effects and the pollutants of most concern are CO, PM_{10} and oxides of nitrogen (NO_X). The MfE Transport Guide states that if the assessment of these indicator contaminants are is within relevant assessment criteria, then there is reasonable confidence that levels of other traffic related pollutants will also be acceptable. The NZTA Guide (2012) and the Tier 2 Screening Tool also include criteria for assessing $PM_{2.5}$, but exclude CO. CO has been consistently shown to comply with the NZAAQGs except in the vicinity of roadways with high AADT and significant congestion, such as Khyber Pass[115]. The Project is not expected to have high AADT or significant congestion therefore CO was not directly considered by the Air quality team.

[115] Refer Section 6.1 of the Air Quality Assessment Report.

For the two HSAPLUs most likely to be affected by the Project operation, 466 SH1 and the Hungry Creek Arts School, the operation of the Project will result in a small decrease in effects on air quality compared to if the Project did not proceed. This reduction is due to their proximity to the Project cumulatively with their proximity to the existing SH1.

Given the separation distance to HSAPLUs for the remainder of the indicative alignment, the effects of the operational phase of the Project will be less than minor, particularly when considered with the background air quality.

Based on the NZTA Screening Tool, even for a dwelling located 5m from the road edge, air quality guidelines and standards would still be met when considered cumulatively with the background air quality, indicating that properties would not be significantly adversely affected by an alignment change.

18.4.1 Network effects

The operation of the Project will reduce traffic on the existing SH1, which will be a benefit to the existing, higher density of HSAPLUs along this route. Without the Project all traffic would continue to travel on SH1, leading to increased traffic and congestion along that route, particularly at Warkworth. This would result in consequential increases in emissions and therefore exposure to air contaminants in the town. The relative differences in the mass emissions from motor vehicle contaminants travelling through the town for the 'with the Project' and 'without the Project' scenarios were compared in order to quantify the potential impact of not having the Project.

Total mass emissions predicted to be discharged from the Project are comparable to those predicted along SH1 in the 'with Project' scenario. The overall traffic discharges are predicted to increase in the region, but will be divided more or less equally between the existing SH1 and the Project. Consequently, the 'with Project' scenario will result in overall reductions in contaminant levels at HSAPLUs near the roads compared to 'without the Project'. Predicted mass emissions for the Project are similar for both 2021 and 2031, likely due to the increased AADT on the Project alignment being offset by predicted reductions in emissions per vehicle kilometre over time.

The mass emission estimations do not provide actual concentrations of contaminants at particular locations, but the approach does provide an indicative assessment of the effects for the two scenarios by estimating the total mass of pollutants likely to be discharged to atmosphere. Differences in the discharge rates are primarily due to the predicted decrease in traffic volumes on SH1 and auxiliary roads due to the Project and improved traffic flow on both the Project and SH1. As expected, the mass of contaminant emissions discharged in Warkworth and on SH1 between Pūhoi and Warkworth is predicted to decrease with the Project.

18.5 Recommendations, mitigation and monitoring

Construction activities have the potential to give rise to dust emissions that have moderate to significant adverse environmental effects. The residence at 466 SH1 is particularly close to sources of dust from construction traffic on yard access roads, the indicative construction yards and road construction activities.

For the construction phase, an air quality management plan should be developed prior to construction activities commencing. The management plan will incorporate procedures for daily visual monitoring and recording of activities, and for responding to dust complaints in order to ensure that the appropriate mix of controls are put in place and adapted as necessary to suit the conditions. If an exceptional event should occur such that controls fail or are inadequately applied, cleaning services to mitigate adverse effects from dust deposition onto neighbouring properties should be provided. In such circumstances, dust monitoring may be needed to assist in providing dust controls to avoid future incidents. The management plan will also be used to determine any site-specific measures to mitigate dust effects on nearby receivers or flora and fauna where necessary.

Systems for dust suppression will need to be incorporated into the design and management of the mobile crushing plant. Such measures could include enclosure of dust sources and extraction to specific air pollution control systems for particulate matter removal, such as to a water scrubber or baghouse filtration system, or water suppression. The mobile crushing plant will be operated at a minimum distance of 150m from any dwelling.

Sealing of access roads adjacent to properties with residences closer than 50m is recommended.

The good practice management approach will need to include a complaint management and response system that can be actioned as necessary to adapt the management regime to avoid, remedy or mitigate adverse effects if they do arise.

With the above in place, the operation of the Project will have less than minor impacts on air quality.

No further mitigation measures are needed for the operation of the Project because the potential effects have been appropriately mitigated through the Project design. In the event that the indicative alignment is shifted within the proposed designation boundaries reducing the separation distance of the road to any HSAPLU, relevant air quality guidelines and standards would still be achieved for the Project.

Monitoring for the construction phase is recommended to comprise visual assessment and record keeping on a daily basis to assess the adequacy of the measures in place. Complaint recording and response should also be used to inform the adequacy of the measures in place and the need for further measures or mitigation. Monitoring of weather conditions will assist in applying the recommended good management practices and undertaking dust complaint investigations.

I support the recommendations regarding dust management and monitoring during construction.

No specific air quality monitoring is recommended for the Project when in operation.

19. Hydrogeology

The Hydrogeology Assessment Report presents an assessment of the potential effects of the construction and operation of the Project on the existing groundwater regime. The Hydrogeology team assessed the potential effects on groundwater by field investigations including drilling, lithological logging, installation of monitoring wells and aquifer testing, and through the development of a regional 3-dimensional steady state groundwater model calibrated to water level monitoring data.

The Hydrogeology Assessment Report provides a detailed description of the existing groundwater environment in the Project area and the methodology used to model and determine effects. The following is a summary of the issues and potential effects identified in the Report.

This summary and the Report subsequently inform the recommended mitigation contained in Section 28 and will inform the Project conditions.

19.1 Existing groundwater environment

Several hydrogeological regimes are found within the Project area and are strongly influenced by the underlying geological units. The regional hydrogeology is described in Section 4.3.4 of this AEE.

19.1.1 Groundwater levels and quality

Borehole records obtained by the Hydrogeology team from Auckland Council indicate a total of 112 boreholes drilled within a 2 km radius of the indicative alignment. The Hydrogeology team obtained water levels from 44 of these boreholes, for which depth to groundwater ranged from 1 m to 132 m below ground level (BGL), with a median depth of 8 m BGL.

The groundwater quality of the Waitemata Aquifers can be broadly divided into shallow groundwater and deeper groundwater. Shallow groundwaters (<200 m depth) commonly have a high total hardness/total alkalinity ratio[116], and are hard calcium carbonate waters with near-neutral pH, high total iron (>1.0 g/m^3), and silica concentrations greater than 40 g/m^3[117]. In comparison, deeper groundwaters commonly have a low total hardness/total alkalinity ratio, and are soft sodium bicarbonate waters with pH >8.5, low total iron (<0.2 g/m^3) and silica concentrations of less than 40 g/m^3.

19.1.2 Groundwater abstraction and use

There are two main clusters of boreholes in the Project area, namely at Pūhoi and Warkworth. These boreholes primarily tap the Waitemata Group and have been drilled mainly for either domestic or stock water supply or as observation piezometers. Borehole depths range from 6 m to 305 m BGL, with an average depth of 135 m BGL.

[116] Total hardness is a measure of total concentration of calcium and magnesium while total alkalinity is a measure of the total concentration of carbonate and bicarbonate anions.

[117] Refer Section 3.10 of the Hydrogeology Assessment Report.

Table 19-1 summarises information for the 11 existing groundwater consents in the Pūhoi and Mahurangi catchments. The majority of the yields are low to very low. However, the exception is the recently obtained Watercare Services Ltd municipal supply abstraction in Warkworth, which is consented to abstract groundwater at a rate of up to 50 L/s (4,320 m^3/day). This bore is extremely high yielding, having intersected a highly fractured zone associated with a local fault. As such, the Watercare bore is considered atypical for the rock type and region.

Table 19-1: Existing groundwater consents

Consent No	Name	Allocation (m^3/day) [L/s]	Bore Depth (mBGL)	Expiry Date	Purpose
21606	Buckley	100 [1.2]	168	31/05/2015	Irrigation Market Garden
22840	Morton-Jones	40 [0.46]	305	31/05/2014	Community Supply
23056	Lawson Investments Ltd	40 [0.46]	15	01/05/2015	Irrigation Market Garden
31071	Warwick Rhodes Contractors Ltd	80 [0.93]	Unknown	31/05/2015	Potable Supply
34117	Summerset Villages Ltd	60 [0.69]	180	31/12/2029	Potable Supply
34119	Stockyard Holdings Ltd	60 [0.69]	180	31/12/2029	Potable Supply
35264	Watercare Services Ltd	4,320 [50.0]	200	03/04/2045	Municipal
35620	Atlas Concrete Ltd	80 [0.93]	160.5	31/05/2029	Industrial
36585	Bio Marine Properties Ltd	100 [1.2]	Unknown	31/05/2029	Industrial
38170	Pūhoi Valley Cheese	130 [1.5]	Up to 4 bores	31/05/2025	Industrial
40713	Southern Paprika Ltd	500 [5.8]	60	31/05/2029	Irrigation

The Hydrogeology Assessment Report does not specifically identify groundwater takes less than or equal to 20 m^3/day. Such takes can be undertaken as permitted activities, provided they are not within the High Use Aquifer Management Zone[118]. However, the Report is not influenced by the groundwater takes that are less than 20m^3/day.

[118] Defined and mapped in the ARP:ALW, not within the Project area.

19.1.3 Groundwater / surface water interaction

Potential changes in groundwater levels or flows may affect surface water features such as streams/rivers, springs/seeps, ponds, wetlands and drains. A desktop survey of aerial photos and maps identified approximately 45 such features within 2 km of the indicative alignment that could potentially be affected.

In areas underlain by the Waitemata Group or Northern Allochthon materials, groundwater typically emerges in the form of seeps at the base of slopes, and springs along geological boundaries. Some of these springs and seeps feed small streams, many of which are ephemeral.

In areas where alluvium has infilled the valleys, groundwater is responsible for the baseflow in the larger streams and rivers. Baseflow also feeds wetlands such as those found north of Carran Road in the vicinity of Warkworth.

19.2 Assessment methodology

The Hydrogeology team undertook a Project field investigation programme February and May 2013 to obtain site-specific geological and hydrogeological data. The scope of the investigation included:

- Drilling of 28 boreholes;
- Geotechnical testing in the boreholes;
- Installation of piezometers for recording groundwater levels;
- Monitoring of groundwater levels; and
- Aquifer hydraulic testing, including rising and falling head tests, and packer (lugeon) testing.

The details and locations of the boreholes are shown in Appendix A of the Hydrogeology Assessment Report.

19.2.1 Geological drilling

The ground conditions encountered during investigations typically comprise of Pakiri Formation with alluvium and colluvium deposits observed in low lying regions and valleys. The Hydrogeology team identified Northland Allochthon in the Schedewys Hill area and near the Moirs Hill Road area. The team constructed a geological long section and cross sections through specific areas along the alignment using the collected information.

19.2.2 Groundwater levels and flow measurement

Piezometers installed in 25 of the drilled boreholes provided information on static water levels. In summary, depth to groundwater is typically shallower, being close to the surface, and absolute groundwater level is typically lower in the valleys where infill alluvium is present. In the upland areas typically comprising Waitemata Group materials, groundwater levels are higher, albeit deeper (ie greater distance from the ground surface).

Groundwater levels in the alluvial deposits are shallow (typically between 0.17 m and 0.9 m BGL) and relatively sensitive to rainfall events and higher stream flows. These factors suggest that the

alluvium deposits are directly connected to surface processes. Piezometer results indicate an upward flow potential in valley floor locations, though this is likely influenced by very dry conditions during the investigation period.

Groundwater levels in the Waitemata group are deeper (typically between 3.8 m BGL and 39.93 m BGL) and have shown little variation over time and little response to rainfall events.

A model developed for the Project shows that groundwater predominantly flows through the alignment from the west to the east. However, south of Moirs Hill Road between Ch. 57000 and Ch. 58000, groundwater is flowing southward and crossing the alignment from the eastern side.

19.3 Assessment of hydrogeological effects

The impact of the Project on groundwater will largely arise from deep excavations. Excavations below the water table can impact on the natural groundwater regime in the following ways:

- Drawdown – Groundwater drawdown and associated ground settlement may have the potential to impact on existing structures and services.
- Surface water resources – Reduction in groundwater levels may affect stream baseflow regimes, and alter present inflows and outflows from springs, streams, rivers, ponds and wetlands.
- Groundwater quantity and quality – Reduction in groundwater quantity (yield) and possible changes to water quality at existing abstraction bores through the alteration of groundwater flow patterns.
- Migration of existing contaminants – Potential to spread contaminants residing in areas of past landfilling and/or contaminated sites through groundwater drawdown in these areas.

19.3.1 Groundwater drawdown

The Hydrogeology team assessed drawdown for each of the proposed cuts with a calibrated numerical groundwater model. The extent of groundwater drawdown from the cuts on the indicative alignment is shown in Figure 19-1, which indicates that drawdown is very localised to the cut alignment. Although the maximum extent of drawdown extends to 700m from the centre of the indicative alignment, drawdown of any great significance (ie 5m or greater) is typically constrained to within 160m of the indicative alignment.

There are only two existing consented abstraction bores and the calculated drawdown profile. The maximum drawdown impact simulated in these bores is only 0.5m. Both these bores are over 150 m deep and hence the hydrogeologists consider this level of impact to be minor.

Groundwater drawdown has the potential to induce ground settlement in soft compressible sediments, such as alluvium and highly weathered rock or clay. The cuts that will induce groundwater drawdown are mainly located in Waitemata Group materials that display very low compressibility potential. Groundwater drawdown is typically localised to within the Waitemata Group materials, and hence the Hydrogeology team do not expect measureable settlement.

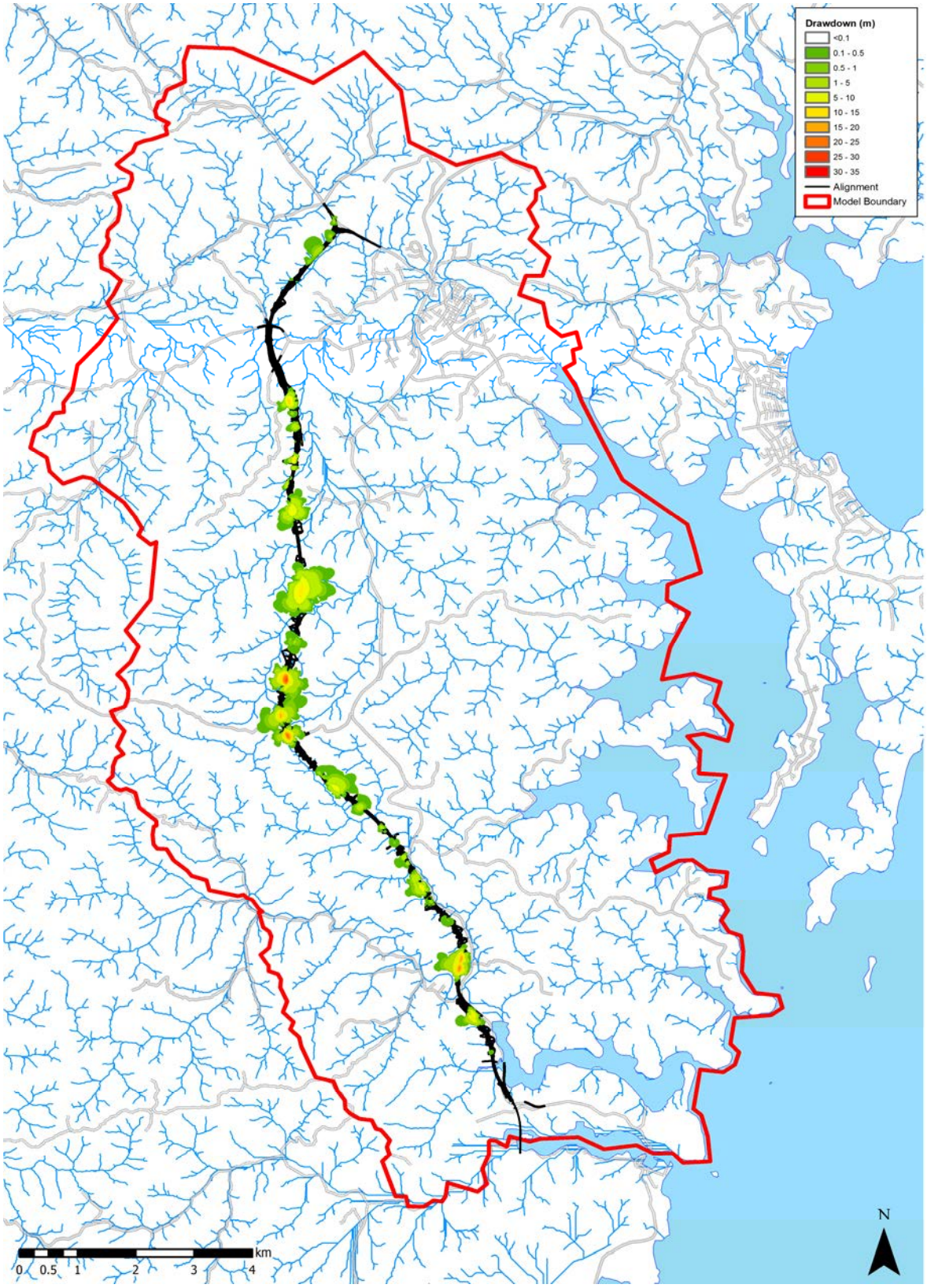


Figure 19-1: Extent of groundwater drawdown from alignment cuts

19.3.2 Impact on neighbouring groundwater users

As noted above, only two of the 112 bores within a 2km radius of the indicative alignment are located within the calculated drawdown profile. Details for these bores are shown in Table 19-2. They are of small diameter and deep, which suggests that the shallow aquifer has very low permeability. Drilling to construct these wells to significant depth was necessary for the Hydrogeology team to gain an acceptable yield.

Table 19-2: Bores located within predicted drawdown profile

AC bore ID	Owner	Purpose	Bore details	Estimated drawdown (m)
828	C Brown	Stock and domestic supply	Diameter: 100 mm Bore Depth: 160 m Casing Depth: 50 m	0.5
22861	Boys to Men Trust	Domestic Supply	Diameter: 100 mm Bore Depth: 200 m Casing Depth: 80 m	< 0.5 (located in cut)

The estimated drawdown for these bores is 0.5m or less. For bore 828, the Hydrogeology team considers this drawdown to be less than minor in terms of the impact on the ability of the bore to supply water for stock and domestic purposes. It is noted that bore 22861 is located in the vicinity of a large cut at Billing Road. This property and bore have been purchased by the NZTA and consequently the groundwater take will cease to be used for a domestic water supply.

19.3.3 Stream baseflow reduction

The Hydrogeology team assessed the reduction in groundwater contributions to local streams (stream baseflow reduction) with a calibrated numerical groundwater model that considered the worst case impact on perennial streams crossing or adjacent to the indicative alignment.

Stream baseflows under natural conditions range from a trickle or 15% of a typical garden hose (0.2 L/s) to roughly a third of a fire hydrant (20 L/s), respectively. The modelled reductions in stream baseflows as a result of the Project are shown in Table 19-3.

Table 19-3: Modelled stream baseflow reductions

Stream chainage	Stream order	Baseflow (natural) (L/s)	Baseflow (with cut) (L/s)	Baseflow reduction (L/s)	Percentage decrease (%)
47400	1	0.10	0.10	0.01	6.3
47700	1	0.03	0.02	0.01	46.0
48000	2	0.66	0.62	0.04	5.9
49500	4	2.69	2.69	0.00	0.1

Stream chainage	Stream order	Baseflow (natural) (L/s)	Baseflow (with cut) (L/s)	Baseflow reduction (L/s)	Percentage decrease (%)
50800	1	0.06	0.05	0.01	16.3
52100	4	3.41	3.33	0.08	2.4
54700	4	7.29	7.18	0.11	1.6
55000	1	0.14	0.14	0.00	1.4
55300	2	0.53	0.50	0.03	5.2
56400	2	0.16	0.14	0.01	9.5
56700	2	0.30	0.26	0.04	12.9
58400	2	0.16	0.15	0.01	3.5
60200	3	1.18	1.17	0.00	0.4
61100	2	0.20	0.20	0.00	0.3
61300	1	0.04	0.04	0.00	2.4

The absolute magnitude of reduction in baseflows is from 0.0007L/s to 0.11L/s. Lower order streams (ie smaller streams with less baseflow) are impacted more significantly in terms of stream baseflow reduction (0.3-46.0% of flow) than higher order streams (0.1-2.4% of flow). However, flow in these lower order streams is small and hence the stream is likely to be a perennial wet area rather than a free flowing stream.

Overall, the absolute reduction in flow in these areas is very small and unlikely to be detectable over and above the influence that surface runoff may have. The Hydrogeology team considers the reduction in baseflow from a flow volume perspective to be minor. The consequential influence on the Mahurangi River will be imperceptible. As such, the Hydrogeology team considers that the effects on existing surface water takes from the Mahurangi River will be negligible.

19.3.4 Groundwater quality

Effects on groundwater quality as a result of groundwater disturbance required by the Project may include:

- Mobilisation of metals – Change in the redox characteristics within the aquifer at the position of the new 'drawn down' groundwater table resulting in the mobilisation of connate metals from within the aquifer, commonly seen as iron seeps or staining on cut exposures or drainage swales;
- Turbidity production – any excavation of aquifer materials to beneath the groundwater table has the potential to increase the turbidity of groundwater;

- Reduced assimilative capacity – Reduction in stream baseflow may reduce the assimilative capacity of the streams, exacerbating any water quality issues already occurring in streams; and
- Shallow aquifer contamination – Road runoff infiltration of the local groundwater system may contaminate shallow groundwater.

The Hydrogeology team considers the scale of these effects on groundwater quality throughout the Project area to be minor due to the low permeability, and thus very slow infiltration and flow rates of Waitemata Group materials, and the very small volumes of water that will be diverted at the cuts.

It is unlikely that surface discharges of TSS during construction will affect groundwater quality due to the low permeability and low likelihood of runoff infiltrating the groundwater system. However, the Hydrogeology team recommends that stormwater treatment ponds located in elevated areas where there are downward pressure gradients have a clay or synthetic liner with low transmissivity. The team does not consider liners necessary in wetland areas where the flow potential is upwards towards the surface as the risk of surface contamination is low.

19.3.5 Overall effects on groundwater

The Hydrogeology team considers construction and operational impacts of the Project on groundwater to be negligible because of the surface water containment system developed for the Project, the underlying groundwater system being so impermeable and diverted groundwater being re-directed in natural water courses through the surface water drainage system.

19.4 Recommendations and mitigation

Based on the indicative design for the Project, the Hydrogeology team does not consider mitigation or monitoring necessary for groundwater impacts because of the very low likelihood of any significant impacts, the fact that there are no affected parties, and because any diversions are routed through the Project's stormwater system or discharged back into natural watercourses. This conclusion will be confirmed following detailed design of the Project. I support this conclusion.

20. Contaminated land

A Contaminated Land Assessment Report has been prepared to present the results of an investigation into potential soil contamination at properties within the Project area. The Report has identified a small number of properties within the proposed designation boundaries that are, have previously been, or may have been subject to land uses listed on the Ministry for the Environment's Hazardous Activities and Industries List (HAIL).

A number of these properties have been subject to a further investigation, the levels of contamination tested, and the potential risks to environmental and human health quantified. Other properties are yet to be assessed and will be investigated following the NZTA taking ownership of those properties.

20.1 Consent requirements for Contaminated Land

Certain activities, such as excavation of soil, extraction or lowering of groundwater and filling of land will be subject to consent under the National Environmental Standard (NES) for Assessing and Managing Contaminants in Soil to Protect Human Health[119] and the ARP:ALW.

The process of obtaining consent under the NES to disturb soil on a HAIL site itself requires a number of measures aimed at avoiding, remedying and mitigating potential adverse effects.

Given that the Contaminated Land Assessment Report is based on an indicative alignment, and detailed design is yet to be undertaken, the NZTA will seek any necessary consent under the NES and/or the ARP:ALW prior to construction of the Project.

Works on or in proximity to contaminated sites will be identified, assessed and managed on a case-by-case basis through the NES consenting process.

The Contaminated Land team undertook a preliminary site investigation for the entire Project area. 10 detailed site investigations (DSIs) were then undertaken. The DSIs were limited to areas of potential soil disturbance based on the indicative alignment and construction methodology. DSIs were not undertaken where no soil disturbance was anticipated.

20.2 Assessment of effects regarding contaminated land

At some of the sites that were investigated, the Contaminated Land team identified exceedances of the soil contaminant standards adopted for protection of human health and the environment.

20.2.1 Human health

Laboratory test results for the following sites indicate that concentrations of certain contaminants, including Cadmium, Copper, Lead, Zinc and Arsenic, exceed the Soil NES concentrations for rural residential and commercial / industrial land uses:

- 3 Pūhoi Road - a possible sheep dip;

[119] Note that the NES does not apply to a piece of land where a Detailed Site Investigation demonstrates that contaminants are at or below naturally occurring background concentrations.

- 517 SH1 - cottage industry mechanical repair workshop;
- 815 SH1 - possible sheep dip and treated timber; and
- 173 Carran Road.

These concentrations have the potential to pose a risk to human health in relation to these specific land uses and for outdoor workers.

Although construction works will span several years, the exposure duration for the Project is likely to be a few weeks at most. The actual risk to construction workers is therefore likely to be minimal. Worker exposure to contaminated soils would only occur at the sites where contaminated soils occur, and not over the entire indicative alignment. The opportunity for rural residents to be exposed to soil contaminants during the construction works will be limited, as generally residents will not be near the construction site or areas of disturbed soil. Therefore, the Contaminated Land team considers the risk to human health to be is minimal.

20.2.2 Environmental risk

Laboratory test results for sites at 3 Pūhoi Road, 517, 813 and 815 SH1, 40 Wyllie Road and 173 Carran Road indicate that concentrations of certain contaminants pose a potential risk to environmental receptors.

The contaminants identified in soil (metals, organochlorine pesticides, and petroleum) are generally not very mobile within the soil environment, as metals will tend to bind to the mineral / clay fraction of the soil and organochlorine pesticides will tend to bind to the organic fraction in the soil. Therefore, a portion of these contaminants will not be bioavailable (available for organism uptake).

Some of the metal concentrations measured in samples collected from some of the properties are very high, and have the potential to negatively affect environmental receptors, if not managed appropriately. However, these metals are likely to be confined to a relatively small area, in relation to the wider earthworks development.

Elevated hydrocarbon concentrations were measured in samples collected from the automotive workshop located at 173 Carran Road. It is anticipated that this property will not be directly disturbed as part of the construction process, and as such, the risk of mobilising contaminants into the environment would be avoided.

Assuming targeted removal and management of contaminated soils within the Project area, existing contamination is likely to have a negligible environmental effect.

20.3 Recommendations and mitigation

The range of identified contaminants relates largely to typical land use activities in the rural areas and the distribution is limited to a relatively small area. NES consents will be obtained prior to the commencement of construction in areas where contamination may be present. Therefore, it is recommended that contaminated soil is removed and disposed of at an appropriately licenced

(Class A) landfill facility, in accordance with a Remedial Action Plan (RAP)[120] to be submitted to Auckland Council.

Accidental discovery protocols, including the engagement of a suitably qualified and experienced contaminated land practitioner (as required under the NES), will also be implemented to manage any unexpected contamination uncovered during the construction phase.

By following the NES process and developing a Remedial Action Plan (RAP) for the Project, and disposing of contaminated soil appropriately, we consider the risk of adverse effects regarding contaminated land will be minimised.

The NZTA will require a consent for contaminated land disturbance under the NES. I do not consider that designation conditions are necessary. To avoid the potential for conflicting conditions, I recommend that the NES consent deal with all aspects including accidental protocols and disposal of contaminated soil.

[120] To be prepared in accordance with Ministry for the Environment, revised 2011, *Contaminated Land Management Guidelines: Reporting on Contaminated Sites in New Zealand*

21. Operational water management

An Operational Water Assessment Report has been prepared for the Project, which provides an assessment of the environmental effects of the Project, specifically those effects arising from motorway stormwater management and stream works. Effects on water in relation to erosion and sediment control and the construction phase of the Project are the subject of a separate report and are summarised in Section 10 of this AEE. Other effects relating to water are also included in Sections 11 (Freshwater ecology) and 19 (Hydrogeology) of this AEE.

The Operational Water Assessment Report describes the Project's operational water systems, including the permanent stormwater management systems and modifications to streams and flood plains necessary for the operation of the motorway. The approach to operational water management has been to minimise effects by designing mitigation measures into the Project based on a BPO approach. The extent of the mitigation measures discussed in the Report is based on consideration of the sensitivity of the receiving environment and the assessment of any potential unmitigated effects.

The following is a summary of the issues and potential effects identified in the Operational Water Assessment Report. This summary and the Report subsequently inform the recommended mitigation contained in Section 28 and will inform the Project conditions.

21.1 Operational water systems

Figure 21-1 provides an overview of how water will be managed during throughout operation of the Project.

Rainfall onto cuts and the motorway is collected and conveyed via stormwater treatment devices prior to discharge to streams, which then drain to the estuary and harbours. Rainfall onto adjacent areas is diverted away from cuts and the motorway. Streams that intersect the motorway alignment are conveyed via a culvert or crossed by a bridge. In limited circumstances (not shown in Figure 21-1) the motorway fills occupy floodplains.

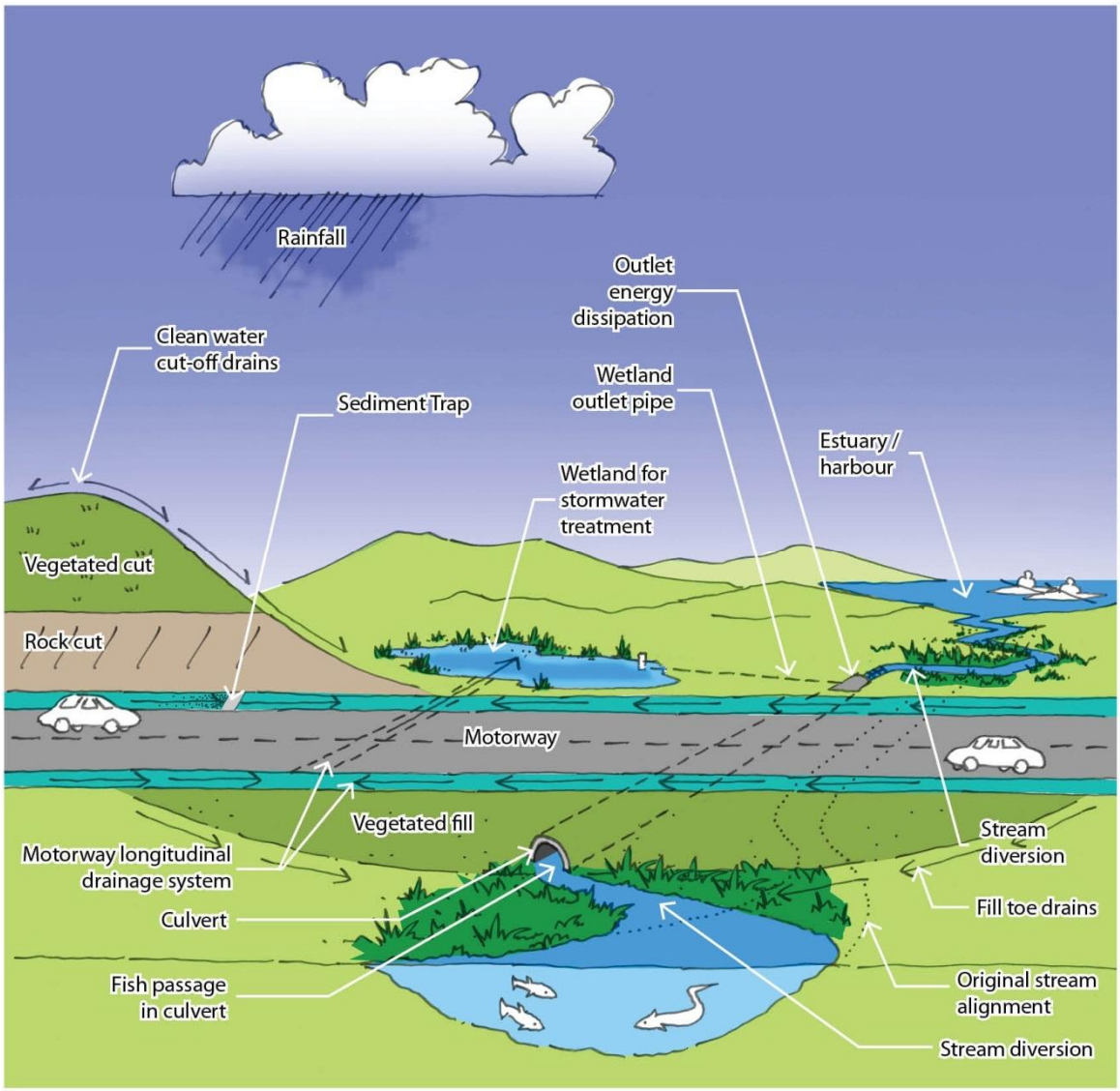


Figure 21-1: Motorway operational water systems and the environment

The proposed operational water systems for the motorway include measures designed to minimise adverse effects on receiving environments.

Stormwater collected in motorway drainage systems will be conveyed by drains, swales or pipes to constructed wetlands for treatment prior to discharge to the natural environment. Wetlands are the preferred stormwater treatment device and 27 are potentially required for the Project. Sediment traps will also be installed to provide initial capture of sediment generated from rock cuts upstream of the wetlands.

The constructed wetlands have been designed to achieve:

- Treatment of all runoff from the motorway for 75% TSS removal; and

- Extended detention for most areas of the motorway to reduce the potential for erosion of streams. However, extended detention is not required in four locations where the Project discharges to the Pūhoi Estuary.

The Project proposes seven large viaducts and five bridges along the indicative alignment. Nine of these structures cross streams or rivers. Two structures (Woodcocks Road Viaduct and the Carran Road Flood Relief Bridge) span the lower Mahurangi floodplain and have been designed to minimise effects on the floodplain.

The Project also proposes 40 culverts, three of which will be concrete arch culverts. The total length of culverts is approximately 1,120m for permanent streams and approximately 3,050m for intermittent streams. Energy dissipation and erosion control will be provided for all stormwater outfalls. Fish passage is provided in all but two culverts for permanent streams with upstream habitats (post-development). The two exceptions are where required upstream drop structures create a barrier to fish passage. Fish passage is provided in culverts for all intermittent streams where the Freshwater Ecology team has identified potential for fish habitat upstream. Refer to Section 7 of the Freshwater Ecology Assessment Report for information regarding fish passage for diadromous species.

A summary of the proposed culverts and bridge structures is included in Section 3.2 of the Operational Water Assessment Report and in Drawings S-121 to S-111 and SW-101 to SW-307 (refer Volume 4).

The stream diversions are characterised into three typologies with approximate total lengths as follows:

- Stream Diversion Type 1: Lowland Stream with estimated length = 1,500m;
- Stream Diversion Type 2: Steep Stream with estimated length = 1,575m; and
- Stream Diversion Type 3: Flow Channel with estimated length = 4,695m.

Type 1 and Type 2 are natural stream forms that replicate the stream bed morphology and the flow hydraulics of the natural stream being diverted and are proposed for permanent streams that support fish habitat and also for intermittent streams where there is potential for fish habitat upstream[121]. Type 3 provides only for flow requirements. Refer to Drawings SW-401 to SW-403 for further details of stream diversions.

21.2 Existing environment

The Project traverses the Pūhoi and Mahurangi catchments, as shown in Figure 21-2. The Project area is largely characterised by steeper rolling hill country with interconnected ridge and valley systems in the central Sectors. The terrain changes to low undulating country in the northern parts of the Mahurangi catchment. Moirs Hill Road represents the approximate divide between the Pūhoi and Mahurangi catchments.

[121] Based on the Freshwater Ecology Assessment Report

21.2.1 Catchment descriptions

In the Pūhoi catchment, the receiving environments are the tributaries and main streams of the Hikauae Creek and Pūhoi River, and ultimately the Pūhoi Estuary. In the Mahurangi catchment the receiving environments are the tributaries and main streams of the Mahurangi River, its Left and Right Branches, and ultimately the Mahurangi Harbour. The indicative alignment crosses a mixture of permanent and intermittent streams and rivers, varying from natural streams with good riparian vegetation to farm drains. The streams have rock outcrops in places, but also consist of soft bottom streams.

Refer to Sections 4.2, 10.4, 11.1 and 19.1 of this AEE for a description of the catchments and existing water environment within the Project area.

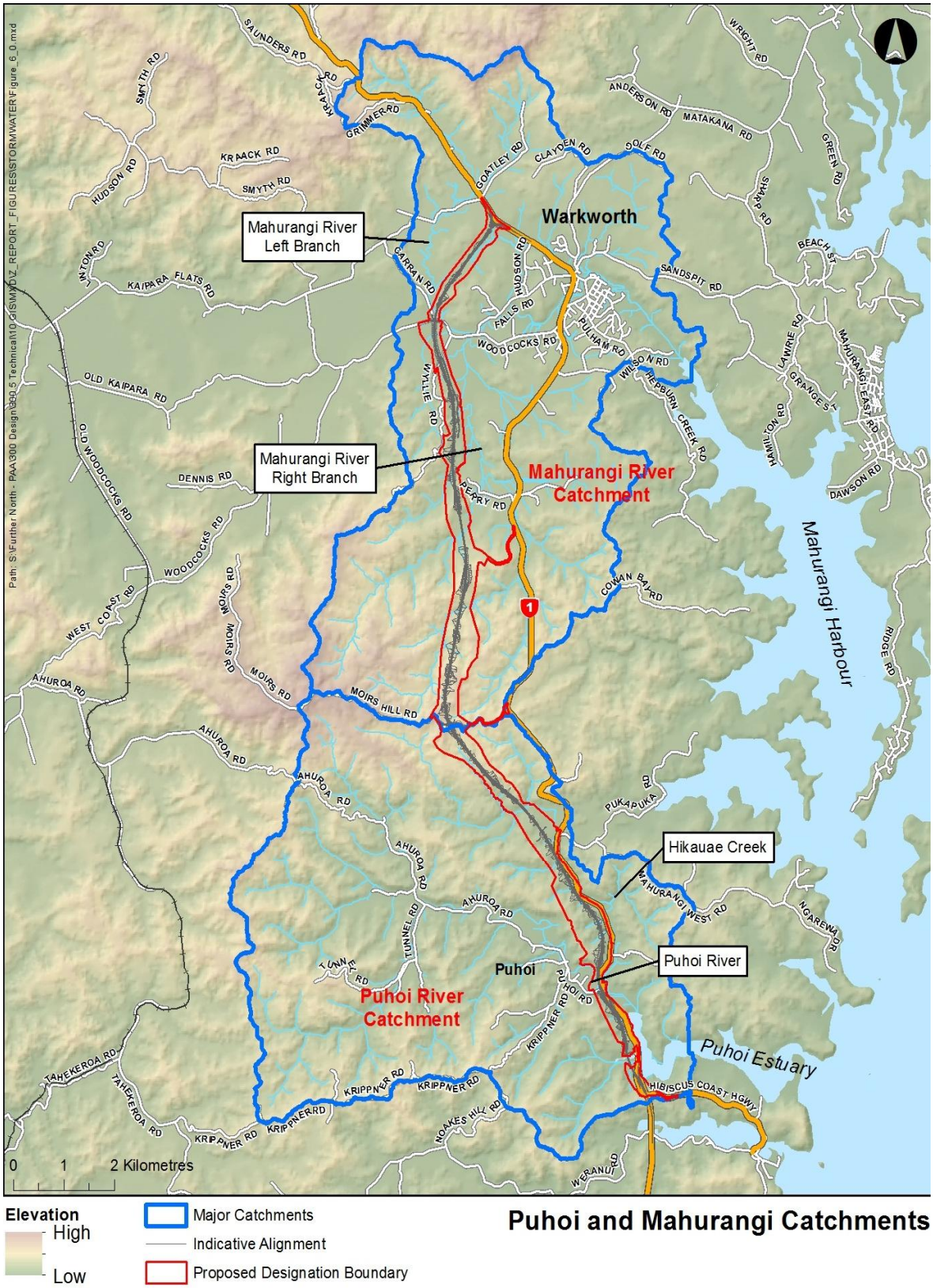


Figure 21-2: Catchments and key watercourses in the Project area

21.2.2 Flooding

Flooding is an existing issue in the lower Mahurangi catchment, including in parts of Warkworth. Auckland Council is developing flood management models for the Mahurangi and Warkworth area to define hazards and to plan for mitigation options. The Water team used this initial data from Council to identify areas of flooding within the Project area.

The key areas of flooding that interact with the Project are as follows:

- Mahurangi River Left Branch in the vicinity of Woodcocks Road; and
- Secondary flow path from Mahurangi River Left Branch up the flat valley to the north following the indicative alignment. The secondary flow path has depths up to 3m with water levels grading from 35.5m RL to 35m RL at the north and it is estimated to convey a peak 100 year ARI flow of approximately 90m^3/s. The secondary flow path flows north before returning via the Hudson Road area to the Mahurangi River downstream of Falls Road. During normal flows the farm drains in this area flow both north and south. Essentially the secondary flow path conveys flood flow out of the Mahurangi River Left Branch into an adjacent sub-catchment and back into the Mahurangi River.

The Water team reviewed Auckland Council GIS data showing the extent of flooding in a 100 year ARI rainfall event in the Pūhoi catchment. Flooding in the Pūhoi catchment is not a concern for the Project due to the limited works proposed in proximity to the Pūhoi River. The Pūhoi Viaduct will span the river and floodplain. The viaduct is significantly larger than the existing SH1 bridge across the river and therefore will not impact on flooding. Similarly, the proposed Okahu Viaduct will not impact on flooding.

The 100 year ARI floodplain for both the Pūhoi and Mahurangi catchments is shown on Drawings SW-101 to SW-115 Volume 4.

21.2.3 Water quality

Water quality in the Project catchments is discussed in in Section 4.4 of the Operational Water Assessment Report.

21.2.4 Existing catchment uses and values

The existing and potential uses and values of the Project catchments and estuarine and harbour catchments are shown in Table 21-1 and Table 21-2 below.

Table 21-1: Existing freshwater catchment land uses and values

Value or use	Details
Aquatic ecology	The nature of the existing freshwater ecology and the assessment of effects of the Project on aquatic ecology, are provided Sections 5 and 6 and 7 respectively in the Freshwater Ecology Assessment Report. The in-stream water quality is a significant control on aquatic ecology. As such, water quality has been compared to guideline values intended to protect aquatic ecology values.
Cultural values	Cultural values include use of freshwater resources for food and their general cultural history and significance. These matters are covered in the Cultural Assessment Report.
Stock watering	Stock watering is provided in the catchment through direct stock access to waterways or through stock watering systems reticulated from streams. Stock water takes from surface waters would generally be permitted activities so no consents would be held.
Irrigation	Irrigation activities include horticulture and small scale pasture irrigation. No resource consents exist for irrigation from surface water within the Project area. The only consent for irrigation in the Mahurangi catchment is for irrigation of a 1.5 ha nursery, where water is taken from a tributary that will be unaffected by the Project (consent 21828). Permitted takes for small scale irrigation may however be undertaken in areas the Project could affect but no records are kept by AC to determine whether any exist or not.
Aquaculture	Genesis Aquaculture fish farm is located within the Mahurangi catchment and takes water from a tributary of the Mahurangi adjacent to the fish farm and downstream of the proposed Kauri Eco Viaduct.
Water supply from surface water	As discussed previously, Watercare holds consent for the take of surface water from the lower Mahurangi to provide for the Warkworth town water supply. Watercare holds consent for the taking of surface water (from the River) and another recently acquired consent for the taking of ground water. It is in the process of developing a water supply bore. Watercare anticipates the bore will be in operation from 2016 It is envisaged the bore will be the primary water supply for Warkworth and the surface water will be a back-up supply, but the bore is still in development, and therefore the bore source is not guaranteed at this point. No other consented surface water takes are known. However, surface water may be abstracted under the permitted rule.
Recreational activities	Recreational activities include contact recreation, kayaking, fishing and general amenity use of streams from accessible reserve areas. No bathing areas have been identified within the freshwater catchments in proximity to the indicative Project alignment. Many small streams are in private land and are unlikely to be used for contact recreation because they are generally small and shallow. The lower reaches of the Mahurangi and Pūhoi have areas where access can be gained. Occasional informal use of the streams for bathing may occur. There is a popular swimming hole at Falls Road on the Mahurangi River. Kayaking is a popular recreational activity in the lower Pūhoi River Estuary. Fishing may also occur in lower areas of the river and the estuaries. However, no specific data has been identified to indicate whether fishing does occur. Fishing, with the exception of eeling, is less likely to occur in streams higher in the catchment as they are so small. Public access is limited in most of the Hikauae Creek and upper streams of the Mahurangi. The watercourse is visible to property owners and also to the public at bridge locations. The lower Mahurangi has areas within Warkworth where the general public can view the watercourse. The main recreational opportunities occur along the banks of the tidal area of the Mahurangi estuary.

Table 21-2: Existing estuarine and harbour catchment uses and values

Value or use	Details
Marine aquatic ecology	The nature of the existing ecology and assessment of effects of the Project on the marine aquatic ecology are provided in Marine Ecology Assessment Report. The estuarine and harbour water quality is a significant influence on aquatic ecology. As such water quality has been compared to guideline values intended to protect marine aquatic ecology values.
Cultural Values	Cultural values include use of marine aquatic ecology resources for food and the general cultural history and significance of the coast, estuary and harbour. These matters are covered in the Cultural Assessment Report.
Aquaculture	Oyster farms are located in the Mahurangi Harbour and are detailed in the Marine Ecology Assessment Report. There are currently 42 AC resource consents granted for marine farming activities in the Mahurangi. There are no oyster farms or other aquaculture within the Pūhoi estuary.
Other consented activities	Other than the marine farming consents there are few other activities with resource consents associated with the estuarine environments recorded in information provided by Auckland Council. NZTA has consents for some earthworks and coastal reclamation associated with the existing State Highway 1. There is a consent for the network discharge of stormwater from Warkworth and a discharge consent for the Warkworth wastewater treatment plant. The Project activities are not considered likely to affect any of these consented activities.
Recreational activities	Recreational activities include contact recreation, kayaking, boating (motor and sail), fishing and food gathering and general amenity use of coastal areas. The marine areas of the Mahurangi and Pūhoi estuaries are managed for contact recreation with bathing being more common in the lower estuaries. Kayaking is a popular recreational activity in the Pūhoi estuary and also in the Mahurangi estuary and harbour. Other surface based recreational activities such as sailing and boating occur throughout the Mahurangi Harbour. Fishing and gathering of other food (eg shellfish) occurs throughout the Pūhoi Estuary and Mahurangi Harbours. Public access is provided to the Mahurangi estuary with a waterfront walkway in Warkworth town. Access to the shoreline is also possible in many other areas of the Mahurangi Harbour. The estuaries contain the Mahurangi and Wenderholm (in Pūhoi estuary) regional parks.

21.2.5 Existing infrastructure

There is limited downstream infrastructure (such as roading or drainage of water supply infrastructure) that has the potential to be affected by the Project.

In the Mahurangi catchment there are bridges on Perry Road, Woodcocks Road, SH1 and Elizabeth Street, and a ford at Falls Road, which are all remote from the Project.

In the Pūhoi catchment there are culverts on the existing SH1 downstream of the indicative alignment in the Pūhoi and Hungry Creek Sectors. Details of these existing culverts are provided in the Operational Water Assessment Report.

Water is taken for supply for Warkworth by Watercare and used for aquaculture by Genesis Aquaculture. There may also be other users operating under the permitted activity threshold.

21.3 Assessment criteria and considerations

The assessment criteria and conditions applying to the Operational Water Assessment Report are based on the requirements of the RMA, ARP:ALW, the ACDP (Rodney Section), relevant Auckland Council guidelines and the NZTA policy, standards and guidelines. Assessment matters relevant to operational water management include:

- The BPO approach;
- Stormwater quantity, including attenuation, bed/channel disturbance, erosion control at stormwater outfalls and overland flow;
- Stormwater quality, including water quality treatment, aesthetics and odour and sediment discharge;
- Human impacts, including human health and amenity and water users;
- Ecological impacts, including protection of aquatic ecosystems and habitat, effects of piping/culverting and fish passage; and
- Flooding.

These assessment matters establish the framework for the assessment of effects relating to operational water management. Refer to Section 5.5 of the Operational Water Assessment Report for further detail on assessment matters.

There are 417 regional consents, including stormwater discharge consents, in the Mahurangi and Pūhoi catchments. The NZTA holds 66 of these consents for stormwater discharges, earthworks, coastal structures, reclamation, stream works and bores. The NZTA holds a number of relevant consents for the diversion and discharge of stormwater for the NGTR (including the Johnstone's Hill tunnels and the northern portal area), Titfords Bridge and the turnaround area at the SH1 toll booth. The NZTA also holds consents for culverts that will be affected by the Project at the Hungry Creek passing lane (Pūhoi catchment) and Twin Streams (Mahurangi catchment).

The consents relevant to the potential effects of discharges to water from the Project are:

- A consent held by Watercare for the supply of the Warkworth water treatment plant from the Mahurangi River at Warkworth; and
- Resource consents for 42 marine aquaculture activities in the Mahurangi Harbour. Section 3.1.2 of the Marine Ecology Assessment Report provides further information regarding the nature and locations of these activities.

With the exception of the Watercare surface water abstraction on the Mahurangi River, there are no consented surface water abstractions on watercourses within the Pūhoi or Mahurangi catchments that could be affected by the Project.

Surface water abstractions within the permitted activity thresholds of the ARP:ALW have not been considered as part of the Operational Water Assessment Report. The permitted surface water abstraction rule in the ARP:ALW allows for the taking and use of no more than $5m^3$/day of water from a river, stream or spring, subject to the relevant permitted activity conditions. No information on permitted users is available from Auckland Council. For purposes of their assessment the Water team assumed that surface water is taken by Genesis Aquaculture as a permitted activity for the fish farm.

The Operational Water team identified that there is a pending Auckland Council consent in process for revised stormwater network discharge consent for Warkworth township.

Further information regarding existing consents is contained in Section 5.4 of the Operational Water Assessment Report.

21.4 Methodology

The Operational Water team applied the following methodologies throughout the design of the Project's operational water systems and for the assessment of related effects:

- Designing stormwater treatment devices based on TP10;
- Assessing stormwater quality aspects using the water quality datasets for the catchments, stormwater contaminant concentrations from motorway studies and the Auckland Council Contaminated Load Model;
- Designing and assessing stormwater quantity aspects based on the TP108 method and the XP- SWMM[122] model;
- Designing and assessing culverts using the TP108 method and HY-8 culvert model for culvert sizing, HEC14 for energy dissipation design and assessment of velocity changes, and TR 2009/084[123] for fish passage design; and
- Assessing flooding aspects from the motorway footprint using the Auckland Council rapid flood hazard model.

21.5 Mitigation measures in Project design

The Project includes mitigation measures within the proposed operational water systems. These measures are incorporated into the Project to mitigate any potential adverse environmental effects associated with stormwater management and stream works. The Operational Water team developed these mitigation measures through the assessment of a number of potential options and the selection of a BPO for avoiding, remedying or mitigating effects. Mitigation measures are also included for key areas of risk.

In this consenting phase, the recommended mitigation aims to provide flexibility for designers and contractors in subsequent phases of the Project. This flexibility allows for alternative and innovative designs to meet or exceed the stormwater management objectives, and can react to and account for design changes that may result from design refinement.

Specific measures for stormwater treatment and stream works, including bridges, culverts and diversions, are discussed in the following sections.

[122] XP Solution Storm Water Management Model (software) refer Section 6.2.1 of the Operational Water Assessment Report.

[123] Refer Section 8.5.3 of the Operational Water Assessment Report.

21.5.1 Stormwater treatment systems

For stormwater systems, the BPO approaches include:

- Stormwater treatment for all of the motorway and cut slopes by wetlands to remove sediment and contaminants from the runoff;
- Stormwater treatment for rock cuts with sediment traps for near source capture of additional sediment prior to wetlands; and
- Stormwater outfalls with erosion protection to minimise erosion.

In addition to the measures listed above, permanent planting will be adopted to stabilise slopes following construction. Early stabilisation will be implemented, as discussed in the Construction Water Assessment Report. The Landscape and Visual Assessment Report and Terrestrial Ecology Assessment Report refer to the need to provide a proper vegetation cover following the construction of the Project.

The Operational Water team used the BPO approach to determine the most appropriate stormwater treatment devices based on the options in TP10. The BPO assessment described in Section 7 of the Operational Water Assessment Report concludes that constructed wetlands are the preferred stormwater treatment devices due to the overall water quality treatment achieved and their ability to provide attenuation.

Constructed wetlands perform well as treatment devices by removing a range of contaminants and have advantages over ponds due to increased filtering and biological treatment performance. The treatment features of wetlands include:

- Settling of suspended solids;
- Uptake by wetland plants of nutrients and soluble metals;
- Filtering of particulates and absorption of nutrients and trace elements by wetland plants;
- Organic bottom sediments providing nitrification / dentrification (transformation and loss of nitrogen);
- Evaporation of (volatile) petroleum compounds; and
- Trapping of gross pollutants.

Wetlands limit temperature increases better than ponds, mainly because the vegetation protects the water from light penetration. Temperature changes can provide direct stresses on aquatic species and also make nutrients in sediments more susceptible to algal growth. Compared to other treatment devices available, wetlands incorporate low impact design principles, have low maintenance requirements, low whole-of–life costs, and provide visual amenity and are a better habitat for wildlife.

Constructed wetlands for the motorway will be densely planted to maximise the treatment effectiveness. A staggered series of depths will be used to increase the wetland vegetation, and planting will be in accordance with Auckland Council and NZTA standards.

Wetland outfalls will be sized to convey the 100 year ARI flow rate and will incorporate erosion protection measures to minimise bed scour and bank erosion in the receiving watercourse. Typically this protection will be through an energy dissipation device and/or rock aprons.

The Operational Water team proposes sediment traps in the drains at the base of cut faces as an extra treatment measure. These sediment traps are bespoke treatment devices that will capture sediment generated from rock cuts. The sumps will be used as additional treatment devices upstream of wetlands.

The Operational Water team proposes clear water cut-off drains at the top of all cut faces where flow from above would otherwise flow over the downstream cut face. These drains will reduce erosion on cut faces by intercepting clean water flow. Vegetation cover on cut and fill slopes and the capture and treatment of runoff from cut slopes will assist in minimising and controlling sediment generation.

The Operational Water team considers that vegetated roadside drains are the BPO for treatment of runoff for existing low traffic ancillary roads that will be constructed or upgraded as part of the Project. These include the proposed access road off Wyllie Road, the access road to the Perry Road Viaduct, upgrades to Moirs Hill Road, and roads associated with underpasses. The primary function of vegetated roadside drains is to capture runoff. However, research has shown that they are effective at TSS removal and achieve high removal rates for particulates, total copper and zinc through filtration and infiltration.

21.5.2 Stream works

For works associated with streams, the BPO approaches include:

- Bridge or viaduct structures over nine river / stream crossings;
- Culverts for other stream crossings;
- Fish passage at culverts where the freshwater ecologists identified freshwater habitats with the exception of two culverts in the Carran Road sector;
- Energy dissipation measures at all culverts to minimise erosion;
- Ecological features included in stream diversions to restore stream and riparian habitats where the freshwater ecologists identified freshwater habitats;
- A risk framework to assess the risk from debris and determine mitigation measures such as larger culverts and debris racks for culverts at high risk and relief inlets for culverts at moderate risk; and
- Alignment of the motorway to avoid the floodplain and minimise hydraulic effects where it is necessary to cross floodplains with bridges.

(a) Bridges

Bridges are proposed as the BPO for seven stream crossing locations. These locations and the key considerations at each site are shown in Table 21-3.

Table 21-3: Overall design considerations and BPO assessment for bridges

Bridge name	Consideration
Okahu Viaduct	• Estuary crossing • Moderate size catchment • Desire to avoid reclamations and effects on estuary • Combined crossing of Billing Road driveway • Height and length crossing (vertical grade from Johnstone's Hill Tunnels) • Prestressed concrete box girder has 75m spans which reduce the piers and construction activity in water • Reduced impact on Te Pā o Te Hēmara Tauhia at the southern abutment
Pūhoi Viaduct	• Significant river crossing (design flow too high for culvert) • Desire to avoid reclamations • Major road crossing (Pūhoi Road) • Height and length of crossing • Good crane access available from flat terrain, concrete box girder gantry launching not required
Hikauae Viaduct	• Minor creek crossing • Hikauae access track required to private residence
Schedewys Viaduct	• Major river crossing • Height and length of crossing • Geotechnical conditions make embankment unsuitable • Prestressed concrete box girder has 75m spans reduced piers in rolling terrain
Perry Road Viaduct	• Major river crossing • Height and length of crossing • Height and length crossing geotechnical conditions make embankment unsuitable
Kauri Eco Viaduct	• Major river crossing • Height and length of crossing • Kauri natural forest in area
Wyllie Road Overpass	• Passing over local road
Woodcocks Road Viaduct	• Major river crossing and floodplain – Mahurangi River Left Branch • Road crossing
Carran Road Flood Relief Bridge	• Major secondary flow path • Stock access incorporated

Bridge name	Consideration
Minor Bridge – Property access road	• Stream crossing • Natural bush area conserved by minor bridge structure

Where possible, bridge and viaduct piers are positioned outside of watercourses to:

- Reduce impacts of working within a watercourse during construction;
- Reduce potential scour of the riverbed; and
- Minimise the need for abutments and piers being located within the CMA.

(b) Culverts

Culverts represent the BPO for 40 stream crossings where they meet the following conditions:

- Culverts have sufficient capacity for the design flows and satisfy the relevant sizing criteria;
- Flooding effects from predicted afflux (rise in water level on the upstream side of a bridge/culvert) are acceptable;
- Environmental requirements such as fish passage, erosion control and energy dissipation are met; and
- Debris and sediment transport is managed.

The horizontal and vertical alignments of the culverts have been designed to limit their environmental impacts. In general, the culverts will be concrete pipes. Larger concrete arch culverts are proposed for three crossings of main tributaries of the Mahurangi River because the design flows are too large for concrete pipe culverts. Special features of the concrete arch culverts include:

- Arch to achieve sufficient cross-section areas to meet the flow capacity and debris mitigation requirements;
- Racks upstream of the arch entrance to mitigate the risk of blockage by intercepting logs and other debris;
- Natural bed for fish passage; and
- Maintenance access through the culvert.

Refer to Drawings SW-201 to SW-203 Volume 4 for indicative design of culverts for the Project.

Fish passage in culverts has been provided for permanent streams with upstream habitats, and for intermittent streams where there is potential for fish habitat upstream. The only exception is two streams in the northern valley area of the indicative alignment, where upstream drop structures required due to geometric constraints mean that the provision of fish passage is not possible. The identification of these streams and the effect of no fish passage for two culverts were undertaken by the Freshwater Ecology team and are documented in the Freshwater Ecology Assessment Report.

Figure 21-3 shows the process for determining the type of fish passage required for the 40 culverts. Refer to Section 7.7 of the Operational Water Assessment Report for a description of the types of fish passage incorporated into culvert design.

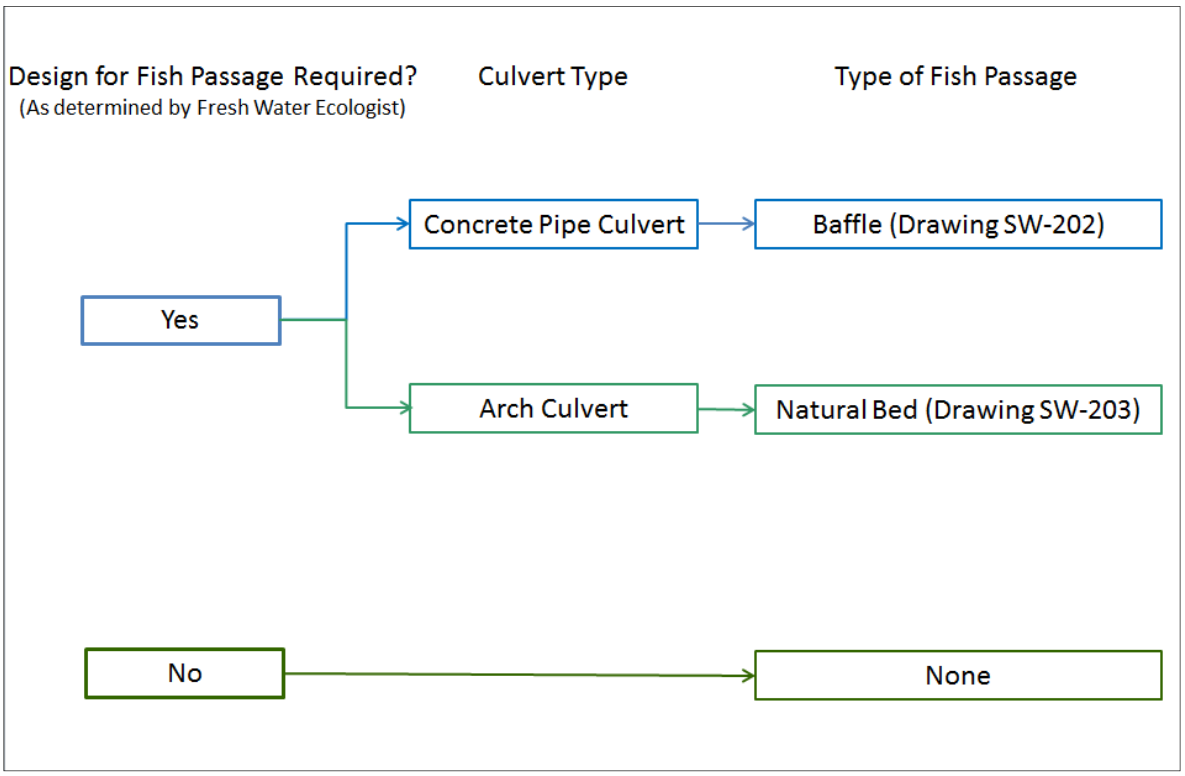


Figure 21-3: Flow chart for fish passage

The Operational Water team assessed all culvert flows and velocities and assigned energy dissipation structures to ensure that downstream erosion potential is minimised. These structures are discussed in Section 7.7.3 of the Operational Water Assessment Report and indicative design for culverts is shown in Drawings SW-201 to SW-203 in Volume 4.

Debris control measures have also been incorporated into culvert design where there is a high or moderate risk of debris blockage. The Operational Water team used a risk framework to assess the risk to culverts from debris sand determine mitigation measures for inclusion in the Project. This framework is discussed in Section 7.8 of the Operational Water Assessment Report.

(c) Overland flow paths

Culverts, bridges or stream diversions will convey flows for permanent and intermittent streams up to the 100 year ARI peak flow.

Identified floodplains and major secondary flow paths in the Carran Road Sector will be crossed with bridges designed to convey the 100 year ARI flood event.

All constructed wetlands will be designed during the detailed design phase so that local overland flow will be diverted away from the wetland. Each wetland will be located off-line. Additional clean water cut-off drains will be constructed above the new motorway to prevent overland flow from entering the Project.

(d) Stream diversions

The Project will require a number of stream diversions. The extent to which diversions of main streams are required has been minimised through the overall route selection and the development of the indicative alignment. However, diversions are required:

- Where fill and spoil sites impinge on streams and/or flow channels; and
- Where proposed culverts are built off-line and require a diversion to and from the natural stream to convey the flow.

The Operational Water team determined the most appropriate type of stream diversion for different stream types using a BPO approach based on fish passage criteria. Figure 21-4 shows how the most suitable type of stream diversion was selected.

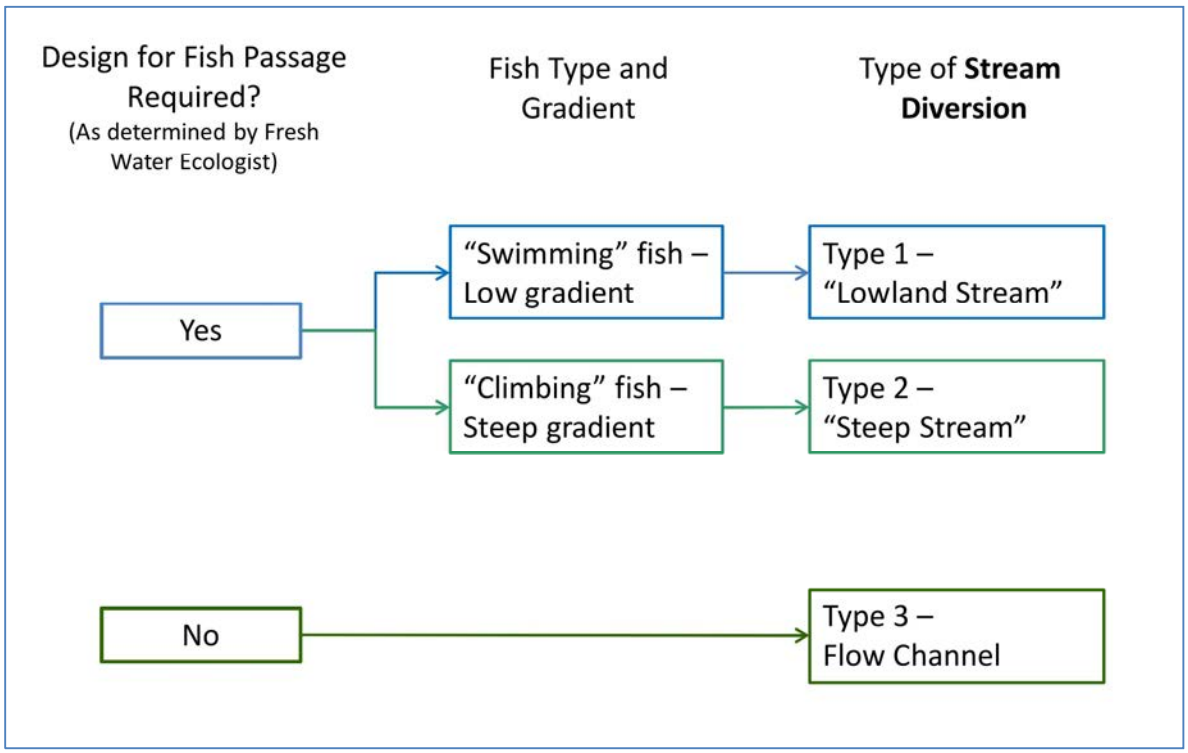


Figure 21-4: Flow chart for selection of stream diversion type

Additional considerations and requirements for stream diversion Types 1, 2 and 3 are discussed in Section 7.10 of the Operational Water Assessment Report. Refer to Drawings SW-101 to SW-115 Volume 4 for locations and details of stream diversions.

(e) Flooding

The Carran Road Sector is a key area for flooding as the motorway crosses the Mahurangi floodplain at the Woodcocks Road Viaduct, and again crosses a major secondary flow path between Woodcocks Road and SH1. The BPO approach was to minimise the effects of flooding in these areas by changing the indicative alignment to avoid the floodplain where possible, and by

using bridges to cross the floodplain where necessary to mitigate those adverse effects where avoidance was not possible.

In response to rapid flood hazard modelling undertaken by Auckland Council to determine flood hazards the indicative alignment was moved to a position further north-west to avoid the floodplain in this area. The Carran Road Flood Relief Bridge has been designed to pass the 100 year ARI flood with a maximum afflux of 100mm, where the indicative alignment crosses the secondary flow path. A 60m span Carran Road Flood Relief Bridge is the BPO that is considered to provide an acceptable afflux (less than 100m). The flooding effects are partly mitigated by these avoidance and mitigation measures incorporated in the Project, but the residual effects remain minor to moderate (refer to Section 21.6.5 below).

The hydraulic sizing of both the Carran Road Flood Relief Bridge and the Woodcocks Road Viaduct will be refined during detailed design when further hydraulic modelling will be carried out.

21.6 Assessment of effects

The Operational Water team assessed the effects of the Project based on the design that incorporates BPO measures to avoid, remedy and mitigate effects. Overall, the Team considers the residual operational water effects of the Project to be negligible to minor, with the exception of the flooding predicted where the current design has moderate potential effects.

21.6.1 Stormwater quantity

The assessment of effects in relation to stormwater quantity is summarised as follows:

- Changes in flow, volume and time to peak for the 2, 10 and 100 year ARI events at locations downstream of the Project are predicted to be small and have negligible effect on flooding and infrastructure, which confirms that attenuation of flood flows is not required;
- There are changes in flows in tributaries that result from changes to drainage patterns associated with the motorway. Tributaries that receive flow from the motorway will have an increased flow. The risk of erosion for tributary streams receiving discharges from the motorway will be mitigated by providing extended detention for all wetlands. Meanwhile, in the main branches of the Mahurangi and Pūhoi Rivers the predicted flow changes are no more than 5%;
- The potential effects of the Project on stream bed / channel disturbance will be moderate due to the loss of stream habitat. However, these effects will be mitigated by replacement with natural stream forms and the overall effect will be minor; and
- The effects of the Project on overland flow will be minor as these effects will be mitigated by the use of bridges, culverts and stream diversions.

21.6.2 Stormwater quality

The assessment of effects in relation to stormwater quality is summarised as follows:

- Runoff from all new impervious motorway surfaces and rock cuts for the Project will be captured and then treated by the wetlands whereas there is currently no formal treatment for the SH1;

- Wetlands are an appropriate BPO method for managing the stormwater runoff from the motorway and associated rock and vegetated cuts;
- Wetlands will treat for TSS removal and toxic, persistent and bioaccumulative contaminants;
- Vegetated roadside drains are an appropriate BPO for managing the stormwater runoff from ancillary roads being constructed or upgraded by the Project;
- Water quality will be maintained with the proposed treatment in place;
- Effects from oil, grease films and litter will be negligible;
- Effects of the wetlands and permanent streamworks on the development of foams and scums in receiving freshwater will be minor, and there is no anticipated change in the risk of scums and foams associated with algal blooms in the harbours;
- Contaminant loads associated with the Project are negligible compared to existing loads;
- Marine sediment quality will experience only a minor change (refer to Section 12 of this AEE);
- There may be changes in colour and clarity at discharge locations. However, these changes will be temporary, and are likely to coincide largely with the natural change in colour and clarity that will occur during storm events;
- There will be no effect on the colour and clarity of water in the lower reaches of the Mahurangi or Pūhoi Rivers or in the harbours;
- Effects on aesthetics and odour will be minor; and
- Any physical changes on the surrounding environment from the deposition of sediment will be minor.

21.6.3 Human impacts

The assessment of effects in relation to human impacts is summarised as follows:

- Predicted increases in TSS and contaminants will have a minor impact on the suitability of the Mahurangi River water for potable municipal water supply at Warkworth.
- The effects on Warkworth Town potable supply will be minor with the proposed Warkworth groundwater supply expected to come on line in 2016 and predicted to provide the main potable municipal water supply by 2021;
- Effects on human health and amenity will be minor;
- Effects on stock drinking water quality will be negligible; and
- Effects on water users will be minor.

21.6.4 Ecological effects

A full assessment of ecological effects is provided in the Freshwater and Marine Ecology Assessment Reports and summarised in Sections 5 and 6, and 4 and 5 of those Reports, respectively.

The following points from the Operational Water Assessment Report regarding ecological effects support those assessments:

- Nine stream/river crossings will have bridges and therefore avoid the potential ecological effects of culverts;

- Fish passage in culverts will be provided for all but two permanent streams and in intermittent streams where potential suitable habitat exists upstream; and
- Stream diversion Types 1 and 2 will have a natural form and include riparian planting.

Fish passage is provided in all instances for the Project with the exception of two culverts where drop structures are required at the upstream end. These drop structures create a barrier to fish passage. These drop structures are required because the motorway is in cut or close to the level of the existing ground, which requires a drop at the inlet to the culvert for the culvert to be located at sufficient depth under the road surface.

21.6.5 Flooding

The Operational Water team designed culverts to head up in accordance with the relevant design sizing criteria described in Section 6.7 of the Operational Water Assessment Report. This design approach is standard practice to efficiently convey flow through a culvert.

The headwater extents are generally local and/or within the floodplain of the streams. The only location where 100 year ARI flood headwater extents are predicted to extend beyond the designation is at Culvert 49500 (refer to the SW-101 to SW-115 of Drawings in Volume 4). The headwater floods a major branch of the Mahurangi River for approximately 500m of stream length beyond the proposed designation (measured inclusive of stream meander). No dwellings are affected. The predicted headwater extent is contained within the floodplain of the rapid flood hazard assessment for the area outside the proposed designation, indicating that flooding here is not made worse by the Project.

The Operational Water team assessed the performance of existing SH1 culverts through the Pūhoi and Hungry Creek Sectors in the hydrological model described in Section 6.2 of the Operational Water Assessment Report. Upgrades to three of the existing SH1 culverts will allow conveyance of 100 year ARI flood flows with a minimum of 500mm freeboard.

Overall the Team considers the effects of the Project on flooding in relation to culverts to be minor.

Flooding in the Carran Road Sector is an important consideration for the new motorway. The main issues are the floodplain of the Mahurangi River Left Branch, and the major secondary flow path that spills from the Mahurangi River Left Branch and flows north before returning via the Hudson Road area to the Mahurangi River downstream of Falls Road. The Operational Water team undertook rapid flood hazard modelling for the pre-development and post development scenarios to determine potential effects in relation to flooding in the Carran Road Sector.

Based on the Team's pre-development model results:

- The indicative alignment was moved north-west to avoid the floodplain;
- Woodcocks Road Viaduct (280m span) is provided which crosses the floodplain of the Mahurangi River Left Branch. Whilst flooding is not the sole driver for the span of this viaduct, it has been sized to accommodate the predicted floodplain extent. A key consideration for the detailed design phase is where the southern abutment of the proposed viaduct occupies a small area of the floodplain which may reduce flood conveyance; and

- Carran Road Flood Relief Bridge (60m span) is provided to cross the major secondary flow path. Flooding is the primary reason for the specified span of this bridge as discussed in Section 7.6 of the Operational Water Assessment Report. A key consideration for the detailed design phase is where the approach abutments occupy the floodplain which may reduce flood conveyance.

The results of the Operational Water team's post-development modelling indicate that:

- The indicative alignment north of the Carran Road Flood Relief Bridge is located outside the floodplain, with the exception of where it is necessary to cross it;
- The Carran Road Flood Relief Bridge conveys the secondary flow path, but there is an afflux upstream of the bridge that results in an increase in flood levels of up to 100mm. There is also an increase in flood levels of up to 100mm in the vicinity of the Woodcocks Road Viaduct. The extent of the increase in flood levels occurs along the Mahurangi River until the Falls Road area. The flood levels decrease along the secondary flow path downstream of the Carran Road Flood Relief Bridge;
- The dwelling floor levels at 151 Carran Road and 346 and 372 Woodcocks Road are below the pre-development flood level. The dwellings flood pre-development and the flood level increases by only 30mm, 70mm and 80mm respectively post-development. The Water team considers the effect of these increased flood levels on the dwellings to be moderate;
- At 152 Carran Road, the dwelling floor level is 260mm above the pre-development flood level. The Project increases this flood level by only 50mm. Therefore, the flood level remains 210mm below the floor level of the dwelling. The Water team considers the effect of the increased flood level at 152 Carran Road to be minor; and
- No dwellings in the Carran Road Sector located within the predicted 100 year ARI floodplain, with a floor level above the flood level pre-development, become inundated by a higher flood level caused by the Project.

There is potential during the detailed design phase to improve the capacity of the secondary flow path at the northern end of the alignment, which may enable the proposed Carran Road Flood Relief Bridge span to be reduced.

It has not been possible to provide an alignment that does not occupy the flood storage volume below the 100 year ARI flood level in some areas in the Carran Road sector. However, the BPO to mitigate the effects of this was to move the indicative alignment out of the floodplain north of the Carran Road Flood Relief Bridge, and provide sufficient cross drainage and bridges to allow the floodplain and secondary flow paths to get from one side of the alignment to the other. With mitigation of the effects by BPO, the Operational Water team considers the effects of the Project occupying an area of flood storage volume below the 100 year ARI flood level to be minor.

There may be a slight shift in the frequency at which flood depths occur as a result of the Project ie the pre-development 100 year ARI flood depth will occur slightly more frequently with the Project. This change is expected to be minimal and of minor effect.

Overall, the Operational Water team considers that the Project has a minor to moderate effect on flooding in the Carran Road Sector due to the afflux upstream of the Carran Road Flood Relief Bridge and the increase in flood depth predicted for four dwellings. The flooding effects are partly

mitigated by avoidance and mitigation measures incorporated in the Project, resulting in residual effects due to the increase in flood levels being minor to moderate. Further investigation during the detailed design phase will refine the mitigation measures proposed.

21.7 Overall effects and mitigation

The Operational Water team developed operational water systems for the Project based on a BPO approach that considered alternatives and how to best practically minimise adverse effects on the environment.

Effects on water quality are mitigated by stormwater treatment systems that include wetlands throughout the Project and sediment traps at the base of rock cuts. Vegetated roadside drains are proposed for ancillary roads. Overall, effects on water quality will be minor.

Water quantity effects are mitigated by extended detention systems in wetlands to minimise stream erosion. Overall, the effects from changes to water quantity will be minor.

Human impacts, including effects on the Warkworth potable water supply, amenity, recreation, water users and farm takes, are mitigated by the stormwater treatment systems. Overall, the effects on humans will be minor.

The stream work elements of the Project include bridges over streams, culverts with fish passage and stream diversions with natural stream forms. These measures provide fish passage and restoration of stream habitats. Ecological effects are assessed in detail in the Freshwater Ecology Assessment Report and in Section 11.4 of this AEE.

Flooding effects will be mitigated by designing culverts to convey the 100 year ARI flood. Impacts on the existing floodplain of the Mahurangi Left Branch River are avoided by changing the alignment and mitigated by the Woodcocks Road Viaduct and Carran Road Flood Relief Bridge. Overall, effects in relation to flooding will be minor to moderate.

Based on the Operational Water Assessment Report I support the use of wetlands for stormwater treatment, and the provision of sediment traps and extended detention as an integral component of the Project design. I support the use of extended detention within the wetlands to minimise stream erosion.

22. Landscape and visual

The Landscape and Visual Assessment Report provides an assessment of landscape and visual effects and analyses the physical effects of the Project. It considers the character and quality of the existing environment and landscape and amenity values, with specific regard to natural character. The Report also assesses the nature and extent of visual effects on the main audiences within the receiving environment.

The policy context for the Project area, a description of the existing environment and an explanation of the methodology used to assess potential landscape and visual effects are provided in the Landscape and Visual Assessment Report. The following is a summary of the issues and potential effects identified in that Report. This summary and the Report subsequently inform the recommended mitigation contained in Section 28 and will inform the Project conditions.

22.1 Landscape and visual effects assessment

The potential landscape and visual effects of the Project as they relate to the RMA are:

- Effects on the natural character of wetlands and rivers and their margins;
- Effects on outstanding natural features and landscapes;
- Effects on visual amenity values;
- Effects on the quality of the environment (biophysical aspects of the landscape); and
- Landscape effects during construction.

The Landscape and Visual Assessment Report has considered the effects of the Project on three interrelated components – biophysical, visual amenity and landscape/natural character. Specific effects during the construction phase of the Project and proposed mitigation measures are also evaluated.

Visual simulations of the indicative alignment from selected viewpoints have been used to inform the assessment of landscape and visual effects. The simulations are included in the LV set of drawings in Volume 4.

For the purposes of assessing landscape and visual effects, the landscape within the Project area has been divided into character areas with a readily distinguishable landscape character. These landscape character areas are areas within the landscape that display a relatively homogenous and consistent landscape character. Their edges are determined by changes in landscape character, which often correspond to changes in land use or natural boundaries such as catchments, prominent landforms (eg ridgelines) or water bodies.

An assessment of the actual and potential effects of the Project within each of these landscape character areas is presented in the following sections. Effects have been rated on a five-point scale[124], namely negligible, low, moderate, high and significant.

[124] Refer Landscape and Visual Assessment Report Section 2.7.

22.1.1 Pūhoi

The Pūhoi landscape character area extends from the northern portals of the Johnstone's Hill Tunnels to the vegetated escarpment north of Pūhoi Road.

Key attributes of the Pūhoi landscape character area are:

- Pūhoi River with its estuarine and intertidal influences;
- Residential settlement pattern;
- Enclosing hill country landform following discrete landscape sub-units;
- River valley flats;
- Intermix of pasture and scattered vegetation with pockets of indigenous vegetation;
- Cultural heritage values; and
- Influence of the existing SH1 and Johnstone's Hill tunnels.

The existing environment, natural character and landscape values for this landscape character area are described in detail in Section 5 of the Landscape and Visual Assessment Report.

(a) Biophysical effects

The indicative alignment necessitates some significant earthworks to negotiate the localised ridge and gully systems, including cut slopes and fill embankments. Two large viaducts will span Okahu Creek and Pūhoi Road/Pūhoi River. Although the hill country is not highly sensitive, the earthworks and structures will result in considerable disruption to the existing natural landform in this area.

Vegetation removal will be limited to localised clearance of riparian vegetation on the river and wetland margins and removal of some native and exotic tree species scattered through areas of pasture, as outlined in Section 5 of the Terrestrial Ecology Assessment Report.

(b) Visual amenity effects

Although the landform and existing vegetation will provide some visual containment of the motorway, large sections of the carriageway and extensive areas of earthworks will be visible from SH1, the Hibiscus Coast Highway and the areas to the east. The most visible areas will be the southern tie-in at the Johnstone's Hill tunnels, from the Hibiscus Coast Highway and where the alignment crosses the Pūhoi River flats and enters the hill country to the north.

In this area the large cutting will cause high adverse visual effects for motorists on SH1 and users of the new motorway, particularly during construction. However, their views will be transient and brief.

Within this landscape character area there is a small, permanent local residential audience clustered around Pūhoi Close and at Billings Road. For residents of Pūhoi Close, the new motorway will have a high level of effect on the visual amenity of the area. Their current rural outlook will be replaced by views towards the 300m long viaduct crossing the Pūhoi River and Pūhoi Road.

SH1 already has an influence on the character of this area. Regardless, the cumulative effects of the two alignments will reinforce the transport function as a main component of the landscape

character locally. The proximity of the new motorway will present a significant visual intrusion, further decreasing the remaining levels of rural amenity for the residential population. Existing vegetation will assist in partially screening views and mitigation planting could be undertaken to minimise potential adverse effects.

(c) Landscape and natural character effects

The main landscape sensitivity in the Pūhoi landscape character area is associated with the river tributaries and wetland areas, which will be spanned by viaduct structures across Okahu Inlet and the Pūhoi River. While these structures will present an imposition upon the natural character of these areas, they will reduce the physical effects to the landscape considerably by spanning rather than culverting these waterways.

The Landscape team considers the implications of the alignment on ONL 44 (Mahurangi–Waiwera, as described in Section 4.3.1 of this AEE) to be low as the indicative alignment skirts along the periphery of the delineated area near the Pūhoi River. The natural character and landscape values of this area are already significantly modified by the existing SH1 and Johnstone's Hill tunnels.

(d) Summary of effects – Pūhoi

Overall, the Landscape team considers the landscape and visual effects of the highway on this area to be high. These effects will be particularly pronounced during the construction stage due to the extent of earthworks and exposed cut slopes.

Following suitable mitigation measures, these effects will be reduced to a moderate level over 3-5 years as the cut slopes, fill embankments and MSE slopes take on more natural appearances through weathering and revegetation.

The visual effects for the residents in Pūhoi Close will be high until the mitigation planting between the viaduct and the residential area has become established and views towards the viaduct are progressively screened.

22.1.2 Hungry Creek

The Hungry Creek landscape character area extends from the vegetated escarpment north of Pūhoi Road to immediately west of Mahurangi Road West.

Key attributes of the Hungry Creek landscape character area are:

- Exotic pine forested landscape traversed with forestry tracks;
- Scattered and sparse residential settlement pattern;
- Physical proximity to the existing SH1; and
- Contrasting and more natural characteristics to the east of SH1.

The existing environment, natural character and landscape values for this landscape character area are described in detail in Section 5 of the Landscape and Visual Assessment Report.

(a) Biophysical effects

The new motorway will pass perpendicular across the grain of the land through this landscape character area. Due to the relatively complex landform of the low hill country the Project will necessitate a significant amount of earthworks in the form of a continuous sequence of cut slopes, fill embankments and large retaining structures in the vicinity of Hungry Creek. The construction works will require the removal of sizable areas of the existing exotic pine forest and associated vegetation. This landscape character area has a relatively low sensitivity to these effects due to the degraded landscape character and quality.

(b) Visual amenity effects

The permanent residential audience is limited to several properties along the eastern side of SH1 and three properties within the proposed designation, which will be unoccupied and are likely to be removed during construction. For most of this section, the alignment will be largely contained by the existing landform and vegetation for many of the residents to the east of SH1 and for users of SH1 itself. However, SH1 users will have views of slopes and a steep embankment, particularly for southbound vehicles. These glimpses will be brief and transitory.

The design anticipates MSE walls, which are hydroseeded following construction, resulting in a green vegetated wall which will minimise adverse effects associated with hard constructed retaining walls.

(c) Landscape / natural character effects

The main natural character effects are associated with the culverting of a number of watercourses. As the alignment extends through predominantly exotic forestry, the effects on natural character will be low.

(d) Summary of effects – Hungry Creek

The landscape and visual effects of the Project on this landscape character area during and immediately following construction are likely to be in the moderate to high range. Following suitable mitigation measures, these effects could be reduced to a low level over a short time period (approximately 3-5 years) as the cut slopes, fill embankments and MSE walls take on more natural appearances through weathering and revegetation.

22.1.3 Schedewys Hill

The Schedewys Hill landscape character area extends from where the alignment emerges from the forested hill country to the west of Mahurangi West Road through to Moirs Hill.

Key attributes of the Schedewys Hill landscape character area are:

- Open rolling pasture on undulating slopes;
- Scattered vegetation pattern;
- Exotic pine forested landscape traversed with forestry tracks;
- Scattered and sparse residential settlement pattern;
- Physical proximity to the existing SH1; and

- Contrasting and more natural characteristics to the east of SH1.

The existing environment, natural character and landscape values for this landscape character area are described in detail in Section 5 of the Landscape and Visual Assessment Report.

(a) Biophysical effects

The main physical changes to the landscape will result from the earthworks in the south and combination of earthworks and vegetation removal in the more elevated sections to the north. Neither of these landscape sub-units is particularly sensitive in landscape terms. Although very exposed to the surrounding countryside, the low undulating farmland in the southern section has the capacity to readily assimilate the proposed earthworks in the vicinity, which will have a low effect on the natural character of the landform in this area.

The elevated section of the alignment that ascends the hillside to the north will require significant cuts and several large embankments. The 33m box cutting immediately to the south of Moirs Hill Road will also be significant.

This area is also not particularly sensitive to the proposed effects of the earthworks and vegetation clearance. The visual diversity created by the existing variable vegetation patterns offers a reasonably high capacity to accommodate the consequential physical and visual change.

(b) Visual amenity effects

The most affected audience of the indicative alignment will be the residents of the two land holdings in the vicinity of Mahurangi West Road between the alignment and SH1. Even though the existing SH1 is an established part of the local character, for these residents, the effects of being surrounded by the two alignments will result in a reduction in rural amenity values. Visual amenity effects for these residents will be high. The Landscape team considers the two landholdings on the eastern side of SH1 will be less affected, due to distance and the existing SH1 in the foreground. Visual amenity effects for these residents will be moderate.

The large box cutting immediately to the south of Moirs Hill Road will not be visible from most of the surrounding area and views will be restricted largely to those from the alignment. The Hikauae Bridge and Schedewys Hill Viaduct will be visible from parts of SH1 in the vicinity of Mahurangi West Road and from elevated locations immediately to the east of the motorway.

The main visual effects of the Project will be during and soon after construction. These effects will diminish quickly once pasture and vegetation in the disturbed areas re-establish. Though the alignment will form a distinctive band running over the landscape, it will not be overly intrusive or incongruous given the scale, modified character and unexceptional qualities of this landscape character area.

(c) Landscape / natural character effects

The natural character in this area is not high. It is characterised by the farming and forestry activities, which have significantly altered natural patterns and processes within this landscape

character area. As the alignment extends through predominantly exotic forestry and grazed pasture, the effects on natural character will be low.

(d) Summary of effects – Schedewys Hill

The effects will reduce to low to moderate over 3-5 years as the cut slopes and fill embankments 'mature' through weathering and revegetation. The visual amenity effects for the residents of the two land holdings in the vicinity of Mahurangi West Road between the Project and the existing SH1 will be high. Mitigation planting within the designation area would reduce these effects over time.

22.1.4 Moirs Hill North

The Moirs Hill North landscape character area extends from Moirs Hill Road through the forested area towards Perry Road.

Key attributes of the Moirs Hill North landscape character area are:

- Exotic pine forested landscape traversed with forestry tracks;
- Scattered and sparse residential settlement pattern;
- Elevated views; and
- Physical proximity to Pohuehue Scenic Reserve.

The existing environment, natural character and landscape values for this landscape character area are described in detail in Section 5 of the Landscape and Visual Assessment Report.

(a) Biophysical effects

The biophysical effects through this landscape character area will be high due to the extensive earthworks and modification to the existing landform. Small retaining walls or MSE slopes will be required along parts of the Moirs Hill Road alignment. However, due to the low landscape quality and modified level of natural character, the landscape associated with the alignment in this landscape character area has a high capacity to accommodate the change associated with the Project.

(b) Visual amenity effects

The visual effects of the motorway through much of this landscape character area will be well contained locally due to the landform and forestry, and there will be limited opportunities to view the motorway from SH1. The main visual effects will be to several residential properties along the ridge of Moirs Hill Road who will gain views towards parts of the alignment. These views will be highly variable as the alignment is cut into the complex landform.

(c) Landscape / natural character effects

The extensive exotic forestry has significantly degraded the natural character values of this area. The alignment extends entirely through the pine forest and the effects on natural character will be low. The main natural character effects are associated with the culverting of a number of watercourses. The spoil disposal areas provided within the proposed designation will also necessitate the culverting or diversion of watercourses.

The Project will not adversely affect the landscape and natural character values of the Pohuehue Reserve ONL or SNA as it is physically and visually separated from these areas by the intervening ridgeline.

(d) Summary of effects – Moirs Hill North

The landscape and visual effects of the Project on this landscape character area would be low to moderate due to the relatively low landscape quality and modified level of natural character. With the implementation of mitigation these effects could be reduced to low.

22.1.5 Perry Road

In the Perry Road landscape character area, the alignment emerges from the forested hill country to the southern abutment of a viaduct into the river valley occupied by the right branch of the Mahurangi River. The alignment in this landscape character includes the Perry Road Viaduct and the Kauri Eco Viaduct.

Key attributes of the Perry Road landscape character area are:

- The Mahurangi River and riparian vegetation;
- Remnant mature and regenerating vegetation;
- River valley landform surrounded by rolling hill country;
- Rural-residential settlement pattern interspersed with pastoral activities; and
- Compartmentalised landscape defined by shelterbelts and specimen tree plantings.

The existing environment, natural character and landscape values for this landscape character area are described in detail in Section 5 of the Landscape and Visual Assessment Report.

(a) Biophysical effects

This landscape character area is highly sensitive in landscape and visual terms. The construction of the motorway will bisect the valley, existing stands of indigenous vegetation and areas of pasture. Although the alignment avoids the main cluster of the settlement associated with Perry Road, it will have high biophysical effects in the southern part of the landscape character area.

The indicative alignment just clips the large area of mature indigenous bush, including kauri, immediately northwest of Genesis Aquaculture, through the construction of the Kauri Eco Viaduct.

(b) Visual amenity effects

This area will require extensive earthworks that will cause considerable disruption to the local landform and result in high visual effects for the local residential population. The Project will have a high effect on the rural amenity values of the area, and will change the landscape character of the valley. Such effects will be exacerbated by the enclosure and intimate scale of the landscape locally.

(c) Landscape / natural character effects

The existing natural character values will be adversely affected in this area by extensive earthworks, alteration to landform, stream culverting and removal of mature indigenous bush. The close proximity to the residential settlement will degrade the landscape character and amenity values of the area.

The portion of ONL 43 affected by the indicative alignment is an appendage of the West Mahurangi Harbour ONL, which extends inland in the vicinity of Perry Road. The effects on this immediate area will be moderate due to the removal of the indigenous vegetation to the west of Genesis Aquaculture. However, the alignment will have low effects on the integrity of the overall ONL due to the small portion affected.

(d) Summary of effects – Perry Road

The landscape and visual effects for this landscape character area will be high. Although landscape mitigation offers the potential for some amelioration over time, the effects will remain moderate to high.

22.1.6 Wyllie / Woodcocks

Within the Wyllie / Woodcocks landscape character area the motorway crosses the flat expanse in the vicinity of the confluence of the Left Branch and Right Branch of the Mahurangi River.

Key attributes of the Wyllie / Woodcocks landscape character area are:

- Flat and open pastoral landscape bisected by the Mahurangi River tributaries;
- Rising foothills to the west;
- Scattered vegetation patterns with shelterbelts, riparian vegetation, exotic forestry and specimen trees; and
- Rural-residential settlement pattern interspersed with pastoral activities.

The existing environment, natural character and landscape values for this landscape character area are described in detail in Section 5 of the Landscape and Visual Assessment Report.

(a) Biophysical effects

Although open and exposed, the sensitivity of this modified rural landscape character area is relatively low. The indicative alignment will fragment the existing productive land units and alter the character and reduce the rural amenity of the area. The Project can be accommodated without significant adverse effects to the overall character and quality of the landscape.

(b) Visual amenity effects

For the local residential population and users of nearby roads, the alignment will become a distinctive visual feature traversing the flat, open landscape on a raised embankment. However, its visual integration will be assisted by the low-lying landform, and further by suitable mitigation planting within the proposed designation.

(c) Landscape / natural character effects

The alignment will have a low effect on the natural character values of the area. The main effects on natural character will relate to the culverting of a tributary to the Mahurangi River and several small watercourses. The landscape fill areas to the south of Woodcocks Road would assist the assimilation of the alignment into the surrounding pastoral land.

(d) Summary of effects – Wyllie / Woodcocks

The Landscape team considers the landscape and visual effects of the Project on this landscape character area will be low to moderate during the construction of the motorway on the raised embankment. The implementation of mitigation measures will reduce these effects to low during the operational phase and the Project will integrate into the existing open rural character of the setting, which has the ability to accommodate the development.

22.1.7 SH1 Link

North of the Woodcocks Road/Carran Road intersection, the alignment heads in a north-easterly direction from Woodcocks Road, where it departs from the flat open farmland along a cut through a south facing slope adjacent to the Mahurangi River floodplain. The alignment then heads along the base and lower northern slopes of a narrow valley before connecting to SH1 between Hudson Road and Kaipara Flats Road.

The existing environment, natural character and landscape values for this landscape character area are described in detail in Section 5 of the Landscape and Visual Assessment Report.

(a) Biophysical effects

The construction of the Project through this landscape character area will not require any significant modification to the landform, removal of vegetation or impact on any other notable landscape features. Also, due to the predominantly rural character of the area and its proximity to Warkworth and the existing SH1, the motorway will assimilate into the landscape, which exhibits a capacity to accommodate the type of change the Project will bring.

(b) Visual amenity effects

The location of the alignment in combination with the surrounding landform will limit the visibility of the motorway from much of the surrounding area. Those most sensitive to any visual effects generated by the Project are the nearby residents in the vicinity of the alignment, particularly those with properties accessed off Viv Davie-Martin Drive. However, most of this audience is located in elevated locations with views out across the wider landscape.

The Project will have a moderate to high impact on the existing rural amenity values for this permanent but very small and localised audience as it will become a distinctive visual feature traversing the valley floor and gently undulating slopes.

(c) Landscape / Natural character

The natural character values of this area have been diminished to a large degree by farming and settlement activities and the proximity of the area to the existing SH1. The alignment will have a low to moderate effect on the landscape quality and natural character of the area.

(d) Summary of effects – SH1 Link

The Landscape team considers the landscape and visual effects of the Project on this landscape character area to be moderate to high during and immediately following construction for approximately five residential properties on the northern side of Viv Davie-Martin Drive.

The main effects in this character area relate to the visual amenity. Following mitigation, the overall landscape and visual effects will reduce to moderate.

Where the new alignment coincides with SH1, it will add cumulatively to the established effects, although such areas generally have a greater ability to accommodate the Project than less modified areas.

22.2 Construction effects

The route selection process for the indicative alignment has sought to minimise potential adverse construction effects of the Project. However, the visual change and contrast caused by modification to the landform and the contrast between exposed earthworks and the surrounding areas of pasture and vegetation during construction will be unavoidable.

Areas with high existing natural character and landscape values, exposure to the existing SH1 or established rural residential populations will be the most affected by construction activities. The Pūhoi Sector and the Perry Road Sector in particular will be most affected during construction.

The effects will be generated by:

- large scale earthworks;
- vegetation removal; and
- general construction activity, noise, dust and nuisance.

Biophysical landscape effects during the construction stage of the Project will include alteration to streams and watercourses, vegetation clearance and potential sedimentation of waterways. Landscape amenity effects will result from the extent and exposure of earthworks and construction activity including noise, dust and lighting. Visual amenity effects will result from vegetation clearance and earthworks.

Effects during construction are relatively short-term and are regarded by the Landscape team as temporary effects. The effects will be mitigated progressively following completion of each stage of works.

In addition to route selection, construction effects can be alleviated by forward planning, particularly where there are specific effects on local populations. Such pre-emptive mitigation prior to or during construction may include:

- the establishment of strategic screen planting within the designation;
- the construction of permanent or temporary bunding; and
- sequential rehabilitation of motorway verges and adjacent areas of pasture and vegetation immediately following completion of construction.

Post construction, the enduring effects of the motorway will be the modification of the rural character and amenity values. Well-considered specific mitigation will assist considerably in ameliorating such effects.

22.3 Overall landscape and visual effects assessment

While a project of this nature and scale will inevitably have adverse landscape and visual effects, the process of route selection has meant that the indicative alignment largely avoids the most sensitive landscapes in this part of the region. In some areas there will be high landscape and visual effects during both the construction and operation of the Project. However, a best practice approach has been taken to avoid adverse effects as far as possible.

The Project will introduce changes to the various landscape character areas along the route including the Pūhoi River and estuary. However, the majority of the route traverses landscapes already highly modified by farming and forestry activities, and the existing SH1.

The Project's adverse effects on natural character are limited, given the modified nature of the route. Adverse effects on natural character have been reduced through the use of bridges and viaducts across the Okahu Inlet, Pūhoi River, tributaries of the Mahurangi River, and the Mahurangi River mainstem. The most extensive areas of earthworks are largely restricted to existing areas of exotic forestry.

The most significant changes and resultant effects on visual amenity will arise from large scale earthworks, retaining walls, bridges and viaducts. These effects will be more prominent in areas where there is a permanent residential population, including Pūhoi Close, Perry Road and Viv Davie-Martin Drive.

The main visual effects of the Project will occur during and soon after construction. These effects will diminish over approximately three to five years once pasture and vegetation in the disturbed areas re-establishes, and the cut faces take on a more weathered appearance, as experienced with the NGTR.

Where avoidance of all adverse effects has not been practicable, the Landscape team has recommended a number of mitigation measures (refer to Section 22.4 of this AEE).

Through the detailed design and OPW processes, the design of the motorway, in conjunction with well-considered planting, will provide scope to reduce many of the temporary construction effects and the operational effects of the Project within a short time period.

22.4 Recommendations and mitigation

The process of route selection has meant that the indicative alignment largely avoids the most sensitive landscapes in this part of the region. However, due to the challenging terrain and the

rural lifestyle settlement in some parts of the Project area, some effects on the landscape and local populations are unavoidable.

In the Sectors where high landscape and visual effects are anticipated, suitable mitigation is fundamental to achieving integration of the motorway into the landscape setting. Although the motorway will alter the local landscape character, appropriate mitigation can enable 'fit' within the landscape to ensure that the Project may co-exist comfortably with the natural elements, rural production and patterns of settlement.

Well-designed mitigation techniques can successfully integrate highways into the landscape and minimise any potential adverse effects of construction and ongoing operation. A number of mitigation measures are proposed for the Project. These include:

- Construction of cut slopes and fill embankments to provide more natural integration with the surrounding landform;
- Appropriate surface treatment of cut slopes – grassing, hydroseeding, revegetation or naturally exposed rock face;
- Revegetation of fill embankments where practicable;
- Contouring of spoil disposal sites and integration with adjoining landforms;
- Well-designed bridges and viaducts to reduce the physical and visual effects on the wetland and river flat areas;
- Retention of existing vegetation and extensive planting between the highway alignment and the existing SH1 in areas where the new alignment is not contained by the landform, to provide screening and visual integration; and
- Extensive planting based on established vegetation patterns along the alignment to integrate the highway and screen it from the residential settlement areas, including early permanent planting to proactively mitigate visual effects.

A more detailed description of the proposed mitigation measures is provided in Section 7 of the Landscape and Visual Assessment Report and Section 28 of this AEE. I support these proposed measures as being an appropriate response to the Project's potential adverse landscape and visual effects, and to mitigate those effects.

23. Operational traffic and transport

The Transportation and Traffic Assessment Report provides an assessment of the effects on the existing and future transport network arising from the operation of the Project. Traffic effects in relation to the construction phase of the Project are the subject of a separate report and are summarised in Section 13 of this AEE.

The Report describes the existing transport environment in the Project area, including the existing SH1 and the local road network. It discusses the methodology and modelling used to determine the future transport environment and assesses the actual and potential effects of the operation of the Project on the road network and road users.

The following is a summary of the issues and potential effects identified in the Transportation and Traffic Assessment Report. This summary and the Report subsequently inform the recommended mitigation contained in Section 28 and will inform the Project conditions.

23.1 Assessment methodology

The Transport team assessed the operational effects of the Project by first forecasting the performance of the transport network in the future for a 'Base Case' scenario, which assumed that the Project was not constructed. They then forecast the performance of the transport network in the future for a 'Project' scenario, which assumed construction of the Project. The Transport team then determined the transport effects of the Project by comparing the performance of the transport network in the two scenarios.

23.1.1 Traffic modelling

Much of the Transport team's assessment of operational transport effects was based on the outputs of traffic modelling. A SATURN traffic model was initially developed for the Auckland to Whangarei Strategic Assessment[125] by SKM. The Transport team updated that model for the Pūhoi to Wellsford scheme assessment phase which was completed in 2011. The model was again used by the Transport team for use in the transport assessment for this Project. They enhanced the accuracy of the model by including a more detailed road network and applying a zoning system around Warkworth and Wellsford.

Further information regarding the details of the SATURN model is provided in Section 2.2 of the Transportation and Traffic Assessment Report.

23.1.2 Base Case and Project scenario definition

(a) Base Case scenario

The Base Case scenario represents the future transport environment baseline. The Transport team developed land use forecasts for the Base Case scenario from the following sources:

- Auckland Regional Growth Strategy (and Auckland Regional Transport model);

[125] Refer Section 2.2.1 of the Transportation and Traffic Assessment Report.

- Rodney District Council Growth Model (as at late 2009); and
- Adopted Structure Plans, including the non-statutory Warkworth Structure Plan growth figures which the NZTA and the former RDC have used to help predict future infrastructure needs.

The Transport team used year 2026 as the forecast model year in order to be consistent with information gleaned from the Regional Growth Strategy and SATURN model.

The Base Case scenario also assumes a number of changes relating to the future transport network. These changes include works likely to be undertaken (or already completed) around the Hibiscus Coast Highway, in and around Warkworth township, on SH16 and SH18, and on SH1 between Constellation Drive and Greville Road.

(b) Project scenario

The Project scenario is essentially the same as the Base Case model, but includes the Project, some increased land use growth and some changes to the form of the Hill Street intersection with the existing SH1 at Warkworth. The Transport team have assumed that the construction of the Project will induce additional traffic across the Project Area due to improved accessibility between Pūhoi and Warkworth / Northland. To account for the additional traffic in the SATURN model, they applied an extra 1% traffic growth per annum in the Project scenario. The Transport team have sensitivity tested this assumption. The results showed no material change assuming that this level of induced traffic is not experienced. The Transport team also assumed some small induced traffic during the holiday peak periods as a result of the Project.

The Project scenario assumes that land closest to the Project's northern interchange will become more attractive for development, and that the forecast growth within Warkworth would relocate to an area adjacent to Hudson Road. This assumption has also been subject to sensitivity testing by the Transport team, which showed no material change in the event that this relocation of growth does not occur.

Further information on the assumptions made for the Base and Project scenarios is provided in Section 2 of the Transportation and Traffic Assessment Report.

23.2 Existing transport environment

The SH1 corridor from Pūhoi to Warkworth is primarily characterised by rolling or steep terrain with some particularly low speed horizontal curves and steep grades. The route is primarily a single carriageway with some passing lanes. The majority of the route has a posted speed limit of 100kph. Warkworth experiences significant congestion during the weekday evening commuter peak, on weekends and also during holiday periods.

Traffic volumes on the existing SH1 are forecast by the Traffic team to grow at a rate of approximately 4.4% per annum between 2009 and 2026 without the Project. This rate means that daily traffic volumes on SH1 between Pūhoi and Warkworth are expected by the Traffic team to be in the order of 25,000 vpd in 2026 without the Project.

The following sections highlight a number of key transport issues for the existing SH1 corridor in the Base Case scenario. The Transport team anticipate that these issues will generally to worsen over time as traffic volumes increase.

23.2.1 Travel times and congestion

Warkworth is currently subject to regular congestion during weekday evening peak periods. More severe congestion is experienced when incidents such as slips, flooding or crashes occur, or during holiday periods. This congestion results in increased and unpredictable travel times.

Without the Project in place, travel times in the corridor as a whole are forecast to increase as traffic volumes on SH1 increase in the future. For example, compared to 2009, the Traffic team forecast travel times on SH1 southbound (between the proposed northern tie-in and Pūhoi) to increase by 11 minutes (75%) in the PM peak from 15.5 minutes to 26.5 minutes by 2026.

They consider that these increased travel times will have an adverse impact on the efficiency of general traffic and freight movements in the corridor. Increased travel times will also have a negative impact on accessibility between Auckland, Warkworth and Northland.

23.2.2 Consistency of journey times

As noted above, the corridor is currently subject to regular congestion during weekday evening peak periods, when incidents occur or during holiday periods. This congestion not only results in increased travel times but also increased variability of travel times. Increased variability makes journey planning difficult for individuals and businesses such as freight operators.

The Traffic team consider that without the Project in place, travel time consistency in the SH1 corridor is likely to become a significant issue in the future as traffic volumes and travel times increase.

23.2.3 Crashes

Although some road safety improvements have been achieved in recent years along the existing SH1 route, the ability to achieve further reductions in the frequency and severity of crashes is constrained by its geometry.

Compared to the five years up to 2012, the average number of injury crashes per year on SH1 (between the proposed connection north of Warkworth and the Johnstone's Hill tunnels) is forecast by the Traffic team to increase by nine (68%) to 22 by 2026.

23.2.4 Route security

The existing SH1 route is often fully or partially closed for varying durations as a result of incidents such as crashes, flooding or slips blocking the road.

23.2.5 Other Modes

As discussed in Section 13.7 of this AEE, inter-city bus services and tourist shuttles currently provide public transport services within the corridor. A bus service between Warkworth and

Silverdale has been included in the Draft Auckland Regional Public Transport Plan for implementation within the next ten years. These buses and shuttles utilise the existing SH1 and will be subject to the same network issues as general and freight traffic.

There is some use of the existing SH1 by recreational cyclists. Walking and cycling also takes place within Warkworth itself. Whilst the SH1 corridor has seen some improvements in pedestrian and cycle facilities in recent years, these road users can feel intimidated by the high volumes of SH1 traffic, which affects the perceived safety and enjoyment of travel by these modes of transport. As the demand for walking and cycling increases (in line with growth in Warkworth) and traffic volumes on SH1 also increase, this problem will worsen.

Further information regarding the existing transport environment is provided in Section 3 of the Transportation and Traffic Assessment Report.

23.3 Assessment of operational effects

The Project has been specifically developed to address many of the issues identified for the existing transport environment under the Base Case scenario described in Section 23.2 above.

The Project will provide a new four-lane dual carriageway road designed and constructed to motorway and NZTA RoNS standards. This road will provide a higher quality alternate route to the existing SH1 and will improved journey times and safety.

The Traffic team assume daily traffic volumes in the corridor as a whole will grow by approximately 1% per annum, as a result of induced demand for travel from the Project. However, they expect daily volumes on the existing SH1 to reduce significantly with the Project due to traffic electing to use the new route. Daily traffic volumes on SH1 between Pūhoi and Warkworth are expected to be in the order of 14,500 vpd in 2026. This volume is 10,500 vpd (40%) less compared to the Base Case scenario. The Traffic team expect traffic volumes on the Project road between Pūhoi and Warkworth to be in the order of 14,000 vpd in 2026.

23.3.1 Travel times and congestion

The Project's new motorway standard four-lane alignment will reduce travel times and allow journeys to be planned with a greater level of certainty. The Project will reduce congestion and travel times between Pūhoi and the north during typical peak periods. This benefit will be experienced by general and freight traffic alike. The Project will also improve travel times during the holiday periods when large delays are currently experienced.

Travel times on both the existing SH1 and on the Project road to and from the north of Warkworth will be faster than the Base Case travel time on SH1. For example the Traffic team forecast travel times on the Project alignment southbound (between the proposed northern tie-in and Pūhoi) to be 10 minutes in the 2026 PM peak. This is a reduction of 16 minutes (approximately 60%) when compared to the Base Case travel time on SH1.

23.3.2 Consistency of journey times

The Project will result in significant reductions in regular congestion and the effects of random incidents. This reduction will almost eliminate travel time variability for travel between Pūhoi and north of Warkworth. These are important benefits of the Project, enabling individuals and businesses to plan their travel with a much greater degree of certainty. It also provides for a much more robust network that can cater for some disruption without significant increases in travel time.

Travel time consistency will be improved for freight traffic because of the reduced congestion, improved geometric alignment and improved passing opportunities.

By enabling reduced and more certain travel times during all periods, the Project will remove deterrents to travel in the corridor and improve accessibility between Auckland, Warkworth and Northland.

23.3.3 Crashes

The Project will be constructed to meet modern motorway standards, including:

- Grade separation of all local roads;
- Design speed of 100-110km/h;
- Dual lanes in each direction with divided carriageways;
- Minimum shoulder and median widths with a wire rope barriers (safe systems approach);
- Minimum horizontal curve radius of 820m and maximum uphill grade of 6%; and
- Minimum sight distance requirements.

The motorway will have an improved crash performance when compared with the existing SH1. This means that the average annual number of injury crashes in the corridor is forecast to decrease from 22 to 17, a reduction of five (23%) in 2026 when compared to the Base Case scenario. As a result, the Project will have a positive effect on road safety across the corridor as a whole.

23.3.4 Route security

The Project will introduce a high-quality, parallel alternative route to SH1. As a result, the effects of incidents (crashes and natural events such as slips and flooding) on travel along the existing SH1 or along the Project alignment will be significantly reduced.

23.3.5 Other Modes

The Project will have a minimal but positive impact on existing or potential public transport service performance. Following the construction of the Project, the same performance improvements anticipated for general traffic would be enjoyed by existing or improved public transport services.

The much lower volumes of traffic along the existing SH1 route will improve safety and amenity for vulnerable road users (ie pedestrians and cyclists). These lower volumes will also create opportunities for the implementation of measures to encourage walking and cycling, which would be more consistent with the new more local function of the existing SH1 route.

The Project will improve recreational cycling amenity along the existing SH1 between Pūhoi and Warkworth by reducing traffic volumes. It will also improve crash risk by reducing the exposure of cyclists along this section.

As the Project will remove a significant amount of traffic from SH1 through Warkworth, it will improve walking and cycling amenity and reduce potential conflicts between modes in and around the township. Parts of the Warkworth community will also benefit from improved levels of connectivity, accessibility and safety, thereby reducing physical severance.

23.3.6 Off-line effects

The Transport team forecast there to be a two-way increase in traffic volumes between the Base Case and the Project scenario of 4,700 vpd (24%) to 23,900 vpd in 2026 on SH1 between Hill Street and Hudson Road. This increase is predominantly as a result of the additional growth assumed adjacent to Hudson Road (as described in Section 4.1 of the Transportation and Traffic Assessment Report), and partly as a result of changed traffic patterns as a result of the Project. Vehicles accessing the Project from Warkworth or the eastern beaches that used to travel south on SH1 through Warkworth, now travel north to access the Project alignment to travel south via the northern interchange. Mitigation is recommended to address this potential traffic effect.

23.4 Overall effects and recommendations

Overall, it is considered that the operation of the Project will have a significant positive effect on the transport network. The Project will increase capacity within the corridor, improving road safety, reducing journey times, and improving consistency of journey times for general traffic and freight. It will improve route security by providing an alternative route built to higher standards which is more resilient to incidents.

There are two potentially adverse effects identified as a result of the induced traffic north on the Project (1% additional traffic) north of Warkworth. The additional 1% induced traffic results in increased delay during the peak hour at the intersection of Kaipara Flats road and SH1 and also an increase in the predicted accident rate on SH1 north of Warkworth.

The Project design has allowed for the provision of a right turn bay into Kaipara Flats Road which will ensure the potential adverse effect at Kaipara Flats Road is minor. Whilst there is an increase in accident rate predicted north of Warkworth, overall the Project results in an overall reduced accident rate between Pūhoi and Wellsford.

The Transportation and Traffic Assessment Report provides the following recommendations:

- A review of road safety associated with Warkworth Primary School should be undertaken prior to the opening of the Project or any significant development adjacent to Hudson. The NZTA and Auckland Transport have confirmed that they will undertake such a review if traffic volumes on Hill Street continue to rise.
- Prior to the completion of the Project, a management strategy should be developed by the NZTA for the section of SH1 from the northern tie-in to Hill Street. This may include closure of the northbound passing lane north of Hudson Road, a revised speed limit(s) for

this length and treatments such as painted flush medians to cater for adjacent land uses and reinforce the lower speed and more urban environment.

I support these recommendations.

The Transportation and Traffic Assessment Report concludes in Section 5 that the Project will:

- Increase travel time consistency;
- Decrease travel times;
- Alleviate congestion at Warkworth;
- Improve long-term corridor capacity; and
- Improve route quality, safety and resilience.

The Transport team considers that the Project contributes positively to all of the NZTA's objectives for the Project. In particular, the Project will reduce congestion in Warkworth compared to the existing transport environment and Base Case scenario. In the year 2026 with the Project in place, congestion levels would be close to levels experienced in 2009. In my opinion, this represents a significant benefit of the Project.

24. Operational noise

The Operational Noise Assessment Report provides an assessment of actual and potential noise effects relating to the operational phase of the Project, namely the potential effects generated by road traffic noise from the new motorway. The existing noise environment and receivers within the Project area, results of noise modelling and potential noise effects at specific locations are described in detail in the Operational Noise Assessment Report.

The following is a summary of the issues and potential effects identified in the Report.

This summary and the Report subsequently inform the recommended mitigation contained in Section 28 and will inform the Project conditions.

24.1 Noise assessment criteria

Road traffic noise effects can be assessed by applying various standards and guidelines. The Noise team has reviewed the methodologies most commonly used in New Zealand and considered New Zealand Standard NZS 6806:2010 *Acoustics – Road-traffic noise – New and altered roads* to be the most appropriate and applicable New Zealand document to guide the Noise team's assessment of the Project. The Standard has been tested in several Council and Board of Inquiry hearings and has, with minor modifications, been accepted and applied to all recent major roading projects.

The relevant noise criteria categories under NZS 6806:2010 are shown in Table 24-1.

Table 24-1: NZS 6808:2010 noise criteria categories

Category	Altered Roads	New Roads with a predicted traffic volume of 2,000 to 75,000 AADT at the design year
	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
A primary external noise criterion	64	57
B secondary external noise criterion	67	64
C internal noise criterion*	40	40

* This criterion is triggered if habitable rooms would receive internal noise levels greater than 45 dB $L_{Aeq(24h)}$ despite external mitigation such as bunds, barriers and low-noise road surface materials being used.

Compliance with NZS 6806:2010 will achieve reasonable noise levels for all affected residents in the vicinity of the Project. The methodologies for noise level measurement, prediction and assessment set out in this Standard ensure an equitable management of noise effects for all assessment positions. The Standard is based on the BPO approach, which aligns with the duty to avoid unreasonable noise in section 16 of the RMA.

The Noise team has assessed traffic noise effects on residents by interpreting the general subjective response of people based on international research, to predicted noise level changes, both along the Project alignment and along SH1 (where a reduction in noise level would occur). The Noise team compared the percentage of people predicted to be 'highly annoyed'[126] by traffic noise along the new alignment and the existing SH1 for the existing and predicted future circumstances. This comparison allowed the Noise team to weigh potential positive and negative effects based on their significance and the number of people affected.

24.2 Existing environment

The existing ambient noise environment provides a base for assessing noise effects due to noise level changes in terms of the RMA. For the Project, existing noise levels along the indicative alignment were measured and predicted. Measurements included both short and long-duration surveys. The Noise team also used the results of the surveys to verify and calibrate the computer noise model.

Ambient noise measurements show that noise levels extend over a wide range. Beside the existing SH1, noise levels are elevated, generally above 60 dB $L_{Aeq(24h)}$. In areas removed from SH1 and other noise sources, eg Pūhoi Township and to the west of Warkworth, noise levels are low (generally between 43 and 50 dB $L_{Aeq(24h)}$).

The long-duration unattended noise measurements (provided in Appendix B of the Operational Noise Assessment Report) show that $L_{Aeq(24h)}$ levels are around 50 dB at the four survey locations at 8 Pūhoi Close, 87 Perry Road, 40 Wyllie Road and 815 SH1.

24.3 Assessment methodology

Computer noise modelling allowed the Noise team to take into account many factors that affect the propagation of road traffic noise. The computer noise model includes information on the form of the terrain, the road alignment and dwelling locations. The road information includes traffic volume, speed, road surface material, gradient and percentage of heavy vehicles. The model outputs are specific noise levels at individual receivers and noise contours over a larger area. The individual receiver noise levels are used to assess compliance with NZS 6806:2010 and to determine the noise level change at each dwelling assessed. The noise level contours provide a wider picture of the road noise effects of the Project. The Noise team uses the contours to determine the number of people that may be highly annoyed by road traffic noise, and to visually represent the extent of road traffic noise in the wider area.

The Noise team's assessment is three-pronged:

- Assessment of compliance with NZS 6806:2010 following the BPO process and focussing on achieving the most stringent Noise Criteria Category A, where applicable;
- Assessment of noise effects through determination of noise level changes and likely annoyance of people; and

[126] The percentage of people predicted to be highly annoyed (%HA) based on the Miedema & Oudshoorn dose-response relationship curve applied to the number of persons within each relevant noise bracket. Refer to Section 2.3 of the Operational Noise Assessment Report for further details on annoyance effects.

- Assessment of effects over the wider area affected by the Project. This assessment is completed by comparing the number of people that may be highly annoyed by traffic noise with and without the Project. This comparison takes into account noise level reductions and increases in the overall area.

The design year is a concept that is used for several engineering disciplines. It requires that the design of a road is based on a future year, making an allowance for increase in traffic volumes over that time. The Standard requires that the design year shall be between 10 and 20 years after the opening of a new road to the public. The year 2031 has been selected as the design year for the Project, which allows for an opening year up to 2021.

24.4 Actual and potential noise effects

The Project area is sparsely populated. More densely populated areas exist around Pūhoi, Perry Road and Wyllie Road through to SH1. The Noise team assessed the receivers against 'new' or 'altered' road criteria of NZS 6806:2010, depending on the influence of the existing SH1 on the receivers. Approximately half of the Protected Premises and Facilities (PPFs)[127] were assessed against 'new' and the other half against 'altered' NZS 6806:2010 criteria.

The do-nothing scenario (where the Project is not built) showed that noise levels would increase by approximately 3 decibels along SH1 as at the design year due to traffic volume increase. The do-minimum scenario (where the Project is built with no noise mitigation) allowed for a chip seal road surface on the entire alignment. A number of receivers would fall into Categories B and C, which is not a desirable outcome.

The main mitigation option considered involved the use of Open Grade Porous Asphalt (OGPA) road surfacing on those sections of the Project where several receivers would benefit from it, ie at the southern and northern ends of the Project. This option achieved effective mitigation for almost all receivers. Most receivers would experience noise levels from the Project only within the most stringent noise criteria Category A. The Noise team considers that noise levels within Category A are appropriate for residential use and will not result in sleep disturbance or adverse effects on noise sensitive activities such as watching TV.

The Noise team also considered other mitigation options, namely the use of road-side or boundary barriers. However, due to the difficult terrain, the distance of receivers from the road and the low population density, these barriers would not present the BPO for mitigation for this Project. Barriers would need to be very high (5m and more) and relatively long to achieve any noticeable noise level reduction at individual receivers only, which would create visual and urban design problems for only marginal acoustic benefit.

Therefore, the selected mitigation option is the use of OGPA at either end of the alignment, where higher population density will benefit from its noise reduction properties.

Notwithstanding that the selected mitigation would bring most receivers into the most stringent Category A, for some currently quiet areas the introduction of the Project will result in a significant increase in noise level. This is particularly the case for dwellings along Wyllie Road. While the

[127] Refer to Section 2.1.1 of the Operational Noise Assessment Report

predicted noise level increase is over 10 decibels for a small number of receivers (equivalent to a perceived doubling in noise level), the Noise team considered that the resultant noise levels at these receivers will be appropriate for residential use.

24.5 Overall effects of operational noise

The Noise team has assessed the overall traffic noise effects of the Project by comparing existing and do-nothing noise levels with the predicted noise levels of the Project when implemented (including mitigation). The results of this comparison showed that with the Project in operation, the number of people experiencing traffic noise levels that have been shown to cause high annoyance would decrease. This reduction is due to the fact that traffic will be moved away from the densely populated areas of Warkworth township to sparsely populated areas. The modest decrease in noise level from traffic reduction on SH1 will benefit many residents.

The Noise team concluded that the Project can be operated so as to achieve reasonable noise levels at affected dwellings, while reducing the overall noise level for a large number of dwellings.

24.6 Recommendations and mitigation

The Noise team recommends application of an OGPA road surface on the motorway from its southern end to approximately chainage 62360 (north of Pūhoi) and again from chainage 50840 to the Project's tie-in with SH1 at Warkworth to mitigate the effects of motorway traffic noise. The use of OGPA will result in most receivers being subject to noise levels in the most stringent Category A of NZS 6806 and will provide effective and noticeable noise level reductions when compared with the base situation of chip seal being used.

In order to ensure that appropriate traffic noise outcomes are achieved, the Noise team recommends that designation conditions cover the following issues:

- the application of the NZS 6806: 2010 methodology in determining the most appropriate traffic noise mitigation;
- A requirement to install, where appropriate, noise mitigation measures prior to opening of the Project to the public; and
- a requirement to maintain noise mitigation measures to the degree practicable to retain their noise reducing capabilities.

I support these recommendations.

25. Cultural

Hōkai Nuku prepared a Cultural Effects Assessment for the Project, which identifies and assesses the potential effects of the Project on the cultural values and associated overall wellbeing of Hōkai Nuku and its constituent Hapū and Iwi groups. Hōkai Nuku prepared the Cultural Effects Assessment with the input of Ngāti Manuhiri, Ngāti Mauku/Ngāti Kauwae, Ngāti Rango and Ngāti Whātua Iwi.

The Cultural Effects Assessment identifies and describes the relationships that Hōkai Nuku has with the Project area and determines the level of cultural, environmental, economic and social effects that the Project may have in a wider cultural context. The Cultural Effects Assessment also provides information regarding culturally significant areas and taonga within the proposed designation.

The following is a summary of the issues and potential effects identified in the Cultural Effects Assessment. This summary and the Report subsequently inform the recommended mitigation contained in Section 28 and will inform the Project conditions.

25.1 Hōkai Nuku

Hōkai Nuku is the alliance formed by the mana whenua of the RoNS area (from Johnstone's Hill Tunnels to Te Hana), namely Ngāti Manuhiri, Ngāti Mauku/Ngāti Kauwae, Ngāti Rango and Ngāti Whātua iwi with the support of Ngāti Paoa. Representatives of Hōkai Nuku offer expert advice to the Project team as required.

25.2 Assessment model

Hōkai Nuku has identified its key cultural values and developed a "Cultural Footprint Framework", which highlights the relationship of mana whenua with the Project area. These values and the framework have been used by Hōkai Nuku to assess the cultural effects of the Project.

25.2.1 Cultural Effects Assessment process

The Hōkai Nuku Cultural Effects Assessment states that it is an environmental management tool used to identify the potential effects a proposed activity may have in a cultural context. The Cultural Effects Assessment identifies the past, present, and future relationships, values and aspirations held by Hōkai Nuku. The Cultural Effects Assessment recommends that these values and aspirations be recognised, protected and managed in decision-making relating to the Project. Hōkai Nuku considers that all effects in the Cultural Effects Assessment Report, be they bio-physical, social or economic, are 'cultural' insofar as they affect the well-being of Hōkai Nuku, to some degree.

25.2.2 Cultural values

The Cultural Effects Assessment identifies key principles which Hōkai Nuku uses to assess the impact or effects of the Project on Hōkai Nuku cultural values. These include:

- Mauri – All elements of the natural environment, including people, possess mauri (life force) and all forms of life are related.
- Kaitiakitanga – Māori have an obligation to protect and enhance the mauri of all natural resources, for the benefit of ourselves, other people living in our homeland and for future generations Ki uta, ki tai (from inland to the sea) – The mauri of the waterways is also viewed holistically and includes from the source of the waterway (mountains, springs and wetlands) to the sea.
- Hauhake, Kohikohi (harvest and gather) – The use of flora and fauna to sustain the people.

These concepts are explained in further detail in Section 2.2 of the Cultural Effects Assessment.

25.2.3 Cultural Footprint Framework

The Cultural Footprint Framework expresses Hōkai Nuku's connections to ancestors, highlights iconic identity markers which provide reference points to the environment and notes specific associations through historical events and activities. This framework shows Hōkai Nuku's "cultural footprint" on the landscape. When used in conjunction with the cultural values described above, the footprint offers a position statement for assessing the effects of the Project on cultural values.

Figure 25-1 provides an overview of the Cultural Footprint Framework for Hōkai Nuku. Refer to the Cultural Effects Assessment for further explanation of the concepts included in the framework.

Hōkai Nuku Cultural Footprint Framework					
Mana Tangata	***Acknowledging and upholding the mana (authority) of the people that whakapapa (have genealogical connections) and whanaungatanga (relationships) to the area***	**Iwi**	**Ngāti Wai**	**Ngāti Whātua**	
		Hapū	**Ngāti Manuhiri**	**Ngāti Mauku/ Ngāti Kauwae**	**Ngāti Rango**
Mana Whenua	***Identifying the features of the physical landscape that are of particular cultural importance to the Mana Tangata, and explaining the relationship***	**Moana** (ocean) **Awa** (river) **Maunga** (mountain) **Pā** (fortified village) **Kāinga** (residential areas) **Urupa** (burial sites)			
Pūtake	***Addressing the particular historical and contemporary issues relating to these areas, and any future aspirations***	**Tuku** (ceded/sold) **Raupatu** (confiscation) **Rāhui** (prohibition of use) **Tapu** (sacred/restricted)			

Figure 25-1: Hōkai Nuku Cultural Footprint Framework[128]

[128] Excerpt from Section 2.3 of the Cultural Effects Assessment

25.2.4 Methodology

Hōkai Nuku assessed cultural effects using the following methodology:

- Collectively identifying key principles to be used to assess the impact or effects of proposed activities on the cultural values of Hōkai Nuku;
- Developing the Cultural Footprint Framework;
- Obtaining primary data from Hōkai Nuku members and specialist advisors representing the wider knowledge base and interests of constituent hapū and iwi;
- Reviewing background information provided by the NZTA, including design information and specialist environmental assessments;
- Reviewing all relevant Project documents and technical reports including draft assessment reports and providing feedback to the Project team and incorporating this information into the Cultural Effects Assessment;
- Discussing the Project with the NZTA's specialist advisors and Project management;
- Reviewing statutory provisions relevant to the recognition and protection of Māori values and interests; and
- Presenting the final Cultural Effects Assessment to Hōkai Nuku for formal endorsement.

25.3 Effects on the Cultural Footprint of Hōkai Nuku

Hōkai Nuku has identified areas of significance that may be impacted by the Project, the possible effects on those areas, and recommended management of those effects.

The following sections summarise Hōkai Nuku's assessment of cultural effects, both on identified areas of cultural significance and on cultural values and principles integral to the wellbeing of Hōkai Nuku. Descriptions of these sites, values and principles, and explanations of their significance to Hōkai Nuku in a cultural context are provided in Section 3 of the Cultural Effects Assessment.

25.3.1 Ngā Pā o Te Hēmara Tauhia

The Project alignment will avoid direct impact on the Nga Pā o Te Hēmara Tauhia and the pā rediscovered on the Straka property.

The Project will pass through the wider settlement area associated with Ngā Pā o Te Hēmara Tauhia and will therefore have a significant impact both physically and on the mauri and the responsibility of Hōkai Nuku as kaitiaki. One midden associated with Ngā Pā will be destroyed by the Project alignment.

25.3.2 Te Koroto

Te Koroto is an island wāhi tapu known as Motutere at the head of the Waiwera River.

While there are no direct impacts on this island, any impact on the mauri of the wider settlement area of Ngā Pā o Te Hēmara Tauhia will also impact on Te Koroto, therefore Hōkai Nuku considers that the extent of the effects are not yet known.

25.3.3 Te Huarahi o Kahumatamoemoe

Te Huarahi o Kahumatamoemoe is a pathway between the east and west coasts used by Kahumatamoemoe when he lived with Ngāti Manuhiri ancestors.

The Project crosses over this route and will affect the mauri of this pathway and the ability of Ngāti Manuhiri to enact their responsibility as kaitiaki.

25.3.4 Pōhuehue – Nohonga and Scenic Reserve

This reserve is avoided by the Project. The reserve is a significant indigenous landscape which Hōkai Nuku considers should be used as a guide for mitigation planting.

25.3.5 Te Awa Pūhoi (Pūhoi River and Estuary)

The Project crosses the Pūhoi River and its tributaries several times and will have an effect on the mauri of the river catchment and its ability to sustain the taonga species in it and consequently the people.

25.3.6 Waihē (Mahurangi River and Harbour)

The Project crosses the Mahurangi River and its tributaries several times and will have an effect on the mauri of the river catchment and its ability to sustain the taonga species in it and consequently the people.

25.3.7 Pūnaha Taupuhi Kaiao Taketake (Indigenous Ecosystems – Flora and Fauna)

The Project will have an effect on the indigenous ecosystems and biodiversity within the Cultural Footprint of Hōkai Nuku due to the significant area to be developed both for the motorway and the temporary areas required to support the construction process.

Hōkai Nuku views the world as an interconnected and integrated ecosystem allowing consideration of how the species interrelate and support each other.

Hōkai Nuku also considers that the removal of indigenous flora has an impact on the ability of Hōkai Nuku to harvest and gather food, medicines and resources. The removal also impacts on the ability of Hōkai Nuku as kaitiaki to maintain and restore indigenous ecosystems and habitats.

25.3.8 Ahuahu (Earthworks)

Hōkai Nuku considers that the Project will have a significant effect on the land and soil due to the level of earthworks required. Hōkai Nuku is still uncovering the historical connections to some areas of the land that will be affected by the Project. Therefore, the extent of the effects is still to be determined.

In the case of accidental discovery, knowing where the soil was sourced is important to Hōkai Nuku to identify the whakapapa of the discovery.

25.4 Cultural assessment of environmental effects

The Cultural Effects Assessment identifies interfaces where other identified environmental effects may impact on cultural values. The following sections summarise Hōkai Nuku's assessment of the effects on cultural values generated by other environmental effects of the Project. These effects relate to terrestrial and aquatic ecology, water and land modification, landscape and visual effects (including urban design), historic heritage and social and economic effects.

25.4.1 Terrestrial and aquatic ecology

It is important to Hōkai Nuku that the environment be viewed as an interconnected and integrated environment, rather than as isolated parts.

Hōkai Nuku considers that the removal of indigenous flora and fauna will impact on the indigenous ecosystems and wider biodiversity of the area. Therefore, it considers that such removal affects the responsibility of Hōkai Nuku in the role of kaitiaki to manage and protect the environment.

25.4.2 Water and land

Hōkai Nuku considers that the Project will directly impact on the catchments of the Pūhoi River and the Mahurangi River and Harbour, which are both identified as part of the Cultural Footprint of Hōkai Nuku.

Hōkai Nuku also considers that construction of the Project will have a significant effect on the land due to the size of the Project and the large amount of earthworks required. This will impact on the mauri of the land and the ability of Hōkai Nuku to enact the role of kaitiaki. Hōkai Nuku has a particular concern as to the original source for the importation of fill, which it considers affects the mauri and whakapapa of the site and may impact on any accidental discovery of taonga.

25.4.3 Landscape and visual

Hōkai Nuku considers that the size and scale of the Project and the large amount of earthworks required will have a significant effect on the land and natural and cultural landscape. This will impact on the mauri of the land and the ability of Hōkai Nuku to enact the role of kaitiaki.

25.4.4 Historic heritage

There is little information about the full extent of Ngā Pā o Te Hēmara Tauhia and the associated historical settlement and activities, due to difficulties obtaining access to the site.

Hōkai Nuku views the settlement areas as a whole rather than as individual archaeological sites. Ngā Pā o Te Hēmara Tauhia is a significant cultural site, and Hōkai Nuku considers that the Project alignment will have an impact on the wider settlement area of Ngā Pā o Te Hēmara Tauhia.

25.4.5 Social and economic

Hōkai Nuku considers that the Project will have a significant effect on the communities living within and around the Project. Generally, Hōkai Nuku views these effects as providing positive opportunities to support the people through safer passage, but also through opportunities to

engage in economic development throughout the construction phase and in the protection and management of cultural taonga such as Ngā Pā o Te Hēmara Tauhia.

25.5 Recommendations

Hōkai Nuku concludes that the most appropriate approach to addressing potential cultural effects is through strategic management planning built on strong formalised relationships. Many of Hōkai Nuku's recommendations suggest that further management plans be developed to ensure that Hōkai Nuku concerns are adequately addressed and recommendations incorporated at the 'front end' and throughout the process.

We understand that NZTA will continue to engage with Hōkai Nuku throughout the Project.

The NZTA is recommending a series of conditions to address Hōkai Nuku concerns including (but not limited to):

- Establishment of an iwi advisor for the duration of the Project construction to allow on-going cultural input.
- A management plan to record Hōkai Nuku's on-going role and involvement, including cultural indicators especially for monitoring during and post construction and specific procedures regarding accidental discovery protocols.
- That the Pā sites be surveyed and managed, particularly Ngā Pā o Te Hēmara Tauhia.
- Monitoring of earthworks and water quality in conjunction with Hōkai Nuku.
- An integrated management approach to the terrestrial, marine and freshwater ecology, urban and landscape design framework and landscaping plans.
- Ecosourcing of plants for restoration planting and landscaping, and for habitat enhancement (eg food source for kereru).
- Hōkai Nuku inputs into the Urban and Landscape Design Framework and sector plans to reflect and recognise Hōkai Nuku associations.

NZTA's relationship with Hōkai Nuku has been valuable in the preparation of the AEE and Assessment Reports. The recommendations above will in part address potential adverse environmental effects, and ensure we have regard to Part 2 of the RMA. I support the recommendations above on that basis.

26. Social

This chapter presents a summary of our assessment of the Project's potential social effects (the full assessment is included in Appendix F to this AEE).

The study area for the assessment of social effects is divided into a sub-regional area being roughly equivalent to the Project area and nearby communities, and local areas coinciding with local communities covered by census meshblocks.

26.1 Methodology

The assessment addresses matters raised in Schedule 4 of the RMA and the land acquisition process provided in the Public Works Act 1981. The assessment has been based on an accepted framework derived from international principles and practices, and from inputs from community consultation and landowner engagement since 2010.

26.2 Scoping of effects framework

The social effects assessment framework developed for this Project includes:

Way of life considerations – relating to the ability of people to access their community, activities and services in a manner that maximises their social welfare. Maintenance of connectivity and mobility is an important component of the ability of people to establish and maintain social networks and quality of life.

Community considerations – relating to the effects that a project can have on community cohesion and the way in which people identify and interact with a local community. Community cohesion can be affected by the loss of community members through property acquisition, or where community members decide to relocate to avoid the actual or potential adverse effects of project construction and operation.

Health and well-being – relating to the compounding effects of noise, vibration, exposure to air pollution (eg dust generation), and changed traffic movements in both the construction and operational phases.

Property considerations – relating to effects due to the property acquisition process.

26.3 Existing social environment

26.3.1 Sub-regional characteristics

The overall character of the study area is rural and has a low population density. Warkworth is consistent with the character and density of a rural service town, while Pūhoi is consistent with the form and density of a rural village. The Project area consists largely of farms, forestry and lifestyle blocks, with occasional industries and tourist businesses. The former Rodney area in general experienced high levels of population growth (an increase of approximately 30%) over the period 1996 to 2006. This trend is expected to continue.

The median age of residents within the Project area at the time of the 2006 census was older than the median for the Auckland Region with a high proportion of the population aged over 65 years, especially within Warkworth. The proportion of the population aged 50 years or more increased between 1996 and 2006. This trend could be associated with the appeal of the lifestyle blocks within the Project area.

Family structures are characteristic of a growing population. For example, families of 'Couples with children' were the most significant family type in the local board area. This cohort is closely followed by 'Couple only' households, which is consistent with the age structure and the number of people within retirement age, particularly in Warkworth.

The degree of ethnic diversity in the Project area is lower than in the Auckland Region, with the predominant ethnic group comprised of people of European heritage (approximately 80% compared with approximately 57% for Auckland). Personal income levels are comparable with those for the Auckland regional population, although there is a slightly higher proportion of people with lower than median incomes. Again, this is indicative of a population with a significant older population.

The proportion of people participating in the workforce is comparable with the Auckland Region as a whole, as was the proportion of people engaged in full-time work. The principal mode of transport to work place across the whole study area is the private motor vehicle, with the use of public transport being negligible. The area is not well serviced with public transport or active transport facilities.

26.3.2 Local characteristics

The Pūhoi community is characterised by its high level of cohesion and identity deriving from the scale of the place and its population, as well as its history of settlement and the presence of Ngā Pā o Te Hēmara Tauhia adjacent to the village. Community cohesion is evidenced also by the range of active community groups.

Warkworth is the largest urban centre within the Project area, with a resident population of 3,270 in 2006. Assuming growth trends have been maintained, the estimated resident population is now approximately 4,030. Warkworth is a thriving service town that contains a wide range of retail, commercial, and community facilities and services. It acts as a commercial centre for the surrounding rural communities and as a gateway for the coastal communities at Leigh, Omaha, Whangateau, Tawharanui, Algies Bay, Snell's Beach and Sandspit.

Rural residential and other forms of lifestyle properties are clustered along Moirs Hill Road, Perry Road, Wyllie Road, Viv Davie-Martin Drive and Valerie Close, as well as the communities of Mahurangi West off SH1.

The Moirs Hill Road area provides for a number of lifestyle blocks of varying sizes and configuration. While still a small community, this area experienced considerable growth between 1996 and 2006 as people sought alternative lifestyles to those available either in urban areas or larger-scaled farming areas.

The Mahurangi West area is serviced by the Mahurangi West Road and Cowan Bay Road. It is characterised by larger lifestyle blocks which enjoy high scenic amenity. The convenience of these blocks at present is constrained by having access only via SH1, with its challenging traffic conditions.

Perry Road is a discrete community comprised of a combination of lifestyle blocks, small agricultural holdings and the aquaculture site. The area is characterised by a pleasing but highly modified landscape with geometric plantings of introduced vegetation. Perry Road is a no exit road off SH1, with high scenic amenity contributing to a strong sense of local community identity.

The community at Wyllie Road derives its access off Woodcocks Road, which connects to SH1 at Warkworth. A number of rural residential properties sit on elevated land, and are orientated to take advantage of extensive views over the valley below, Warkworth and out to the Hauraki Gulf. Woodcocks Road itself forms part of the local roading network that services the Kaipara Flats communities west of Warkworth. Carran Road provides a link between Woodcocks Road and Kaipara Flats Road.

A conventional rural residential community is situated on the northern edge of Warkworth at Viv Davie-Martin Drive (which is a no-exit road ending in a cul-de-sac), and accessed from Falls Road. Most of the sites in the subdivision lie on the reverse slope from the new motorway. Being a relatively recent subdivision, not all sites have been developed with housing. Three dwellings have direct views into the valley to be traversed by the motorway.

26.4 Community consultation

The consultation programme implemented to this point in the Project has spanned across three distinct phases and is now in a fourth phase (as discussed in Section 8 of this AEE). The formal notification process associated with the lodgement of the notices of requirement and applications for resource consents will mark the commencement of the fifth phase of consultation. The consultation phases were implemented as follows:

- Phase 1 – to raise awareness of the Project and to inform the development of corridor options
- Phase 2 – to inform the route selection process and to update the community on progress with the early planning work
- Phase 3 – to inform design development for the scheme assessment report and identification of a preferred route
- Phase 4 – to inform further design refinement and the preparation of the AEE

An indication of the relative sensitivities for a wide range of issues identified particularly during phases one to three of the consultation process is presented in Table 26-1 below. Many of the planning and design issues have been resolved through the iterative design process, as community inputs informed design development. Other issues, such as the environmental concerns, are addressed elsewhere in this AEE through a combination of design, construction and operational management measures, and ultimately, the conditions to be imposed on the designation and the resource consents.

Table 26-1: Issues identified in consultation

Issues / Sensitivity	Regional Interests	Local Interests					Other Interests
		Pūhoi	Moirs Hill / Perry Rd	Wyllie Rd / Carran Rd	North Warkworth	Warkworth	
● High sensitivity							
● Moderate sensitivity							
● Low sensitivity							
○ Little or no sensitivity							
PLANNING & DESIGN							
Investment in road infrastructure	●	●				●	●
Funding mechanism (eg tolling, other)	●	○				○	●
New, off-line route bypassing business centres		●	○			●	
Provide partial upgrades to SH1 (Warkworth bypass)	●					●	
Provide local connections to new route		●				●	
Location of possible local connections to new route		●	●			●	
Provide a 'Matakana link' as part of Project	●				●	●	●
Upgrade Hill St intersection (Warkworth)						●	
Local traffic planning (Western Collector, Warkworth)						●	
Property impacts		●	●	●	●		
Impacts to local businesses		●	●			●	○
Maintaining access to local roads		●	●	●	○	○	
Impacts on ecological, landscape or conservation	●	●	●	○			●
Cultural heritage		●		○	○		
Impacts on environmental amenity & rural lifestyle		●	●	●	●		
CONSTRUCTION							
Direct effect of construction activities (air, noise)		●	●	●	●	○	
Construction traffic		●	●	●	○	●	
Impacts on heritage places (cultural, historic)	○	●					●
Soil erosion & sedimentation impacts on water	●	●	○			●	●
Impacts on terrestrial ecology	○						●
Impacts on freshwater ecology	○		○				●

Issues / Sensitivity		Regional Interests	Local Interests					Other Interests
			Pūhoi	Moirs Hill / Perry Rd	Wyllie Rd / Carran Rd	North Warkworth	Warkworth	
●	High sensitivity							
●	Moderate sensitivity							
○	Low sensitivity							
○	Little or no sensitivity							
Impacts on marine ecology		●						●
Effects on landscapes		●	●	●	●	●		
OPERATION								
Timing (eg likely commencement date)		●	●	○	○	○	●	●
Direct effects of operations (air, noise)			●	●	●	●	○	
Impacts on water quality			○					●
Funding (eg tolling)		○	○	○	○	○	●	○
Local traffic effects (eg changed traffic flows)						○	●	

26.5 Regional assessment of social effects

This Project will deliver positive social effects through enhanced accessibility and connectivity. These positive effects are generally as follows:

- greater journey time reliability and network resilience for people moving between Northland and the Auckland metropolitan area;
- an improvement in traffic safety for trips between Auckland and Warkworth, with consequential reductions in crash rates and fatalities;
- an improvement in access for people in the former Rodney area to tertiary services (employment, health, education, personal and professional services, entertainment and recreation) in Auckland;
- a potential increase in the availability, frequency and timeliness of public transport connections between Warkworth and the North Shore, Albany and the Auckland metropolitan area; and
- maintenance of current levels of connectivity during the construction phase by adopting an off-line route.

At a sub-regional level, we would expect patterns of living, convenience, transport safety and mobility to benefit from delivery of the Project. Community networks presently constrained by traffic conditions on SH1 will be freed up as inter-regional traffic, including freight, moves from SH1 to the new route. We expect the effects of the Project on community cohesion to be slightly positive as people are able to move around the sub-region more freely and more safely. The off-line indicative alignment avoids potential adverse effects on communities in the Project area.

Careful management will be required in proximity to Mahurangi College to avoid effects associated with construction traffic on Woodcocks Road. However, none of the schools within the former Rodney area will be adversely affected by operation of the Project. Both Warkworth Primary School and Mahurangi College will benefit from the redistribution of traffic from the current SH1 alignment, Woodcocks Road, Hill Street, and respective intersections to the new route. These effects are likely to be positive (in terms of traffic volumes on Woodcocks Road and SH1, and reduced traffic noise and emissions).

Traffic management during construction will be required to avoid, or mitigate and manage potentially adverse, construction-related traffic effects on Woodcocks Road, and redistribution of traffic on Hill Street.

At the sub-regional level, we expect the effects on business activity to be positive, with flow-on effects in terms of employment and business viability.

Recreational facilities or assets will not be adversely affected by the indicative alignment or proposed designation footprint. The Project is also likely to enhance opportunities for wider utilisation of these facilities by improved accessibility at the regional or sub-regional level.

At the sub-regional level, the actual or potential effects of the Project on community health and well-being are expected to be beneficial as a consequence of enhanced access to tertiary services in Auckland and enhanced community networks through traffic relief on SH1. In the absence of the Project, there are potential adverse effects on community health and well-being as traffic congestion on the existing route becomes more severe, and public safety risk increases.

26.6 Local assessment of social effects

The direct social effects of the Project, both positive and negative, will be largely felt at the local community level and in relatively discrete areas.

26.6.1 Property effects

The Project will require the acquisition of land under the provisions of the Public Works Act.

The indicative alignment requires the acquisition of 129 separate parcels of land, either wholly or in part. A total of 46 landowners will be affected by these acquisitions, reflecting the common ownership of many parcels. Some landowners are government agencies, while others are private companies (15%), families or individuals (64%). The NZTA has purchased nine properties thus far.

Of the 660 hectares required for acquisition, approximately 64% or 420 hectares, is held by companies, compared with 28% (186 hectares) held by individuals or family interests. Government agencies and public entities hold approximately 8% or 54 hectares.

The acquisition process adopts a process where fair and reasonable compensation is paid to the affected owners as provided for in section 24 of the Public Works Act 1981.

For some people, the acquisition process will result in them leaving their neighbourhoods, while some others may choose to relocate within it. For those people who will leave their

neighbourhoods, the change can be disturbing and stressful, or it can be liberating by allowing people to choose alternative lifestyles. Some people prefer to relocate within their neighbourhoods or districts once the acquisition and compensation processes have been completed. The effect on people typically is very personal and is able to be mitigated to some extent by the compensation process.

The pattern and extent of this potential social dislocation will become apparent as the acquisition process is implemented and people exercise their choices in relation to new living arrangements. Considering there are 46 landowners, including individuals and families, directly affected by acquisition, the potential for social dislocation at the local community level is very low. There will be some losses of community 'membership' in locations such as Moirs Hill Road, Perry Road and Wyllie Road.

An anticipated effect of the acquisition process is that some social connections and networks will be disrupted. The effects of such disruptions tend to be of a short to medium term nature as communities continue to evolve and respond to a wide range of internal and external influences. Again, considering the number and diversity of the acquisitions in the context of the robust community life evident in the Project area, any social disruptions which do occur are expected to be less than minor.

26.6.2 Construction effects

The construction phase may have social effects in terms of increased business activity, heightened employment opportunities, changes to people's sense of place, aesthetics and heritage, changes to people's sense of belonging, security and liveability.

During the community consultation, many people expressed concern about potential construction effects such as noise, dust, construction traffic and landscape. To balance this, some people also anticipated beneficial impacts such as increased business activity through the provision of goods and services to the proposed works, direct and in-direct employment, and increased demand from the Project workforce. These latter views were expressed by people from both Warkworth where there is an established industrial base, and Pūhoi.

The construction effects will be mitigated and managed through an integrated suite of measures including modifications to construction methods, monitoring and management, and early and on-going consultation with local communities and near neighbours in particular. Early communication about construction methods and specific construction events, such as blasting, transport of large equipment or components and changes to local access arrangements, will allow people to adjust and manage their daily patterns to either avoid or minimise the effects of construction.

Local communities may be affected during the construction phase by restrictions on or changes to accessibility and connectivity. Construction traffic management planning is proposed to be implemented to maintain access to properties and local access roads. While delays may be experienced, careful management in combination with effective community engagement, can minimise potential disruptions to travel and trip patterns.

Changes to local landscapes as outlined in the Landscape and Visual Assessment Report are anticipated as a consequence of the major earthworks required to implement the Project. Impacts

on community values, arising from landscape changes, are likely to be significant in exposed locations such as the Pūhoi viewshed and the open ground to the north of Warkworth and Wyllie Road. Landscape changes elsewhere along the route will be obvious to smaller populations or be sufficiently distant from sensitive receivers as to reduce the impact on community values.

The median age of residents within some of the affected communities is higher than the sub-region median age, and the proportion of the total population in the 65+ age group is growing. For this older age group the effects on well-being may be more acute and lead to avoidance or aversion behaviours to minimise conflict with construction-based activity.

26.6.3 Operational effects

In the operational phase, there will be a period of adjustment, as communities come to terms with the Project as a fully operational motorway, and with the subsequent changes in community composition, social networks and accessibility.

The social benefits of the Project are expected to flow from enhanced accessibility to tertiary services and employment opportunities in Auckland, improved safety and travel time reliability in accessing such services, and improved environmental amenity and accessibility for those communities still relying on the existing SH1 for access.

The social benefits accruing from enhanced accessibility will be more pronounced for people living in Warkworth and the surrounding communities of Kaipara Flats and the eastern beaches, than for people living in Pūhoi. Travel via the Project to Auckland for tertiary level health care, education, entertainment, personal and professional services, will become more convenient, safer and more predictable as a consequence of the Project. Similarly, the removal of inter-regional traffic including freight from SH1 to the Project, will help deliver similar social benefits as a consequence of improved travel time reliability and traffic safety for those communities to the south of Warkworth.

For the Pūhoi community, the social benefits will derive from improved access to the existing SH1 at Pūhoi Road through a reduction of regional traffic on the existing SH1.

The Project will improve safety and travel time reliability, which in turn will reduce risks and apprehensions regarding the safety and consistency of road travel within the corridor.

The Project design will maintain local access and connectivity in the local road network. Present levels of social cohesion and social networks can be maintained as a result.

Minor changes in community structures are likely as a result of people either relocating within or leaving their districts due to property acquisitions.

We do not expect changes in environmental amenity due to operating effects, such as traffic noise, air quality and surface water quality, to be significant. Consequently, there should be no impact on community values attaching to environmental amenity, such as general well-being. For some near neighbours, the changes in environmental amenity will be noticeable, especially during the first few years of operation. These effects will lessen for some neighbours after a period of adjustment.

26.7 Design, mitigation and monitoring measures

- The design of the Project has benefited from the extensive community consultation programme with the early identification of a number of potential social effects. The NZTA has used design development as a primary means of avoidance and mitigation of adverse effects. The key elements of the design in this regard are the provision of motorway ramps at Pūhoi for trips to and from the south (ensuring the current level of service is maintained);
- Separation of local roads from the motorway to maintain local community connectivity in the operational phase of the Project;
- The selection of a Project area that traverses areas of low population and separated from urban communities;
- An indicative alignment that avoids areas of community value; and
- An off-line route that supports connectivity for Warkworth with a substantial reduction in through traffic.

The mitigation of actual or potential adverse social effects during the consenting and construction phases can be primarily achieved by:

- Maintaining an engagement and consultation process that seeks to inform directly affected landowners, adjacent landowners and affected communities about the Project design, implementation, and timing, and which seeks to identify the ways in which individual circumstances can be accommodated; and
- The use of Construction Environmental Management Plans and a Construction Traffic Management Plan to set the parameters around the management of the effects of the construction phase on directly affected communities.

Three management plans will provide for the mitigation of certain environmental effects including actual or potential adverse social effects. These are:

- The Construction Traffic Management Plan (CTMP);
- The Stakeholder Consultation and Engagement Management Plan (SCEMP); and
- The Construction Noise and Vibration Management Plan (CNVMP).

The CTMP will identify techniques to manage the construction-related traffic and maintain an adequate level of accessibility for local residents who need to traverse the construction works.

A SCEMP will assist in the identification and resolution of issues arising from the communities' engagement with the Project over the construction phase and in the early stages of the operational phase.

I support the use of a CTMP, SCEMP and CNVMP along with public engagement during the preparation of the ULDF (as referred to in Section 5.11) as mitigation of potential adverse social effects during construction.

The scope of the CNVMP is discussed in Sections 15.5.1 and of this AEE. It will identify and manage the effects of construction works on the acoustic settings along the Project alignment.

27. Planning assessment

27.1 Introduction

There are a number of objectives and policies relevant to the Project. For assistance, the relevant objectives and policies from all documents considered are contained in Appendix G to this AEE. The following assessment demonstrates that the Project will generally be consistent with the relevant planning documents and not contrary to them.

27.2 New Zealand Coastal Policy Statement 2010 (NZCPS)

The Project activities are associated within the coastal environment, so I have given regard to the NZCPS. The NZCPS identifies a number of issues facing New Zealand's coastline and coastal environment. Potentially relevant to the Project, are the following issues:

- continuing decline in species, habitats and ecosystems in the coastal environment under pressures from subdivision and use, vegetation clearance, loss of intertidal areas, plant and animal pests, poor water quality, and sedimentation in estuaries and the coastal marine area;
- demand for coastal sites for infrastructure uses (including energy generation) and for aquaculture to meet the economic, social and cultural needs of people and communities;
- poor and declining coastal water quality in many areas as a consequence of point and diffuse sources of contamination, including stormwater and wastewater discharges;
- adverse effects of poor water quality on aquatic life and opportunities for aquaculture, mahinga kai gathering and recreational uses such as swimming and kayaking.

There are seven overarching objectives in the NZCPS as follows:

Objective 1 - To safeguard the integrity, form, functioning and resilience of the coastal environment and sustain its ecosystems, including marine and intertidal areas, estuaries, dunes and land

Objective 2 - To preserve the natural character of the coastal environment and protect natural features and landscape values

Objective 3 - To take account of the principles of the Treaty of Waitangi, recognise the role of tangata whenua as kaitiaki and provide for tangata whenua involvement in management of the coastal environment

Objective 4 - To maintain and enhance the public open space qualities and recreation opportunities of the coastal environment

Objective 5 - To ensure that coastal hazard risks taking account of climate change, are managed

Objective 6 - To enable people and communities to provide for their social, economic, and cultural wellbeing and their health and safety, through subdivision, use, and development

Objective 7 - To ensure that management of the coastal environment recognises and provides for New Zealand's international obligations regarding the coastal environment, including the coastal marine area

I consider Objectives 1, 2 and 3 to be most relevant to the Project. The specific policies of relevance to the Project, with reference to their guiding objective are discussed below.

The Project has a single point of contact with the CMA on the Pūhoi River at the Okahu Inlet. However, the NZCPS addresses issues of the land and water interface and addresses the broader "coastal environment". The Project's ultimate discharges are to the Mahurangi Harbour in the north and to the Pūhoi River in the south. As such, my assessment of the NZCPS has considered the Project's relationship to the coastal environment overall.

27.2.1 Objective 1 and Policy 1

Objective 1 and Policy 1 address the extent and characteristics of the coastal environment. I consider the Project achieves Objective 1 as the piers in the CMA will not affect the coastal processes within Okahu Inlet and the Marine Ecology Assessment Report concluded that the effects of the bridge structure will have only a minor effect on the environment.

27.2.2 Objective 3 and Policy 2

Objective 3 and Policy 2 consider the Treaty of Waitangi, tangata whenua and Maori heritage. Objective 3 is in part achieved through the relationship of NZTA with Hōkai Nuku. The Cultural Effects Assessment provided with this AEE identifies opportunities for further active engagement of Hōkai Nuku as the Project progresses, and includes recommendations with respect to the acknowledgement of culturally significant areas, including inputs into the design of significant structures and at the gateway to Warkworth, access to Ngā Pā o Te Hēmara Tauhia, a proactive approach to identification of unrecorded sites, involvement during construction and operation, including through identification of key cultural indicators and monitoring, inputs from Hōkai Nuku in vegetation plans, and wider relationship opportunities including knowledge sharing and economic development potential with NZTA.

Objective 3 is achieved otherwise through opportunities for mitigation of potential adverse effects such as providing access for iwi to previously inaccessible heritage sites and through planting of indigenous species of vegetation. The indicative alignment was deliberately amended to avoid a recently rediscovered pā site during the investigations that informed the development of the Assessment Reports.

27.2.3 Policy 6

Policy 6 recognises that the provision of infrastructure in the coastal environment is important to social, economic and cultural wellbeing of people and communities (6.1(a)). The importance of the Project is demonstrated in Section 2 of this AEE. Neither Section 5 nor Section 6 of the Landscape and Visual Assessment Report identified any specific adverse effects of the Project in relation to the coastal environment (6.1(h)). The Project may facilitate better access to public open space along Pūhoi River, where current traffic conditions discourage pedestrian use of the marginal strips (6.2(b)). The viaduct structure across Okahu Inlet will occupy a very small percentage of the

coastal marine area and is not considered to result in any significant adverse effects on the marine ecology of that area (refer Sections 4 and 5 of the Marine Ecology Assessment Report) (Policy 6.2.(e)).

27.2.4 Policy 11

Policy 11 covers indigenous biological diversity. Section 3 of the Marine Ecology Assessment Report and Section 4 of the Terrestrial Ecology Assessment Report have considered indigenous biodiversity in the descriptions of the environment. At risk species are identified, including coastal bird species and the species along the coastal margins and inland wetland areas.

To fully recognise and give effect to Policy 11, the Terrestrial Ecology Assessment Report has identified suitable species for replanting and methods to ensure terrestrial fauna is protected during construction and operation. The Marine Ecology Assessment Report identifies similar protective recommendations for marine species, including the collection and movement of mud snails to outside the construction footprint and scheduling of certain activities outside bird breeding season. The Landscape and Visual Assessment Report has included recommended principles for replanting, including (for a complete list recommended refer to Section 7 of that report):

- planting should be site specific and appropriate to the existing soil and environmental conditions;
- planting should respond to the natural vegetation patterns by fragmenting and feathering the edges of planting to reflect naturally occurring gradations;
- planting should evoke a 'sense of place' and emphasise the contrasting character areas along the route;
- a more structured or designed approach to planting may be appropriate in some areas, such as interchanges, to provide visual interest and strengthen local identity.

Given the assessments undertaken and mitigation recommended, it is my opinion that the Project will protect the indigenous biodiversity of the Pūhoi Estuary and Mahurangi Harbour and will enhance that biodiversity in the long-term.

27.2.5 Objective 2, Policy 13 and Policy 15

Objective 2 seeks to preserve the natural character of the coastal environment and protect natural features and landscapes. Policies 13 and 15 identify the mechanisms to achieve Objective 2. These Policies are mostly relevant to the southern extent of the Project, as beyond Pūhoi the alignment has a lesser influence on the natural character of the coastal environment. The first concept of these Policies is to preserve the natural character of the coastal environment from *inappropriate* use and development. The existing coastal environment is significantly influenced by the existing SH1. The Project is located in close proximity to the existing SH1 in this area, and positioning the indicative alignment next to SH1 will result in a minor reduction in the natural character of the wider coastal area. The preservation of natural character is assisted by the limited interface of the Project with the coastal environment. The design of the Project at this location is also driven by a functional necessity to tie into the Johnstone's Hill Tunnel portals. I therefore do not consider that the use (ie the Project) is inappropriate when viewed against these Policies.

27.2.6 Objective 4 and Policy 18

Objective 4 and Policy 18 cover public open space. The Project will assist with reducing traffic on the current SH1 and thus assist with enhancing access to public open space along the Pūhoi River margins. These areas will be more accessible to the public through the reduction in traffic on the existing SH1, improving safety for pedestrians wishing to access these areas.

27.2.7 Objective 1, Policy 21, Policy 22 and Policy 23

These components of the NZCPS cover water quality sedimentation and the discharge of contaminants. I am of the opinion that, as demonstrated by the assessments of the Operational Water and Construction Water Assessment Reports, the Project achieves Objective 1 and these Policies. The Project has identified a range of best practice techniques to manage sediment control during construction so that the overall effect on the marine environment is minor. During operation all stormwater will be treated in wetlands prior to discharge to ensure that contaminants from the roading network entering the coastal environment are within acceptable limits.

The effects of sediment deposition that would occur in the Mahurangi Harbour in the event of an extreme rainfall event (50 year ARI event over a 24 hour period) would potentially be significant. However, the probability of such an event occurring at the peak open area, within the earthworks season and during the construction period is low. I recommend a condition to appropriately mitigate this potential effect.

With respect to contaminated sites, preliminary investigations have indicated that there are site specific issues to be managed under the Soil NES and the NZTA will seek consents prior to construction. These potentially contaminated sites are well removed from the coastal environment and do not pose a risk to it.

27.2.8 Conclusions - regarding NZCPS

Having had regard to the provisions of the NZCPS, I am of the opinion that the Project will contribute to achieving the objectives of the NZCPS.

27.3 Hauraki Gulf Marine Park Act

The HGMPA integrates management across land and sea so that land use effects on the Gulf are given due attention. For the coastal environment of the Hauraki Gulf, sections 7 and 8 of the HGMPA must be treated as a NZCPS.

The Project has ensured, through the NZTA relationship with Hōkai Nuku and recommended mitigation, that it will facilitate the protection of the relationship of iwi with the historic, cultural and spiritual elements of the Hauraki Gulf. The assessment of environmental effects in Sections 10 to 26 of this AEE (notably the Operational Water, Marine Ecology, and Construction Water Assessment Reports) demonstrate that the Project will not compromise the life supporting capacity of the Gulf. Accordingly, I consider the Project is consistent with the HGMPA.

27.4 Auckland Regional Policy Statement

The ARPS sets out the broad resource management issues, objectives and policies for the Auckland Region to achieve the integrated management of the Region's natural and physical resources. The assessment that follows identifies those sections of the ARPS that I consider are of particular relevance to the Project (refer to Appendix G, page 9).My analysis demonstrates that the Project is consistent with the relevant objectives and policies in the ARPS overall.

27.4.1 Chapter 2 – Regional Overview and Strategic Direction

Chapter 2 (Regional Overview and Strategic Direction) of the ARPS provides objectives and policies relating to the strategic framework for managing the significant environmental issues of the Region.

In my opinion, the Project supports the strategic objectives of the ARPS, particularly Objective 2.6.1.6. ("to achieve a high level of mobility and accessibility within the region that provides for an integrated, responsive, sustainable, safe, affordable and efficient movement of goods and people."). The Project provides for improved accessibility within the Project area and provides a safer transport corridor. The Project will provide for a more efficient movement of goods through improved reliability and travel time. Objective 2.6.1.6 is supported by Objective 2.6.1.14 "to enable the redevelopment, operation, and maintenance of existing and provision of new regionally significant infrastructure".

The Project is consistent with the policy direction of the ARPS in relation to regionally significant infrastructure (Strategic Policy 2.6.14.1). The Project demonstrates that new or upgraded regionally significant infrastructure can be provided in a way that:

- supports the strategic outcomes of the Auckland Plan (which essentially replaced the Auckland Regional Growth Strategy through the Local Government (Auckland Council) Amendment Act 2010);
- can generally avoid, remedy or mitigate adverse effects on the environment, as demonstrated in Sections 10 to 26 of this AEE; and
- enables the safe and efficient operation, maintenance and development of the State highway network (as demonstrated by the Transportation and Traffic Assessment Report), which is a necessary component of the social and economic wellbeing of the people of the Region.

I consider the Project is consistent with the Objectives and Policies of Chapter 2 of the ARPS.

27.4.2 Chapter 3 – Matters of Significance to Iwi

Chapter 3 of the ARPS contains objectives and policies regarding matters of significance to iwi.

NZTA has engaged with Hōkai Nuku throughout the design and assessment process and Hōkai Nuku representatives have assisted in the Project development during the assessment phase by assessing the Project form a cultural perspective, providing comments on other technical reports and sharing cultural information with the NZTA. This collaborative process began during the

scheme assessment phase and has culminated in the provision of a Cultural Effects Assessment by Hōkai Nuku, which has informed this AEE.

The ARPS Objectives (3.3), including the Objective seeking to prioritise the relationship of tangata whenua and their culture, traditions and taonga (Objective 3.3.2), are achieved through the established relationship between Hōkai Nuku and the NZTA. Hōkai Nuku fully involves its members in the process of preparing the Cultural Effects Assessment to accompany the resource consent applications and NORs (Objective 3.3.3).

In my opinion, the Project is consistent with the Objectives of Chapter 3 of the ARPS. The methods to achieve the Policies and Objectives of Chapter 3 relate to the relationship of local government with tangata whenua, and I do not discuss these further.

27.4.3 Chapter 4 - Transport

Chapter 4 of the ARPS contains objectives and policies regarding transport matters. Issue 4.2.4 of the ARPS recognises that:

> *"The transport system is a significant regional resource providing for the movement of people, goods, services and resources. The existence of deficiencies in the transport network leads to poor access between some parts of the Region and congestion in some parts of the transport network, inhibiting the ability of the community to provide for its social, economic and cultural wellbeing."*

The Project is consistent with the Objectives of the ARPS in relation to transport The Project will:

- manage the adverse effects of the Project on the environment through the provision of integrated stormwater treatment and discharge systems (Objective 4.3.2 (i));
- avoid as far as reasonably practicable adverse effects, for example by avoiding a pā site and by the treatment of stormwater through wetlands prior to discharge (Objective 4.3.2 (i));
- manage the effects of the Project on community wellbeing and amenity through providing an offline Project and rigorous construction environmental and traffic management plans (Objective 4.3.3); and
- provide transport choices that are efficient and practical through a design that enhances accessibility in the northern part of the Region and provides a significant safety improvement on the existing SH1 component of the network (Objective 4.3.4).

The Project design is consistent with Policy 4.4.1 and Policy 4.4.7 in recognising that the northern part of the Region will continue to have transport choices that are dominated by private vehicle based trips. The Project is an integral component of a State highway network that promotes the efficient movement of people, goods and services throughout the Region. As such, it is required to be protected in the District Plan. Policy 4.4.7.1 specifically addresses the efficient movement of people, goods and services throughout the Region.

While several of the Policies of Chapter 4 are designed to address more urban-oriented traffic and transport issues, the Environmental Results Anticipated (4.5) within Chapter 4 include "*ensuring the regionally significant parts of the transport network are able to function effectively and*

efficiently". Accordingly I consider that the Project is consistent with the relevant objectives and policies of Chapter 4.

27.4.4 Chapter 6 – Heritage

Chapter 6 of the ARPS recognises that "*the heritage of the Auckland Region has been depleted and continues to be under threat*" (Issue 6.2.1). Chapter 6 contains objectives and policies regarding the protection of the Region's natural and physical heritage resources.

Proposed Change 8 to the ARPS (PC8) was notified in 2005. It introduced amendments to the Heritage chapter of the ARPS (Chapter 6) to replace the existing "Outstanding and Natural Features" with "Outstanding Natural Landscapes". Decisions were released by the Auckland Regional Council (now Auckland Council) in October 2010. There are outstanding appeals on this Change, which have to be resolved. Given the advanced state of PC8 it should be accorded some weight in the consideration of the Project.

The following assessment includes reference to parts of Chapter 6 that are still subject to appeal. I consider Objectives 6.3.1, 6.3.4, 6.3.6 and 6.3.9 (refer to Appendix G, page 11) to be relevant to consideration of the Project.

The Project has been designed to avoid the Ngā Pā o Te Hēmara Tauhia to the extent possible given the other constraints in the immediate area. The Project avoids ONLs as much as possible, skirting ONL 44 at the south end of the Project area, and passing through ONL 43 on its outer periphery. I do not consider the Project to be "inappropriate" in the context of the Chapter 6 Objectives, on the basis of its status as a RoNS project and being an infrastructure project having intra-regional benefits. The additional constraints at the southern end of the alignment in the vicinity of the ONLs and pa sites further reinforce my opinion that the Project is not "inappropriate" in the context of these objectives and policies.

With respect to the policies and methods, the Project avoids significant adverse effects on sites of cultural heritage and ONLs. Through early and ongoing discussions with Hōkai Nuku, tangata whenua has participated in and contributed to the comprehensive assessment of the potential effects of the Project.

In my opinion the Project has been developed in a manner that ensures it is consistent with the Heritage Chapter Objectives and Policies.

27.4.5 Chapter 7 – Coastal Environment

Chapter 7 identifies the significant coastal management issues of the Auckland Region's coastal environment and considers the policies of the NZCPS.

The southern end of the Project has the only direct locational relationship with the coastal environment. As identified in Section 5.1 of the Landscape and Visual Assessment Report, the coastal environment has already been modified by the existing SH1, Johnstone's Hill Tunnels and Hibiscus Coast Highway tie-ins. The tunnel portals have had a direct influence on the design of the Project; the short length of the alignment that passes over the coastal marine area cannot be

avoided. The part of the CMA that is affected by the Project is not within an ONL, and has minor effects on coastal ecology (refer to the Marine Ecology Assessment Report).

The Project does not compromise public access to the coastal environment, as most of the Project is within private land. There is no adverse effect on recreational activities, such as kayaking, given the structures have sufficient height above mean high tide to maintain passage and there are no piers in the Pūhoi River. Any potential adverse effect on amenity will be mitigated through the ULDF, which will include consideration of the design of the underside of the Pūhoi Viaduct. The piers that will support the viaduct over Okahu Inlet and the intertidal area will have only a minor effect on marine ecology (refer Marine Ecology Assessment Report). There are no recreational values that have been identified in consultation with stakeholders or interest groups that would be compromised. None of the Assessment Reports have identified potential significant effects on areas of protection, including the ASV and CPA1 classification.

Policy 7.4.10 (Subdivision, use and development) identifies several relevant matters to give effect to the Objectives of Chapter 7. The methods subsequently identified to achieve these Objectives entail the development of regional and district plan policies and rules. I have had regard to regional and district planning documents, as discussed below in Sections 28.5 to 28.8 below.

I consider the Project is consistent with Chapter 7 of the ARPS.

27.4.6 Chapter 8 – Water Quality

Chapter 8 of the ARPS provides for the maintenance and enhancement of water quality in the Auckland Region through a comprehensive and integrated management approach. Objectives and policies relevant to the Project include Objective 8.3.1 and Policies 8.4.7.3 (stormwater and sediment discharges), 8.4.21.3 and 8.4.21.4 (areas that are either susceptible to water quality degradation, already degraded or have significant values). I also consider Policy 8.4.10 to be relevant as it is specifically related to the industrial trade premise proposed for the production of precast concrete components for the Project (refer to Appendix G, page 13).

The Objectives of 8.3.1 seek to ensure that water quality is maintained for purposes relating to ecosystem protection, and recreational and cultural purposes (among other reasons). Two general Policies and a number of activity-specific Policies are identified as being the means to achieve the Objectives. The two general Policies relate to the management of the discharge of contaminants and the application of minimum water quality standards.

Operational and construction stormwater treatment is an integral part of the design of the Project. The Construction Water team has assessed the Project to determine the maximum open area of earthworks during construction to ensure that fresh and coastal water quality is not compromised. I consider there is sufficient evidence in the Assessment Reports to confirm that the Project will achieve the Objectives and Policies relating to water quality.

With respect to the area identified in RPS Plan Map Series 5 and the identification of the Mahurangi River Right Branch as “Surface waters used for potable water supply”, the Operation and Construction Water Assessment Reports have addressed the potential effects on the surface water quality as discussed in Section 7.10 of the Operational Water Assessment Report. Some areas of existing riparian vegetation will be removed as part of the construction of the Project. I

recommend conditions of consent and designation require planting, including along riparian edges, to mitigate for the loss of riparian vegetation, to restore instream habitat and to mitigate adverse visual effects thus providing an overall improvement in the longer term to sediment management and water quality.

The Project will not have a significant effect on water flows or quantity within watercourses. The diversions and culverts will generally maintain flows with only minor variations to the existing flow regime. The Project's stormwater system will be designed to ensure that the potential effects from increased flood risk are minimised, that outfalls are installed with energy dissipation to protect stream banks from erosion, and treatment is to acceptable standards (Policy 9.4.1). The Project will incorporate diversions and culverts to pass the existing base flow (with a minimum design to pass the 10 year ARI) to ensure that downstream users of the surface water resource are not subject to changes to natural flow rates that would compromise their ability to take water (Policy 9.4.4).

The Hydrogeology Assessment Report (Section 5) has confirmed that the diversions that are anticipated to occur as a result of cuts during Project construction will not have any adverse effects on groundwater and will not compromise any groundwater takes (Policy 9.4.7).

It is my opinion that the Project is consistent with the ARPS Objectives and Policies in relation to Water Quality, allocation and conservation.

27.4.7 Chapter 10 – Air Discharges

Chapter 10 provides for the maintenance and enhancement of air quality in the Auckland Region. From this chapter, Objective 10.3.2 and Policy 10.4.1 are most relevant to the Project.

The Project will generate potential effects on air quality during construction. Objective 10.3.2 seeks to avoid, remedy or mitigate the adverse effects that arise from the discharge of contaminants to air. The Project will generate dust from earthworks and rock crushing. These effects, along with dust generated by general construction activities from the Project will be managed through a CAQMP to comply with relevant air quality criteria.

The operational effects of the Project have been assessed to be within the National Environmental Standards for Air Quality, 2004, the New Zealand Ambient Air Quality Guidelines, 2002, the Ministry for the Environment, Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions, 2001, the ARP:ALW standards and the NZTA Draft Guide to assessing air quality effects for state highway projects 2012. The Project is found to have only minor effects at most.

I consider the Project will be consistent with the Chapter 10 Air Discharges Objectives and Policies.

27.4.8 Chapter 11 – Natural Hazards

Chapter 11 of the ARPS includes Objectives and Policies to deal with the risks posed by natural hazards, aiming at avoidance and mitigation, and remediation if required. The most frequently occurring natural hazards in the Auckland Region are flooding and erosion/land stability.

The Project is affected by flooding risk at:

- The Mahurangi River Left Branch in the vicinity of Woodcocks Road; and
- A secondary flow path from the Mahurangi River Left Branch up the flat valley to the north following the indicative Project alignment.

The design of the Project adopted a BPO approach to minimise the effects of flooding in these areas by changing the alignment of the motorway to avoid the floodplain, and by using bridges to cross the floodplain. This BPO approach is consistent with Policies 11.4.1.6 and 11.4.1.7.

At Okahu Inlet, the introduction of the bridge over the Inlet and the similar structure over the Pūhoi River are consistent with Policy 11.4.1.9, which requires development to be located so that the need for flood hazard protection measures is avoided.

I consider the Project will be consistent with the Natural Hazard Objectives and Policies of the ARPS.

27.4.9 Chapter 12 – Soil Conservation

Chapter 12 seeks to control the use and development of land from natural and induced degradation for the purpose of soil conservation. Objective 12.3.3 seeks to avoid, remedy or mitigate adverse effects of activities on soil degradation, and to minimise the effects of soil degradation on the water quality of receiving environments.

Soil degradation includes the natural process of soil erosion. The RPS recognises that sediment is the “single largest pollutant of Auckland’s waterways”. However, in recognition of the potential effects of the Project, especially during construction, I regard the Objectives and Policies of Chapter 12 to be relevant considerations.

The Construction Water Assessment Report addresses erosion and sediment control, water quality and construction management, and has assessed the potential causes of sediment entering the streams, rivers and ultimately Mahurangi and Pūhoi Estuary. The Report identifies a range of structural and non-structural management techniques that have been demonstrated to work in similar conditions to those that will be encountered through the Project area. Based on both the conclusions of that Report and on the Marine and Freshwater Ecology Assessment Reports, I consider the Project will be consistent with the Soil Conservation Objectives and Policies.

27.4.10 Conclusion – ARPS

Overall, the Project can reasonably fall to being considered as regionally significant infrastructure. The Project design and proposed mitigation will ensure that the overall effects of the Project are minor. In my opinion, the Project is consistent with the provisions of the ARPS, given the established and ongoing relationship with Hōkai Nuku and the assessments of environmental effects, as demonstrated in the supporting Assessment Reports.

27.5 Auckland Regional Plan: Coastal

The ARP:C is structured to identify values, management areas and activities. The relevant Objectives and Policies identified below relate to the structure, occupation and use of the Project's proposed viaduct across Okahu Inlet and the stormwater discharge during operation into the same location Refer to Appendix G for the full text of relevant Objectives and Policies. Okahu Inlet and the estuarine area to the west of the existing SH1 form part of a wider scheduled area of upper Pūhoi River. The schedule specifies this area as Coastal Protection Area 1 (CPA1) (75g) and an Area of Significant Conservation Value (115) (ASCV) as noted on the Coastal Plan maps (sheet 35). Okahu Inlet and the upper Pūhoi River are identified as being a Regionally Significant Landscape (Rating 5) (being lower than "outstanding"). With respect to the assessment below I have referred to the whole CPA1 area west of SH1 as "Okahu Inlet".

27.5.1 Values – Natural Character, Landscape, Natural Features and Ecosystems – Chapters 3, 4 and 5

My assessment against the Objectives of 3.3 (refer to Appendix G, page 17) of the ARP:C relating to preservation of the natural character of the coastal environment is the same as for the NZCPS and ARPS, from which the ARP:C has been derived. The Policies all relate to subdivision, use and development of the coastal environment and the effect on natural character. Therefore, I consider that all Policies (3.4.1 – 3.4.4) are relevant. The functional necessity to locate the Project within the CMA and the regional significance of the Project, coupled with the design constraints relating to the pā and the location of the Johnstone's Hill Tunnel portals, leads me to the opinion that the Project is not inappropriate. Neither the Landscape and Visual Assessment Report nor the Marine Ecology Assessment Report identifies any significant adverse effects from the piles and viaduct structure located in Okahu Inlet.

Objective 4.3.1 of the ARP:C seeks to protect the key elements, features and patterns of Regionally Significant landscapes from inappropriate use and development. I consider Policy 4.4.2(a) and (b) to be relevant to the Project.

Section 5 of the Landscape and Visual Assessment Report does not identify any significant adverse effects of the Project on the coastal landscape character. The Project is located to the west of the current State highway and, in that respect; the wider coastal landscape will be unaffected. While the Project is located within a Regionally Significant Landscape, the effects on the landscape as a whole are minor, as assessed in the Landscape and Visual Assessment Report. I have relied on that assessment, and on the limited occupation of the Project within the coastal landscape to come to the opinion that the Project will not compromise the Objectives of Chapter 4 as a whole. The Project is separated from the main Pūhoi River by the existing SH1, which enables the broader coastal character to be maintained.

Chapter 5 relates to natural features and ecosystems. The piers within Okahu Inlet have been located to minimise disruption to the flow of coastal water and the Project does not compromise the dynamic functioning of physical coastal processes (Objective 5.3.1).

There are no significant environmental effects identified in Sections 4 or 5 of the Marine Ecology Assessment Report that might suggest that the location of the Okahu Viaduct is inappropriate,

even with its scheduling as a CPA1 and ASCV. The design of the wetland and the landscaping will ensure that appropriate species are planted to support the wildlife that visit Okahu Inlet for food and/or roosting. The recommendations of the Marine Ecology Assessment Report with respect to the removal of adult mud snails prior to construction starting will ensure that the existing populations of the mud snails can be maintained. I have had regard to the relevant Objectives and Policies of Chapter 4 and I consider the Project is consistent with them.

27.5.2 Nga Take Takutai Mo Tangata Whenua – Coastal Matters of Significance to Tangata Whenua – Chapter 6

Chapter 6 addresses the coastal area's special significance to Maori culture, traditions and wellbeing. The management of the coastal area takes into account the Treaty of Waitangi and the effects on claims and/or customary rights.

It is my opinion that in relation to the Objectives in Section 6.3 (refer to Appendix G, page 18) of the ARP:C, the Project would give recognition to special spiritual, historical and cultural sites in the Project area – especially those in relation to Ngā Pā o Te Hēmara Tauhia. Various methods to give Hōkai Nuku the ability to better express their relationship to this site and the surrounding area, including the immediate coastal environment, have been identified in the Cultural Assessment Report and, in my opinion, some of these are appropriate to attach to the designation as conditions. The Project, in my opinion, ensures that the relationship of Tangata Whenua to the coastal environment can be maintained and enhanced and that the Project is consistent with the Objectives and Policies of section 6 of the ARP:C.

27.5.3 Public Access – Chapter 7

Chapter 7 of the ARP:C addresses the responsibility of Council to maintain and enhance access to the coast as a matter of national importance.

Public access to the coastal environment in the southern extent of the Project area is largely controlled by the limited access to coastal margins due to SH1 and private land ownership. There are three marginal strips in the immediate vicinity of the existing SH1 and the Project. The Okahu Creek Scenic Reserve is located on the western side of SH1 north of Billings Road, and to the south of the manual toll payment booth. It falls partly within the existing designation of SH1. The site is described in the Auckland Conservancy Land Inventory (page 189) as a "small part of the roadside vegetation which borders State Highway 1 along the visually attractive Pūhoi River estuary." The Project seeks to confirm a designation over the remainder of the site, although the indicative alignment affects only the north eastern corner of the reserve, and could possibly be subject to some redesign to avoid it all together.

The Pūhoi River Conservation Area abuts the Pūhoi River to the east of the existing SH1 and outside of the proposed designation boundary. This Conservation Area adjoins to the Hikauae Creek Marginal Strip, which forms the esplanade margin on the true right bank of the Pūhoi River from the SH1 crossing of the Pūhoi River toward the Pūhoi Village. The Pūhoi Viaduct will pass over the Hikauae Creek Marginal Strip with some 20m of clearance. The viaduct, coupled with reduced traffic on the existing SH1, will offer better opportunities of access to the eastern side of the current SH1 and the Pūhoi River conservation area.

Any further public access along the foreshore is restricted by the existing SH1, public safety considerations and/or private land ownership. I consider the Project is consistent with the Objectives and Policies relating to Public Access in the ARP:C.

27.5.4 Cultural Heritage – Chapter 8

The Cultural Assessment Report did not identify any specific sites of "Maritime" significance. Accordingly, I do not regard Chapter 8 as being particularly relevant. Both the Objectives and the resultant Policies of Chapter 8 are premised on such sites existing.

27.5.5 Subdivision, Use and Development – Chapter 9

I consider Objective 9.3.2 (refer to Appendix G, page 18) to be relevant to the Project as it seeks to recognise the national and regional importance of activities, including regional infrastructure that may be located within the coastal environment. The Project is regional infrastructure.

The Project does not align well with the Policies supporting Objective 9.3.2. Policy 9.4.1 considers use and development in the CMA appropriate where it is dependent on the natural and physical resources, and Policy 9.4.2 references specific activity areas that are not related to the Project. Overall it would appear that while the Project aligns with Objective 9.3.4, the Policies are silent with respect to a wider application of "regional infrastructure". Using the "anticipated environmental outcomes" to assist with the intent of Chapter 9, it appears the Project would be "appropriate" given the points made in the assessment of the Objectives within sections 3.3, 4.3 and 5.3 in the ARP:C as outlined above, and that the effects will be adequately avoided, remedied or mitigated (refer to Section 12 of this AEE). With those points in mind it is my opinion that the apparent inconsistency of the Project with the Policies of Chapter 9 does not result in a significant departure from the intent of Chapter 9 overall.

27.5.6 General – Chapter 10

The Objectives of Chapter 10 (refer to Appendix G, page 18) recognise that for appropriate use of the CMA (Objective 10.3.1), it is necessary to use the CMA efficiently (Objective 10.3.2) and to maintain the open space nature of the coastal environment (Objective 10.3.3). I consider all of these Objectives to be relevant, as are all of the Policies that follow.

As acknowledged above (Public Access – Chapter 7), the Project provides for the opportunity to improve the pedestrian environment linking the two marginal strips in the location of the SH1 intersection with Pūhoi Road alongside the Pūhoi River, through the removal of some traffic from the current State highway to the new alignment. Public access south of this point is restricted by private property and by the existing SH1 and is outside the influence of the Project (Policy 10.4.1). The recreational use of the CMA will not be inhibited by the Project, as the area where the viaduct is located is accessed entirely by private property (Policy 10.4.2). The location of the viaduct structure immediately adjacent to the existing SH1 is both necessary (given the location of the northern portals of the Johnstone's Hill Tunnels) and ensures that the consolidation of the network in this area does not affect the wider Pūhoi River coastal environment and avoids Ngā Pā o Te Hēmara Tauhia (Policy 10.4.3). The Project's wider benefits beyond the immediate context of the CMA have been identified in Section 2.5 of this AEE (Policy 10.4.4). The Pūhoi Viaduct will be located in the part of the CMA most removed from Pūhoi River, due the location of the existing

SH1, and has been assessed in Sections 4 and 5 (being the Assessment of Effects for construction activities and operational phase respectively) of the Marine Ecology Assessment Report and Sections 5 and 6 (being the assessment of landscape and visual effects and construction effects respectively) of the Landscape and Visual Assessment Report as having minor effects ecologically and visually (Policy 10.4.5). The effects of the viaduct will not result in a loss of feeding or roosting habitat (refer Sections 4 and 5 of the Marine Ecology Assessment Report) and will not result in any irreparable damage to the CMA beyond the location of the piles (Policy 10.4.6), given the limited area to be occupied and the construction process. Given the limited extent of occupation of the CMA and the assessments finding no significant adverse effects on Okahu Inlet (primarily in Marine Ecology and Landscape and Visual Assessment Reports) none of the elements for an "inappropriate" development are triggered (Policy 10.4.7).

Policy 10.4.8 seeks to avoid, remedy or mitigate cumulative adverse effects on the CMA. I am of the opinion that the Project will consolidate the existing sense of modification, but that the effect is local to SH1 and westward, with the wider Pūhoi River and coastal environment remaining free of structures and modification associated with either the Project or the existing SH1. By selecting a westward alignment, the Project avoids further expansion into the more obvious and more valued CMA area. The effects of the Project have been assessed as being minor (also relevant to 10.4.9), as noted above.

The Project has a functional necessity to locate in the CMA given the location of the tunnel portals and the width of CMA in the immediate vicinity of the portals (Policy 10.4.10).

27.5.7 Activities – Chapter 11

The Objectives in Chapter 11 (refer to Appendix G, page 21) provide for a range of activities to locate in the CMA, and to ensure efficient use is made of the CMA. Policy 11.4.1 outlines a series of tests to determine whether an activity is "appropriate" in the CMA.

I note that the indicative alignment passes through the CMA given the proximity to the Johnstone's Hill Tunnel portals, which determines the starting point for the Project. There are no practical alternatives beyond the CMA. This design constraint is demonstrated in the options analysis for the alignment outlined in Section 7 of this AEE (Policy 11.4.1a i and iii). Furthermore, as demonstrated by the Assessment Reports that accompany this AEE, the Project's potential adverse effects can be adequately avoided, remedied or mitigated (Policy 11.4.1c). The relevant provisions of Chapters 3 to 9 have been considered as outlined above (Policy 11.4.3).

I consider that the Project is consistent with the Objectives and Policies of Chapter 11.

27.5.8 Structures – Chapter 12

Chapter 12 (refer to Appendix G, page 21-22) has a single objective – to provide for appropriate structures in the CMA while avoiding, remedying or mitigating the adverse effects on the environment (Objective 12.3.1). I consider Policies 12.4.1-12.4.4, 12.4.6-12.4.7, 12.4.9 and 12.4.12 to be relevant.

I consider that the Project structure within the CMA is appropriate given the design, topographical and existing infrastructure constraints that result from the location of the Johnstone's Hill Tunnel

portals. These portals are the chief constraint on any design, and avoidance of the CMA in its entirety is not an option for the Project, especially given the extent of the CMA to the east of SH1. The Okahu Viaduct is part of an alignment that benefits the regional community (Policy 12.4.7(d)). The structure has been designed to take into account the coastal processes, and sea level rise is not an issue, given the structure's elevation above sea level.

I consider that the Project is consistent with the Objectives and Policies of Chapter 12.

27.5.9 Disturbance – Chapter 16

Chapter 16 has a single Objective 16.3.1 "to provide for appropriate activities ... which involve disturbance of the foreshore and seabed while avoiding, remedying or mitigating the adverse effects on the coastal environment".

This Objective is directly relevant to the construction phase of the Project, and the Okahu Inlet Viaduct, which is anticipated to take two years to construct. The construction methodology has identified several techniques to minimise the disturbance to the seabed during construction of that viaduct. The disturbance is, in my opinion, appropriate as it seeks to facilitate the provision of a roading structure where no practical alternative outside the CMA exists (Policy 16.4.1 (a)(vi)) (refer to Appendix G, page 22). Section 3.3 of the Marine Ecology Assessment Report identified the overall marine ecological values of the Pūhoi Estuary to be moderate. Okahu Inlet is considered to have moderate values given the prevalence of adult breeding populations of mud snail. The area involved is negligible in the wider context of the Pūhoi Estuary, and the Marine team assessed the effects of the structure, including construction, as being very low (Policy 16.4.3(a)). The only specific mitigation recommended by the Marine Ecologist is the physical relocation of the mud snails immediately prior to the construction of the access track across the inlet for the pier construction.

I consider that the Project is consistent with the Objectives and Policies of Chapter 16 as the potential adverse effects can be appropriately mitigated.

27.5.10 Conclusion – Auckland Regional Plan: Coastal

Overall the Objectives and Policies of the ARP:C places an emphasis on the "appropriate location of structures" and the avoidance, remedying or mitigation of potential adverse effects. The Project is demonstrably "appropriate" and the Assessment Reports (especially Marine Ecology, Landscape and Visual and Operational Water) provide evidence that the effects are minor to moderate at worst, that the Ohaku Inlet has moderate environmental values and that the Project has a necessity to locate there. I am of the opinion that overall the Project is consistent with the ARP:C.

27.6 Auckland Regional Plan: Air, Land and Water

The ARP:ALW provides a framework to promote the integrated and sustainable management of Auckland's air, land and water resources (excluding the CMA). Some discrete sections of Chapter 5 – Discharges to land and water and land management are still subject to appeal, and as noted above, none of the outstanding appeals are material to this assessment. Transitional provisions of the Freshwater National Policy Statement are included in the ARP:ALW, and I have assessed the Project against Policies A4 and B7 of that Policy Statement below.

27.6.1 Freshwater National Policy Statement – Policies A4 and B7

The Freshwater NPS has two transitional policies that must be considered in relation to resource consents for discharge in relation to water quality and water quantity (refer Appendix G).

Policy A4 relates to water quality (refer to Appendix G, page 24). The Freshwater Ecology, Operational Water and Construction Water Assessment Reports address the issue of water quality on the life supporting capacity of freshwater including any ecosystems. These Reports have not identified any adverse effects on the life supporting capacity of freshwater including any ecosystems. The Construction Water Assessment Report has identified that sediment will deposit in the watercourses downstream of Project construction. Anticipated sediment levels are within the tolerances of the receiving environment as identified by the Freshwater Ecology Assessment Report. The post-construction management of the Project area will ensure that water quality will be maintained with the treatment of stormwater runoff from the Project and with the potential to retire remnant land within the designation from grazing or forestry. Although the Marine Ecology Assessment Report identifies a potential significant effect from sediment discharge during a 50 year ARI rainfall event, the probability of such an event occurring during the construction period is low and the ability through adaptive management to secure the site prior to such a rain event will assist to mitigate the potential effects. Overall, the Project's effects during construction and operation on the life supporting capacity of freshwater are minor.

Policy B7 relates to allocation of freshwater resources. Water allocation is not an issue relevant to the Project as no water take has been applied for. The Mahurangi River is at maximum allocation and no water would be available. Any water required during construction will be sourced from existing authorised water takes or from the public reticulated system or trucked in using tankers.

27.6.2 Chapter 2 – Values

Chapter 2.1 of the ARP:ALW provides management direction for the protection and management of the Region's natural values. Relevant provisions include Objectives 2.1.3.1 to 2.1.3.4, and Policies 2.1.4.1 through to 2.1.4.9 (refer to Appendix G, page 25).

The Project is, in my opinion, appropriate, as has been demonstrated by the discussion above and through the validation of the Project by strategic policy considerations set out in Section 3 of this AEE. Therefore, I consider that the Project is consistent with the high level Chapter 2 Objectives (2.1.3.1 – 2.1.3.4) relevant to the Project. Route selection has avoided, to the greatest extent possible, areas of high environmental quality. The route passes through the periphery of ONLs thereby leaving the bulk of the ONL intact. The Project will, where practicable, enhance the permanent river margins post construction through riparian planting where such areas are currently open pasture.

I consider all of the Chapter 2 Policies relating to Natural Character to be relevant to the Project. The effects of the Project on the natural character of the watercourses is in part mitigated through the route selection, which avoids or minimises the intrusion into valued areas such as the Natural Stream Management Areas, ONLs and Significant Natural Areas (noted in the Auckland District Plan: Operative Rodney Section). Policy 2.1.4.2 requires the assessment of the Project against the policy direction to maintain the high levels of natural character. Neither, the Terrestrial Ecology, Freshwater Ecology nor the Landscape and Visual Assessment Reports identify any significant

effects on natural character. Elements of natural character will be retained as much as possible through the bridging of watercourses where appropriate, and through careful restoration of diverted watercourses and riparian planting as mitigation.

Fish passage has been an integral part of the design of the Project and will be incorporated in culvert designs where it is required to maintain or enhance the ability of fish to access habitat upstream of the Project.

At Section 5.1.3, the Terrestrial Ecology Assessment Report considers the effects on one significant area of vegetation where the design of the Project has been modified to accommodate concerns about the effects on this area. The area is west of Perry Road, where a significant stand of kauri is located within a block of indigenous vegetation of approximately 23ha. The eastern extent of this stand is located on an unformed part of Perry Road and immediately west of the Genesis Aquaculture fish farm. The vegetation extends northwards along the banks of the Mahurangi River Right Branch. The alignment was originally moved westward to overcome concerns from the Perry Road community and it has subsequently been shifted to avoid the stand of kauri. The consequence of the latest design amendment was to bridge a section of the Right Branch, which was previously to be reclaimed and culverted. The design geometrics, coupled with the Perry Road residents' concerns require some removal of vegetation. The effect is to ensure that the bulk of the site where the kauri is located remains intact and that the effects on the Right Branch are minimised. Overall, the design avoids any significant adverse effects on the remainder of the vegetation within Site 15. The loss of 0.4ha of kauri is considered significant in the Terrestrial Ecology Assessment Report and mitigation is recommended in Section 6 of that Report.

Objectives relating to the use of natural and physical resources are outlined in Chapter 2.2.3 of the ARP:ALW. These objectives provide for sustainable use of the natural resources in line with the ARPS and the ARGS. Notably provision is made in Objective 2.2.3.4 for the "ongoing operation, maintenance, development and upgrading of physical infrastructure. Objective 2.2.3.5 seeks to protect network utility infrastructure from inappropriate use and development. Policies 2.2.4.2, 2.2.4.3 and 2.2.4.6 – 2.2.4.11 are relevant in the context of Objective 2.2.3.4. The Project is consistent with the ARPS, as outlined in Section 28.4 of this Report, and it will mitigate significant adverse effects on the environment. With respect to being undertaken in an "efficient and cost effective manner that recognises the community's ability to pay" I am of the opinion that Policy 2.2.4.4(d) is more relevant to Council's own services rather than the NZTA's.

Policy 2.2.4.7 recognises that network utility activities and infrastructure is appropriate in rural areas where the use of air, land and/or water resources is necessary. To the extent practical, the Project avoids significant natural areas and mitigates significant adverse effects, where they cannot be avoided (Policy 2.2.4.7). The Project has social and economic benefits in removing a significant traffic issue that divides Warkworth, with essential community facilities (the schools) on the western side of the State highway and the bulk of the community to the east. The Project's key objective is to advance an improved transport network to Northland.

The Assessment Reports have assessed effects and do not identify any significant cumulative effects that cannot be mitigated. The quantity of sediment that might deposit into the Mahurangi Harbour is considered to have minor effects. The exception to this would be an extreme rain event (1:50 year over a 24 hour period), which would likely result in significant adverse effects on marine

ecological values and moderate effects on freshwater ecological values. However this rainfall would have to occur during the earthworks season and at the peak open area and the coincidence of these three occurrences is considered to be of low probability. However, a condition is recommended to address appropriate mitigation in the Marine Ecology Assessment Report.

One of the anticipated environmental results of Chapter 2 is that "network utility infrastructure develops and operates in an efficient and cost effective manner while avoiding, remedying or mitigating adverse effects on the environment." The Project will achieve this result, qualified by the comment above regarding "cost effective".

Objective 2.3 – Nga Take Tuturu Mo Tangata Whenua (Matters of Significance to Tangata Whenua) identifies three key objectives to govern the consideration of the use of air, land and water with respect to Tangata Whenua. These objectives are the same as those in the ARPS, which have been discussed in Section 28.4.2 above. Policy 2.3.4.4 is the only policy of relevance to the Project. The extensive consultation and integral involvement of Hōkai Nuku in the Project development have provided an immediate platform for iwi to exercise their cultural traditions and kaitiaki over the area and to ensure that adverse effects on their taonga are avoided to the greatest extent possible.

Overall, I consider the Project will be consistent with Chapter 2 of the ARP:ALW.

27.6.3 Chapter 4 – Air Quality

Chapter 4 of the ARP:ALW addresses air quality. The objectives and policies relevant to the Project are Objectives 4.3.1 through to 4.3.6 and Policies 4.4.1 through to 4.4.4, 4.4.6, 4.4.7, 4.4.9, and 4.4.15 through to 4.4.17 (refer to Appendix G, page 28).

Objective 4.3.1 seeks to maintain the excellent air quality currently experienced throughout the Project area. Section 8 of the Air Quality Assessment Report confirms that the predicted concentrations of potential pollutants that might be generated by the operation of the road are negligible ("less than minor" in the Report). There are no significant adverse effects that cannot be managed. During construction when potential dust effects may be identified, these effects will be managed using proven techniques to ensure that the effects of dust will be contained within the Project area. The Air team have recommended specific measures to protect the Genesis Aquaculture fish farm. These measures would entail the erection of a wind fence along the common boundary with the designation and extend to a distance sufficient to ensure that the dust does not adversely affect the fish farm operation.

We have considered Policies of Chapter 2 – Values (refer above) and, given the proximity to the coastal marine area, the ARP:C (4.4.1 and 4.4.2). The Project does not result in any significant adverse effects with respect to air quality during construction or operation of the Project (4.4.3). The Project does not result in any discharge to air that would significantly compromise the ability of the Region to meet National Environmental Standards for Ambient Air Quality (4.4.4). Section 7 of the Air Quality Assessment Report considers the appropriate mechanism to manage dust is through implementation of standard measures, to be identified in a Construction Dust Management Plan. Mitigation measures proposed are listed in Section 8 of that Report. Provided this is implemented throughout the period of earthworks during construction, I consider that the discharge of contaminants (mostly dust) would be appropriate (Policy 4.4.5).

Overall, I consider the Project will be consistent with Chapter 4 of the ARP:ALW.

27.6.4 Chapter 5 – Discharges to Land and Water

Chapter 5 of the ARP:ALW addresses discharges to land or water, and acknowledges that vehicle use is a major cause of stormwater contamination. The Objectives and Policies of Chapter 5 provide for the appropriate management of adverse effects of stormwater discharges. Particularly relevant to the Project are Objectives 5.3.1, 5.3.3 and 5.3.5, and Policies 5.4.1 through to 5.4.4A and 5.4.13 (refer to Appendix G, page 28-32).

I consider the Objectives and Policies of Chapter 5 that relate to stormwater discharges from networks and industrial or trade activities to be particularly relevant. As these Objectives and Policies are consistent with the general Objectives of Chapter 5. I do not consider the more general objectives in any detail.

Objectives 5.3.5 to 5.3.7 address discharges from stormwater networks. The Project has integrated erosion and sediment control and operational stormwater measures into the design of the Project. The potential adverse effects that might be generated are minimised through design and the adoption of the best practicable option to treat both construction and operational stormwater prior to discharge (Objectives 5.3.5 and 5.3.6). The extent of the designation is sufficient to ensure that the ongoing operational maintenance and management of stormwater can be undertaken ensuring the longevity of the systems being used. The NZTA is seeking integrated discharge consents to ensure that the network can be managed efficiently (Policy 5.3.6). The integration of stormwater treatment with the wider Project design will ensure that the Project will provide adequate safeguards to the health and safety and social and cultural wellbeing of the community through appropriate levels of treatment. Additionally good design will ensure that the stormwater system copes during rain events so as to not adversely affect motorists.

The single objective (Objective 5.3.9) relating to industrial or trade activities is relevant to the precast yard at Woodcocks Road. The yard will be designed to ensure that any discharges from the site are managed to ensure the effects on the receiving environment are minor. The Construction Water Assessment Report notes that all potentially contaminated water will be treated before discharge through onsite means or by trucking the contaminated water off site for treatment elsewhere. The Industrial Trade premises discharge consent will only be necessary for the duration of the construction activity and will then be surrendered. Accordingly the effects of the stormwater discharges from the precast yard can either be avoided or mitigated to a point where the effects are minor.

There are Objectives in Chapter 5 relating to instream and riparian habitat management in relation to stock access to watercourses. The Project will lead to some watercourses that form part of the designated area and are currently accessible to stock being retired from grazing. The motorway will be fenced in accordance with NZTA standard practice to avoid stock access to the motorway. The watercourses will benefit from the removal of stock access to watercourses within the designation (Objectives 5.3.17 and 5.3.18).

The ARP:ALW has extensive Policies relating to stormwater diversions and discharges. The following are considered particularly relevant to this assessment. The approach taken in the Operational Water Assessment Report reflects the BPO for the Project, and that Report has

extensive commentary in Section 7 in support of Policy 5.4.4(a). The Project is part of the State highway network (5.4.4(b)). The mitigation proposed in Section 28 of the AEE specifically addresses the quality of the discharge having considered water quality as an integral part of both the Construction and Operational Water Assessment Reports and taking into consideration the findings contained in the Freshwater and Marine Ecology Assessment Reports (Policies 5.4.4(c) (i) and (ii)). The Operational Water Assessment Report includes specific consideration of the potential effect of the Project on the existing flood issues in the Carran Road Sector (refer 7.9 of the Operational Water Assessment Report) (Policy 5.4.4(c)(iii)). The Operational Stormwater Assessment Report did not identify any existing stormwater treatment devices along SH1 in the vicinity of the Project. The existing drainage systems under SH1 will be increased in size and three of the outfalls and associated erosion protection will be broadened, but these will not result in any new locations for discharges and therefore, there will be no significant cumulative effects (Policy 5.4.4(d)).

Policy 5.4.4A requires the strategic importance of the stormwater system operated as part of any regionally significant infrastructure to be considered in the processing of resource consent applications. It is not disputed that the Project is regionally and nationally significant given its status as a RoNS, and the stormwater system is an integral part of the Project.

I do not consider Policy 5.4.4B to be relevant to the Project as it relates to non-network stormwater diversion and discharges, and the NZTA applications are on the basis of a network based consent.

Irrespective of Policy 5.4.4C, a full AEE has been prepared to support the Project consent applications and the design of the stormwater management devices is in accordance with TP10.

Policy 5.4.8 requires the adoption of the BPO to minimise the potential effects of discharges from stormwater networks controlled by a network utility operator. The Operational Stormwater Assessment Report has addressed the BPO for stormwater discharges and with respect to this Policy I note the following points. The treatment devices have been identified and form part of the indicative design. This work was heavily informed by the Assessment Reports that identify the characteristics, including sensitivity, of the receiving environments (refer Freshwater and Marine Ecology Assessment Reports). The wetland treatment option that will be employed on the Project is the most effective option for stormwater that runs off roads and collects heavy metals and oils. No significant unavoidable effects are identified in the Operational Water Assessment Report. Wetland treatment devices are used on the Northern Gateway Toll Road with good results. Wetlands are, at this stage, identified as the most successful option for treatment of stormwater from the motorway . NZTA will be wholly responsible for managing the stormwater discharging from the Project and there is no need to transfer this responsibility to another operator.

I have considered the policies relating to industrial and trade processes. Policy 5.4.16(j) requires an Environmental Management Plan to be prepared to manage the potential effects of discharges from the precast yard. Given that the detail of the location, layout and the controls for managing the operational detail of the precast activity will be provided at a later date, I recommend that there be a condition of consent that the Environmental Management Plan be prepared and provided to Auckland Council for approval prior to the precast yard being commissioned. This Environmental Management Plan will take the form of a Construction Erosion Sediment Control

Plan and will address the management of discharges, including any specific treatment required to ensure that the quality of the discharge will not have an adverse effect on the receiving environment. Given the short-term life of the precast yard, the regular review of the implementation of the Environmental Management Plan is likely to be self-assessing with the agreement of the Auckland Council (Policy 5.4.17).

Overall, I consider the Project is consistent with Chapter 5 of the ARP:ALW.

27.6.5 Chapter 6 – Water Allocation

Chapter 6 of the ARP:ALW addresses water allocation. The Objectives and Policies provide for the appropriate management of adverse effects from the taking and use of water. Objectives 6.3.2 and 6.3.3, and Policies 6.4.35 and 6.4.50 are relevant to the Project (refer to Appendix G, page 32).

Objective 6.3.3 seeks to maintain the quantity and levels of water in the Region's aquifers in the long-term for maintenance of spring and stream base flows, water quality and amenity reasons (among others). Objective 6.3.8 enables the diversion of groundwater where adverse effects are managed accordingly, including effects on groundwater regimes, surface water, structures and people and communities. These two Objectives are particularly relevant to the Project.

The groundwater issues relate to the interception and diversion of groundwater in the area of significant cuts required for construction of the Project. These are located largely in the isolated sections of the Project within forestry areas. The Hydrogeology Assessment Report has not identified the presence of any significant aquifers. Relying on this Report, I consider the quantity of groundwater that will be diverted will not give rise to adverse effects on the broader area's groundwater resource. Any groundwater diverted by Project construction will be collected and discharged into the surface water network along with treated stormwater runoff during construction and operation. These diversions will be primarily higher up in the catchments in the vicinity of Moirs Hill Road. Therefore there will be no adverse effect on surface water flows.

The single Policy specifically relevant to the diversion of groundwater is 6.4.50. This Policy provides guidance for proposals to divert groundwater. With reference to the Hydrogeology Assessment Report, the most likely locations along the Project where groundwater will be encountered is in the areas of the deepest cuts, being areas isolated from existing groundwater usage, which is predominantly around the northern two Sectors. The Hydrogeology Assessment Report confirms that the groundwater quantities will be relatively minor, but given the depth of the cuts will most likely change the water level regime, the Project cannot meet the permitted activity criteria of Rule 6.5.76. However, as noted above, the water diverted will remain in the general area of origin and flow into the same freshwater systems. Given the distance between the larger cuts and the existing groundwater users, it is not expected that there will be any effects on existing takes (refer Section 5 of the Hydrogeology Assessment Report). Similarly, given the cuts are isolated from existing development, there are no buildings that would likely be affected by settlement caused by a lowering of groundwater. The diverted groundwater will be diverted into the stormwater system, which is designed to discharge at rates that will not exacerbate any flooding risk. The discharges will be treated prior to discharge in accordance with the standards in TP10, as noted in the Operational Stormwater Assessment Report. The SEV methodology as outlined in the Freshwater Ecology Assessment Report (Section 3.3) includes hydraulic function as one of the assessment

criteria, including base rates and connectivity to groundwater. In using the SEV to consider values of streams, the Freshwater Ecology Assessment Report has considered the potential adverse effects of the groundwater diversions and discharges and confirms that due to the proposed management of discharge standards and rates of discharge the potential effects are minor.

Overall, I consider the Project to be consistent with the relevant Objectives and Policy of Chapter 6 of the ARP:ALW.

27.6.6 Chapter 7 – Beds of Lakes and Rivers and diversion of surface water

Chapter 7 of the ARP:ALW addresses works that require occupation of the beds of lakes and rivers and the diversion of surface water. The relevant Objectives and Policies of this Chapter are Objectives 7.3.1, 7.3.2 and 7.3.3, and Policies 7.4.1 through to 7.4.7 and 7.4.9 through to 7.4.17 (refer to Appendix G, page 32-34).

The Project includes resource consents for works in and on the beds of the streams that the Project crosses. While the potential effects of works in intermittent watercourses are relevant to the assessment of environmental effects in a broad sense, the works are a permitted activity under Chapter 7. Therefore, the following analysis is more relevant to the works within the beds of permanent watercourses.

There are four Objectives for the management of the beds of rivers (and lakes, but not relevant in this instance) and the diversion of surface water. Objective 7.3.1 seeks to maintain and, where practical, enhance the natural character of streams and rivers. Relevant to this Project is the intention to avoid or mitigate the effects of modification from structures and diversions. Objective 7.3.2 recognises and provides for structures in and over streams for regionally significant infrastructure, where such infrastructure is the BPO and provides for the protection of the environment, while enabling people and communities to provide for their needs as required by section 5 of the RMA. The Operational Water and Freshwater Ecology Assessment Reports have specifically addressed the issues around managing the effects of the Project to ensure that natural character of the watercourses is enhanced and that the number of culverts is minimised as far as practicable.

Policy 7.4.1 requires regard to be had to the Objectives and Policies of 2.1, 2.2 and 2.3. This consideration is outlined above at Section 28.6.2.

Policy 7.4.3 states that resource consent for works in or on a bed of a stream (as is the case with this Project) shall be considered appropriate subject to certain criteria. With reference back to these criteria, the following are relevant:

- Irrespective of the route; some stream crossings are inevitable given the topography (7.4.3(a)). Alternative methods would include bridging all watercourses, which would be impractical given the number of crossings and the costs associated with bridging all watercourses (7.4.3(b)). During preparation of the AEE, the design was changed to avoid an extensive culvert in the Mahurangi River Right Branch, and replaced with a bridge structure (7.4.3(c));
- Efficient use of stream beds will be made, with the culvert design length being determined by the alignment and any necessary embankment. The extent of culverting does not result

in any cumulative effect along a single tributary (refer Policy 7.4.3(e)) with multiple tributaries being crossed by the alignment and very little other modification of the natural watercourses in the catchment, given low density land uses and isolated development.

Policy 7.4.9 addresses issues relevant to the Project associated with flood hazard. As noted previously, the northern extent of the Project passes through an area identified in the Operational Water Assessment Report as being influenced during the 100 year return rain fall event (1% AEP). That Report has identified the hydrological conditions that will need to be managed as a result of the Project to ensure that additional flood risk does not lead to adverse effects on private land beyond that which would be experienced without the Project. The Carran Road Flood Relief Bridge has been designed to maintain the 100 year flood flow. Neither the Freshwater Ecology Assessment Report nor the Terrestrial Ecology Assessment Report has identified any rare or endangered species, nor will the design of culverts cause any permanent long-term effect from deposition of sediment. Erosion protection will be an integral component of the Project design.

In consideration of Policy 7.4.10, the proposed permanent diversions offer a better opportunity to maintain open watercourses, which will be subject to remedial works to reflect their current natural state. The inclusion of diversions is in preference to longer culverts being installed. These diversions will be designed to accommodate the appropriate flows, will be planted and secured to avoid erosion, and plantings will be consistent with establishing healthy riparian margins to encourage and protect instream habitat.

With respect to Policy 7.4.14, in relation to the modification and loss of lengths of permanent streams through culverting, I acknowledge that the Project induces a number of watercourses to be culverted to provide for the operation of the Project. As noted above, given the topography, it would be impossible to construct the Project and remain clear of all watercourses. These culverts are unavoidable, and will be mitigated through riparian restoration within the Project area, the retiring of land currently subject to forestry or farming activities, and planting to enhance both terrestrial and instream habitat.

The culvert and bridge structures and diversions are all sized to accommodate the passage of flood flows, as discussed in the Operational Stormwater Assessment Report (Policy 7.4.15).

Fish passage is provided in culverts where the Freshwater Ecology Assessment Report has identified up stream habitat should be maintained (Policy 7.4.16) with the exception of two locations in the Carran Road Sector that have drop structures immediately upstream to maintain hydraulic function.

Overall, I consider the Project to be consistent with the relevant Objectives and Policies of Chapter 7 of the ARP:ALW.

27.6.7 Conclusion – Auckland Regional Plan: Air, Land and Water

The ARP:ALW clearly provides for the construction and use of regionally significant infrastructure in the context of the use of air, land and water resources. I consider the Project to be appropriate within the context of the use of these resources. The Assessment Reports confirm that the Project will be consistent with the relevant Objectives and Policies and the overall intent of the ARP:ALW

to facilitate appropriate development and use of resources, whilst ensuring that the potential effects can be avoided, remedied or mitigated.

27.7 Auckland Regional Plan: Sediment Control

I have assessed the Project against the NPS on Freshwater Management in Section 28.6.1 of this AEE. That discussion is not repeated here but is acknowledged for completeness.

The ARP:SC has four broad objectives, which are not numbered, but appear on page 17 of the Plan (refer page 35 of Appendix G). The following assessment is against all four objectives as I consider them to be particularly relevant.

The Construction Water Assessment Report has identified the range of techniques available to the NZTA to ensure that the potential sediment lost into the watercourses will not result in a significant adverse effect. Post construction, the retirement of the wider designated area from forestry or farming activities and riparian planting will provide better protection of the watercourses within the designation and assist with maintaining water quality of the watercourses downstream.

The Hōkai Nuku Cultural Effects Assessment has considered the potential effects of the construction activities especially on the mauri of the watercourses. That Report has identified a number of potential mitigation measures to assist in sustaining the mauri of the watercourses.

The Construction Water Assessment Report has outlined a number of techniques that are recommended be adopted to reduce the risk of sediment generation and sediment discharge during construction. These techniques include proven techniques used in similar projects within similar geological and topographical conditions – drawing on NZTA's experience during the construction of the NGTR especially. Other techniques such as careful monitoring of weather forecasts, pre-storm checking of sediment control devices and post-storm water quality monitoring will be built into the conditions for inclusion in the Construction Erosion and Sediment Control Plans.

The ARP:SC has two specific objectives under section 5 – Regulation. These are:

> *5.1 Objectives*
>
> *5.1.1 To maintain or enhance the quality of water in waterbodies and coastal water.*
>
> *5.1.2 To sustain the mauri of water in waterbodies and coastal waters, ancestral lands, sites, waahi tapu and other taonga*

Both are addressed above and I consider that the Project is consistent with them.

An analysis of the Project against the Policies contained in 5.2 is provided below.

The Water team has identified a range of methods to suit the varying conditions along the designation to ensure that the generation and discharge of sediment is managed in a satisfactory manner. Some of these are well proven methods including clean water diversions, sediment retention devices, stabilisation of exposed earth, maximum limits on open work areas in each catchment. There are also methods that the NZTA will implement, including monitoring weather

forecasts, regular inspections of devices, securing devices ahead of predicted storm events and the like (Policy 5.2.1).

The degree to which the earthworks associated with the Project affect the features listed in Policy 5.2.2 (i) to (iii) has been discussed in the Terrestrial, Freshwater and Marine Ecology Assessment Reports and the Landscape and Visual Assessment Report. These Reports concluded that the earthworks would not result in any significant adverse effects on the listed features, largely though the features being kept largely intact, with the Project affecting the outer periphery of them, or through the mitigation proposed that will address potential effects, such as the visual effect of the alignment through the ONL west of Perry Road.

With respect to Policy 5.2.2 (iv) and (v), the Cultural Effects Assessment Report provided by Hōkai Nuku has identified the features through the Project area that are of value to Tangata Whenua, and the mitigation they consider appropriate. The Project passes close by Nga Pā o Te Hēmara Tauhia. The potential effects of the Project on Ngā Pā o Te Hēmara Tauhia have been addressed in the Cultural Effects Assessment Report, and protocols developed to ensure that Hōkai Nuku remain integral to the Project through construction to commissioning of the new road. A retaining wall below the recently rediscovered pa site will protect the integrity of the pa. Accordingly I consider the Project adequately avoids or mitigates the potential adverse effects of earthworks in a manner that is consistent with the intent of the Policies in 5.2 of the ARP:SC.

The ARP:SC has Objectives and Policies directly related to minimum earthwork strategies. These provisions have no rules attached to them, nor are there any clear linkages back to section 5 of the Plan. The policies are implemented through other methods. The Objectives seek first to minimise erosion, which leads to sediment generation (7.3.1), and then to minimise the discharge of sediment to the receiving environment (7.3.2). The Construction Water Assessment Report has, through a series of models and in consideration of the receiving environments (both freshwater and marine), identified the maximum area of open ground that can be accommodated within the Mahurangi and Pūhoi catchments. These maximum earthworks areas are. From that condition stems a sequence of conditions that address and reflect the range of methods available to the NZTA to further manage earthworks activities through physical management and proactive behaviours. The recommended Erosion and Sediment Control Plans will further assist with minimising surface erosion and sediment discharge into the receiving environment. In my opinion, the Project, including the suite of recommended conditions, is consistent with the ARP:SC Objectives relating to minimum earthworks strategies through the identification of the maximum open area per catchment and then subsequent management techniques to further reduce potential effects.

The extent and duration of vegetation removal and earthworks will be a consideration for the NZTA and its contractor, within the traditional control of the earthworks season and the construction programme. However, the recommended conditions will contain a suite of methodologies to minimise the loss of sediment from the site. Given the intent of section 7 of the ARP:SC appears to target industry practice rather than resource consents per se, I consider that the Project is not inconsistent with the Policies.

27.7.1 Conclusion – Auckland Regional Plan: Sediment Control

I have considered the Project against the Objectives and Policies of the ARP:SC and I am of the opinion that the Project is consistent with these provisions as demonstrated above.

27.8 Auckland Council District Plan – Operative Rodney Section 2011

Land use activities associated with the Project are within the jurisdiction of the ACDP. The ACDP contains the planning policies and rules for activities and developments in the jurisdiction of the former RDC. The relevant objectives and policies for the Project are as outlined below and contained in full in Appendix G.

27.8.1 Natural Hazards

Chapter 5 of the ACDP (Auckland Council, 2011) addresses Natural Hazards. Particularly relevant Objectives and Policies in this Chapter are Objectives 5.3.1 and 5.3.2, and Policies 5.4.1, 5.4.2 and 5.4.3 (refer to Appendix G, page 36).

Objectives 5.3.1 and 5.3.2 state that adverse effects on natural hazards should be avoided. The Project seeks to avoid, remedy or mitigate potential effects, including natural hazards, when developing the alternative alignments for route selection. The mapping of constraints, described in Section 7 of this AEE, allowed the selection of an indicative alignment that will avoid known natural hazards.

As noted in the Operational Water Assessment Report (specifically at Section 8.6 of that Report), the Project has been designed to avoid the flood plain to the north west of Carran Road. The three houses that would currently be affected during a 100 year flood event would be affected in a minimal way by increased flood flows with the Project in place. However the change in flood level would not be particularly discernible. The mitigation recommended includes a maximum change in increased flood levels through this area.

Policy 5.4.1 relates to areas prone to natural hazards. Works have been located to avoid the need for hazard protection. Furthermore, appropriate mitigation measures will avoid any risk of loss of life or injury and will ensure environmental damage is minimised.

Policy 5.4.2 seeks to avoid development that would exacerbate hazards. Project works will include altering wetlands, clearing vegetation and changing overland flow paths and stormwater. Effects will be mitigated to avoid exacerbation of hazards on or off-site.

A precautionary approach is sought by Policy 5.4.5 as there is often little information about natural hazards particularly associated with climate change and geological threats. I note that the Operational and Construction Water Assessment Reports have used data that is inclusive of climate change projections and that the indicative design can accommodate any changes in sea level as a consequence of climate change. The Geotechnical Team has identified all known and significant geotechnical hazards and, where there is potential for natural hazards, such as subsidence, the assessment takes a precautionary approach that in turn is taken into account by the design and designation boundaries.

I consider the Project will be consistent with the Natural Hazards Objectives and Policies of the ACDP.

27.8.2 Highly Valued Natural Resources

Chapter 6 of the ACDP addresses Highly Valued Natural resources, including Significant Natural Areas, Highly Valued Landscapes and Geologically Significant Sites. The provisions relevant to the Project include Objectives 6.3.2 and 6.3.3, and Policies 6.4.1 through to 6.4.4 (refer to page 37 of Appendix G).

As discussed in Section 4.3.1 of this AEE, the alignment and design of the Project have been selected cognisant of the highly valued landscapes and SNAs in the Project area. The designation boundary will skirt the edges of several SNAs classified as being of moderate or moderate to high significance. These areas are adjacent to Woodcocks Road to the west of Falls Road, adjacent to SH1 north of Moirs Hill Road, to the east and west of the existing SH1 at Schedewys Hill, adjacent to the existing SH1 south of Mahurangi West Road and north of Fowler Access Road at the exit of the Johnstone's Hill Tunnels (refer to Section 4.1.4 of this AEE for further detail on the SNAs).

The Project will extend through two Outstanding Natural Landscapes (ONL) - West Mahurangi Harbour (43) and Mahurangi – Waiwera (44). Further detail on these ONLs is provided in Section 4.1.4 of this AEE. Both areas are classified as 'Hill Country' in the Construction Water Assessment Report and all share the same Landscape Type Descriptors (in the Landscape and Visual Assessment Report), including relatively high relief/significant areas of maturing vegetation and low level of built modification.

The indicative alignment passes through the CMA where it crosses Okahu Creek and Billing Road at the upper reaches of the Pūhoi Estuary. This area is identified as CPA (75c–h) 'Pūhoi Estuary'. Further detail on the Pūhoi Estuary is provided in Section 4.3.2 of this AEE. This existing environment is significantly influenced by the existing SH1. The Project's location in this area will lead to a consolidation of infrastructure thus reducing a wider effect on the natural coastal character.

Appropriate measures such as planting and restoration will be implemented to mitigate effects on highly valued resources and significant areas. Such measures are discussed further in Section 28 and in the Landscape and Visual Assessment and Terrestrial Ecology Assessment Report. Planting will be site specific, appropriate to conditions, respond to natural vegetation patterns, and reflect contrasting character areas.

Geologically significant sites have been avoided.

I consider that the Project will be consistent with the relevant High Valued Natural Resources Objectives and Policies of the ACDP. Highly valued vegetation, wildlife habitats, landscapes and geological areas will generally be maintained and protected. Some effects will be unavoidable where the designation passes through ONLs. Policy 6.4.1 states "...Where avoidance is not possible, remedial or mitigation measures should be undertaken, including restoration, enhancement or protection." Mitigation is offered through the Landscape and Visual Assessment Report and in Section 28 of this AEE.

27.8.3 Rural zone

Chapter 7 of the ACDP relates to land within the Rodney area that is zoned Rural. The Objectives and Policies relevant to the Project include Objectives 7.3.1, 7.3.2, 7.3.3 7.3.9, 7.3.10 and 7.3.12, and Policies 7.4.3, 7.4.4, 7.4.8 through to 7.4.11, 7.4.13, 7.4.15, 7.4.16 and 7.4.18 (refer to Appendix G, page 37-42).

The majority of land within the Project area is zoned Rural or East Coast Rural under the ACDP. The land has been modified and a large portion is productive land associated with exotic forestry and pastoral farming. As such, the majority of land in the Project area does not exhibit a high degree of naturalness or high landscape and amenity values. However, certain areas along the alignment are identified in the Landscape and Visual Assessment Report as displaying high landscape and natural values. These areas include the Pohuehue Reserve, the Pūhoi River and the Perry Road landscape and areas of rural lifestyle settlement.

The Landscape and Visual Assessment Report concludes that the areas where the effects from the Project will be most pronounced are in locations where there are existing established rural residential settlements, usually in combination with significant landscape values. For this group, the Project will irrevocably change the existing rural character and amenity values associated with the rural environment.

However, the assessment acknowledges that temporary construction effects could be appropriately mitigated. Operational effects will reduce over time with appropriate mitigation. Although the Project will have altered the local landscape character, it will, with mitigation, 'fit' with the landscape and co-exist comfortably with natural elements, rural production and patterns of settlement.

The assessment in Sections 10 to 26 of this AEE outlines the effects of the Project in relation to vegetation clearance, earthworks, stormwater treatment and water quality. Appropriate erosion and sediment controls and stormwater treatment will be implemented during the respective construction and operation phases of the Project to minimise potential effects on water bodies in the Project area.

The Project will be consistent with Policies 7.4.8 and 7.4.18, in that the Okahu Inlet coastal environment and the main rivers within the Project area will be bridged to minimise adverse ecological effects on these waterbodies. Where watercourses will be culverted, culvert lengths will be kept as short as possible and appropriate habitat restoration and enhancement measures will be undertaken to mitigate ecological effects.

Policy 7.4.4 requires that activities occur without the generation of noise and vibration that may adversely affect neighbouring sites. Management plans will detail the specific mitigation measures to minimise potential noise and vibration effects.

Consultation is established with iwi and will be on-going for the duration of the Project (refer Objective 7.3.12).

For these reasons, I conclude that the Project will be consistent with the relevant Rural Objectives and Policies of the ACDP.

27.8.4 Open Space and Recreation

Chapter 10 of the ACDP addresses Open Space and Recreation zones. Relevant Objectives and Policies of this Chapter include Objective 10.3.3 and Policy 10.4.2 (refer to page 42 of Appendix G), which seek to ensure that the natural character and conservation values of areas with significant vegetation or wildlife are maintained, managed, protected and enhanced so they remain in a relatively natural unmodified state.

The route selection process for the Project had regard to avoiding, remedying or mitigating effects on open space within the Project area, in particular those areas of open space identified as ecologically sensitive environments or with significant landscape values, such as the Pohuehue Reserve. The designation has been selected to avoid potential adverse effects on the Pohuehue Reserve, which is a remnant and regenerating stand of native forest and a significant natural feature of the area.

Public access along the Okahu Inlet and the Pūhoi River and Estuary may be temporarily impacted during the construction phase of the Project. However, following completion, it is my opinion that access to the reserves will be improved through the viaduct offering a safer pedestrian connection to the Pūhoi Estuary from Pūhoi Road across the existing SH1.

Effects on open space are further discussed in Section 22 of this AEE. I consider the Project will be consistent with the relevant Open Space Objectives and Policies of the ACDP.

27.8.5 Inland Waters

Chapter 11 of the ACDP addresses Inland Waters, meaning beds of lakes, rivers and streams, the water column, the water surface and the air space above lakes, rivers and streams, as well as the sequence of vegetation from floating to submerged, including partially submerged vegetation at the water's edge. Relevant provisions in this Chapter include Objectives 11.3.2 and 11.3.3, and Policies 11.4.2, 11.4.3, 11.4.4 and 11.4.6 (refer to Appendix G, page 42-43).

Policy 11.4.2 refers to areas of high ecological and wetland value, wildlife and habitat significance. The route selection process for the Project sought to avoid, remedy and mitigate effects on areas identified as having high quality habitat or ecological values, including the estuarine areas and watercourses within the Project area.

Policy 11.4.3 relates to the enhancement of inland waters, Policy 11.4.4 to natural character and landscape values, and 11.4.6 to cultural values.

The indicative design uses bridges and viaducts to cross major watercourses within the Project area and the Okahu Inlet coastal environment. Where watercourses will be culverted and any temporary or permanent stream works undertaken, appropriate mitigation measures, including the restoration and enhancement of inland waters, inclusive of their riparian margins will be implemented to minimise potential environmental effects.

The Project will include appropriate erosion and sediment control measures and temporary stormwater management, in accordance with Section 10 of this AEE and the Construction Water Assessment Report, during construction to protect and maintain waterbodies within the Project

area. Permanent stormwater treatment will be implemented during the operation of the new motorway, in accordance with Section 21 of this AEE and the Operational Water Assessment Report.

I consider the Project will be consistent with the relevant Inland Water Objectives and Policies of the ACDP.

27.8.6 Cultural Heritage

Chapter 17 of the ACDP addresses Cultural Heritage. I consider that Objective 17.3.1 and Policies 17.4.1, 17.4.2, 17.4.3, 17.4.5 and 17.4.8 are relevant to the Project (refer to page 43 of Appendix G).

Objective 17.3.1 seeks to protect the District's cultural heritage resources. The relevant Policies address retention of heritage values while allowing sympathetic proposals, appropriate modification, and prevention of destruction of archaeological and waahi tapu sites, and discussions with iwi.

The Heritage Assessment Report has identified that the indicative alignment will potentially result in adverse effects on several heritage sites, most with low to moderate heritage significance. Potential heritage sites affected by the new motorway include two platforms and middens and several World War II military camps. The indicative alignment directly affects Titford Cottage, which is located beneath the Okahu Creek Viaduct and will be destroyed. The Schollum Villa will be affected during construction and will also suffer adverse effects due to the proximity of the motorway in the operational phase. Relocation of the villa to a location further from the indicative alignment will likely be required, if feasible. Titford House will not be directly affected by the Project.

The indicative alignment would affect Ngā Pā o Te Hēmara Tauhia, Titford Cottage and Titford House, all of which are located on the same property. The exact nature and extent of potential effects and opportunities to avoid, remedy or mitigate these effects will be determined following approval to access the property and the undertaking of detailed field investigations, to determine the extent of the pā and the quality of the heritage houses.

Though such effects are undesirable, their avoidance is not practical in the context of the Project, the constraints in the immediate location and the need to balance the national importance of the Project with a number of potential environmental effects.

As discussed in the Heritage Assessment Report, the majority of potential effects of the Project on historic heritage will be appropriately avoided, remedied or mitigated.

In order to minimise effects on sites of significance to iwi, NZTA discussion with iwi is well established and will remain ongoing for the duration of the Project.

I consider the Project will be consistent with the Cultural Heritage Objectives and Policies of the ACDP.

27.8.7 Hazardous Substances and Contaminated Sites

Chapter 20 of the ACDP addresses Hazardous Substances and Contaminated Sites. Provisions relevant to the Project are Objectives 20.3.1, 20.3.2 and 20.3.3 and Policies 20.4.1, 20.4.2 and 20.4.3 (refer to page 44 of Appendix G).

A preliminary assessment of potentially contaminated sites has been undertaken for the Project, to determine the possible presence of contaminated soils within the Rodney area and whether the Project may disturb any areas of contamination. Information on potentially contaminated sites within the Project area obtained from the former RDC and ARC was assessed and site investigations undertaken where access to private property was provided by landowners. The assessment concluded that the risk of ground contamination along the indicative alignment is low and could be appropriately avoided, remedied or mitigated. Individual and site specific areas of potential contamination were identified, such as historic sheep dips and an ex mechanic workshop. Consents under the NES for Assessing and Managing Contaminants in Soil to Protect Human Health will be necessary.

Site works will require the use of machinery on site and will thus involve the storage of diesel and other potentially hazardous substances, such as water treatment chemicals and heavy metals.

I consider the Project will be consistent with the Objectives and Policies for hazardous substances and contaminated sites outlined in Chapter 20 of the ACDP.

27.8.8 Transportation and Access

Chapter 21 of the ACDP addresses Transportation and Access. Objectives 21.3.1 through to 21.3.4, and Policies 21.4.1, 21.4.2 and 21.4.3 are relevant to the Project (refer to of Appendix G, page 44-45).

The Project will contain mitigation to minimise the effects of the Project on the natural environment, including stormwater treatment, riparian planting and wetland restoration (Objective 21.3.1) The Project will improve the health and safety of the community by the design providing a safer transport environment and a reduction of traffic on the existing SH1 through Warkworth (refer Objective 21.3.2). The Project will improve the amenity of residents within Warkworth and along the current SH1, through a reduction of noise and vehicle emissions. The amenity of residents along Pūhoi Road, Perry Road and Carran Road will be adversely affected, especially during construction and while mitigation planting is established. Overtime this change in amenity in my opinion will become a minor effect as residents adjust to the change to the environment introduced by the Project (Objective 21.3.3). The Project will have a positive effect on the safe, efficient and convenient movement of people and goods, through improved travel times, improved travel time reliability and more network resilience (Objective 21.3.4).

Effects on highly valued natural resources and landscapes, amenity values and cultural heritage are discussed in Sections 16, 22 and 25 of this AEE and the Project will be designed to minimise adverse effects on these features (Policy 21.4.1).

The Project will be designed to ensure that construction noise and vibration effects will, in general, be avoided, remedied or mitigated due to the separation distances of most dwellings from the

alignment and proposed construction activities. Where construction activities may result in adverse effects on sensitive receptors, in particular during night-time works, appropriate measures will be implemented to mitigate potential effects as described in the Construction Noise Assessment Report and Vibration Assessment Report. Such measures will also be detailed in the CNVMP.

The operation of the Project will, in general, comply with the relevant criteria of NZS 6806: 2010. The Project will potentially result in adverse noise effects on dwellings within close proximity to the new motorway, in areas with low ambient noise levels currently not affected by noise from the existing SH1. Effects will be managed and mitigated to an appropriate standard using the BPO approach as detailed in the Operational Noise Assessment Report. This approach is consistent with Policy 21.4.2.

The design of the Project will allow for the construction of the new route to be delivered as an off-line solution. As such, impacts on the existing section of the SH1 network between Pūhoi and Warkworth will be limited to the construction and implementation of the tie-in with the existing network at the Johnstone's Hill Tunnels to the south of the alignment and the tie-in to the north of Warkworth.

During construction, access and egress to construction areas will be from the local road network along the alignment. Some disruption to the function of the local road network and the existing SH1 will be unavoidable during construction. A CTMP will be implemented to minimise the effects of this disruption on traffic flow and access in the vicinity of the works.

With respect to effects on the local road network from the operation of the Project, all the local roads traversed will be maintained and will be grade separated, crossing either over or under the new motorway. Additional local roads will be provided to the west of the alignment near Mahurangi Road West and south of Wyllie Road to enable access to property in these areas that will otherwise have their current access severed.

Overall, the Project will ensure resilience of the State highway network and enable the safe, efficient and convenient movement of people and goods and I consider the Project is consistent with Policy 21.4.3.

I consider the Project will be consistent with the Transportation and Access Objectives and Policies of the ACDP.

Overall and outlined in the discussion above, I conclude that the Project is consistent with the relevant Objectives and Policies of the ACDP.

28. Proposed mitigation

The assessment of the Project's effects on the environment in Sections 10 to 26 of this AEE has identified a wide range of actual and potential effects on the environment, both positive and adverse. While many potential adverse effects will be avoided or at least significantly reduced at the detailed design phase of the Project, the effects assessment identified a range of adverse effects that will require remediation (for example during construction) and or mitigation to ensure that they are appropriately managed (for example during operation).

This section provides a discussion of the mitigation proposed to be implemented before, during and after Project construction, in order to adequately avoid, remedy or mitigate the Project's actual or potential effects. Where relevant, the proposed mitigation, remediation and monitoring measures summarised here have been included as recommended conditions for the designations or resource consents. Recommended conditions will form part of the suite of material to be considered by the Board of Inquiry.

28.1 Principles for project delivery

The following principles inform the basis for the development of the plans and proposed conditions that will influence delivery of the Project, including its construction, operation and maintenance:

- The proposed conditions of consent and designation are designed to provide ease of comprehension for the public, ease of administration for compliance monitoring by the Council and for ease of implementation by the contractor;
- All works will be undertaken to comply with current New Zealand standards and legislation, and NZTA standards, where appropriate;
- The construction and operation of the Project will use the best practicable option (BPO) to avoid, remedy or mitigate adverse effects;
- An integrated team approach will be adopted for the development of the design and the methods to avoid, remedy or mitigate actual and potential effects; and
- Each technical specialist, consultant, or contractor involved in the Project has equal responsibility to use the best endeavours to avoid, remedy or mitigate adverse effects.

In addition to these principles, the methods used require:

- Maintenance of on-going communication with the local authorities who will be responsible for monitoring and enforcing conditions placed on the designation and resource consents sought; and
- Maintenance of strong communication links with directly affected landowners, Tangata Whenua, key stakeholders, affected landowners, neighbours and the wider community.

28.2 Designation conditions

The conditions of designation will fall into two areas – (i) specific conditions and (ii) conditions relating to the methods to be used to achieve the specific standards. Some conditions will require further consideration through the outline plan of working process under s168A RMA, while others will not. For example, the requirement for an urban and landscape design framework (ULDF) will

be submitted to Council for consideration prior to any outline plan of work. This requirement will ensure that the appropriate framework is implemented prior to the detailed design of structures, which will be integral to the successful integration of urban design into the detailed design of the Project, which will be considered in the OPW.

The OPW is explained in Section 1.9 of this AEE.

28.3 Methods to avoid, remedy or mitigate potential effects

The assessment of alternatives (Section 10 – 26 of this AEE) discussed how the preferred alignment and proposed designation have already led to the avoidance and mitigation of effects, as evidenced (for example) by the avoidance of the recently rediscovered pa site at the south of the Project area, the bridging of larger watercourses and the shift in the indicative alignment to avoid the flood plain in the Carran Road Sector.

The following methods to remedy and mitigate the remaining actual and potential adverse effects are proposed:

- Designation and consent conditions specifying standards to be achieved or actions to be taken;
- Delivery mechanisms (including Management and/or Monitoring Plans) that require an authorisation by Council prior to proceeding to ensure compliance with a specified practice or standard; and
- OPW to identify how the conditions of designation and s176A can be achieved.

The Management Plan process will be used where there is a specified standard in the condition, where a clear outline of the tools that the contractor will use is necessary to demonstrate compliance. Management Plans will also be used where a process will be determined by the contractor as to how to achieve a condition. For example the contractor's submission of the Erosion and Sediment Control Plan will demonstrate how the conditions relating to sediment control will be achieved. Such Plans would need to be approved by the appropriate Council Manager. Subsequent site specific erosion and sediment control plans will demonstrate compliance with the ESCP and would require Manager certification, rather than a comprehensive review.

Outlined below is a scope of potential conditions that will be developed through the lodgement, submission and hearing process. The conditions are split between the three general stages of implementation – being pre-construction, construction and operation.

28.3.1 Pre-construction

Confirmation of performance/design relating to:

- Access and movement (traffic management);
- Erosion and sediment control measures;
- Stream and natural wetland works (including fish passages);
- Stormwater management systems (construction and operational);
- An urban and landscape design framework, including inputs from iwi liaison advisor and local residents;

- Culvert and bridging structures (especially in relation to 100 year event design, bed scour prevention);
- Protocol for increasing open area limits;
- Application of earthworks seasonal constraints;
- Protocol for stream classification (including habitat assessment);
- Protocol for notification to Watercare re elevated sediment discharging to the Mahurangi River;
- Methodology for removal of mud snails;
- Stakeholder and communication plan relating to construction activities;
- Long tail bat protocols;
- Management of land snails;
- Kauri die back protocols;
- Wetland restoration protocols; and
- Cultural heritage and archaeological management plan.

28.3.2 Construction

Management practices to address:

- Open area limits;
- Discharges from the precast concrete yard;
- Erosion and sediment control measures;
- Access and movement (internal roads, wheel wash, access controls to local roads and State highway);
- Cut and fill processes and locations;
- Stream and natural wetland works including rehabilitation to natural form and to support fish habitat;
- Stream diversion management regarding flow and channel stability;
- Stormwater management systems (construction and operational);
- Culvert and bridging structures;
- Landscaped and revegetated areas;
- Works near and within watercourses and/or wetlands and culvert installation;
- Dust management – especially construction traffic and rock breaking;
- Noise and vibration;
- Discovery of unpredicted environmental conditions or heritage areas;
- Integration of riparian planting with landscape plans and suitability of species for cultural harvest where appropriate;
- Stormwater design to achieve 75% TSS;
- Management of kauri removal;
- Wetland management (eg preventing vehicle access where practical) and restoration;
- Management of construction activity to avoid Ngā Pā o Te Hēmara Tauhia; and
- Pre-cast Yard Management Plan.

Reporting

- As built Plans of CESCPs;
- Routine monitoring of ecological values during construction including base sampling prior to construction;
- Submission of as built stormwater treatment devices to Council;
- As builts of bridge structure across Okahu Inlet; and
- Adaptive Monitoring programme and associated reporting.

28.3.3 Post construction

- Maintenance provisions for stormwater ponds;
- Maintenance provisions for operational noise mitigation measures (if any necessary); and
- Monitoring programme for limited period of new plantings, stream bank erosion.

The suite of conditions that will be populated and developed through the lodgement, submission and hearing process will demonstrate the Project commitment to the process above to ensure that the potential adverse effects that might arise from the construction, operation and maintenance of the new motorway will be adequately avoided, remedied or mitigated to a level necessary to achieve the purpose of the RMA.

29. Statutory assessment

29.1 Introduction

This section sets out the assessment of the Project against the statutory requirements of Part 2, and sections 171, 104D, 104, 105 and 107 of the RMA. Sections 1.7 and 1.8 of this AEE identify the NORs and suite of Resource Consents sought in this process.

29.2 Part 2 analysis

29.2.1 Section 5 RMA

The Project will enhance the use of an existing regionally and nationally significant physical resource through providing better and more reliable travel times, a safer travel environment and greater efficiency in movement of goods and services for people and communities. The Project will also enable Auckland, Warkworth and those communities further north to provide for their health, safety and wellbeing.

The Project will be undertaken in a manner that does not significantly compromise the natural or physical resources of the area. The management of effects during construction, as identified in Section 28 above, will ensure that there are no significant long-term effects on natural resources, that water quality is maintained, and that erosion is managed to avoid exacerbating siltation of the Mahurangi and Pūhoi Rivers and Harbours. The Project includes a suite of measures appropriate to the scale and significance of the potential effects that may arise to avoid, remedy or mitigate those effects.

Accordingly I consider the Project meets the purpose of the RMA.

29.2.2 Section 6 RMA

The section 6 matters of national importance that must be recognised and provided for are addressed below.

(a) The preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development

The Project has a relatively small, direct relationship with the CMA, and coastal environment. The crossing of Okahu Creek is unavoidable, given the design, cultural and topographical constraints of the immediate location. The works are being undertaken in a location removed from the Pūhoi River by the existing SH1, leaving the broader coastal environment in the locality intact.

Section 5.1.3 (Biophysical Effects) of the Landscape and Visual Assessment Report identifies the Okahu Creek area as having high values. The Report goes on (under Landscape/Natural Character Effects) to state that the “physical effects of the viaducts on the landscape will be reduced by the structures spanning these waterways. The reduction is due to some of the natural character of the waterways being retained”. In my opinion, given the limited interaction with the coastal

environment and the necessity of the location of the Okahu Viaduct, the Project recognises and provides for preservation of the natural character of the coastal environment.

With respect to the natural character of wetlands, and rivers and their margins, the natural character of the more significant waterbodies will be maintained through structures. Where diversions of watercourses are necessary, the remediation of the watercourse will be dictated by its type, with restoration designed to recreate a natural character including bank shaping and riparian planting (refer Operational Water Assessment Section 21.5 above). Significant watercourses will be bridged rather than culverted, which will ensure as much of the natural character can be retained as practical. The mitigation offered through management of diversions and riparian restoration of those watercourses will ensure that the effect of the Project on the natural character of rivers and their margins will be minor.

The stormwater discharges during construction and operation will not result in any significant change to water quality that might influence the natural character of the coastal environment. I rely on the Marine Ecology Assessment Report to conclude that the long-term contribution to the sedimentation of the Mahurangi and Pūhoi harbours is considered to be minor. Accordingly I do not consider the Project will adversely affect the natural character of the coastal environment.

(b) The protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development

The Project passes through two ONLs, as defined in Proposed Change 8 to the ARPS, one west of Perry Road (ONL 43) and one near the Johnstone's Hill Tunnels (ONL 44).

ONL 43 west of Perry Road is a portion of a large ONL around the West Mahurangi Harbour. The Landscape and Visual Assessment Report records that "the ONL is extensive and largely focused around the West Mahurangi Harbour and the river and stream values... which will be unaffected by the Project" (Section 5.5.3). It is my opinion that the Project design has considered this ONL and, given that the ONL remains largely intact, the Project is not an inappropriate development.

The Landscape and Visual Assessment Report notes that the Project "skirts along the periphery of the delineated area of ONL 44 near Pūhoi River". The Report also records the modification to the landscape values given the SH1 and Johnstone's Hill Tunnels. Based on that Report and on my own consideration of the ONLs and Proposed Change 8, I conclude that the Project has no significant effects on these ONLs.

(c) The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna from inappropriate subdivision, use, and development

The Project passes through one area identified as a Significant Natural Area in the ACDP, in the vicinity of Woodcocks Road and Carran Road. The Terrestrial Ecology team has surveyed the significant natural area (SNA) and especially that portion affected by the proposed designation. The Terrestrial Ecology Assessment Report concludes that the SNA has low values and, as it is not fenced off, is subject to undergrazing by cattle, which further affects its long-term viability.

A section of the Project is indicatively located within a Natural Stream Management Area (NSMA) under the ARP:ALW. However, Auckland Council and I agree that this area does not meet the

definition of NSMA in Chapter 3 of the ARP:ALW (refer to 3.4.2(b)(i) for analysis) and I therefore have not considered further the Plan provisions relating to NSMAs.

The proposed designation also affects approximately 8.5 hectares of indigenous vegetation, although through alignment design shifts, the designation avoids much of the area of kauri trees at Perry Road. The Project team has had regard to the protection of significant indigenous vegetation and habitats. In my opinion, through the mitigation that will be offered in conditions, overall the Project area will continue to protect these values and is not an inappropriate development.

(d) The maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers:

The Project will enhance and maintain access to or along the margins of the coast or rivers. In a minor way access to reserves along the Pūhoi River to the east of SH1 will be enhanced by the reduction in traffic on the current SH1 providing greater opportunities for public access to the eastern side of SH1 where there is a succession of reserves along the coastal margin.

(e) The relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga:

The Project team has recognised and provided for the relationship of tangata whenua with their ancestral lands, water, sites, waahi tapu, and other taonga in the following main ways:

- Ongoing iwi input into the Project's development and design, including collaborative engagement regarding sites of cultural significance;
- The relationship between the NZTA and Hōkai Nuku;
- Proposed mitigation designed to address cultural impacts and to provide an ongoing Iwi Advisor role during the construction and operation of the Project.

(f) The protection of historic heritage from inappropriate subdivision, use, and development:

The Heritage Assessment Report identifies a small number of heritage sites and buildings that fall within the proposed designation. Where these sites and buildings cannot be avoided, the Report addresses potential mitigation. Adverse effects on historic heritage will be largely avoided through design, for example, in the case of the recently rediscovered pā, through a modification to the indicative alignment.

The Heritage team considers loss of the midden sites to be acceptable from an archaeological perspective with the adoption of mitigation as recommended in the Heritage Assessment Report. The two historic houses are assessed as being adversely affected but the effects can be mitigated through detailed recording of the buildings and relocation. Overall the Project protects historic heritage where practical.

(g) The protection of protected customary rights.

Paragraph (g) does not apply.

My overall conclusion with respect to section 6 matters is that the Project team has recognised and provided for these matters of national importance.

29.2.3 Section 7 RMA

The Project team has had particular regard to the matters in section 7 as set out earlier in relation to statutory and non-statutory instruments and the key area of effects (see Sections 10 to 26 and Section 27 of the AEE), so are not repeated here in full. It is noted:

- Kaitiakitanga and the ethic of stewardship are being recognised and actively incorporated into the Project design and proposed mitigation.
- The Project provides improved gradients, safety standards and travel time reliability, which will offer greater efficiency for the users of the network.
- Amenity values will be affected by the Project. The compounding effects during construction for some residents will reduce their amenity. The Assessment Reports and recommended mitigation reflect how to best manage the amenity issues that local residents will face. During construction, the expectations of residents will be managed through clear communication and messaging. This communication will enable residents affected by works to plan around events, including traffic management and blast events. The ability to be prepared will assist residents to continue their daily lives with minimal disruption. Post construction analysis of noise (as identified in the Operational Noise Assessment Report) will ensure that while the current level of amenity (including a low ambient noise environment) will not be fully restored, the noise levels will be within the most stringent category according to NZS6806, which will protect the amenity of residents with regard to daily activities such as sleeping. Enabling community input into the draft Urban Design and Landscape Framework prior to it being considered by Council will enable some engagement with the design and look of the Project. The Landscape and Visual Assessment Report has assessed several of the viewing catchments as having high visual amenity, including around Pūhoi, and west of Perry Road. Post construction the remediation through landscaping and planting and the adjusted amenity will gradually become part of the broader environment.
- The Project, through option analysis and route selection, has avoided significant natural and built environments, such as Pohuehue Scenic Reserve and Warkworth township. The Project will include a range of measures (many encapsulated in the Urban Design and Landscape Framework) that will offer opportunities to enhance the physical environment both at key tie-in locations such as Pūhoi and Warkworth, but also along the route (eg at the Kauri Eco Viaduct).

29.2.4 Section 8 RMA

The Project team has taken the principles of the Treaty of Waitangi into account by engaging with the relevant iwi early in the development of the Project, and through maintaining ongoing relationship with Hōkai Nuku in a partnership arrangement that will endure beyond this Project.

29.3 Consideration of Notices of Requirement

Section 171 of the RMA sets out various matters to be had regard to when considering notices of requirement. These matters have been discussed and assessed throughout the AEE and associated

Assessment Reports in relation to the NORs. The purpose of this Section is to draw these matters together to provide a clear outline of the s171(1) considerations and where these are addressed in more detail.

Matter for Consideration	Comment
Part 2 (s171(1))	Consideration of the Project against the matters within Part 2 of the Act is set out below.
Relevant provisions of NPS (s171(1)(a)(i))	The relevant provisions of the New Zealand Policy Statement for Freshwater Management are addressed in Chapter 27.6.1. I found the Project to be consistent with the provisions of the NPSFW
Relevant provisions of NZCPS (s171(1)(a)(ii))	Consideration of the NZCPS is contained in Section 27.2 of this AEE. I found the Project to be generally consistent with the objectives and policies of the NZCPS.
Relevant provisions of RPS or proposed RPS (s171(1)(a)(iii))	Consideration of the relevant provisions of the RPS is contained in Section 27.4 of this AEE. I consider the Project to be consistent with the objectives and policies of the ARPS.
Relevant provisions of a Plan or Proposed Plan (s171(1)(a)(iv))	Consideration of the relevant provisions of the ARP:C, ARP:ALW and ARP:SC and the ACDP:RS are provided in Sections 27.6, 27.7, and 27.8 respectively. I consider the Project to be generally consistent with the objectives and policies of these plans.
Adequate consideration to alternative sites, routes or methods (s171(1)(b))	A comprehensive assessment of alternative sites, routes and methods was undertaken as part of the scheme assessment phase of the Project, which has continued throughout the duration of the current assessment of environmental effects stage. The alternatives identified and the means by which the Project was selected are outlined in Section 7 of this AEE. Overall, my view is that proper consideration has been given to alternative sites, routes and methods.

Matter for Consideration	Comment
Whether the work and designation are reasonably necessary to achieve the objectives of the NZTA (s171(1)(c))	The works and the designation are considered reasonably necessary because: 1. The works are considered reasonably necessary for the reasons outlined in Section 2 above, particularly regarding improving traffic and transport safety, efficiency and reliability; 2. The designation is considered reasonably necessary for the reasons outlined below including that it will: • allow the NZTA and/or its authorised agents to undertake any proposed works; • allow the land required to be identified in the ACDP, giving a clear indication of the intended use of the land; • help identify land required to be purchased under the PWA process; • enable the Project to be undertaken in a comprehensive and integrated manner; • protect the proposed route from future development which may otherwise preclude the construction of the Project; and • Provide a more efficient tool than using resource consents or plan changes to authorise the Project given the complexity of design detail and the mitigation planning that I recommend be used to manage the construction and operation of the Project;
Any other matter that the decision-maker considers reasonably necessary. (s171(1)(d))	A full analysis of other matters I consider are relevant to the decision is contained in the NORs, resource consent applications, AEE, Assessment Reports and Drawings. Key matters include that the Project will: 1. help facilitate the benefits of the wider RoNS programme; 2. enable the NZTA to meet its broader LTMA objectives and functions; and 3. help Auckland Council meet its growth aspirations for Warkworth as set out in the Auckland Plan.

With respect to the alteration of the existing Designation (ACDP:R reference 401), I note that the alterations sought are to conditions only, to ensure that the new Designation will not render NZTA non-compliant with conditions of the existing designation, where they do not enable the works proposed at the southern tie-in. There are no additional effects that would result from this alteration. In any case, my conclusions also apply to the alteration to Designation 401.

Having had regard to the potential effects of the proposed designation, the relevant provisions of planning documents as outlined in Section 28 above, the assessment of alternatives and the objectives of the Project, and sections 5, 6, 7 and 8 and s 171 of the RMA it is my opinion that the NORs can be confirmed subject to appropriate conditions.

29.4 Consideration of the resource consent applications

The full suite of resource consent applications are identified in Section 1.8 above.

The consideration of the coastal permits required at Okahu Inlet fall to being considered as non-complying activities. Non-complying activities require a consideration against section 104D prior to the substantive assessment of the Project under section 104(1). I propose to unbundle the coastal permits from the wider suite of resource consents.

29.4.1 Bundling of activities

When considering a suite of associated consents with varying individual consent categories, the "bundling" principle ensures that these consents are considered as a complete package. The bundling principle ensures that associated consents are assessed against the most stringent activity status.

As noted in Section 1.4 above, the consent status of the wider suite of resource consents falls to being considered as discretionary and restricted discretionary activities with the exception being the activity status of the structure and associated works in the CMA at Okahu Inlet (the bridge structure, construction of the bridge, occupation of the sea bed, and removal of mangroves). This is the only location where a consent is triggered under the ARP:C. The CPA1 notation relates to the quality of the feeding ground and specifically to the quality of the saline vegetation areas in the Pūhoi estuary.

If the consent applications were bundled, overall the Project would be considered as a non-complying activity by virtue of that particular activity.

In my opinion, both the ARP:C and the CPA1 notation relate to a very discrete element (calculated to be less than 0.5% of the indicative area) of the Project, and relate to a very specific issue that is not relevant to any other location in the Project area. To separate the coastal consent applications from the rest of the consents for assessment purposes would not be artificial in my opinion, but would more accurately reflect the separate nature of the activity, its locational environment and its effects. Additionally, to consider the entire alignment as a non-complying activity on the basis of discrete coastal ecological values that are not represented anywhere else within the Project area would inappropriately skew the overall consideration of the Project.

In summary, I am of the opinion that the coastal permits can be unbundled from the remainder of the consents required for the Project for the following reasons:

- The coastal permits are for a discrete section of the alignment, and are considered under a different regional plan than the remainder of the alignment;
- The area's notation as a CPA1 is for specific coastal ecological reasons which relates to the saline vegetation for feeding and roosting habitat; and
- The effects of the proposed structure and associated works in the CMA are distinct from the rest of the Project effects and do not overlap with, or have consequential effects on, the rest of the Project.

It is my opinion that this Project, whilst involving a number of consent matters, would be misrepresented by consideration as a non-complying activity as a whole. On that basis I have undertaken an analysis of the non-complying aspect of the Project below, and applied the

substantive section 104 analysis over the entire Project on the basis that the activity status for the remainder of the Project is discretionary overall.

29.4.2 Threshold analysis of non-complying coastal permits

The threshold test of section 104D requires that the proposal for a non-complying coastal activity passes either the test whereby the effects on the environment will be minor OR that the application is for an activity that will not be contrary to the objectives and policies of the relevant plan or proposed plan. In my opinion, the activity passes both gateway tests in s104D:

1. The conclusion of the Marine Ecology Assessment Report in relation to the activity specifically within Okahu Inlet is that the permanent and temporary loss of habitat will be of very low significance after mitigation. The effects are minor or less than minor.

2. I note that the phrase "not contrary to" has been considered in light of established case law to mean not "opposed to in nature, different to, opposite to". I also understand that my assessment should be based on whether the activity is not contrary to the overall objectives and policies of the plan, rather than assessing the non-complying activity against the detailed provisions of those plans. In this case, as demonstrated in Section 27.5, my opinion is that the Project is not contrary to the objectives and policies of the ARP:C, being the only relevant plan in this instance.

The non-complying coastal activity can therefore be assessed under section 104.

In the event that the decision-maker considers the whole Project should be assessed as a non-complying activity overall, I have assessed the Project against the relevant objectives and policies of the ARP:C, the ARP:ALW, the ARP:SC and the ACDP:R in Section 27 of this AEE. That assessment concludes that that the Project as a whole is not contrary to objectives and policies of relevant plans including those parts of the ARP:ALW that are subject to appeal.

29.4.3 Section 104 assessment

Under s104 of the RMA the decision-maker in its deliberation of the applications sought for the Project, including consideration of any submissions received must, subject to Part 2, have regard to:

(a) any actual and potential effects on the environment of allowing the activity; and

(b) any relevant provisions of—

(i) a national environmental standard:

(ii) other regulations:

(iii) a national policy statement:

(iv) a New Zealand coastal policy statement:

(v) a regional policy statement or proposed regional policy statement:

(vi) a plan or proposed plan; and

(c) any other matter the consent authority considers relevant and reasonably necessary to determine the application.

29.4.4 Section 104(1)(a) – Effects on the environment

Sections 10 to 26 of this AEE and the Assessment Reports outline the actual and potential effects of the Project.

In summary, the Project will have a number of positive and adverse effects. These effects vary in potential significance, scale (local, regional and national), intensity and duration.

The Project will have significant positive transport effects at a local and regional level, including:

- Improved resilience for the road network;
- Improved safety and reduced crash risk;
- Significant travel time savings between the Johnstone's Hill Tunnels and Warkworth; and
- More efficient freight movement and associated economic benefits.

There are several related positive social and economic effects arising from these transport benefits.

Potential short-term effects during construction of the Project will be:

- Nuisance effects (eg dust, noise, traffic, lighting, amenity) from construction activities;
- Visual effects;
- Increased sediment and contaminants entering waterways;
- Disruption and displacement of wildlife; and
- Diversions, degradation and loss of terrestrial and freshwater habitats.

Potential long-term positive effects from operation of the Project (in addition to the improved transport environment and the positive effects derived from this) will be:

- Restoration of the connectivity of Warkworth's community facilities with the wider residential and commercial activities through the reduction of traffic on the existing SH1; and
- Less noise, lower stormwater contaminant discharges through treatment of stormwater from the motorway and the removal of traffic from the existing SH1 and a safer route for cyclists and pedestrians from traffic reduction on SH1; and
- Gradual bedding in of alignment into the landscape, through mitigation planting and through readjustment to the change of amenity.

The long term adverse effects will be the discharge of treated stormwater, and visual and noise effects. I consider these effects to be minor.

29.4.5 Section 104(1)(b) – Relevant provisions of planning documents

With respect to the assessment of the Project against the statutory planning documents listed in s104(b)(i) to (iv), I consider the Project to be generally consistent with these documents and I refer you to Section 27 of this AEE along with the following sections:

- National Environmental Standard Air Quality Standard – refer Section 18 of this AEE and the Air Quality Assessment Report;
- National Environmental Standard for Sources of Human Drinking Water– refer Sections 10 and 21 of this AEE and the Construction and Operational Water Assessment Reports;
- National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) – refer Section 20 of this AEE. Consents required under this NES will be acquired at a later date when access to all property is available;
- National Policy Statement for Freshwater Management 2011 - refer Sections 10, 11 and 21 of this AEE and the Construction Water, Freshwater Ecology and Operational Water Assessment Reports;
- New Zealand Coastal Policy Statement – refer Marine Ecology Assessment Report and Landscape and Visual Assessment Report;
- Auckland Regional Policy Statement – refer Section 27.4 of this AEE;
- Auckland Regional Plan: Coastal; Auckland Regional Plan: Air, Land and Water; and Auckland Regional Plan: Sediment Control – refer Sections 27.5, 27.6, and 27.7 of this AEE respectively; and
- Auckland Council District Plan – Operative Rodney Section – refer Section 27.8 of this AEE.

29.4.6 Section 104(1)(c) – Other matters

The other matters that I consider relevant to the determination of this matter fall into two broad categories:

1. Transport policy and NZTA's LTMA objectives and functions, including those discussed in Section 3.4.4 above; and
2. Non-RMA policy, documents or plans that have been developed through community engagement.

(a) Transportation policy

I consider the following documents to be relevant to the consideration of the Project under section 104(1)(c):

- Connecting NZ 2011;
- The National Freight Demand Strategy 2008;
- NZ Transport Agency Statement of Intent 2013-2016;
- State Highway Plan 2013/2014; and
- Auckland Regional Road Safety Plan 2009-2012.

A number of the relevant non-statutory documents listed above are based on strategic and policy documents, including the GPS, the NIP and the Road Safety Strategy. Key themes underpinning these documents relate to the NZTA's role in managing the State highway network

Delivering the RoNS programme is outlined in the aforementioned documents as being integral to the above functions.

Connecting NZ 2011 recognises the pivotal role of the State highway network in the movement of freight, particularly via HVC and that "a number of our highways are affected by congestion, unreliable journey times or have a poor safety record". The RoNS programme is outlined in Connecting NZ 2011 as an example of the Government's significant investment in the State highway network to address the needs of key supply chain routes, enhance connections with our major sea and airports with the State highway system and reduce traffic congestion around our metropolitan areas. The RoNS are identified as high-use highways in the State Highway Classification System, with the existing SH1 identified as a Nationally Strategic State highway.

The movement of freight plays a vital role in supporting economic development. The National Freight Demand Strategy (NFDS) (discussed earlier in Section 2 of this AEE), provides a snapshot of freight volumes and movements, and forecasts the future freight task. In relation to the movement of freight between Northland and Auckland, the NFDS suggests that road freight traffic between these Regions will increase by over 250% over the 25 year period from 2006-07 to 2031.

The NZTA Statement of Intent (SOI)[129] illustrates how the NZTA will deliver the Government's goals as outlined in the GPS and NLTP. The SOI recognises that significant investment in the RoNS programme is integral to the Government's ability to provide opportunities for economic growth through the safe and efficient movement of people and freight, greater network resilience and security and congestion relief. Development of the Pūhoi to Warkworth section of the Ara Tūhono Pūhoi to Wellsford RoNS is identified in the milestones over the 2013/14 – 2015/16 years, reflecting the forecast from the NLTF.

The State Highway Plan (SHP)[130] outlines the NZTA's annual State highway work programme, which is consistent with the objectives of the State Highway Asset Management Plan. The SHP outlines the Government's commitment to the RoNs programme, in particular progressing the Ara Tūhono Pūhoi to Wellsford RoNS.

The Auckland Regional Road Safety Plan[131] is a regional plan developed in alignment with the GPS, which outlines the Government's target for fewer road fatalities. The Plan recognises the importance of increased safety engineering as one response.

As outlined in Section 1 of this AEE, the Pūhoi to Warkworth section of the Ara Tūhono Pūhoi to Wellsford RoNS will be a new four-lane motorway between Pūhoi and Warkworth. The motorway will reduce travel times and improve travel time reliability between Pūhoi and Warkworth that will in turn provide for improved accessibility and the more efficient movement of freight between Northland and Auckland. These transport benefits are important with the forecast increase in freight movements as outlined in the NFDS and will provide opportunities for economic growth. The Project will improve the safety performance of the existing SH1 with the new motorway designed, operated and constructed in accordance with the RoNS Standards to provide a high level of safety in accordance with the Government's objectives outlined in Safer Journeys[132]

[129] NZ Transport Agency 2012, NZ Transport Agency Statement of Intent 2013-2016

[130] NZ Transport Agency 2012, State Highway Plan 2013/2014

[131] Auckland Regional Transport Authority 2009, Road Safety Plan

[132] http://www.saferjourneys.govt.nz/

Other matters I consider relevant with respect to transport policy that I considered earlier in this AEE include:

- Government Policy Statement on Land Transport Funding 2009/10 – 2018/19 – (refer Section 2.3.3 of this AEE);
- National Infrastructure Plan 2011 (refer Section 3.11.1);
- New Zealand Transport Strategy 2008 (refer Section 2.3.3);
- Auckland Regional Land Transport Strategy 2010 – 2040 (refer Section 2.3.4);
- Safer Journeys: New Zealand's Road Safety Strategy 2010 – 2020;
- The Upper North Island Freight Story 2013;
- The Auckland Integrated Transport Plan 2012 – 2041; and
- The Regional Asset Management Plan 2012-2015.

The discussion immediately above and in Sections 2 and 3 shows a strong central and regional transport policy direction. The Project is consistent with that direction and supports the broader transport objectives contained in them.

(b) Non-statutory RMA Policy

Other matters I consider relevant to consideration of the Project include NZTA's own policy documents (in addition to specific documents which informed the Assessment Reports), an NPS that is still in draft form, and structure plans that have not yet been incorporated into the ACDP. These documents assist to inform a strategic direction within which the Project will sit. The other document is one promulgated out of a concern for the effects of increasing siltation of the Mahurangi Harbour, on commercial, recreational and ecological interests.

These other matters are:

- Proposed National Policy Statement on Indigenous Biodiversity (NPS:IB):
- Warkworth Structure Plan 2004;
- Pūhoi Structure Plan;
- The Mahurangi Action Plan;
- The NZTA Environmental Plan 2008; and
- The Auckland Plan.

Proposed National Policy Statement on Indigenous Biodiversity

The NPS:IB was publicly notified for submissions between January and May 2011. It is yet to take effect. The NPS:IB has the single objective:

> *To promote the maintenance of indigenous biological diversity by protecting areas of significant indigenous vegetation and significant habitats of indigenous fauna, and to encourage protection and enhancement of biodiversity values more broadly while:*
>
> - *supporting best practice of local authorities*
> - *recognising the positive contribution of landowners as guardians/kaitiaki of their land*
> - *recognising that the economic, social and cultural well-being of people and communities depends on, amongst other things, making reasonable use of land.*

The Project generally affects only pockets of indigenous vegetation and habitats. These effects have been identified and assessed in the Terrestrial Ecology Assessment Report. The mitigation proposed in Section 28 of this AEE is informed by the findings in that Report and will ensure that the Project will maintain biodiversity in the limited areas where there may be an adverse effect. The Operational Stormwater and Landscape and Visual Assessment Reports identify further opportunities to enhance existing indigenous vegetation or rehabilitate within the proposed landscaping that will be detailed in the OPW for the Project. The Project mitigation will be informed by Hōkai Nuku as part of their on-going expression of kaitiaki over the Project area. Regardless of the draft status of the NPS:IB, I consider the Project to be generally consistent with it.

Warkworth Structure Plan 2004

The Warkworth Structure Plan (WSP) was adopted by the former Rodney District Council in 2004. The Plan was developed in response to population growth projections for Warkworth and provides a growth management strategy and concept for the revitalisation of Warkworth. The Plan focuses on providing additional land for employment, retail and residential activities and improvements to movement safety and connection for all modes. The WSP is a non-statutory document and not included in the ACDP.

The Project has been developed with regard to the strategic direction for future growth and development of Warkworth as outlined in the WSP. The new motorway will extend west of Warkworth, allowing land planned for urban expansion to remain well connected to the remainder of the settlement. The Project will provide for improved transport connections with the State highway network and reduce congestion in Warkworth, particularly at the intersection of the current SH1 and Hill Street.

The Pūhoi Structure Plan

The Pūhoi Structure Plan was adopted by the former Rodney District Council in 2010. Pūhoi is not identified as a growth node from a regional perspective and minimal land use change is anticipated by the Plan. The Plan acknowledges that a new route between Pūhoi and Wellsford was being developed during the preparation of the Plan.

The indicative alignment has been developed with consideration to minimising potential impacts on the Pūhoi settlement and community, in particular, effects on Pūhoi Village and the heritage character of the area. As outlined in Section 5 of this AEE, the Project design includes the provision of a single lane northbound off-ramp and a single lane southbound on-ramp to and from Pūhoi in the vicinity of the intersection with Pūhoi Road and the existing SH1. These ramps will provide access between Pūhoi and the new motorway.

Mahurangi Action Plan

I have considered the Mahurangi Action Plan given its purpose and the level of community engagement undertaken in its preparation. The Mahurangi Action Plan was developed out of increasing community concerns over the increasing level of sedimentation of the Mahurangi Harbour. This concern was shared by the then Auckland Regional Council and Rodney District

Council. The Mahurangi Action Plan was released in September 2010, and was the product of workshops and engagement with a wide range of concerned parties, from local residents, business (including oyster farmers), tangata whenua, forestry operators, Federated Farmers and individual landowners.

The Mahurangi Action Plan's key focus is sediment accumulation in the Mahurangi River and Harbour and its effect on habitat, recreation, navigation and commercial activities. The Plan also considers other contaminants from land use, effluent discharge, agricultural leachate and fertiliser to be an issue to the River. Whilst the implementation of the Mahurangi Action Plan has lost some momentum with the formation of the Auckland Council, the objectives and priority actions are still valid. Some recognition has been given to the Mahurangi Action Plan with the Rodney Local Board advocating for funding to support the environmental initiatives offered through the Mahurangi Action Plan. The objectives of relevance to the Project are to reduce sediment (Objective 1), that vegetation cover is maintained and increased (Objective 2), and that water quality is safe for recreational and commercial users (Objective 3). The Project supports these Objectives through its commitment to management of sediment during construction and the treatment of stormwater during operation, and will further the objective to maintain and increase vegetation cover of tributaries of the Mahurangi River Right Branch through landscaping that will be detailed in the OPW.

The NZTA Environment Plan

The Environment Plan[133] outlines the NZTA's intentions with respect to the contribution of State highways to the environment and social wellbeing of New Zealand. The LTMA, NZTS and RMA are the primary supporting legislative and policy context for the Plan.

The Plan guides the design, construction, operation and maintenance of the State highway network in relation to a range of potential environmental and social impacts in order to:

- Protect and enhance the environment where appropriate;
- Avoid adverse effects to the extent reasonable in the circumstances;
- Use and manage resources efficiently;
- Consider environmental issues early;
- Contribute to sustainable outcomes by working with others; and
- Continually improve environmental performance.

In my opinion, the Project will meet the relevant objectives of the NZTA Environmental Plan, including those regarding noise emissions, air quality, stormwater discharges, sediment and erosion control, landscaping, heritage and biodiversity.

The Auckland Plan

The Auckland Plan is a requirement of section 79 of the Local Government (Auckland Council) Amendment Act 2010. The purpose of the Auckland Plan is to

[133] Transit New Zealand 2008, Environment Plan

"...contribute to Auckland's social, economic, environmental, and cultural well-being through a comprehensive and effective long term (20 – 30 year) strategy for Auckland's growth and development".[134]

The Major Transport Projects identified in the Auckland Plan (page 334), include "construction of the Pūhoi-Wellsford Motorway, first Phase Pūhoi to Warkworth within the first decade projects (being 2011 – 2020)". The Project is consistent with the objectives of the Auckland Plan through the delivery of consents to enable the construction of the Project.

29.4.7 Overall conclusion under s104

Having had regard to the potential effects of the Project and the relevant provisions of planning documents as outlined in Section 28 above, and sections 5, 6, 7 and 8 and 104 of the RMA, it is my opinion that the resource consents can be granted subject to appropriate conditions.

29.5 Section 105 Assessment

Section 105(1) of the RMA requires that, for discharge permits or coastal permits that would contravene section 15 or section 15B[135], the decision maker must, in addition to the matters in s104(1), have regard to the following:

(d) the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and

(e) the applicant's reasons for the proposed choice; and

(f) any possible alternative methods of discharge, including discharge into any other receiving environment.

29.5.1 Nature of the discharge and the sensitivity of the receiving environment

I have considered the nature of the stormwater discharge from the Project and the sensitivity of the receiving environment. The Project involves significant earthworks and discharges, particularly during the construction period. The earthworks, the management of associated discharges and the immediate and eventual receiving environment are identified and considered in the Construction Water, Operational Water, Freshwater Ecology and Marine Ecology Assessment Reports.

29.5.2 The applicant's reasons for the proposed choice and possible alternative methods of discharge

The alternative methods of discharge considered by the NZTA are set out in the Operational Water Assessment Report. The consideration of alternatives identified the particularly sensitive environments to be avoided. In my opinion, it would be impossible to avoid the receiving environment within either the Pūhoi or Mahurangi catchments. At a macro level, there is no practical alternative to the discharge into the respective environments. All discharges will be

[134] Auckland Plan page 10

[135] We note that section 105 also relates to discharges under section 15B but these are discharges from ships or offshore installations which are not relevant in this instance

treated (both during construction and operation) and all points of discharge will be designed to ensure that ongoing sedimentation of the watercourse can be managed appropriately. The Construction Water Assessment Report addresses construction water management including applying a maximum earthworks area for each catchment, through directly addressing earthworks on steeper slopes and steep cut faces, using cut-off drains for diversions above earthwork areas and other management techniques to minimise the loss of sediment from the site into watercourses. Given that it is not practical to discharge to an alternative receiving environment, I consider that the selection of the BPO for managing sediment control is appropriate.

29.6 Section 107 Assessment

The Project is to be considered under section 107. Section 107(1) sets out restrictions on granting discharge permits if, after reasonable mixing, the containment or water discharge is likely to give rise to certain effects (as listed in s107(1)(c)-(g)):

A consent authority may grant a discharge permit which gives rise to these effects if it is satisfied –

a) That exceptional circumstances justify the granting of the permit; or

b) That the discharge is of a temporary nature; or

c) That the discharge is associated with necessary maintenance work –

and that it is consistent with the purpose of the RMA to do so.

Discharges to water during construction and operation of the Project may increase contaminants that after reasonable mixing potentially give rise to the following s107(1)(c)-(g) effects:

1. The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials during construction and operation;

2. Sedimentation during construction causing a conspicuous change in the colour or visual clarity; and

3. Significant adverse effects on aquatic life from sedimentation during construction due to a possible severe weather event.

In my opinion, the Project will meet the tests of section 107 allowing the grant of discharge permits for the following reasons:

- The potential for effects on receiving waters associated with odours, conspicuous oils, floatable or suspended solids are considered in both the Construction Water Assessment Report and the Operational Water Assessment Report, supported by the Marine and Freshwater Ecology Reports, and are assessed as minor;
- The Construction Water Assessment Report concludes (at 10.3) that, at worst, there will be minor effects on water quality after reasonable mixing;
- The potential for significant effects from sediment discharges will be temporary, as they are limited to the construction period and during the earthworks season only, with the balance of the site being stabilised during the winter months;

- The potential effect on aquatic life in marine environments from sedimentation arising from the Project would only occur during a 50 year rain fall event, which is unlikely. Such effects are considered significant on a marine environment with medium ecological values (refer Marine Ecology Assessment Report Section 4.1.3). To the extent that such an event occurred during construction, the conditions I propose include a process for post event monitoring and reporting on any remedial recommendations that need to be implemented;
- The Operational Water Assessment Report concludes that the design of instream structures and the use of stormwater wetlands will ensure that, after reasonable mixing, effects of granting the discharge consents will be minor (refer Section 8 of the Report);
- Treatment of the construction water will ensure that the quality (as a result of increased TSS) of the construction water discharged will be restricted to a temporary period and can be tolerated by the resident fish species as assessed in Section 6.2.5 of the Freshwater Ecology Report;
- The NZTA will adopt non-structural practices to ensure that in advance of forecasted significant rain events all practicable measures are taken to minimise the loss of sediment via the treatment systems and into the watercourses; and
- Once completed, the Project will treat all stormwater runoff from the motorway to the BPO prior to discharging to the watercourse, and water quality effects will be negligible. There may be improvements in water quality due to less traffic using existing SH1 on which there is no existing stormwater treatment.

In my opinion, it would also be consistent with the purpose of the RMA to grant the discharge consents given the scale and significance of the Project. The possibility of a significant effect on aquatic life from sedimentation in particular is unlikely. Mitigation is available to remedy any such effect in the event that significant effects occur, due to the potentially high impact of such effects.

29.7 Conclusion

The Project is a project of national significance. As outlined above, the notices of requirement and resource consent applications achieve the statutory requirements of sections 171 and 104 respectively. The Project offers significant transportation and health and safety benefits to both road users, through improved travel time and travel reliability, and the Warkworth community, through the reduction of traffic on SH1 through the town. I accept that the Project will have adverse effects on the environment, especially during construction. Where effects cannot be avoided or remedied, appropriate mitigation has been identified by the Project team and will inform the conditions. It is my opinion that the Project will promote the sustainable management of natural and physical resources and therefore achieves the purpose of the RMA. I accordingly consider that the notices of requirement can be confirmed and the resource consents granted.

Appendix A. Gazette Notice

THE

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Departmental Notices

Agriculture and Fisheries

Animals Protection Act 1960

Approval of Code of Ethical Conduct Notice No. 5330 (100-A1-07)

Pursuant to section 19A of the Animals Protection Act 1960 and on the advice of the National Animal Ethics Advisory Committee, I hereby approve the code of ethical conduct submitted to me by Elanco Animal Health, which is the same as the approved code of ethical conduct of Massey University.

Dated at Wellington this 22nd day of February 1994.

JOHN FALLOON, Minister of Agriculture.

go1646

Revocation of Approval of Code of Ethical Conduct Notice No. 5329 (100-A1-07)

Pursuant to section 19A of the Animals Protection Act 1960 and on the advice of the National Animal Ethics Advisory Committee, I hereby revoke the approval of Tauhara Furs Partnership to use the code of ethical conduct of the Ministry of Agriculture and Fisheries.

Notice No. 4421 appearing in the *New Zealand Gazette* on the 30th day of June 1988, at page 2628 is hereby revoked.

Dated at Wellington this 22nd day of February 1994.

JOHN FALLOON, Minister of Agriculture.

go1647

Approval of Code of Ethical Conduct Notice No. 5328 (100-A1-07)

Pursuant to section 19A of the Animals Protection Act 1960 and on the advice of the National Animal Ethics Advisory Committee, I hereby approve the code of ethical conduct submitted to me by Lowe Walker Hawera Limited, which is the same as the approved code of ethical conduct of NZ Pastoral Agriculture Research Institute Limited.

Dated at Wellington this 22nd day of February 1994.

JOHN FALLOON, Minister of Agriculture.

go1648

Conservation

Resource Management Act 1991

Notice of Approval of Bylaws Amendment

The Minister of Transport and the Minister of Conservation, pursuant to section 424 (6) of the Resource Management Act 1991, hereby give approval to The Northland Regional Council Maritime Bylaw Amendment No. 5 (Bylaw Charges 1992/93) resolved by way of Special Order and confirmed by a meeting of the said Council on 19 May 1993.

Dated at Wellington this 14th day of February 1994.

DENIS MARSHALL, Minister of Conservation (in relation to section 232 (37) of the Harbours Act).

B. A. MARTIN, for Russell Kilvington, Director of Maritime Safety in exercise of powers delegated by the Minister of Transport.

go1499

Crown Law Office

Judicature Act 1908

Appointment of Temporary Judge Made Permanent

Pursuant to section 4 of the Judicature Act 1908, Her Excellency the Governor-General, in the name and on behalf of Her Majesty the Queen, has been pleased to appoint

The Honourable Dame Silvia Rose Cartwright

to be a Judge of the High Court.

Dated at Wellington this 17th day of February 1994.

PAUL EAST, Attorney-General.

go1498

Environment

Resource Management Act 1991

The Resource Management (Approval of Transit New Zealand as Requiring Authority) Notice 1994

Pursuant to sections 167 and 420 (6) of the Resource Management Act 1991, the Minister for the Environment, hereby gives the following notice:

Notice

1. Title and commencement—(1) This notice may be cited as the Resource Management (Approval of Transit New Zealand as Requiring Authority) Notice 1994.

(2) This notice shall come into force on the 7th day after the date of its publication in the *New Zealand Gazette*.

2. Interpretation—In this notice "State highway" and "motorway" have the same meaning as in section 2 (1) of the Transit New Zealand Act 1989.

3. Application of notice—This notice shall apply in addition to and not in substitution for the Resource Management (Approval of Transit New Zealand as Requiring Authority) Order 1992.

4. Approval as requiring authority—Transit New Zealand is hereby approved as a requiring authority under section 167 of the Resource Management Act 1991, for its particular network utility operation being the construction and operation (including the maintenance, improvement, enhancement, expansion, realignment and alteration) of any State highway or motorway pursuant to the Transit New Zealand Act 1989.

5. Approval in respect of existing designation—Transit New Zealand is hereby approved as a requiring authority under section 167 of the Resource Management Act 1991 for the Christchurch Northern Arterial (State Highway 74) in the district of Christchurch City Council.

Dated at Wellington this 17th day of February 1994.

SIMON UPTON, Minister for the Environment.

go1500

29 New Agency replaces Transit New Zealand as requiring authority

(1) This clause applies to any Order in Council, notice, or other instrument that approves of Transit New Zealand as a requiring authority and that was in effect immediately before 1 August 2008, including (without limitation)—

(a) the Resource Management (Approval of Transit New Zealand as Requiring Authority) Order 1992; and

(b) the Resource Management (Approval of Transit as Requiring Authority) Notice 1994.

(2) Without limiting clauses 26 and 28, on 1 August 2008,—

(a) the new Agency replaces Transit New Zealand as a requiring authority under any Order in Council, notice, or other instrument to which this clause applies; and

(b) every reference to Transit New Zealand in any Order in Council, notice, or other instrument to which this clause applies, is, unless the context otherwise requires, to be read as a reference to the new Agency; and

(c) anything done, or omitted to be done, or that is to be or may be done (under or in relation to an Order in Council, notice, or other instrument to which this clause applies) by Transit New Zealand is to be treated as having been done, or having been omitted to be done, or to be or may be done, by the new Agency; and

(d) every notice of requirement and designation of Transit New Zealand is transferred to and held by the new Agency, with the same status and priority as if Transit New Zealand and the new Agency were the same entity.

30 First members of new Agency

In appointing the first members of the new Agency, the Minister may, but need not, consult in accordance with section 98(2) of the Land Transport Management Act 2003.

Compare: 2004 No 97 Schedule 2 cl 4

31 Transferred employees

(1) The terms and conditions of employment of a transferred employee immediately before 1 August 2008 continue to apply in relation to that employee until—

Appendix B. Acronyms, terms and definitions

Glossary of abbreviations

Abbreviation	Definition
AADT	Average Annual Daily Traffic
ABM	Automatic Bat Monitoring device
ACDP	Auckland Council District Plan - Operative Rodney Section 2011
AEE	Assessment of Environmental Effects
AEP	Annual Exceedance Probability
ANZECC	Australian and New Zealand Environment Conservation Council
ARAQT	Auckland Regional Ambient Air Quality Targets
ARC	Auckland Regional Council (preceded the Auckland Council)
ARDS	The Department of Conservation's Amphibian and Reptile Distribution Scheme
ARI	Average Recurrence Interval
ARLTS	Auckland Regional Land Transport Strategy
ARP:ALW	Auckland Regional Plan: Air, land and water
ARP:C	Auckland Regional Plan: Coastal
ARP:SC	Auckland Regional Plan: Sediment Control
ARPS	Auckland Regional Policy Statement
ASCV	Area of Significant Conservation Value
BPO	Best Practicable Option
BS 5228-2:2009	British Standard BS 5228-2:2009 *"Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration"*
CAS	NZTA's Crash Analysis System
Ch	Chainage
CESCP	Construction Erosion and Sediment Control Plan
CHI	Auckland Council's Cultural Heritage Inventory
CMA	Coastal Marine Area
CO	Carbon monoxide

Abbreviation	Definition
CPA 1	Coastal Protection Area 1 (as defined in ARP:C)
CPA 2	Coastal Protection Area 2 (as defined in ARP:C)
DIN 4150-3:1999	German Standard DIN 4150-3:1999 "*Structural Vibration – Part 3: Effects of Vibration on Structures*"
DEB	Decanting Earth Bund
DoC	Department of Conservation
EEM	The NZTA Economic Evaluation Manual
EPA	Environmental Protection Authority
GIS	Geographic Information System
GLEAMS	Groundwater Loading Effects of Agricultural Management Systems
GPS 2012	Government Policy Statement on Land Transport Funding 2012/13-2021/22
Ha	Hectare(s)
HAIL	Hazardous Activities Industries List
HCV	Heavy Commercial Vehicle
HGMPA	Hauraki Gulf Marine Park Act 2000
HPA	Historic Places Act 1993
HSAPLU	Highly sensitive air pollution land uses
KiwiRAP	New Zealand Road Assessment Programme
kg	kilograms
Km	Kilometre(s)
Km^2	Square Kilometres
LGAAA	Local Government (Auckland) Amendment Act 2004
LTMA	Land Transport Management Act 2003
m	Metres
m^2	Square metre(S)
m^3	Cubic metre(s)
mg/m^3	Milligrams per cubic metre
mm	Millimetre(s)

Abbreviation	Definition
MAP	Mahurangi Action Plan
mBGL	Metres Below Ground Level
MCI	Macroinvertebrate Community Index
MfE	Ministry for the Environment
MHWS	Mean High Water Springs
MOU	Memorandum of Understanding
MSE	Mechanically Stabilised Earth
NAL	North Auckland Line (Railway)
NES	National Environmental Standards
NFDS	National Freight Demand Study
NGTR	Northern Gateway Toll Road
NIWA	National Institute of Water and Atmospheric Research Limited
NLTP	National Land Transport Programme 2012-2015
NO	Nitric oxide
NO_2	Nitrogen Dioxide
NO_X	Oxides of nitrogen
NOR(s)	Notice of Requirement(s)
NPS	National Policy Statement
NS 8176.E:2005	Norwegian Standard NS 8176.E:2005 *"Measurement of vibration in buildings from land based transport and guidance to evaluation of its effects on human beings"*
NTU	Nephelometric Turbidity Unit
NZAA	New Zealand Archaeological Association
NZCPS	New Zealand Coastal Policy Statement 2010
NZFFD	New Zealand Freshwater Fish Database
NZHPT	New Zealand Historic Places Trust
NZS 6801:2008	New Zealand Standard NZS 6801:2008 "*Acoustics – Measurement of environmental sound*"
NZS 6802:2008	New Zealand Standard NZS 6802:2008 "*Acoustics – Environmental Noise*"
NZS 6803:1999	New Zealand Standard NZS 6803:1999 *"Acoustics – Construction Noise"*

Abbreviation	Definition
NZS 6806:2010	New Zealand Standard NZS 6806:2010 *"Acoustics – Road traffic noise – New and altered roads"*
NZTA	NZ Transport Agency
NZTS	New Zealand Transport Strategy
NZUDP	New Zealand Urban Design Protocol
OGPA	Open Grade Porous Asphalt
ONL	Outstanding Natural Landscape
OPW	Outline Plan of Works
PPFs	Protected premises and facilities
PPV	Peak Particle Velocity
PM_{10}	Fine particulate matter less than 10 microns in diameter
$PM_{2.5}$	Fine particulate matter less than 2.5 microns in diameter
P-W	The Pūhoi to Wellsford Project Road of National Significance
PWA	Public Works Act 1981
P-Wk	Pūhoi to Warkworth section of the Pūhoi to Wellsford Road of National Significance Project
RDC	Rodney District Council (preceded Auckland Council)
RARP	Regional Arterial Road Plan
RMA	Resource Management Act 1991
RoNS	Roads of National Significance
SES	Site of Ecological Significance
SEV	Stream Ecological Valuations / Stream Ecological Value Assessment
SHx	State Highway (number)
SIA	Social Impact Assessment
SNA	Significant Natural Area
SO_2	Sulphur dioxide
SRP	Sediment Retention Pond
SSF	Super Silt Fence
TD	Permanent Stormwater treatment device

Abbreviation	Definition
TMS	NZTA's Traffic Monitoring System
TP10	AC Technical Publication Number 10: Stormwater Management Devices Design Guideline Manual
TP90	AC Technical Publication Number 90: Erosion and Sediment Control Guidelines for Land Disturbing Activities
TP108	ARC Technical Publication 108: Guidelines for Stormwater Runoff Modelling in the Auckland Region
TSS	Total Suspended Solids
ULDF	Urban and Landscape Design Framework
USEPA	United States Environmental Protection Agency
USLE	Universal Soil Loss Equation
VEPM	Vehicle Emissions Prediction Model (Version 5.1)
vpd	Vehicles Per Day
vph	Vehicles Per Hour
WHO	World Health Organisation
WSP 2004	Warkworth Structure Plan 2004

Glossary of Defined Terms

Term	Definition
Annual Exceedance Probability Storm Event	The probability of exceeding a given storm discharge or flood level within a period of one year. For example, equivalent return period terms 1% AEP = 1 in 100 year.
Allochthon	A large block of rock which has been moved from its original site of formation, usually by low angle thrust faulting.(colloquially known as "Onerahi chaos")
Ambient Air	The air outside buildings and structures. It does not refer to indoor air, air in the workplace, or to contaminated air as it is discharged from a source.
Ambient noise / vibration	The total noise or vibration existing at a specified point and time associated with a given environment, excluding the sound or vibration requiring control. It is a composite of all noise or vibration sources, near and far.
Amenity	Defined in section 2 of the RMA as those natural or physical qualities and characteristics of an area that contributes to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes.
Archaeological site	Defined in section 2 of the Historic Places Act 1993 as any place in New Zealand that – (a) Either- • Was associated with human activity that occurred before 1900; or • Is the site of the wreck of any vessel where that wreck occurred before 1900; and (b) Is or may be able through investigation by archaeological methods to provide evidence relating to the history of New Zealand.
Average Recurrence Interval Event	The average time period between rainfall or flow events which equal or exceed a given magnitude.
Auckland Council	The unitary authority that replaced eight councils in the Auckland region as of 1 November 2010
Best Practicable Option (BPO)	Defined in section 2 of the RMA as, in relation to the discharge of a contaminant or an emission or noise, the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to— (a) The nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and (b) The financial implications, and the effects on the environment, of that option when compared with other options; and (c) The current state of technical knowledge and the likelihood that the option can be successfully applied.
Bore	Any hole that has been constructed to provide access to groundwater (for example, for monitoring of ground or groundwater conditions, taking of groundwater or the discharge of stormwater).
Broadleaved	Trees that produce flowers
Building Condition Survey	A survey (by a structural engineer) recording and documenting any damage to the building structure - including superficial damage. Used to track the occurrence or exacerbation of building damage over time to provide objective proof in the event of any damage claims.
Canopy	Tallest layer of the forest

Term	Definition
Construction Runoff	Any runoff, sediment laden or otherwise, that flows as a result of the construction related activities. Typically results from rain events.
Crake	A type of wetland bird
Culvert	A pipe with an inlet from a watercourse and outlet to a watercourse, designed to convey water under a specific structure (such as a road).
dB	A decibel is a unit of sound level.
dBA	A measurement of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
Diversion of stormwater	The turning aside of stormwater from its natural course of flow; causing it to flow by a different route.
Earthworks	The disturbance of land surfaces by blading, contouring, ripping, moving, removing, placing or replacing soil or earth, or by excavation, or by cutting or filling operations.
Eastern Beaches	Beach communities located east of Warkworth including Leigh, Omaha, Sandspit, Snells Beach and Mahurangi East.
Ephemeral	Waterbody that only exists for short period of time following precipitation or snow melt
Erosion Control	Methods to prevent or minimise the erosion of soil, in order to minimise the adverse effects that land disturbing activities may have on a receiving environment.
Fish Passage	The movement of fish between the sea and any river, including up-stream or downstream in that river.
Flocculation	The process whereby fine particles suspended in the water column clump together and settle. In some instances this can occur naturally, such as when fresh clay-laden flows mix with saline water, as occurs in estuaries. Flocculation can be used to promote rapid settling in sediment retention ponds by the addition of flocculating chemicals (flocculants).
Groundwater	Natural water contained within soil and rock formations below the surface of the ground.
Heritage Site	A site that contributes to an understanding and appreciation of New Zealand's history and cultures. A heritage site can be derived from archaeological, architectural, cultural, historic, scientific and technological fields.
Highly sensitive air pollution land uses	A location where people or surroundings may be particularly sensitive to the effects of air pollution. These include residential houses, hospitals, schools, early childhood education centres, childcare facilities, rest homes, residential properties, premises used primarily as temporary accommodation (such as hotels, motels, and camping grounds), open space used for recreation, the conservation estate, marae and other similar cultural facilities.
Impervious Area	An area with a surface which either prevents or significantly retards the infiltration of water into the ground, thereby causing water to run off the ground surface in greater quantities or at an increased rate of flow than would occur under natural conditions
Indicative Alignment	A route and designation footprint selected after short-list and long-list development to enable consultation with the community. This development involved specialist work assessing environmental, social and engineering inputs. It is a preliminary design alignment that may be refined on detailed design within the designation boundary
Intermittent Stream	Any stream or part of a stream that is not a Permanent stream.

Term	Definition
$L_{Aeq(t)}$	The time averaged noise level (on a log/energy basis). This is commonly referred to as the average noise level. The "A" represents A – weighting whereby the value has had its frequency characteristics modified by a filter so as to more closely approximate the frequency bias of the human ear. The suffix "t" represents the time period to which the noise level relates, eg (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent the period between 10 pm and 7 am.
L_{Amax}	The maximum sound pressure level measured during the sampling period. The "A" represents A – weighting as described for $L_{eq(t)}$ above.
Land Disturbing Activity	Any disturbance to the ground surface that may result in soil erosion through the action of wind or water.
Mechanically Stabilised Earth Walls	In-ground structures that improve the shearing resistance of foundation soils and usually involve deep excavations and the importation of engineered fill material.
Motorway	Motorway means a motorway declared as such by the Governor-General in Council under section 138 of the PWA or under section 71 of the Government Roading Powers Act 1989.
Noise Mitigation	An activity or structure which reduces/mitigates the impact or effect of noise.
NOx	Oxides of nitrogen – a suite of gaseous contaminants that are emitted from road vehicles and other sources. Some of the compounds can react in the atmosphere and, in the presence of other contaminants, convert to different compounds (for example NO to NO2).
Overland Flow Path	The flow path of stormwater over the ground.
Peak Particle Velocity (PPV)	A vibration metric which has the unit millimetres per second (mm/s). A triaxial vibration measurement records PPV in all three axes and there is a separate PPV value for each axis.
Permanent Stream	Downstream of the uppermost reach of a river or stream which meets either of the following criteria: (a) has continual flow; or (b) has natural pools having a depth at their deepest point of not less than 150 millimetres and a total pool surface area that is 10m2 or more per 100 metres of river or stream bed length. The *boundary* between Permanent and Intermittent river or stream reaches is the uppermost qualifying pool in the uppermost qualifying reach.
Perennial	Stream or river with continuous flow all year round.
Pier	Vertical support structure for a bridge.
Piezometer	A device used to measure groundwater pressure head at a point in the subsurface.
$PM_{2.5}$	Particulate matter smaller than 2.5 microns in diameter.
PM_{10}	Fine particulate matter with an equivalent aerodynamic diameter of less than 10 micrometres. Fine particulates are predominantly sourced from combustion processes. Vehicle emissions are a key source in urban environments.
Podocarp	Trees that produce cones: eg rimu, kahikatea, totara, tanekaha.

Term	Definition
Preliminary design for the statutory approvals	The notation used on the plans and drawings attached to this AEE in Volume 4 which show the designation boundary and a preliminary design alignment more commonly referred to as the "indicative alignment".
Portal	The entrance way to a tunnel starting where the road is completely uncovered to where it is completely covered.
Project Area	From the Johnstone's Hill tunnel portals in the south to Kaipara Flats Road in the north defined by the designation boundary
Receptors	Points specified within an area where the concentration of contaminants in air is specifically calculated by an air dispersion model.
Reclamation	Defined in the Auckland Regional Plan: Coastal as any permanent filling of an area previously inundated by coastal water either at or above mean high water spring mark, whether or not it is contiguous with the land, so that the filled surface is raised above the natural level of MHWS, and thus creates dry land, removed from the ebb and flow of the tide.
Relict	Trees that were part of the original forest of the area.
Rhytid	A type of land snail of the genus Rhytida.
Secondary forest	Not the original forest of the area; forest that has developed after human clearance of the original forest.
Sediment Control	Capturing sediment that has been eroded and entrained in overland flow before it enters the receiving environment.
Sediment Generation	That sediment that is generated on the site of earthwork activity prior to treatment through any sediment retention device.
Sediment Retention Pond	A detention structure that is utilised during the construction phase of earthworks activity to treat any sediment laden runoff and retain sediment.
Sediment Yield	That sediment which leaves the sediment retention devices and enters the receiving environment
Sensitive Receiver (vibration)	A building or building occupant that is sensitive to vibration. The majority for this Project are residences, but may also include other receivers that are either close to the alignment and/or particularly susceptible to vibration effects.
Settlement	The gradual sinking of the ground surface as a result of the compression of underlying material.
Shear Keys	In-ground structures that improve the shearing resistance of foundation soils and usually involve deep excavations and the importation of engineered fill material.
Specimen Design	A design for the Project, which includes detail sufficient for obtaining statutory approvals and the initial phase of the construction procurement process. Not a full detailed design.
Stormwater	Water that flows from impervious areas and completed areas of the motorway after the construction period.
Stormwater Pond	A stormwater management device which detains runoff, typically from a design storm, and then discharges it, usually at the pre-development peak discharge rate. It can also provide water quality treatment primarily through sedimentation. A stormwater pond can either be a dry pond which is normally dry between storm events, or a wet pond which has a standing pool of water.
Terrestrial	Land-based.

Term	Definition
Transmissivity	The rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient. Transmissivity is given in cubic metres per day through a vertical section of an aquifer one metre wide and extending the full saturated height of an aquifer under a hydraulic gradient of 1.
Triaxial	In three axes. This is a term used in vibration measurements (refer 'Peak Particle Velocity' and 'Axes')
Turbidity	Turbidity is a measure of water clarity or murkiness of a waterbody.
$V_{w,95}$	Vibration metric utilised by the Norwegian Standard NS 8176.E:2005 to assess human response to traffic vibration. It is the 5th percentile of a measured velocity signal that has had a frequency weighting applied.
Wetland	Vegetated stormwater treatment device designed to remove a range of contaminants, providing superior water quality treatment to wetponds with increased filtering and biological treatment performance.

Appendix C. Letter from M Copeland

22 August 2013

Mr Tony Innes
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Dear Tony

1 As requested, I have undertaken a high level assessment of the economic effects of the Ara Tūhono Pūhoi to Wellsford Road of National Significance – Pūhoi to Warkworth Section (*the Project*). This letter sets out my conclusions on the positive and adverse actual and potential economic effects of the Project at a national, regional and local scale.

2 In summary, there will be traffic-related benefits from the Project and also increases in economic activity generated by the Project during both its construction and operation for the local north Rodney area and the Auckland and Northland regions. This letter also considers the Project's business redistribution effects as a consequence of the new alignment of State Highway 1 (*SH1*).

ANALYSIS FRAMEWORK

Viewpoint for economic assessment

3 An essential first step in carrying out an evaluation of the positive and negative economic effects of a project is to define the appropriate viewpoint that is to be adopted. Defining the appropriate viewpoint helps to identify which economic effects are relevant to the analysis. Typically a city (district) or wider regional viewpoint is adopted and sometimes a nationwide viewpoint might be considered appropriate.

4 For the Project, the local north Rodney area (consisting of Pūhoi and Warkworth and the communities located east of Warkworth including Leigh, Omaha, Sandspit, Snells Beach and Mahurangi East) and the Auckland region are the most relevant communities of interest, because the economic (and other) effects of the Project will largely (but not solely) impact on their residents and businesses.

5 The wider Auckland-Northland region is also a relevant community of interest, given the road will create significant transport improvements for businesses and communities across these two regions.

6 Because of its scale and the nature of SH1 being of regional and national importance, the national economic effects of the Project are also relevant.

With and without analysis

7 To analyse the economic effects of the Project, two forward looking scenarios need to be compared ('with Project' versus 'without Project'), rather than a 'before' and 'after'

comparison. This means the proper baseline for evaluating future economic (and non-economic) effects of the Project are the future volumes of traffic on the existing road network without the Project, not current traffic volumes.

POSITIVE ECONOMIC EFFECTS OF PROJECT CONSTRUCTION AND OPERATION

Summary

8 During the Project's five year construction period (2016-20 inclusive) the construction activity will generate increases in expenditure, employment and incomes in the Auckland and Northland regional economies and the local north Rodney economy. As a consequence there are likely to be improvements in the economic welfare of Auckland, Northland and north Rodney businesses and residents from increased economies of scale, increased competition, reductions in underemployed or unemployed resources and/or improvements to central government provided services.

9 During the Project's operation there will be improvements in the economic welfare for Auckland and Northland businesses and residents (especially for those in the north Rodney area) as a result of savings in travel costs and increased economic activity generated by the Project.

10 The Project will help facilitate Auckland Council's current growth aspirations for Warkworth as a significant growth area in the north of Auckland by enabling additional population to be accommodated in Warkworth without significant increased traffic congestion, increased travel times and decreased trip time reliability on and adjacent to SH1. This growth will assist Warkworth to achieve "critical mass" such that it can achieve economic efficiencies from economies of scale and scope.

Project construction

11 During the Project's anticipated five year construction period (2016-20 inclusive) there will be increased economic activity for Auckland and Northland, as a consequence of the additional expenditure, employment and incomes directly generated by the Project's construction and the indirect (or multiplier) expenditure, employment and incomes generated as a consequence of impacts on suppliers of goods and services to the Project and those employed on it.

12 From a national perspective the level of economic activity (i.e. expenditure, employment and incomes) is likely to be the same with or without the Project – if funds are not utilized for the Project they are likely to be utilized on an alternative NZTA project, even if in a different region in New Zealand. However taking an Auckland, Northland or more localised north Rodney perspective there are likely to be increased levels of economic activity as a consequence of the Project, since without it, the funds earmarked for it are likely to be used elsewhere on an alternative road construction project. Although specific details are not yet known, based on past projects, local firms will be engaged to provide goods and services to the Project, local residents are likely to be engaged to work on the Project and other local firms will in turn provide goods and services to these local firms and employees.

13 Economic impacts such as increases in business turnover, employment and incomes are not in themselves measures of improvements in economic welfare or economic wellbeing. However, there are economic welfare enhancing benefits associated with increased levels of economic activity. These relate to one or more of:

13.1 Increased economies of scale: Businesses and public sector agencies are able to provide increased amounts of outputs with lower unit costs, hence increasing profitability or lowering prices;

13.2 Increased competition: Increases in the demand for goods and services allows a greater number of providers of goods and services to enter markets and there are efficiency benefits from increased levels of competition;

13.3 Reduced unemployment and under-employment[1] of resources: To the extent resources (including labour) would be otherwise unemployed or underemployed, increases in economic activity can bring efficiency benefits when there is a reduction in unemployment and underemployment. The extent of such gains is of course a function of the extent of underutilized resources within the local economy at the time, and the match of resource requirements of a project and those resources unemployed or underemployed within the local economy; and

13.4 Increased quality of central government provided services: Sometimes the quality of services provided by central government (such as education and health care) are a function of population levels and the quality of such services in a community can be increased if increased economic activity maintains or enhances population levels.

14 It is reasonable to assume that any increases in economic activity as a consequence of increased road construction activity in Auckland (especially centres in the north of the region) and Northland from the Project will give rise to one or more of these four welfare enhancing economic benefits for local businesses and residents.

Project operation

Traffic benefits

15 The Project will lead to reductions in vehicle operating costs, travel times and accident costs and improvements in trip time reliability for through traffic and local traffic – i.e. local residents and businesses with trip origins and/or trip destinations within the north Rodney area. Trip time reliability improvements mean that less unproductive "buffer time" allowances need to be made to allow for longer trip times which may or may not eventuate. The traffic-related benefits of the Project are detailed in the Traffic and Transportation Assessment Report.

16 It is interesting to note that whereas some major infrastructure projects give rise to national and regional economic benefits, but localised (or "community") costs, the Project is anticipated to bring significant local economic benefits in addition to national and regional economic benefits. It is estimated that around 50% of trips on the new route will be by local traffic i.e. trips having an origin and/or a destination in Warkworth or the eastern beaches.[2] In addition local traffic, which continues to use the existing SH1 or roads intersecting with the existing SH1, will benefit from the Project in that there will be

[1] Underemployment differs from unemployment in that resources are employed but not at their maximum worth; e.g. in the case of labour, it can be employed at a higher skill and/or productivity level, reflected in higher wage rates.

[2] Source: An analysis of northbound traffic for the 2026 PM peak with the Project indicates 50% of trips on the new alignment are going towards Warkworth town centre and the eastern beaches (personal communication, Mr Andrew Bell, Further North Alliance).

lower volumes of traffic on the existing SH1 and therefore less congestion on these parts of the network.

17 For businesses, savings in vehicle operating costs, travel times and accident costs and improvements in trip time reliability result in increased productivity and improvements in business competitiveness. Businesses will benefit from:

17.1 Reductions in freight rates;

17.2 Increased labour productivity – e.g. travel time savings and improvements in trip time reliability for work-related trips free up employee time for other tasks;

17.3 Reduced capital costs – e.g. fewer truck and trailer units are required to perform the same number of trips in a given time period.

18 For residents the traffic related benefits of the Project will provide expenditure savings and the freeing up of time for other productive or leisure activities.

Increased Economic Activity

19 Improving the accessibility within north Rodney, Auckland and the Auckland-Northland region will increase the attractiveness of the local area and the regions for business and residential development. Therefore the Project is likely to result in increased levels of economic activity within north Rodney and the regions from greater employment and population growth. As discussed previously in relation to the Project's construction, increases in levels of economic activity are not in themselves measures of improvements in economic welfare or economic wellbeing. However, there are economic welfare enhancing benefits associated with increased levels of economic activity to the extent that they lead to increased economies of scale, increased competition, reductions in unemployment and under-employment of resources and improvements to services provided by central government.

20 These types of economic benefits arise at the local level. At the Auckland, Auckland-Northland region or national level, some of these benefits will only be transfers – i.e. the faster growth in business and residential development within north Rodney will be at the expense of slower growth elsewhere within Auckland, Northland or elsewhere in the country. This is with the exception of so-called "agglomeration economies" which refer to the beneficial effects of road improvement projects improving the accessibility within a local area, region or country and thereby effectively increasing the density and consequently the economic efficiency of urban centres.

Facilitating Warkworth's Growth as a Satellite Town

21 From an Auckland perspective the Project will help facilitate more extensive residential, industrial and commercial development in Warkworth. The current population of Warkworth of around 3,000 is anticipated to increase to 8,000 by 2040 in the non-statutory Warkworth Structure Plan 2004, whilst The Auckland Plan (*a plan for all Aucklanders te mahere a ta-maki makaurau - ma- te katoa o ta-maki makaurau*) (Auckland Plan) has identified Warkworth as one of two satellite towns (the other being Pukekohe), with a population of 20,000 expected to be accommodated in Warkworth by 2050, together with associated industrial and commercial development to provide local employment opportunities and to meet retail and other servicing requirements. This Warkworth growth scenario from the Auckland Plan has also been incorporated into the draft Auckland Unitary Plan, although it is acknowledged that the draft plan has not been progressed through the RMA process, so these policies are subject to change.

22 The Project will help facilitate Auckland Council's current growth aspirations for Warkworth as a significant growth area in the north of Auckland. This will assist Warkworth to achieve "critical mass" such that it can achieve economic efficiencies from economies of scale[3], scope and agglomeration.

23 Also to the extent that the Auckland Plan's higher population growth forecasts for Warkworth are achieved, the traffic-related benefits of the Project (i.e. savings in vehicle operating costs, travel time costs and accident costs and the improvements in travel time reliability) will be greater than those detailed in the base case results of the Traffic and Transportation Assessment Report, since the base case traffic analysis has used the lower Structure Plan Warkworth population forecasts.

Property Value Changes

24 For some property owners, the increase in attractiveness of the north Rodney area for business and residential development is likely to mean increases in property values. However this is likely to be largely a transfer effect from a broader regional or national perspective. To the extent that the Project increases the demand (and price) of properties for development within the north Rodney area, there will be lesser demand (and price) for properties elsewhere in Auckland.

25 Also, whilst the improved accessibility benefits for the occupiers of existing commercial and residential properties will exert upward pressure on these properties' values, these are a reflection of, not in addition to, the traffic related benefits already discussed above in paragraphs 15 to 18.[4]

BUSINESS REDISTRIBUTION EFFECTS

26 Whilst a small number of businesses on the existing SH1 that will be by-passed by the Project may suffer negative effects from reduced trade due to reductions in passing traffic, the Project will not result in significant business redistribution effects. For some businesses the removal of through traffic on the existing SH1 may enhance business opportunities by improving customer accessibility.

27 Generally under the RMA, retail or business redistribution effects are not relevant insofar as they impact on individual competitors. Such impacts are only relevant under the RMA to the extent they are of such significance that they threaten the public amenity values (e.g. critical mass, sustainability, vibrancy and vitality, etc.) of city, town or suburban centres.[5] Amenity considerations are dealt with in the Assessment of Environmental Effects. However my view is that any impacts on businesses resulting from the Project would be unlikely to have recognisable effects on critical mass, sustainability, vibrancy and vitality, given that negative business redistribution effects will occur for only a small

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[3] E.g. in the provision of infrastructure and social services.

[4] In the same way any negative effects on property values as a consequence of, for example, visual, noise or severance effects of the Project are a reflection of these intangible effects and are not in addition to these effects. Any potential change in property values does not materialise unless and until an owner sells the property. At this point there is a potential wealth loss to the seller, but no ongoing environmental effects to be borne by the seller. The purchaser of the property gains by potentially having to pay a lesser price for the property but incurs the costs of the ongoing intangible effects. These intangible effects are covered in other technical reports.

[5] See *Eldamos Investments Limited v Gisborne District* Council (EnvC W047/2005, 22 May 2005) at paras 217-235; *General Distributors Limited v Waipa District Council* (HC Auckland CIV-2008-404-4857, 19 December 2008) at para 93; and *Discount Brands Limited v Westfield (New Zealand) Limited* [2005] 2 NZLR 597 (SC) at paras 8-17.

number of businesses and negative effects will also be offset by new business and economic growth elsewhere.

28 The Project is not an investment by a competitor in retail or other businesses within city, town or suburban centres, but may nonetheless have a negative impact on the economic wellbeing of some local businesses dependent to some degree on the passing motorized trade along the existing SH1 alignment.

29 Before considering any such businesses that will be 'by-passed' or impacted by the new motorway, there are a number of general comments to be considered:

29.1 From an Auckland and Auckland-Northland regional viewpoint, the Project will not reduce the overall level of business activity – indeed the improvements in accessibility to, from and within the regions brought about by the Project will be likely to increase the overall level of business activity within the regions as a consequence of increased competitiveness for local businesses and an increase in the regions' attractiveness to live in or visit. Therefore, any losses in trade for individual businesses will be offset by increases in trade for other businesses.

29.2 Business transactions involve transactions between suppliers and consumers. Where consumers change their destination purchasing patterns, there are likely to be benefits to them as well as to the suppliers who gain trade. Such benefits should not be ignored by focussing only on suppliers who lose trade.

29.3 Lost sales revenue greatly overstates the "bottom line impact" on business suppliers. It is really only lost profits, which are likely to be considerably less than lost sales revenue, that are the cost impact on suppliers who lose business. Over time, businesses will react to their new business environment to minimise such lost profits by downsizing, changing their offering or by relocating.

29.4 Even without the Project, businesses must address changing business conditions and their future viability is not assured.

29.5 In some instances, property purchases by the NZTA will include a component for lost future business profits, and these business owners will therefore be compensated.

29.6 Competing businesses will be similarly disadvantaged. For northbound traffic, there will be no direct access from SH1 along the length of the highway from the Dairy Flat service centre to north of Warkworth. For southbound traffic this will be the case from north of Warkworth to the Papakura motorway service centre. Motorists will be forced to leave the highway to purchase fuel or food for example, along these entire lengths of the SH1 motorway. In the case of accommodation and goods and services other than fuel and food there will be no outlets with direct access off the SH1 motorway (or expressway) for much greater lengths.

29.7 Over time growth in business sales (as a result of population and household growth and increases in real per capita and per household expenditure) will help to offset any reductions in sales for some individual businesses as a consequence of the Project.

30 From my drive by assessment of the businesses along the existing SH1 (and on side roads to the existing SH1) from Pūhoi to north of Warkworth, it appears that the

businesses that are dependent to varying degrees on the passing motorised trade and therefore will be affected by the Project reducing traffic volumes on the existing SH1 are: the Honey Centre (incorporating a café, a retail outlet for honey related products and a display of a live bees and honey product manufacturing), the Wooden Wheel toy shop, a winery incorporating a café, an art gallery, a motor lodge in Warkworth, a number of bed and breakfast establishments and some fresh fruit stalls. There are other businesses on or near the existing SH1 (e.g. a golf driving range and indoor sports centre, a timber merchants and a concrete products sales yard) but in my assessment these other businesses are not particularly dependent upon impromptu visits of the passing motorised trade but are instead reliant on planned 'destination' trips by the local resident or business population.

31 So far as the businesses within the Warkworth town centre are concerned, they are already bypassed by SH1 and most of the trade for these businesses is not significantly reliant on the existing SH1 passing motorised trade. Vehicles travelling to and from the eastern beach settlements will continue to pass through Warkworth. Also in reducing congestion along existing SH1 and on roads intersecting with existing SH1, the Project will improve local residents' access to and from the Warkworth town centre.

32 To the extent that the Project facilitates greater residential, industrial and commercial growth in Warkworth (and the surrounding area including the eastern beach settlements), and greater numbers of visitors to or passing through north Rodney, the Project is likely to generate additional trade for these businesses. Also during the Project's construction there is likely to be additional turnover for some businesses (e.g. cafes, fast food outlets, etc.).

CONCLUSION

33 In my view (supported by the Traffic and Transportation Assessment Report) the Project will:

33.1 Contribute to national, regional and local area economic growth and productivity;

33.2 Improve the reliability of the transport network between Auckland and Northland;

33.3 Reduce congestion and travel times on SH1 between Pūhoi and Warkworth and the surrounding road network; and

33.4 Improve road safety and travel time consistency.

34 I also consider that the Project will:

34.1 Increase economic activity during the Project's construction and operation;

34.2 Reduce vehicle operating costs, travel time costs and accident costs and improvements in trip time reliability for through traffic and local traffic;

34.3 Improve road network resilience; and

34.4 Help facilitate the Auckland Council's current urban growth aspirations for Warkworth.

The Project will have negative business redistribution effects for a small number of businesses that will be bypassed as a consequence of the new alignment for SH1.

Overall I consider the net economic effects of the Project are positive and significant at a national, regional and local level.

Yours sincerely

Michael Copeland

Brown, Copeland & Co Ltd

Appendix D. Natural Stream Management Area analysis at Carran Road / Woodcocks Road

Memo

12 July 2013

To: Auckland Council
Attention: Sarah Haarhoff

From: Tristan Gielen Planner and Karyn Sinclair Planning Manager Further North

NATURAL STREAM MANAGEMENT AREAS

Introduction

The Further North Alliance has established that an area of the proposed designation for the Ara Tūhono Puhoi to Warkworth roading project (the Project) is noted as an indicative Natural Stream Management Area (NSMA) on the Auckland Council Regional Plan: Air Land and Water Plan (ALWP) map series. The relevant area is located to the north of Woodcocks Road and running parallel to Carran Road (the Indicative Area). The map identifying this Indicative Area (refer Map Series 1 Map 7 ARP:ALW) is enclosed as Attachment One.

As explained below, it is our view that the Indicative Area is not in fact an NSMA (based on the ALWP's definition of NSMAs).

We seek confirmation that the Auckland Council agrees with our assessment, as this will assist in determining the consent status of certain aspects of the Project.

Relevant ALWP provisions

Map is indicative only

The ALWP is clear that NSMAs shown in Map Series 1 are indicative only and that the criteria in Section 3.4.2 are the definitive reference for whether a site falls within an NSMA. The Legend to the map series notes

> *"Natural Stream Management Areas lines are indicative only. Where there is uncertainty over the extent or location of any Natural Stream Management Area, it shall be determined by reference to the criteria in Section 3.4.2 of Chapter 3: Management Areas.*

NSMA definition

The definition of Natural Stream Management Area in 3.4.2 of the ALWP is:

> *"Any **Permanent river or stream**, outside of the **Urban Areas** as defined in the Auckland Regional Policy Statement, with **predominantly indigenous vegetation** cover along a length (reach) of not less than 600 metres; and*
>
> > *(a) an average total width of vegetation cover of 80 metres (i.e. an average width of 40 metres on either side); and*

(b) a minimum total width of vegetation cover of 10 metres from the stream edge, for a length not exceeding 10 percent of the total reach.

Where there are cleared areas for tracks and stream crossings, these are included in the measurements of vegetation length and width.

NB: A Natural Stream Management Area may be determined from measurements taken from an aerial photograph or an accurately scaled plan.

*See Chapter 12: Definitions for definition of "**Predominantly Indigenous Vegetation**".*

Predominately Indigenous Vegetation is defined in Chapter 12 as follows:

> *"For the purpose of the **Natural Stream Management Areas**, predominantly indigenous vegetation means areas of vegetation where the canopy is intact and is dominated by indigenous species, and contains a regenerating understory. It includes stands of predominant kanuka and manuka, and areas of wetland vegetation. It can include areas with exotic species in the canopy or emergent above the canopy, as long as they do not comprise more than 25 percent of the canopy composition."*

We also note that Section 3.4.2 states that, in some areas, indigenous vegetation extends beyond 40 metres from the stream channel and that this vegetation does not form part of the NSMA. Section 3.4.2 also notes that the criteria are based on several pieces of research which indicate that 600 metres in length and 40 metres either side of the stream channel is the minimum area of indigenous vegetation required to re-establish high quality freshwater ecosystems.

As explained below, our analysis concludes that the Indicative Area does not meet the Section 3.4.2 criteria and is therefore not an NSMA.

Terrestrial ecologist site visit

The Further North Terrestrial Ecologist, Jenni Shanks of Bioresearches, has recently undertaken a site visit of the Indicative Area. She entered the site to the north west of the proposed designation. Her observations are as follows:

> *I visited the site on 28/06/2013 and walked the riparian vegetation on the true left of the river. This vegetation comprised second growth totara and kanuka. There is an area of exotic trees on the true right bank in the southern part and some of these have been recently felled. The true left bank was grazed and there was no understorey along much of the river where the canopy was only 1 – 2 trees wide in the northern part. There are wider areas of native vegetation with a sparse understorey of seedling thin-leaved coprosma (Coprosma areolata) in the southern part. There are significant infestations of Wandering Jew in places and tree privet is present also. On the true right of the river the tree canopy is also narrow in many places although there is stand of kahikatea in the northern part and a small area in the southern part that is wider and has a more intact understorey of nikau, hangehange, mapou and thin-leaved coprosma. The botanical values of this vegetation are low to moderate.*

There are a number of shelter belts along the true right bank as shown in the aerial (refer Attachment Two). These are poplars and Ms Shanks has confirmed that some immediately along the river bank have been felled recently.

Our Analysis

Out analysis is based on review of the aerial (attachment two) in conjunction with the definition, and further consideration given the Terrestrial Ecologist's site visit and observations. Furthermore, the discussion is based on the lower extent of the NSMA (as shown on the Map series 1 Map 7), as this is the area where the proposed designation will be located.

A desktop exercise based on taking measurements from an aerial photograph dated (refer to Attachment Two) was undertaken to determine whether the Indicative Area is an NSMA, and therefore subject to the relevant ALWP provisions in this regard.

On the basis of the desktop assessment undertaken, it clear that the criteria contained within the definition of NSMAs in the ALWP are not met. Specifically:

- The area of popular is approximately 294 metres in length – which is 25% of the stream length within the NSMA
- The average of 40 metres either side is not met (25 % of the NSMA has no vegetation on the true right bank

Conclusion and next steps

We consider that, although the NSMA is shown on Map Series is not in fact an NSMA as it does not meet the ALWP's definition of a NSMA. This is on the basis that the Indicative Area does not comprise a sufficient average width of 40 metres nor does it achieve more than 10m cover for 10% of the length.

We would appreciate the Auckland Council's confirmation that the Indicative Area does not meet the definition of an NSMA and accordingly the ALWP rules relating to NSMAs do not apply to that area. We are happy to discuss this matter with you.

Regards

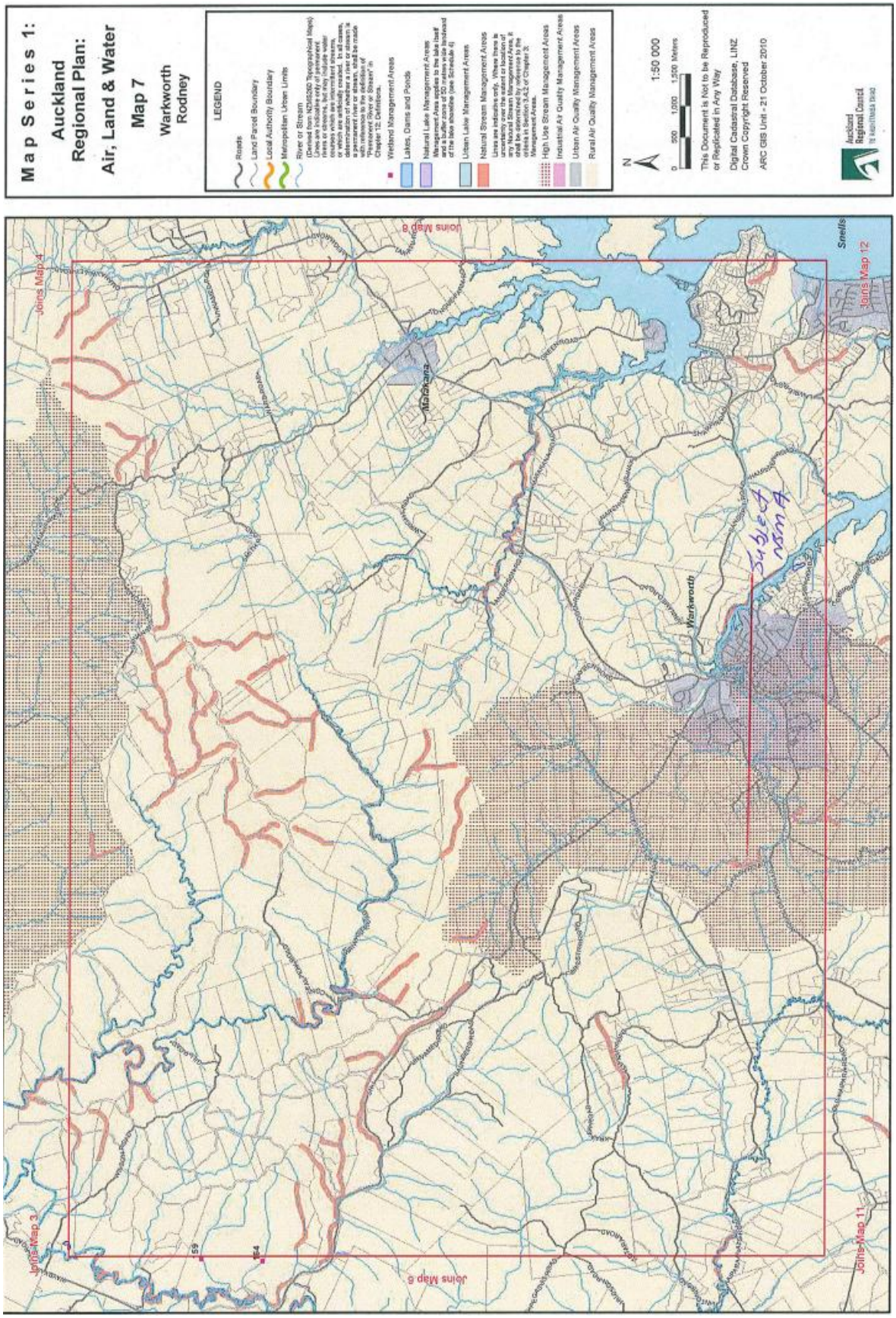
Karyn Sinclair

Planning Manager
Further North

Attachments

Attachment One: ALWP Map Map Series 1, Map 7

Attachment Two: Annotated aerial photograph


Map Series 1:
Auckland Regional Plan:
Air, Land & Water
Map 7
Warkworth
Rodney
LEGEND
Roads
Land Parcel Boundary
Local Authority Boundary
Metropolitan Urban Limits
River or Stream
Wetland Management Areas
Lakes, Dams and Ponds
Natural Lake Management Areas
Urban Lake Management Areas
Natural Stream Management Areas
High Use Stream Management Areas
Industrial Air Quality Management Areas
Urban Air Quality Management Areas
Rural Air Quality Management Areas
1:50 000
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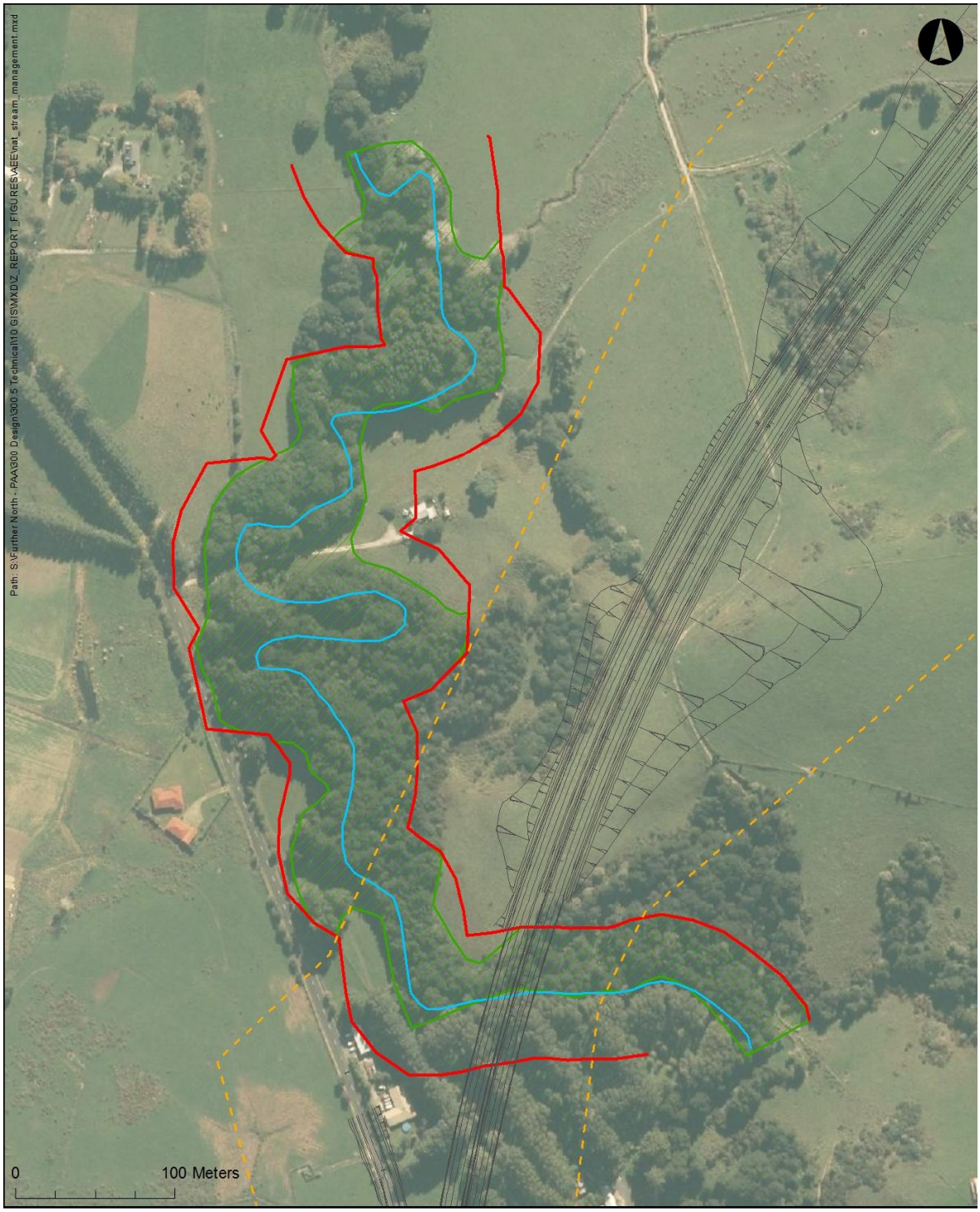
Auckland Regional Council
Joins Map 4
Joins Map 8
Joins Map 3
Joins Map 6
Joins Map 11
Joins Map 12
Warkworth
Snells
Subject area



Indicative Alignment
Proposed Designation
40m buffer from stream
Approximate stream alignment
Area of predominately indigenous forest within 40m of stream

From: Sarah Haarhoff [mailto:Sarah.Haarhoff@aucklandcouncil.govt.nz]
Sent: Thursday, 18 July 2013 10:01 AM
To: Sinclair, Karyn (Further North)
Cc: Matt Byrne
Subject: Re: 200.1 AC NSMA memo 120713

Hi Karyn,

We have reviewed the attached and based on our understanding of the information provided we can confirm that we are supportive of your interpretation of the Regional Plan (ALW) as it relates to the project and 'Natural Stream Management Areas'.

If you have any further queries, please let me know.

Kind regards,

Sarah

Sarah Haarhoff
Senior Planner - Major Infrastructure Team

Projects, Practice & Resolutions Unit

09 301 0101 | Extn (40) 5629| DDI 09 352 2629

Auckland Council, Level 2, 35 Graham Street, Private Bag 92 300, Auckland 1142

Visit our website: www.aucklandcouncil.govt.nz

From: Sinclair, Karyn (Further North) [mailto:kxsinclair@furthernorth.co.nz]
Sent: Friday, 12 July 2013 11:37 AM
To: Sarah Haarhoff
Subject: 200.1 AC NSMA memo 120713

Hi Sarah

As mentioned in our earlier phone conversation, please find attached our thinking on the NSMA in the Woodcocks Road area. The PDF attachment one shows the ALW plan map with the NSMA marked.

I look forward to hearing from you and as mentioned, am happy to discuss our interpretation with the relevant staff member.

Regards

Karyn Sinclair

Planning Manager

Further North

T: 64 9 928 5779 | M: 021814463

E: kxsinclair@furthernorth.co.nz

Level 2, Carlaw Park, 12-16 Nicholls Lane, Parnell, PO Box 9806, Newmarket, Auckland

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Appendix E. Stakeholder list

Educational

Auckland Kindergarten Association

Ahuroa School

Mahurangi College

Warkworth Primary School

Leigh School

Kaipara Flats School

Matakana School

Warkworth Kindergarten

Pakiri School

Rodney College

Snell's Beach Primary School

Tomarata School

Wellsford School

Mahurangi Christian School

Living Way Christian School

Lifeway College

Kowhai Kids Educare

Montessori Small Steps Preschool Ltd

Totara Hill Montessori

Local authorities

Auckland Council

Far North District Council

Whangarei District Council

Kaipara District Council

Northland Regional Council

Auckland Transport

Tourism

Destination Northland

Enterprise Northland

Walton Park Motor Lodge

Hungry Creek Bed and Breakfast

Kauriglen Lodge Pūhoi

Warkworth Lodge

Warkworth Country House

Bridgehouse Lodge

Castle Court Motel

The Retreat

The Ridge Country Lodge

Sun Valley Motel

Wellsford Valley B&B

Whangarei i-site

Warkworth i-site

Orewa i-site information centre

Sheep World Caravan Park

Sheep World

Honey Centre

Road users

Automobile Association (AA)

National Road Carriers

Heavy Haulage Association

Bus & Coach Association

NZ Police

Warkworth Police

NZ Fire Service

Auckland Council Rural Fire Authority

St John Ambulance

Auckland Cycle Group

Cycling Advocates' Network

The Campaign for Better Transport

Bikers' Rights Organisation of NZ (BRONZ)

Gubbs Motors

Government and Non-Government Agencies

Environmental Protection Authority (EPA)

KiwiRail

Ministry of Transport

Housing NZ

Ministry of Education

Department of Conservation

Historic Places Trust

Ministry of Business, Innovation and Employment

Auckland Policy Office (formerly GUEDO)

Auckland Conservation Board (DOC)

Hauraki Gulf Forum

The Tree Council

Forest and Bird

SADD

Grey Power

Fish and Game

NZ Deerstalkers Association

NZ Council for Infrastructure Development

Business

Auckland Chamber of Commerce

Northland Chamber of Commerce

Auckland Business Forum

Northland Inc

Northport

Federated Farmers

Goodman Fielder

Hopper Construction

Wharehine Group

Bayleys Warkworth

Ray White Warkworth

Barfoot and Thompson Warkworth

LJ Hooker Warkworth

Harcourts Warkworth

United Warkworth

Hungry Creek Art & Craft School

Cheese on Wheels

Southern Paprika Ltd

Matariki Forests Ltd

Perrendale Holdings

Fernwood Farms

Asia Pacific International Group (NZ) Ltd

Ckouri Enterprises Ltd

Springhill Estate Ltd

Ransom Wines

Top of the Dome Cafe

Community

Exclusive Brethren

Rural Women New Zealand

Pūhoi Historical Society Inc

Pūhoi Community Forum

Pūhoi & Districts Motorway Action Group (PADMAG)

Matakana Business Group

Wellsford Promotions Association

Waiwera Valley Association Inc

Warkworth Area Liaison Group (WALG)

Warkworth Interchange Group (WIG)

Sandspit Residents Association

Matakana Coast Wine Country

Snells Beach Residents' and Ratepayers' Association

Matakana Community Group

Matakana Coast & Country

Leigh by the Sea

Omaha Beach Community Inc

Orewa Residents & Ratepayers Association

Point Wells Residents

Algies Bay Residents

Scotts Landing/Mahurangi East Residents

Age Concern Rodney

Rainbows End Ratepayers Association

Mahurangi East Residents and Ratepayers Association

Mahurangi West Improvement Society

Whangateau Residents and Ratepayers Association (Inc)

Mahurangi West Ratepayer Association

Matheson Bay Neighbourhood Association

Tomarata Residents' and Ratepayers Association

Baddeleys Beach - Campbells Beach Ratepayers' Association

Buckletons Beach Ratepayers' and Residents' Association

Wellsford Citizen's Advice Bureau

Whangarei Citizen's Advice Bureau

Pūhoi Landcare

Utilities

Chorus

Transpower New Zealand Ltd

Vector Ltd (electricity, gas and communications)

Telecom New Zealand

Vodafone

Refining NZ

Watercare

Appendix F. Social assessment

Purpose of the assessment of social effects

The purpose of the assessment of social effects of the Project is to inform the NOR and associated AEE during the construction and operational phases of the Project.

The assessment includes:

- A social impact assessment (SIA) framework derived from recognised international and national principles and standards (see Table 29-1)[136];
- Identification of the social study area and development of a demographic profile to provide an understanding of the existing social characteristics and conditions of the study area (social baseline);
- A review of the consultation and engagement process to identify social issues and community concerns;
- Identification of social effects against our SIA framework at both a regional and local level; and
- Identification of appropriate mitigation, avoidance or remediation and management strategies.

Project study area

The Project study area for the assessment of social effects is divided into:

- The sub-regional study area, being the area north from the Johnstone's Hill tunnels to the Dome Valley, and from Kaipara Flats to the coastal communities of Leigh, Matakana, Omaha, Sandspit, Algies Bay and Snell's Beach. This area includes Warkworth; and
- The local study area, being the area included within Census meshblocks traversed by the proposed designation and the Warkworth census area unit. This area includes Pūhoi.

Methodology

Summary of methodology

The principal steps in the preparation of this assessment of social effects for the construction and operations phases of the Project are as follows:

1. Scoping, which included:
    - review of relevant literature to inform the development of our assessment framework;

[136] Vanclay F, 2003, *SIA Principles: International Principles for Social Impact Assessment*, in Impact Assessment and Project Appraisal, Vol 21 No 1, Beech Tree Publishing, Surrey

Quigley R and Fitzgerald C, 2012, *Standard for social impact assessment of state highway projects*, Draft v6.1, NZTA, Wellington

- review of the Project indicative design and location to identify local and regional communities along and adjacent to the proposed designation; and
- development of a framework for assessing potential social effects.

2. Profiling of communities within the study area to establish an existing social baseline, using the 2006 Census, and Auckland Council community profiles.
3. Identification of potential social effects, through a review of the community engagement and consultation process from a social perspective.
4. Effects assessment, through an evaluation of the potential positive and adverse social effects arising from the Project.
5. Mitigation and management measures, including:
   - identification of potential avoidance, remediation or mitigation options in relation to adverse social effects; and
   - identification of any future work required from a social perspective, to address risks and uncertainties during the construction and operational phases.

Project phases

The three Project phases adopted for this assessment are:

- the planning and consenting phase;
- the construction phase; and
- the operational phase.

Scoping of effects framework

The impact scoping framework developed for this Project is shown Table F1 in as follows:

Table F1: Assessment framework

IAIA criteria	Effects parameters
Way of Life	Accessibility, barriers and diversions
	Connectivity and choice of mode
	Patterns of living and mobility
	Changes to pedestrian and cycling
	Changes to public transport
Community	Community cohesion
	Identified communities
	Schools
	Community facilities

IAIA criteria	Effects parameters
	Business activities
	Recreational facilities
	Historical and cultural facilities
Health and Wellbeing	Changes to wellbeing
	Personal safety and averting behaviours
	Exposure to noise
	Exposure to discharges to air
	Public safety and risk
Personal and Property Rights	Uncertainty and construction timing
	Relocation
	Effects on properties
Fears and aspirations	Wider community
	Localised community

Way of life considerations primarily relate to the ability of people to access their community, activities and services in a manner which maximises their social welfare. Maintenance of connectivity and mobility is an important component of the ability of people to establish and maintain social networks and quality of life. Changes in the ability to access different modes of transport and the ability to engage in active transport options can affect local connectivity and mobility. There may be short-term construction related effects around perceptions of traffic safety and risk that change community access to connect with wider social networks.

Community considerations relate to the effects that a project can have on community cohesion and the way in which people identify and interact with a local community. Community cohesion can be affected by the loss of community members through property acquisition, or where community members decide to relocate to avoid the actual or potential adverse effects of project construction and operation.

Community effects can also be experienced where demand for particular community facilities and services changes as a consequence of the Project, both in the short-term construction phase and the long term operational phase. Community facilities may need to cope with an influx of workers and their families during construction, or during the operational phase they may need to expand or reconfigure their services to deal with the induced demand generated by greater accessibility and population and employment growth.

There may also be short–term effects on community facilities associated with construction traffic, traffic noise and vibration, and changed traffic flows during the construction period.

Social effects on health and well-being are generally associated with the compounding effects of noise, vibration, exposure to air pollution (eg dust generation), and changed traffic movements in both the construction and operational phases. For some people changes in the physical setting of a place, (eg access, landscapes or the introduction of a workforce), can induce stress or a sense of dislocation. For other people, such change is taken as evidence of progress and prosperity and is welcomed, leading to an enhanced sense of well-being.

Effects associated with private property rights and aspirations are generally felt during the planning phase, but may also be manifested during the construction and operational phases. The primary social impact concerns relate to:

- effects on health due to the stress associated with uncertainty and the property acquisition process,
- concerns about the ability to find a replacement property that fulfils the same amenity values currently enjoyed; and
- the need to develop new social networks if people are relocated is to a site significantly removed from their current community and networks.

Existing social environment

Summary – demographic profile

The overall character of the Study Area is rural and has a low population density. Warkworth is consistent with the character and density of a rural service town, while Pūhoi is consistent with the form and density of a rural village. The Study Area consists largely of farms, forestry and lifestyle blocks, with occasional industries and tourist businesses. The former Rodney area in general experienced high levels of population growth (an increase of approximately 30%) over the period 1996 to 2006. This trend is expected to continue.

The median age of residents within the Study Area was older than the median for the Auckland Region with a high proportion of the population aged over 65 years, especially within Warkworth. The proportion of the population aged 50 years or more increased between 1996 and 2006. This trend may be associated with the appeal of the lifestyle blocks within the Project area.

Family structures are characteristic of a growing population. For example, families of ‘Couples with children’ were the most significant family type in the local board area. This cohort is closely followed by ‘Couple only’ households, which is consistent with the age structure and the number of people within retirement age, particularly in Warkworth.

The degree of ethnic diversity in the Study Area is lower than in the Auckland region, with the predominant ethnic group comprised of people of European heritage (approximately 80% compared with approximately 57% for Auckland). Personal income levels are comparable with those for the Auckland regional population, although there is a slightly higher proportion of people on lower than median incomes. Again, this trend is indicative of a population with a significant older population.

The proportion of people participating in the workforce was comparable with the Auckland region as a whole, as was the proportion of people engaged in full-time work. Relative to the Auckland regional population, the workforce is made up of more managers, technical and trades people and labourers, but proportionally fewer professional, community, administration and sales workers.

The principal mode of transport to work place across the whole study area is the private motor vehicle. The use of public transport is negligible. The area is not well serviced with public transport or active transport facilities.

Pūhoi

European settlement in the Pūhoi area began in 1863 with a group of immigrants from Bohemia who were followed by a second group in 1866. This history defines its character, and the village is a destination for a unique cultural and recreational experience. The settlement beyond the village is rural, centred on forestry, farming, lifestyle blocks and small-scale home businesses. A pocket of more contemporary and intensive residential activity has established in the bow of the Pūhoi River to the east of the historic commercial core (around Pūhoi Close and Slowater Lane).

The Pūhoi community is characterised by its high level of cohesion and identity deriving from the scale of the place and its population, as well as its history of settlement and the presence of Ngā Pā o Te Hēmara Tauhia adjacent to the village. Community cohesion is also evidenced by the range of active community groups.

Pūhoi is not identified as a growth node from a regional perspective. In the Auckland Plan (2013), Pūhoi is considered a rural and coastal village (unserviced).

Warkworth

Warkworth is the largest urban centre within the Study Area, with a resident population of 3,270 in 2006. Assuming growth trends have been maintained, the estimated resident population is now approximately 4,030. Warkworth is a thriving service town that contains a wide range of retail, commercial, and community facilities and services. It acts as a commercial centre for the surrounding rural communities and as a gateway for the coastal communities at Leigh, Omaha, Whangateau, Tawharanui, Algies Bay, Snell's Beach and Sandspit.

Warkworth enjoys an identity as a service centre and demonstrates strong community cohesion through the activities of numerous business associations, service clubs, community networks, sporting and recreational clubs. Community consultation activities undertaken in Warkworth have all been well attended with participants demonstrating a keen interest in the Project, its potential benefits and impacts on their community, and the community's future generally.

Planning for the Auckland region anticipates that, with the timely provision of infrastructure, Warkworth will accommodate substantial residential and employment growth. Warkworth is forecast to grow to a population of 20,000 over the next 30 years, with a balance of houses to jobs close to 1:1 and with strong, accessible, diverse and enhanced centres.

Rural Residential Communities

Rural residential and other forms of lifestyle properties are clustered along Moirs Hill Road, Perry Road, Wyllie Road, Viv Davie-Martin Drive and Valerie Close, as well as the communities of Mahurangi West off SH1.

The Moirs Hill Road area provides for a number of lifestyle blocks of varying sizes and configuration. While still a small community, this area experienced considerable growth between 1996 and 2006 as people sought alternative lifestyles to those available either in urban areas or larger-scaled farming areas.

The Mahurangi West area is serviced by the Mahurangi West Road and Cowan Bay Road. It is characterised by larger lifestyle blocks which enjoy high scenic amenity. The convenience of these blocks at present is constrained by having access only via SH1, with its challenging traffic conditions.

Perry Road is a discrete community comprised of a combination of lifestyle blocks, small agricultural holdings and the aquaculture site. The area is characterised by a pleasing but highly modified landscape with geometric plantings of introduced vegetation. Perry Road is a no exit road off SH1, with high scenic amenity contributing to a strong sense of local community identity.

The community at Wyllie Road derives its access off Woodcocks Road, which connects to SH1 at Warkworth. A number of rural residential properties sit on elevated land, and are orientated to take advantage of extensive views over the valley below, Warkworth and out to the Hauraki Gulf. Woodcocks Road itself forms part of the local roading network that services the Kaipara Flats communities west of Warkworth. Carran Road provides a link between Woodcocks Road and Kaipara Flats Road.

A conventional rural residential community is situated on the northern edge of Warkworth at Viv Davie-Martin Drive (which is a no-exit road ending in a cul-de-sac), and accessed from Falls Road. Most of the sites in the subdivision lie on the reverse slope from the proposed motorway. Being a relatively recent subdivision, not all sites have been developed with housing. Three dwellings have direct views into the valley to be traversed by the motorway.

Summary – community consultation

A comprehensive summary of the consultation process for the Project is presented in Section 8 of this AEE. The consultation programme implemented to this point in the Project has spanned across three distinct phases and is now in a fourth phase. The formal notification process associated with the lodgement of the Notice of Requirement and applications for resource consents will mark the commencement of the fifth phase of consultation. The consultation phases were implemented as follows:

- Phase 1 – to raise awareness of the Project and to inform the development of corridor options;
- Phase 2 – to inform the route selection process and to update the community on progress with the early planning work;

- Phase 3 – to inform design development for the scheme assessment report and identification of a preferred route; and
- Phase 4 – to inform further design refinement and the preparation of the AEE

An indication of the relative sensitivities for a wide range of issues identified particularly during phases one to three of the consultation process is presented in Table F2 below. Many of the planning and design issues have been resolved through the iterative design process, as community inputs informed design development. Other issues, such as the environmental concerns, are addressed elsewhere in this AEE through a combination of design, construction and operational management measures, and ultimately, the conditions to be imposed on the designation and the resource consents.

Table F2: Issues identified in consultation

Issues / Sensitivity		Regional Interests	Local Interests					Other Interests
●	High sensitivity		Pūhoi	Moirs Hill / Perry Rd	Wyllie Rd / Carran Rd	North Warkworth	Warkworth	
◐	Moderate sensitivity							
○	Low sensitivity							
◯	Little or no sensitivity							
PLANNING & DESIGN								
Investment in road infrastructure		●	◐				◐	●
Funding mechanism (eg tolling, other)		◐	○				○	◐
New, off-line route bypassing centres and businesses			◐	○			◐	
Provide partial upgrades to SH1 (Warkworth bypass)		◐					◐	
Provide local connections to new route			●				●	
Location of possible local connections to new route			●	◐			●	
Provide a 'Matakana link' as part of Project		●				●	●	●
Upgrade Hill St intersection (Warkworth)							●	
Local traffic planning (Western Collector Warkworth)							◐	
Property impacts			●	●	●	●		
Impacts to local businesses			◐	◐			◐	◯
Maintaining access to local roads			◐	●	●	◯	◯	
Impacts on ecological, landscape or conservation values		◐	◐	◐	◯			◐
Cultural heritage			●		○	○		

Impacts on environmental amenity & rural lifestyle		●	●	●	●		
CONSTRUCTION							
Direct effect of construction activities (air, noise)		●●	●●	●●	●●	○	
Construction traffic		●●	●●	●●	○	●	
Impacts on heritage places (cultural, historic)	○	●					●
Soil erosion and sedimentation impacts on water quality	●	●	○			●	●
Impacts on terrestrial ecology	○						●
Impacts on freshwater ecology	○		○				●
Impacts on marine ecology	●						●
Effects on landscapes	●	●	●	●	●		
OPERATION							
Timing (eg likely commencement date)	●	●●	○	○	○	●●	●
Direct effects of operations (air, noise)		●●	●●	●●	●●	◯	
Impacts on water quality		○					●
Funding (eg tolling)	○	○	◯	○	◯	●	○
Local traffic effects (eg changed traffic flows)					○	●	

Regional assessment of social effects

This Project will deliver positive effects on accessibility and connectivity. These positive effects are generally as follows:

- Greater journey time reliability and network resilience for traffic flows on an inter-regional basis between Northland and the Auckland metropolitan area;
- An improvement in traffic safety for trips between Auckland and Warkworth, with consequential reductions in crash rates and fatalities;
- An improvement in access for people in the former Rodney area to tertiary services (employment, health, education, personal and professional services, entertainment and recreation) in Auckland;
- A potential increase in the availability, frequency and timeliness of public transport connections between Warkworth and the North Shore, Albany and the Auckland metropolitan area; and
- Maintenance of current levels of connectivity during the construction phase by using an off-line route.

At a sub-regional level, patterns of living, convenience, transport safety and mobility are expected to benefit from delivery of this Project. Community networks presently constrained by traffic conditions on SH1 will freed up as inter-regional traffic including freight moves from SH1 to the new route. The effects of the Project on community cohesion are expected to be slightly positive as people are able to move around the sub-region more freely and more safely. The off-line indicative alignment to the west does not adversely affect the major areas of population and built development within the former Rodney area.

Careful management will be required in proximity to Mahurangi College to avoid effects associated with construction traffic on Woodcocks Road. However, none of the schools within the former Rodney area are adversely affected by the operation of the Project. Both Warkworth Primary School and Mahurangi College will benefit from the redistribution of traffic from the current SH1 alignment, Woodcocks Road, Hill Street, and respective intersections to the new route. These effects are likely to be positive (in terms of traffic volumes on Woodcocks Road and SH1, and reduced traffic noise and emissions).

Traffic management during construction will be required to avoid, or mitigate and manage potentially adverse, construction related traffic effects on Woodcocks Road, and redistribution of traffic on Hill Road.

At the sub-regional level the effects on business activity are expected to be positive, with flow on effects in terms of employment and business viability.

Recreational facilities or assets are not adversely affected by the indicative alignment or proposed designation footprint. They will benefit from redirected or reduced traffic flows in the vicinity, or enhanced accessibility in the case of the Showgrounds given its proximity to the northern tie-in. The Project is also likely to enhance opportunities for wider utilisation of these facilities by improved accessibility at the regional or sub-regional level.

At the sub-regional level the actual or potential effects of the Project on community health and well-being are expected to beneficial as a consequence of enhanced access to tertiary services in Auckland and enhanced community networks through traffic relief on SH1. In the absence of the Project, there are potential adverse effects on community health and well-being as traffic congestion on the existing route becomes more severe, and public safety risk increases.

Table F3 summarises the range of social effects at the regional level, including the stage at which they will take place, who they will affect, the magnitude of effect and proposed mitigation.

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Table F3: Summary ratings of effect: regional assessment of social effects

Note: D: Directly affected; N: Neighbour affected; O: Others affected

Effect Way of Life	Stage	Who	Magnitude	Mitigation
Greater journey time reliability Network resilience	Operational	D N O	High positive	
Enhanced traffic safety for travel between the former Rodney area and Auckland	Operational		High positive	
Potential increase in availability of public transport or access to PT options	Operational	O	Minor positive	
Enhanced accessibility to tertiary level services in Auckland	Operational		Moderate positive	
Maintenance of current levels of accessibility during the construction phase	Construction	D N O	Minor negative	Construction Traffic Management Plan Stakeholder Consultation and Engagement Plan
Impediments to traffic flow on SH1 during construction	Construction	D N O	Neutral	Construction Traffic Management Plan
Strengthening of opportunities for pedestrian and cycling modes in Warkworth	Operational	O	Moderate positive	
Effects on school bus services during the construction phase	Construction	D N	Minor negative	Construction Traffic Management Plan Stakeholder Consultation and Engagement Plan

Effect Community cohesion	Stage	Who	Magnitude	Mitigation
Effects on community cohesion	Construction	D N O	Minor adverse	Construction Traffic Management Plan Stakeholder Consultation and Engagement Plan
Effects on sense of place and identity	Construction	D N	Minor adverse	
	Operational	N O	Neutral	
Effects on education facilities	Construction	D N O	Minor adverse	Construction Traffic Management Plan Stakeholder Consultation and Engagement Plan
	Operational	N O	Neutral	
Effects on community facilities	Construction	D N O	Neutral	Construction Traffic Management Plan Stakeholder Consultation and Engagement Plan
	Operational	N O	Neutral	
Effects on recreational facilities	Construction	D N O	Neutral	Construction Traffic Management Plan Stakeholder Consultation and Engagement Plan
	Operational	N O	Minor positive	
Effects on business activity	Construction	D N O	Moderate positive	Construction Traffic Management Plan Stakeholder Consultation and Engagement Plan
	Operational	N O	Moderate positive	

Effects on historical and cultural facilities	Construction	D N O	Moderate negative	Construction Environmental Management Plan Stakeholder Consultation and Engagement Plan
	Operational	N O	Neutral	
Effect Health and Wellbeing	Stage	Who	Magnitude	Mitigation
Changes in community wellbeing	Construction	D N O	Minor adverse	Stakeholder Consultation and Engagement Plan Construction Environmental Management Plan Construction Traffic Management Plan
	Operational		Moderate positive	
Effects on personal safety Potential for the development of aversion behaviours and loss of social interaction	Construction	D N O	Minor adverse	Construction Traffic Management Plan Stakeholder Consultation and Engagement Plan
	Operational	D N O	Moderate positive	
Effects of exposure to noise	Construction	D N O	Minor adverse	Construction Environmental Management Plan Construction Traffic Management Plan
	Operational	N O	Neutral	
Effects of exposure to air emissions	Construction	D N O	Neutral	Construction Environmental Management Plan Construction Traffic Management Plan
	Operational	N O	Moderate positive	

Effects on public safety and risk	Construction	D N O	Minor adverse	Construction Environmental Management Plan Construction Traffic Management Plan
	Operational	N O	Moderate positive	
Effect Personal and Property Rights	Stage	Who	Magnitude	Mitigation
Effects of uncertainty and construction timing	Planning	D N O	Minor adverse	Stakeholder Consultation and Engagement Plan
Effects of relocation	Planning	D N	Minor/moderate adverse	NZTA property acquisition programme Stakeholder engagement
Effects on properties	Planning	D N O	Minor adverse	Stakeholder engagement
	Construction	D N O	Neutral	NZTA property acquisition programme
	Operational		Neutral	Stakeholder engagement
Effect Fears and Aspirations	Stage	Who	Magnitude	Mitigation
Effects on the wider community	Planning	O	Neutral	Stakeholder Consultation and Engagement Plan
	Construction	O	Moderate positive	Stakeholder Consultation and Engagement Plan
	Operational	O	Moderate positive	

Local assessment of social effects

The direct social effects of the Project, both positive and negative, are largely felt at the local community level and in relatively discrete areas.

Property effects

The Project will require the acquisition of land under the provisions of the Public Works Act.

The Project will require the acquisition of 129 separate parcels of land, either wholly or in part. A total of 46 landowners will be affected by these acquisitions, reflecting the common ownership of many parcels. Some landowners are government agencies, while others are private companies (15%), families or individuals (64%). The NZTA has purchased nine properties.

Of the 660 hectares required for acquisition, approximately 64% or 420 hectares, is held by companies, compared with 28% (186 hectares) held by individuals or family interests. Government agencies and public entities hold approximately 8% or 54 hectares.

The acquisition process adopts a process where fair and reasonable compensation is paid to the affected owners.

For some people, the acquisition process will result in them leaving their neighbourhoods, while some others may choose to relocate within it. For those people who will leave their neighbourhoods, the change can be disturbing and stressful, or it can be liberating by allowing people to choose alternative lifestyles. Some people prefer to relocate within their neighbourhoods or districts once the acquisition and compensation processes have been completed. The effect on people is typically very personal and is able to be mitigated to some extent by the compensation process.

The pattern and extent of this potential social dislocation will become apparent as the acquisition process is implemented and people exercise their choices in relation to new living arrangements. Considering there are 46 landowners, including individuals and families, directly affected by acquisition, the potential for social dislocation at the local community level is very low. There will be some losses of community ‘membership’ in locations such as Moirs Hill Road, Perry Road and Wyllie Road.

An anticipated effect of the acquisition process is that some social connections and networks will be disrupted. The effects of such disruptions tend to be of a short to medium term nature as communities continue to evolve and respond to a wide range of internal and external influences. Again, considering the number and diversity of the acquisitions in the context of the robust community life evident in the Study Area, any social disruptions which do occur are expected to be less than minor.

Construction effects

The construction phase can have a range of ramifications in terms of increased business activity, heightened employment opportunities, changes to people's sense of place, aesthetics and heritage, changes to people's sense of belonging, security and liveability.

During phases one to three of consultation, many people expressed concern about potential construction effects such as noise, dust, construction traffic and landscape. To balance this, some people also anticipated beneficial impacts such as increased business activity through the provision of goods and services to the proposed works, direct and in-direct employment, and increased demand from the project workforce. These latter views were expressed by people from both Warkworth where there is an established industrial base, and Pūhoi.

The construction effects are proposed to be mitigated and managed through a suite of integrated measures including modifications to construction methods, monitoring and management, and early and on-going consultation with local communities and near neighbours in particular. Early communication about construction methods and specific construction events, such as blasting, transport of large equipment or components and changes to local access arrangements, will allow people to adjust and manage their daily patterns to either avoid or minimise the effects of construction.

Local communities could be affected during the construction phase by restrictions on accessibility and connectivity. All of the communities directly affected by construction activity rely on social services and infrastructure concentrated in Warkworth, or in the case of Pūhoi, in Silverdale and Orewa. If residents are dependent on social networks that are not predominantly based on their respective "road", there may be some reduction in the frequency of those interactions.

Construction traffic management planning is proposed to be implemented to maintain access to properties and local access roads. While delays may be experienced, careful management in combination with effective community engagement, can minimise potential disruptions to travel and trip patterns.

Changes to local landscapes are anticipated as a consequence of the major earthworks required to implement the project. Impacts on community values, arising from landscape changes, are likely to be significant in exposed locations such as the Pūhoi viewshed and the open ground to the north of Warkworth and Wylie Road. Landscape changes elsewhere along the route will be obvious to smaller populations or be sufficiently distant from sensitive receivers as to reduce the impact on community values.

It should also be noted that the median age of residents within some of the affected communities is higher than the sub-region median age, and the proportion of the total population in the 65+ age group is growing. This is consistent with other research into the characteristics of lifestyle block owners. For this older age group the effects on well-being may be more acute and lead to avoidance or aversion behaviours to minimise conflict with construction based activity.

Operational effects

In the operational phase, there will be period of adjustment, as communities come to terms with the Project as a fully operational motorway, and with the subsequent changes in community composition, social networks and accessibility.

The social benefits of the Project are expected to flow from enhanced accessibility to tertiary services and employment opportunities in Auckland, improved safety and travel time reliability in accessing such services, and improved environmental amenity and accessibility for those communities still relying on the existing SH1 for access.

The social benefits accruing from enhanced accessibility will be more pronounced for people living in Warkworth and the surrounding communities of Kaipara Flats and the eastern beaches, than for people living in Pūhoi. Travel via the Project to Auckland for tertiary level health care, education, entertainment and personal and professional services, will become more convenient, safer and more predictable as a consequence of the Project. Similarly, the removal of inter-regional traffic including freight from SH1 to the Project, will help deliver similar social benefits as a consequence of improved travel time reliability and traffic safety for those communities to the south of Warkworth.

For the Pūhoi community, the social benefits will derive from improved access to the existing SH1 at Pūhoi Road through a reduction of regional traffic on the existing SH1.

The Project will improve safety and travel time reliability, which in turn will reduce risks and apprehensions regarding the safety and consistency of road travel within the corridor.

The Project design will maintain local access and connectivity in the local road network. Present levels of social cohesion and social networks can be maintained as a result.

Minor changes in community structures are likely as a result of people either relocating within or leaving their districts due to property acquisitions.

Changes in environmental amenity due to operating effects, such as traffic noise, motor vehicle emissions and surface water quality are not expected to be significant. Consequently, there should be no impact on community values attaching to environmental amenity, such as general well-being. For some near neighbours, the changes in environmental amenity will be noticeable, especially during the first few years of operation. These effects will lessen for some neighbours after a period of adjustment.

Table F4 summarises the range of social effects at the local level, including the stage at which they will take place, who they will affect, the magnitude of effect and proposed mitigation.

Table F4: Summary rating of effects: local assessment of social effects

Note: D: Directly affected; N: Neighbour affected; O: Others affected

Effect Way of Life	Stage	Who	Magnitude	Mitigation
Ability to maintain of existing level of accessibility at Pūhoi	Construction	D N O	Minor adverse	Construction Traffic Management Plan Stakeholder Engagement and Consultation Plan
	Operational		Minor positive	
Maintenance of current levels of accessibility during the construction phase at Moirs Hill Road, Perry Road and Wyllie Road	Construction	D N O	Minor adverse	Upgrade of Moirs Hill Road from SH1 to the construction site Alternative construction access routes where possible Construction Traffic Management Plan Stakeholder Consultation and Engagement Plan
Impediments to traffic flow on SH1 during construction at Pūhoi, Moirs Hill Road and Perry Road	Construction	D N O	Neutral	Construction Traffic Management Plan
Effects on school bus services during the construction phase	Construction	D N	Neutral	Construction Traffic Management Plan Stakeholder Consultation and Engagement Plan

Effect Community cohesion	Stage	Who	Magnitude	Mitigation
Effects on community cohesion Removal of dwellings directly affected by the indicative alignment and vacating of other dwellings within the proposed designation footprint	Construction	D N O	Minor/moderate adverse	Stakeholder Consultation and Engagement Plan
	Operational		Minor positive	
Effects on sense of place and identity and effects on visual amenity Loss of values associated with decision to adopt a rural-residential lifestyle	Construction	D N	Moderate adverse	Construction Environmental Management Plan Stakeholder engagement
Ability to adapt to presence of the motorway within the local landscape	Operational	N O	Neutral	Long term rehabilitation and landscape plan to be lodged in conjunction with the Outline Plan of Works Stakeholder engagement regarding draft rehabilitation and landscape plans
Effects on education facilities	Construction	O	Neutral	Construction Traffic Management Plan Stakeholder engagement
	Operational		Neutral	
Effects on community facilities	Construction		Neutral	Construction Traffic Management Plan Stakeholder engagement
	Operational		Neutral	

Effects on recreational facilities	Construction	O	Minor adverse	Construction Traffic Management Plan Stakeholder engagement
	Operational	O	Minor positive	
Effects on business activity	Construction phase	N O	Minor adverse/Moderate positive	Construction Traffic Management Plan Construction Environmental Management Plan Stakeholder engagement
	Operational	O	High positive	
Effects on historical and cultural facilities	Construction		Moderate adverse	Construction Environmental Management Plan Stakeholder engagement
	Operational		Neutral	On-going stakeholder engagement
Effect Health and Wellbeing	Stage	Who	Magnitude	Mitigation
Changes in community wellbeing	Construction	D N O	Minor adverse/minor positive	Construction Traffic Management Plan Construction Environmental Management Plan Stakeholder engagement
	Operational	N O	Neutral	
Effects on personal safety Potential for the development of aversion behaviours and loss of social interaction	Construction	D N O		Construction Traffic Management Plan Construction Environmental Management Plan Stakeholder engagement
	Operational	N O	Neutral	

Effects of exposure to noise	Construction		Minor adverse	Construction Environmental Management Plan
	Operational		Neutral to minor positive	
Effects of exposure to air emissions	Construction	D N O	Minor adverse	Construction Environmental Management Plan
	Operational	O	Minor positive	
Effects on public safety and risk	Construction	D N O	Neutral	Construction Traffic Management Plan Stakeholder engagement
	Operational		Moderate positive	Grade separation of Motorway from local roads
Effect Personal and Property Rights	Stage	Who	Magnitude (do minimum)	Mitigation
Effects of uncertainty and construction timing	Planning	D N O	Moderate adverse	Stakeholder engagement
Effects of relocation	Planning	D N	Moderate adverse	NZTA property acquisition programme
Effects on properties	Planning	D N	Neutral	Stakeholder engagement
	Construction	D N	Moderate adverse	Construction Traffic Management Plan Construction Environmental Management Plan Stakeholder engagement
	Operational	D N		Long term rehabilitation and landscape plan to be lodged in conjunction with the Outline Plan of Works Stakeholder engagement regarding draft rehabilitation and landscape plans

Effect Fears and Aspirations	Stage	Who	Magnitude (do minimum)	Mitigation
Localised community	Planning	D N	Moderate adverse	Stakeholder engagement
	Construction		Moderate adverse	Stakeholder engagement
	Operational		Neutral	Long term rehabilitation and landscape plan to be lodged in conjunction with the Outline Plan of Works Stakeholder engagement regarding draft rehabilitation and landscape plans

Design, mitigation and monitoring measures

The design of the Project has benefited from the extensive community consultation programme with the early identification of a number of potential social effects. The design development has been used as a primary means of avoidance and mitigation of adverse effects. The key elements of the design in this regard are:

- the provision of south-facing ramps at Pūhoi;
- separation of local roads from the motorway to maintain local community connectivity in the operational phase of the Project; and
- the selection of a Project area that traverses areas of low population concentrations and is separated from the principal urban communities;
- an indicative alignment that avoids areas of community value; and
- an off line alignment that assists with the connectivity of Warkworth with a substantial reduction in through traffic which currently divides the community (the existing SH1 currently divides Warkworth).

The mitigation of actual or potential adverse social effects during the consenting and construction phases can be primarily achieved by the following:

- by maintaining an engagement and consultation process that seeks to keep directly affected landowners, adjacent landowners and affected communities fully informed regarding the Project design, implementation, and timing, and which seeks to identify the ways in which individual circumstances can be accommodated; and
- the use of construction environmental management plans and a construction traffic management plan to set the parameters around the management of the effects of the construction phase on directly affected communities.

Mitigation by design

Various decisions have been made by the Project team which seek to avoid or mitigate adverse social effects. The most significant response to both the feedback from community engagement and the social effects assessment has been the decision to provide south facing ramps at Pūhoi. This is directly related to the key issues of maintaining an appropriate level of accessibility and connectivity, commensurate with the level of accessibility the community currently enjoys.

The second component of the design that has significant social benefits is the provision of grade separation at Billings Road, Moirs Hill Road, Wyllie Road and Woodcocks/Carran Road. While the construction of the Project will have short term adverse effects in terms of relocation, disruption to social networks and community cohesion, the long term benefits for the directly affected local communities and adaptation to the Project over time mitigate against the short term effects. Each of these communities benefits from enhancements to the local roading network, and changes to

the distribution of traffic on the local; network that have positive spin-off effects on accessibility and connectivity.

Environmental management plans / procedures

Three management plans form the basis for the mitigation of adverse effects including actual or potential adverse social effects. These are:

- The Construction Traffic Management Plan (CTMP);
- The Stakeholder Consultation and Engagement Management Plan (SCEMP); and
- The Construction Noise and Vibration management Plan (CNVMP) (The contents of the CNVMP are discussed in Sections 15.5.1 and 17.6 of this AEE).
- The CTMP is intended to identify techniques to manage the construction related traffic and to maintain an adequate level of accessibility for local residents who need to traverse the construction works. This has obvious benefits in terms of connectivity and community well-being, and community perceptions of traffic safety and risk.

In addition, it is recommended that a formal SCEMP be put in place, to assist in the identification and resolution of issues arising from the communities' engagement with the Project over the construction phase and in the early stages of the operational phase.

The SCEMP is intended to provide a framework for:

- Informing the community of construction progress;
- Engagement with the community to development good working relationships;
- Providing early information on key project milestones; and
- Responding to queries and complaints and the development of initiatives to proactively address community issues.

A principal component of the SCEMP is the establishment of the Community Liaison Group (CLG). The concept behind the CLG is that the wider community will have a vested interest in how the delivery of the Project affects their local community, and how effects are managed. Some of the effects may lie outside the direct responsibility of NZTA. The CLG is intended as a forum for identifying which agency or organisation is best placed to respond. CLGs have been used successfully on other large infrastructure projects, including:

- The SH16 Causeway Upgrade Project – the CLG was particularly valuable in engaging in discussions regarding demolition works;
- The NGTR – the CLG was instrumental in advising the community of key construction works and timeframes; and
- The Waterview Connection Project – CLGs have helped to communicate and appropriately recognise community interests in aspects such as urban design and landscaping for the project.

Appendix G. Relevant objectives and policies

New Zealand Coastal Policy Statement
Objective 1 To safeguard the integrity, form, functioning and resilience of the coastal environment and sustain its ecosystems, including marine and intertidal areas, estuaries, dunes and land, by: • maintaining or enhancing natural biological and physical processes in the coastal environment and recognising their dynamic, complex and interdependent nature; • protecting representative or significant natural ecosystems and sites of biological importance and maintaining the diversity of New Zealand's indigenous coastal flora and fauna; and • maintaining coastal water quality, and enhancing it where it has deteriorated from what would otherwise be its natural condition, with significant adverse effects on ecology and habitat, because of discharges associated with human activity.
Objective 2 To preserve the natural character of the coastal environment and protect natural features and landscape values through: • recognising the characteristics and qualities that contribute to natural character, natural features and landscape values and their location and distribution; • identifying those areas where various forms of subdivision, use, and development would be inappropriate and protecting them from such activities; and • encouraging restoration of the coastal environment.
Objective 3 To take account of the principles of the Treaty of Waitangi, recognise the role of tangata whenua as kaitiaki and provide for tangata whenua involvement in management of the coastal environment by: • recognising the ongoing and enduring relationship of tangata whenua over their lands, rohe and resources; • promoting meaningful relationships and interactions between tangata whenua and persons exercising functions and powers under the Act; • incorporating mātauranga Māori into sustainable management practices; and • recognising and protecting characteristics of the coastal environment that are of special value to tangata whenua.
Objective 4 To maintain and enhance the public open space qualities and recreation opportunities of the coastal environment by: • recognising that the coastal marine area is an extensive area of public space for the public to use and enjoy; • maintaining and enhancing public walking access to and along the coastal marine area without charge, and where there are exceptional reasons that mean this is not practicable providing alternative linking access close to the coastal marine area; and • recognising the potential for coastal processes, including those likely to be affected by climate change, to restrict access to the coastal environment and the need to ensure that public access is maintained even when the coastal marine area advances inland.

New Zealand Coastal Policy Statement
Policy 1 (1) Recognise that the extent and characteristics of the coastal environment vary from region to region and locality to locality; and the issues that arise may have different effects in different localities. (2) Recognise that the coastal environment includes: (a) the coastal marine area; (b) islands within the coastal marine area; (c) areas where coastal processes, influences or qualities are significant, including coastal lakes, lagoons, tidal estuaries, saltmarshes, coastal wetlands, and the margins of these; (d) areas at risk from coastal hazards; (e) coastal vegetation and the habitat of indigenous coastal species including migratory birds; (f) elements and features that contribute to the natural character, landscape, visual qualities or amenity values; (g) items of cultural and historic heritage in the coastal marine area or on the coast; (h) inter-related coastal marine and terrestrial systems, including the intertidal zone; and (i) physical resources and built facilities, including infrastructure, that have modified the coastal environment.

New Zealand Coastal Policy Statement

Policy 2

In taking account of the principles of the Treaty of Waitangi (Te Tiriti o Waitangi), and kaitiakitanga, in relation to the coastal environment:

(a) recognise that tangata whenua have traditional and continuing cultural relationships with areas of the coastal environment, including places where they have lived and fished for generations;

(b) involve iwi authorities or hapū on behalf of tangata whenua in the preparation of regional policy statements, and plans, by undertaking effective consultation with tangata whenua; with such consultation to be early, meaningful, and as far as practicable in accordance with tikanga Māori;

(c) with the consent of tangata whenua and as far as practicable in accordance with tikanga Māori, incorporate mātauranga Māori in regional policy statements, in plans, and in the consideration of applications for resource consents, notices of requirement for designation and private plan changes;

(d) provide opportunities in appropriate circumstances for Māori involvement in decision making, for example when a consent application or notice of requirement is dealing with cultural localities or issues of cultural significance, and Māori experts, including pūkenga, may have knowledge not otherwise available;

(e) take into account any relevant iwi resource management plan and any other relevant planning document recognised by the appropriate iwi authority or hapū and lodged with the council, to the extent that its content has a bearing on resource management issues in the region or district; and
   - (i) where appropriate incorporate references to, or material from, iwi resource management plans in regional policy statements and in plans; and
   - (ii) consider providing practical assistance to iwi or hapū who have indicated a wish to develop iwi resource management plans;

(f) provide for opportunities for tangata whenua to exercise kaitiakitanga over waters, forests, lands, and fisheries in the coastal environment through such measures as:
   - (i) bringing cultural understanding to monitoring of natural resources;
   - (ii) providing appropriate methods for the management, maintenance and protection of the taonga of tangata whenua;
   - (iii) having regard to regulations, rules or bylaws relating to ensuring sustainability of fisheries resources such as taiāpure, mahinga mātaitai or other non-commercial Māori customary fishing; and

(g) in consultation and collaboration with tangata whenua, working as far as practicable in accordance with tikanga Māori, and recognising that tangata whenua have the right to choose not to identify places or values of historic, cultural or spiritual significance or special value:
   - (i) recognise the importance of Māori cultural and heritage values through such methods as historic heritage, landscape and cultural impact assessments; and
   - (ii) provide for the identification, assessment, protection and management of areas or sites of significance or special value to Māori, including by historic analysis and archaeological survey and the development of methods such as alert layers and predictive methodologies for identifying areas of high potential for undiscovered Māori heritage, for example coastal pā or fishing villages.

New Zealand Coastal Policy Statement

Policy 6

(1) In relation to the coastal environment:

(a) recognise that the provision of infrastructure, the supply and transport of energy including the generation and transmission of electricity, and the extraction of minerals are activities important to the social, economic and cultural well-being of people and communities;

(b) consider the rate at which built development and the associated public infrastructure should be enabled to provide for the reasonably foreseeable needs of population growth without compromising the other values of the coastal environment;

(c) encourage the consolidation of existing coastal settlements and urban areas where this will contribute to the avoidance or mitigation of sprawling or sporadic patterns of settlement and urban growth;

(d) recognise tangata whenua needs for papakāinga, marae and associated developments and make appropriate provision for them;

(e) consider where and how built development on land should be controlled so that it does not compromise activities of national or regional importance that have a functional need to locate and operate in the coastal marine area;

(f) consider where development that maintains the character of the existing built environment should be encouraged, and where development resulting in a change in character would be acceptable;

(g) take into account the potential of renewable resources in the coastal environment, such as energy from wind, waves, currents and tides, to meet the reasonably foreseeable needs of future generations;

(h) consider how adverse visual impacts of development can be avoided in areas sensitive to such effects, such as headlands and prominent ridgelines, and as far as practicable and reasonable apply controls or conditions to avoid those effects;

(i) set back development from the coastal marine area and other water bodies, where practicable and reasonable, to protect the natural character, open space, public access and amenity values of the coastal environment; and

(j) where appropriate, buffer areas and sites of significant indigenous biological diversity, or historic heritage value.

(2) Additionally, in relation to the coastal marine area:

(a) recognise potential contributions to the social, economic and cultural wellbeing of people and communities from use and development of the coastal marine area, including the potential for renewable marine energy to contribute to meeting the energy needs of future generations:

(b) recognise the need to maintain and enhance the public open space and recreation qualities and values of the coastal marine area;

(c) recognise that there are activities that have a functional need to be located in the coastal marine area, and provide for those activities in appropriate places;

(d) recognise that activities that do not have a functional need for location in the coastal marine area generally should not be located there; and

(e) promote the efficient use of occupied space, including by:

(i) requiring that structures be made available for public or multiple use wherever reasonable and practicable;

(ii) requiring the removal of any abandoned or redundant structure that has no heritage, amenity or reuse value; and

(iii) considering whether consent conditions should be applied to ensure that space occupied for an activity is used for that purpose effectively and without unreasonable delay.

New Zealand Coastal Policy Statement
Policy 11 To protect indigenous biological diversity in the coastal environment: (a) avoid adverse effects of activities on: (i) indigenous taxa that are listed as threatened or at risk in the New Zealand Threat Classification System lists; (ii) taxa that are listed by the International Union for Conservation of Nature and Natural Resources as threatened; (iii) indigenous ecosystems and vegetation types that are threatened in the coastal environment, or are naturally rare; (iv) habitats of indigenous species where the species are at the limit of their natural range, or are naturally rare; (v) areas containing nationally significant examples of indigenous community types; and (vi) areas set aside for full or partial protection of indigenous biological diversity under other legislation; and (b) avoid significant adverse effects and avoid, remedy or mitigate other adverse effects of activities on: (i) areas of predominantly indigenous vegetation in the coastal environment; (ii) habitats in the coastal environment that are important during the vulnerable life stages of indigenous species; (iii) indigenous ecosystems and habitats that are only found in the coastal environment and are particularly vulnerable to modification, including estuaries, lagoons, coastal wetlands, dunelands, intertidal zones, rocky reef systems, eelgrass and saltmarsh; (iv) habitats of indigenous species in the coastal environment that are important for recreational, commercial, traditional or cultural purposes; (v) habitats, including areas and routes, important to migratory species; and (vi) ecological corridors, and areas important for linking or maintaining biological values identified under this policy.
Policy 13 (1) To preserve the natural character of the coastal environment and to protect it from inappropriate subdivision, use, and development: (a) avoid adverse effects of activities on natural character in areas of the coastal environment with outstanding natural character; and (b) avoid significant adverse effects and avoid, remedy or mitigate other adverse effects of activities on natural character in all other areas of the coastal environment; including by: (c) assessing the natural character of the coastal environment of the region or district, by mapping or otherwise identifying at least areas of high natural character; and (d) ensuring that regional policy statements, and plans, identify areas where preserving natural character requires objectives, policies and rules, and include those provisions. (2) Recognise that natural character is not the same as natural features and landscapes or amenity values and may include matters such as: (a) natural elements, processes and patterns; (b) biophysical, ecological, geological and geomorphological aspects; (c) natural landforms such as headlands, peninsulas, cliffs, dunes, wetlands, reefs, freshwater springs and surf breaks; (d) the natural movement of water and sediment; (e) the natural darkness of the night sky; (f) places or areas that are wild or scenic; (g) a range of natural character from pristine to modified; and (h) experiential attributes, including the sounds and smell of the sea; and their context or setting.

New Zealand Coastal Policy Statement
Policy 15 To protect the natural features and natural landscapes (including seascapes) of the coastal environment from inappropriate subdivision, use, and development: (a) avoid adverse effects of activities on outstanding natural features and outstanding natural landscapes in the coastal environment; and (b) avoid significant adverse effects and avoid, remedy, or mitigate other adverse effects of activities on other natural features and natural landscapes in the coastal environment; including by: (c) identifying and assessing the natural features and natural landscapes of the coastal environment of the region or district, at minimum by land typing, soil characterisation and landscape characterisation and having regard to: (i) natural science factors, including geological, topographical, ecological and dynamic components; (ii) the presence of water including in seas, lakes, rivers and streams; (iii) legibility or expressiveness—how obviously the feature or landscape demonstrates its formative processes; (iv) aesthetic values including memorability and naturalness; (v) vegetation (native and exotic); (vi) transient values, including presence of wildlife or other values at certain times of the day or year; (vii) whether the values are shared and recognised; (viii) cultural and spiritual values for tangata whenua, identified by working, as far as practicable, in accordance with tikanga Māori; including their expression as cultural landscapes and features; (ix) historical and heritage associations; and (x) wild or scenic values; (d) ensuring that regional policy statements, and plans, map or otherwise identify areas where the protection of natural features and natural landscapes requires objectives, policies and rules; and (e) including the objectives, policies and rules required by (d) in plans.
Policy 18 Recognise the need for public open space within and adjacent to the coastal marine area, for public use and appreciation including active and passive recreation, and provide for such public open space, including by: (a) ensuring that the location and treatment of public open space is compatible with the natural character, natural features and landscapes, and amenity values of the coastal environment; (b) taking account of future need for public open space within and adjacent to the coastal marine area, including in and close to cities, towns and other settlements; (c) maintaining and enhancing walking access linkages between public open space areas in the coastal environment; (d) considering the likely impact of coastal processes and climate change so as not to compromise the ability of future generations to have access to public open space; and (e) recognising the important role that esplanade reserves and strips can have in contributing to meeting public open space needs.
Policy 21 Where the quality of water in the coastal environment has deteriorated so that it is having a significant adverse effect on ecosystems, natural habitats, or water based recreational activities, or is restricting existing uses, such as aquaculture, shellfish gathering, and cultural activities, give priority to improving that quality by: (a) identifying such areas of coastal water and water bodies and including them in plans; (b) including provisions in plans to address improving water quality in the areas identified above; (c) where practicable, restoring water quality to at least a state that can support such activities and ecosystems and natural habitats; (d) requiring that stock are excluded from the coastal marine area, adjoining intertidal areas and other water bodies and riparian margins in the coastal environment, within a prescribed time frame; and (e) engaging with tangata whenua to identify areas of coastal waters where they have particular interest, for example in cultural sites, wāhi tapu, other taonga, and values such as mauri, and remedying, or, where remediation is not practicable, mitigating adverse effects on these areas and values.

New Zealand Coastal Policy Statement
Policy 22 (1) Assess and monitor sedimentation levels and impacts on the coastal environment. (2) Require that subdivision, use, or development will not result in a significant increase in sedimentation in the coastal marine area, or other coastal water. (3) Control the impacts of vegetation removal on sedimentation including the impacts of harvesting plantation forestry. (4) Reduce sediment loadings in runoff and in stormwater systems through controls on land use activities.
Policy 23 (1) In managing discharges to water in the coastal environment, have particular regard to: (a) the sensitivity of the receiving environment; (b) the nature of the contaminants to be discharged, the particular concentration of contaminants needed to achieve the required water quality in the receiving environment, and the risks if that concentration of contaminants is exceeded; and (c) the capacity of the receiving environment to assimilate the contaminants; and: (d) avoid significant adverse effects on ecosystems and habitats after reasonable mixing; (e) use the smallest mixing zone necessary to achieve the required water quality in the receiving environment; and (f) minimise adverse effects on the life-supporting capacity of water within a mixing zone. (2) In managing discharge of human sewage, do not allow: (a) discharge of human sewage directly to water in the coastal environment without treatment; and (b) the discharge of treated human sewage to water in the coastal environment, unless: (i) there has been adequate consideration of alternative methods, sites and routes for undertaking the discharge; and (ii) informed by an understanding of tangata whenua values and the effects on them. (3) Objectives, policies and rules in plans which provide for the discharge of treated human sewage into waters of the coastal environment must have been subject to early and meaningful consultation with tangata whenua. (4) In managing discharges of stormwater take steps to avoid adverse effects of stormwater discharge to water in the coastal environment, on a catchment by catchment basis, by: (a) avoiding where practicable and otherwise remedying cross contamination of sewage and stormwater systems; (b) reducing contaminant and sediment loadings in stormwater at source, through contaminant treatment and by controls on land use activities; (c) promoting integrated management of catchments and stormwater networks; and (d) promoting design options that reduce flows to stormwater reticulation systems at source. (5) In managing discharges from ports and other marine facilities: (a) require operators of ports and other marine facilities to take all practicable steps to avoid contamination of coastal waters, substrate, ecosystems and habitats that is more than minor; (b) require that the disturbance or relocation of contaminated seabed material, other than by the movement of vessels, and the dumping or storage of dredged material does not result in significant adverse effects on water quality or the seabed, substrate, ecosystems or habitats; (c) require operators of ports, marinas and other relevant marine facilities to provide for the collection of sewage and waste from vessels, and for residues from vessel maintenance to be safely contained and disposed of; and (d) consider the need for facilities for the collection of sewage and other wastes for recreational and commercial boating.

Hauraki Gulf Marine Park Act
Section 7: Recognition of national significance of Hauraki Gulf (1) The interrelationship between the Hauraki Gulf, its islands, and catchments and the ability of that interrelationship to sustain the life-supporting capacity of the environment of the Hauraki Gulf and its islands are matters of national significance. (2) The life-supporting capacity of the environment of the Gulf and its islands includes the capacity— (i) to provide for: (i) the historic, traditional, cultural, and spiritual relationship of the tangata whenua of the Gulf with the Gulf and its islands; and (ii) the social, economic, recreational, and cultural well-being of people and communities: (ii) to use the resources of the Gulf by the people and communities of the Gulf and New Zealand for economic activities and recreation: (iii) to maintain the soil, air, water, and ecosystems of the Gulf.
Section 8: Management of Hauraki Gulf To recognise the national significance of the Hauraki Gulf, its islands, and catchments, the objectives of the management of the Hauraki Gulf, its islands, and catchments are: (a) the protection and, where appropriate, the enhancement of the life-supporting capacity of the environment of the Hauraki Gulf, its islands, and catchments: (b) the protection and, where appropriate, the enhancement of the natural, historic, and physical resources of the Hauraki Gulf, its islands, and catchments: (c) the protection and, where appropriate, the enhancement of those natural, historic, and physical resources (including kaimoana) of the Hauraki Gulf, its islands, and catchments with which tangata whenua have an historic, traditional, cultural, and spiritual relationship: (d) the protection of the cultural and historic associations of people and communities in and around the Hauraki Gulf with its natural, historic, and physical resources: (e) the maintenance and, where appropriate, the enhancement of the contribution of the natural, historic, and physical resources of the Hauraki Gulf, its islands, and catchments to the social and economic well-being of the people and communities of the Hauraki Gulf and New Zealand: (f) the maintenance and, where appropriate, the enhancement of the natural, historic, and physical resources of the Hauraki Gulf, its islands, and catchments, which contribute to the recreation and enjoyment of the Hauraki Gulf for the people and communities of the Hauraki Gulf and New Zealand.

Auckland Regional Policy Statement
Objective 2.6.1.6 To achieve a high level of mobility and accessibility within the Region that provides for an integrated, responsive, sustainable, safe, affordable and efficient movement of goods and people.
Objective 2.6.1.14 To manage the Region's natural and physical resources in an integrated manner.
Objective 2.6.1.17 To enable the redevelopment, operation and maintenance of existing and provision of new regionally significant infrastructure.
Objective 2.6.14.1 The operation of existing regionally significant infrastructure and the provision of new or upgraded regionally significant infrastructure shall: (i) be consistent with the Strategic Direction of the Regional Policy Statement; (ii) support and reinforce the Regional Growth Strategy and the proposed outcomes of that strategy; and (iii) ensure that any adverse effects of those activities on the environment (including human health) are avoided, remedied or mitigated in a manner consistent with the relevant provisions of this RPS.

Auckland Regional Policy Statement
Objective 4.3 (1) To develop a transport network that supports a compact sustainable urban form. (2) To avoid, remedy, or mitigate the adverse effects of transport on the environment and, in particular: (i) to avoid, remedy, or mitigate the adverse effects of transport on air quality, water quality and heritage; (ii) to reduce the need for the transport system to use non-renewable fuels; (iii) to avoid, remedy, or mitigate the adverse effects of the transport system on community well-being and amenity. (3) To develop a transport network which provides an acceptable level of accessibility for all sections of the community within and across the region, by encouraging transport choices that are efficient, convenient or practical. (4) To develop a transport network which is as safe as is practicable and which promotes better physical health for the community.
Environmental Results Anticipated 2.7 (w) Regionally significant infrastructure will be maintained and provided in such a way and to an extent that it efficiently and effectively supports anticipated growth within the Region.
Objectives 3.3 (1) To sustain the mauri of natural and physical resources in ways which enable provision for the social, economic and cultural wellbeing of Maori. (2) To afford appropriate priority to the relationship of Tangata Whenua and their culture and traditions with their ancestral taonga when this conflicts with other values. (3) To involve Tangata Whenua in resource management processes in ways which: (i) take into account the principles of the Treaty of Waitangi, including rangatiratanga; (ii) have particular regard to the practical expression of kaitiakitanga.
Policy 4.4.1 (1) Land use and transport planning will be integrated in a way which: (i) seeks to reduce trip lengths and numbers and the need for private vehicle travel and encourages a significant increase in the amount of travel made by public transport, walking and cycling; (ii) recognises that where access cannot yet be met conveniently, efficiently, effectively or practically by public transport, nor by viable walking or cycling, trips will continue to be made by private vehicle; (iii) recognises the need to reinforce an efficient and effective public transport system within and connecting High Density Centres and Intensive Corridors. (2) Development of the transport system will be guided in a way which: (i) promotes the use of forms of transport which have fewer adverse effects on the environment; (ii) reduces the environmental effects of transport at source; (iii) reduces the need to use non-renewable fuels; (iv) avoids, remedies, or mitigates the adverse effects of transport on air and water quality; (v) avoids, remedies, or mitigates the adverse effects of transport in the modification of landscape and the destruction of natural habitats and other heritage; (vi) avoids, remedies, or mitigates the adverse effects of transport on local communities.

Auckland Regional Policy Statement
Policy 4.4.7 The following policies and methods give effect to Objective 4.3.4. (1) Transport networks which promote the efficient movement of people, goods and services throughout the Region will be identified in the Auckland RLTS and district plans and will be required to be protected in district plans. (2) The efficiency of congested transport Corridors will be increased by: (i) encouraging increases in person-carrying capacity (i.e., by supporting public transport, car pooling and high occupancy vehicles); (ii) encouraging increases in freight carrying capacity (i.e., by supporting consolidation of loads and rail freight); and (iii) encouraging walking and cycling. (3) Roading upgrades that accommodate more road vehicles should be used where: (i) congested transport Corridors are no longer able to be effectively managed by Policy 4.4.7.2; (ii) the social, cultural, economic and environmental benefits outweigh investment in alternative transport infrastructure or services. (4) The efficiency of congested transport corridors will be increased by encouraging shorter trips and recreational trips to be made by walking and cycling.
Environmental Results Anticipated 4.5 The policies are intended to produce a transport system which: (a) is less reliant on non-renewable energy sources and requires less land to function effectively; (b) reduces adverse impacts on air quality (including greenhouse gases) and water quality and heritage; (c) minimises community disruption; (d) provides an acceptable level of access to work, services, shops and social and recreational facilities for all groups in the community, including those without access to a car; (e) ensures the regionally significant parts of the transport network are able to function effectively and efficiently; (f) improves the effectiveness of the public transport system; (g) improves the effectiveness of walking and cycling modes; (h) is as safe as practicable and which promotes a healthier community
Issue 6.2.1 The heritage of the Auckland Region has been depleted and continues to be under threat. ...
Objective 6.3.1 To preserve or protect a diverse and representative range of the Auckland Region's heritage resources.
Objective 6.3.4 To protect Outstanding Natural Landscapes from inappropriate subdivision, use and development.
Objective 6.3.6 To recognise some Outstanding Natural Landscapes as working landscapes and to enable appropriate activities that are consistent with the Strategic Direction in this RPS.
Objective 6.3.9 To manage heritage resources in an integrated way to ensure their contribution to the variety of heritage values is protected and enhanced.

Auckland Regional Policy Statement

Policy 7.4.10

(1) The diverse range of values of the coastal environment shall be recognised and the need to enable people and communities to provide for their social, economic and cultural wellbeing shall be provided for in appropriate areas of the coastal environment.

(2) In assessing the appropriateness of subdivision, use and development in the coastal environment particular regard shall be had to the following matters:
- (i) natural character is preserved and protected in accordance with Policies 7.4.4-1 (i), (ii) and (iii), and 7.4.4-2;
- (ii) public access is maintained or enhanced in accordance with Policies 7.4.13-1, 2 and 3;
- (iii) amenity values are maintained or enhanced as far as practicable;
- (iv) public open space is maintained or enhanced as far as practicable;
- (v) there is a functional need for use and development within the CMA;
- (vi) efficient use is made of the natural and physical resources of the coastal environment;
- (vii) activities are of a scale, design and location that maintain or enhance landscape values in the area, including seascapes and landforms;
- (viii) there are no significant adverse effects of activities on the CMA, or on adjacent land, including effects across the MHWS boundary;
- (ix) adverse effects are avoided, remedied or mitigated in Areas of Special Value in accordance with policies in 7.4.7;
- (x) activities are designed and located to avoid the need for hazard protection works;
- (xi) provision is made for adequate utility services (including the disposal of waste);
- (xii) effect is given to all other relevant provisions of this policy statement, in particular those stated in Chapter 2 – Regional Overview and Strategic Direction, Chapter 6 – Heritage and Chapter 8 – Water Quality.

(3) A precautionary approach shall be taken by local authorities when providing for and assessing subdivision, use and development in the coastal environment where potentially significant adverse effects may arise. (The precautionary approach is outlined in Chapter 1 – Introduction.)

(4) Applications to reclaim part of the CMA, extract sand, shell and other natural material and rights to occupy the CMA shall have regard to any available alternatives to the proposal, which would avoid these activities.

(5) Where existing subdivision, use and development is threatened by a coastal hazard, coastal protection works should be permitted only where they are the best practicable option for the future. The abandonment or relocation of existing structures should be considered among the options. Where coastal protection works are the best practicable option, they should be located and designed so as 10 Costal Environmental: 7to avoid or minimise adverse environment effects.(Refer also to the Chapter 11 – Natural Hazards)

(6) In determining the appropriate form and location of subdivision, use and development, it shall be recognised that some natural features may migrate inland as a result of dynamic coastal processes, including sea level rise.

(7) Areas which derive their particular character and amenity value from the predominance of built structures, modifications or activities shall be recognised and, where appropriate, their values maintained or enhanced.

(8) Appropriate subdivision, use and development shall be encouraged to locate in areas where the natural character has already been compromised, thereby avoiding sprawling or sporadic subdivision, use and development in the coastal environment.

(9) Notwithstanding Policy 7.4.10-8, regard shall be had to the protection of those elements of remaining natural character which continue to exist in areas where human modifications or activities predominate.

(10) Papakainga housing and marae developments shall be provided for in a manner that is consistent with Policies 7.4.10-1 through 9 in the coastal environment, where this would provide for the relationship of Maori and their culture and traditions with their land, water, sites, waahi tapu and other taonga.

Auckland Regional Policy Statement
Objective 8.3 (1) To maintain water quality in water bodies and coastal waters which have good water quality, and to enhance water quality which is degraded particularly for the following purposes: (i) Estuaries and harbours: protection of aquatic ecosystems, recreation, fishing and shellfish gathering, cultural and aesthetic purposes. (ii) Open coastal waters, including parts of the Hauraki Gulf: its natural state. (iii) Groundwater: water supply. (iv) Lakes, rivers and streams: protection of aquatic ecosystems, recreation, food gathering, water supply, cultural and aesthetic purposes. (v) Wetlands: protection of aquatic ecosystems.
Policy 8.4.7.3 All land disturbance activities which may result in elevated levels of sediment discharge shall be carried out so that the adverse effects of such discharges are avoided, remedied, or mitigated.
Policy 8.4.21.3 Priority shall be given to maintaining, and where possible improving, water quality in areas which are susceptible to degradation and/or have significant values (as listed in Tables 8.1 and 8.2 and shown in Map Series 5 – Sheets 1-4).
Policy 8.4.21.4 Existing native vegetation on the riparian margins of estuarine, wetland and coastal areas and lakes and streams listed in Tables 8.1 and 8.2 shall be retained, in accordance with the policies of Chapter 6 – Heritage.
Policy 9.4.1 (1) Land use activities that affect the quantity of water contributed to streams, rivers, lakes, wetlands or aquifers shall be managed so as to: (i) protect the quantity of water in water bodies which have high amenity, cultural or ecological values; (ii) avoid or mitigate flooding and erosion; (iii) enhance water quality; (iv) protect highly used water bodies. (2) Planning for changes or intensification of land use shall have particular regard to current water availability and priorities for allocation of available water resources.

Auckland Regional Policy Statement
Policy 9.4.4 The availability of water in water bodies and coastal water for taking, use, damming or diversion shall be determined on the following basis: (i) A precautionary approach shall be taken. (The precautionary approach is outlined in Chapter 1.) (ii) The following matters shall be recognised and provided for: (a) the ability of the water body to sustain the abstraction; (b) the relationship of Tangata Whenua and their culture and traditions with their ancestral water, waahi tapu and other taonga; (c) preservation of the natural character of the coastal environment, streams, rivers, lakes and wetlands and their margins; (d) protection of indigenous vegetation and habitats of indigenous fauna in streams, rivers, lakes, wetlands and the coastal environment; (e) maintenance of the natural flow variability in streams, rivers, lakes and wetlands. (iii) Particular regard shall be had to the following matters: (a) kaitiakitanga; (b) maintenance and enhancement of the recreational, scenic, amenity and intrinsic values of streams, rivers, lakes and wetlands; (c) maintenance of water quality including sufficient capacity for streams, rivers, lakes and wetlands to assimilate contaminants; See also Chapter 8 – Water Quality policies. (d) the security of a specific quantity of water being available in streams, rivers, lakes and wetlands during periods of low flow; (e) estimates of aquifer recharge; (f) maintenance of aquifer water levels adequate to ensure continued recharge between aquifers; (g) maintenance of outflow from aquifers at the coast to prevent salt-water intrusion; (h) retention of adequate spring flow from shallow aquifers which provide base flow for streams; (i) avoidance of land subsidence and structural damage to aquifers; (j) maintenance of geothermal aquifer water levels to prevent cold groundwater or seawater intrusion and reduction in aquifer temperatures; (k) avoidance of long term decline of aquifer water levels; (l) the extent of the overlap, if any, of catchments and aquifers with regional council boundaries. (iv) The principles of the Treaty of Waitangi (Te Tiriti o Waitangi) shall be taken into account.(Refer also to Chapter 3 – Matters of Significance to Iwi.)
Policy 9.4.7 (1) The conservation, efficient use and reuse of the Region's water shall be promoted. (2) Priority shall be accorded to uses of water which give effect to the RPS strategic direction and the regional development policies (see Chapter 2). (3) The taking, damming, diversion and use of available water as determined by Policy 9.4.4, shall be controlled so that: (i) Actual or potential adverse effects on the environment, including effects on other authorised water users, the water body, ecosystems, and amenity values, are avoided, remedied, or mitigated. (ii) The relationship of Tangata Whenua and their culture and traditions with their ancestral water, waahi tapu and other taonga is recognised and provided for. (iii) Particular regard is had to: (a) kaitiakitanga; (b) promoting efficient use of water; (c) avoiding, remedying, or mitigating adverse effects of dams, weirs and other instream structures on the environment including but not limited to reduction in flows, obstruction to the passage and migration of any indigenous fauna; bank or bed erosion or aggradation; flooding or restricting the drainage of any property; (d) providing, in the case of fresh water, for the individual's reasonable domestic needs and for the individual's animal's drinking water; (e) providing, in the case of geothermal water, for tikanga Maori for the communal benefit of the Tangata Whenua of the area; (f) encouraging multiple use of streams, rivers, lakes and aquifers. (iv) The principles of the Treaty of Waitangi (Te Tiriti o Waitangi) are taken into account.

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Objective 10.3.2 To avoid, remedy, or mitigate the adverse effects that arise from the discharge of contaminants to air, including those from: (i) motor vehicles; (ii) industrial or trade premises; (iii) open burning of waste; (iv) domestic fireplaces and solid fuel burning appliances; (v) the application of agrichemicals.
Policy 10.4.1 (1) Cumulative effects of discharges on Regional air quality including, but not restricted to, adverse effects on visibility and formation of secondary pollutants such as ozone, and levels of primary pollutants such as carbon monoxide, or particulates, shall be minimised. (2) A precautionary approach to air quality management shall be adopted where relative contributions of sources of contaminants and the nature and extent of the adverse effects are uncertain.
Policy 11.4.1(6) Where development or use exists within areas susceptible to natural hazards, construction of mitigation works shall be allowed only where people, property, infrastructure and the environment are subject to risk from hazards, the works are the best practicable option, and any adverse effects on the environment are avoided, remedied or mitigated. The abandonment or relocation of existing structures and the use of non-structural solutions shall also be considered among the options.
Policy 11.4.1(7) Any works or structures within the 1% AEP flood plain or overland flow path(s) shall not create or exacerbate a flood hazard, during a flood event with a greater probability than 1% AEP, either at the site or at any location upstream or downstream of the works or structures; unless: (a) The adverse effects of the flood hazard are avoided, remedied, or mitigated; or (b) The work or structure is required to avoid, remedy or mitigate the adverse environmental effects of a flood event; Works may include (but are not limited to) earthworks, riparian planting, piping of streams and the construction of culverts, bridges, retaining walls.
Policy 11.4.1(9) In the coastal environment, new subdivision, use or development should be located and designed, so that the need for hazard protection measures is avoided.
Objective 12.3(3) To avoid, remedy, or mitigate adverse effects of activities that result in soil degradation. To minimise the effects of soil degradation on the water quality of receiving environments.

Auckland Regional Plan: Coastal
Objective 3.3.1 To preserve the natural character of the coastal environment by protecting the coastal marine area from inappropriate subdivision, use and development.
Objective 3.3.2 To preserve the natural character of the coastal environment by encouraging appropriate subdivision, use and development above Mean High Water Springs to locate in appropriate areas of the coastal environment.
Policy 3.4.1 The natural character of the coastal environment shall be preserved and protected from inappropriate subdivision, use, and development by avoiding where practicable, remedying or mitigating the adverse effects of subdivision, use and development on the qualities, elements and features which contribute to the natural character of the coastal environment, including those areas characterised by modification and development.
Policy 3.4.2 In assessing the actual or potential effects of subdivision, use and development on natural character particular regard shall be had to: (a) preserving the natural character of the coastal marine area in Coastal Protection Areas 1 and 2; (b) preserving the natural character of the coastal marine area in Outstanding and Regionally Significant Landscape Areas, where these areas are predominantly natural; (c) avoiding, where practicable, adverse effects on natural character values in other areas of the coastal marine area which are predominantly in their natural state and which have a high natural character; (d) protecting appropriate remaining elements of natural character in those areas characterised by modification and development.
Policy 3.4.3 In assessing the actual or potential adverse effects of subdivision, use and development, including cumulative adverse effects, on the natural character of the coastal environment particular regard shall be had to the relevant policies in Chapters 4, 5, 6, and 8, in recognition of the role that landscape, natural features, ecosystems, and certain cultural and historical areas and sites make to natural character.
Policy 3.4.4 When subdivision, use and development in the coastal marine area gives rise to actual or potential adverse effects on the natural character of the coastal environment, where appropriate these effects shall be remedied or mitigated by restoration or rehabilitation of the natural character of the coastal environment. In determining whether any adverse effects on natural character can be remedied or mitigated by restoration or rehabilitation, and if so, the level and extent of restoration and rehabilitation that is to be carried out, regard shall be had to: (a) the extent to which the qualities and features of natural character in the area of the proposed subdivision, use and development will be adversely affected and the ability to restore or rehabilitate natural character in the area subject to the proposal; or (b) where restoration or rehabilitation is not practicable in the area subject to the proposal, the potential to mitigate any adverse effects by the rehabilitation or restoration of natural character in another area of the coastal environment; and (c) where restoration plantings are carried out, preference shall be given to the use of indigenous species with a further preference for local genetic stock.
Objective 4.3.1 To protect Outstanding Landscapes, and the key elements, features and patterns of Regionally Significant Landscapes (as identified in the Plan Maps) from inappropriate subdivision, use and development in the

Auckland Regional Plan: Coastal
coastal environment.
Policy 4.4.2 (a) Subdivision, use and development in the coastal marine area shall be considered inappropriate where it would result in significant adverse effects on those key elements, features and patterns which contribute positively to the landscape quality, aesthetic value and landscape sensitivity of those areas identified in the Plan as being Regionally Significant Landscapes of the coastal environment. (b) In assessing the significance of such adverse effects, particular regard will be had to ensuring that those landscape elements, features and patterns which contribute to the visual integrity of the landscape unit and its value as a Regionally Significant Landscape are protected.
Objective 5.3.1 To protect the dynamic functioning of physical coastal processes.
Objective 5.3.2 To protect the integrity, functioning and resilience of ecosystems within the coastal environment.
Objective 5.3.3 To protect from inappropriate subdivision, use and development and where appropriate, preserve the ecological and physical values and processes of Coastal Protection Areas, in recognition of their intrinsic values, their regional, national and international significance, and their high vulnerability to adverse environmental effects.
Objective 6.3.1 To recognise that the coastal marine area has characteristics of special spiritual, historical, and cultural significance to Tangata Whenua.
Objective 6.3.2 To sustain the mauri of natural and physical resources of the coastal environment, and to enable provision for the social, economic and cultural wellbeing of Maori.
Objective 9.3.2 To recognise the national and regional importance of activities which depend upon the use of natural and physical resources of the coastal environment, such as maritime and air transport services, regional infrastructure and other water based industrial, commercial and recreational activities.
Policy 9.4.1 Subdivision, use and development within parts of the coastal marine area shall generally be considered appropriate where that subdivision, use and development depends upon the natural and physical resources of the coastal marine area, and where adverse effects are avoided, remedied or mitigated.
Policy 9.4.2 Subdivision, use and development within the Port, Defence, Marina, Mooring, Airport and Special Activity Management Areas, for those purposes, shall be considered appropriate, provided that the subdivision, use and development is consistent with the objectives and policies for those areas.
Objective 10.3.1 To provide for appropriate subdivision, use and development in the coastal marine area, and to protect the coastal marine area from inappropriate subdivision, use and development.

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Objective 10.3.2 To ensure that efficient use is made of the coastal marine area.
Objective 10.3.3 To maintain where appropriate, the open space nature of the coastal environment.
Policy 10.4.1 Subdivision, use and development which maintains or enhances public use and enjoyment of the coastal marine area shall be encouraged except where it is appropriate to restrict the public, having considered the provisions of Chapter 7: Public Access.
Policy 10.4.2 Recreation is a significant and important use of the coastal marine area, and any proposal for subdivision, use and development shall have regard to the desirability of maintaining or enhancing recreational use of the coastal marine area while avoiding, remedying or mitigating adverse effects on existing activities.
Policy 10.4.3 Subdivision, use and development of the coastal marine area shall be considered more appropriate where the environment has already been highly modified by human activities, or located in areas where development already exists, unless: (a) location elsewhere in the coastal marine area of the Auckland Region would better avoid, remedy, or mitigate significant adverse effects of that subdivision, use and development; or (b) an application brought by Tangata Whenua better provides for the special relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga.
Policy 10.4.4 The positive environmental effects and benefits arising from any proposal for subdivision, use and development shall be taken into account when assessing the overall effects of a proposal.
Policy 10.4.5 Any proposal for subdivision, use and development shall be located, designed, constructed or placed to: (a) complement as far as practicable the character of the environment in which it is located; and (b) avoid as far as practicable, remedy or mitigate adverse effects on ecological and physical processes beyond those which are already occurring in the immediate and surrounding area, including any area above Mean High Water Springs; and (c) where practicable, be consistent with relevant resource management strategies of adjoining territorial authorities.
Policy 10.4.6 Where practicable, subdivision, use and development shall be undertaken at times of the day, year or tides where this will avoid adverse effects on the coastal environment. Where complete avoidance is not practicable adverse effects shall be remedied or mitigated, particularly effects on: (a) the growth and reproduction of marine and coastal vegetation and the feeding, spawning and migratory patterns of marine and coastal fauna , including bird roosting, nesting and feeding; or (b) recreational use of the coastal marine area; or (c) other established activities located in the coastal environment which are likely to be affected by any proposal.

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Policy 10.4.7 Subdivision and development within Coastal Protection Areas shall generally be considered inappropriate where it will: (a) result in any regular or sustained disturbance of migratory bird roosting, nesting and feeding areas, which noticeably reduces the level of use by them for these purposes, or which makes them permanently abandon these sites; or (b) result in the disturbance of the foreshore and seabed where this would destroy any regionally or nationally rare, threatened or endangered plant community or indigenous marine or terrestrial fauna; or (c) result in a level of modification, or damage to flora and fauna within these areas such that the values for which the Coastal Protection Area is recognised are affected in more than a minor way; or (d) results in the permanent use or occupation of the foreshore and seabed so that the areas become inaccessible to the plants, bird and other fauna presently using the area, to a level or a degree that the value or function of the Coastal Protection Area is significantly reduced; or (e) result in the disturbance, use or occupation of the foreshore and seabed or any change to physical processes that would destroy any recognised natural feature within the area, or result in a level of modification or damage to the natural feature such that the values for which the area or feature is recognised are affected in more than a minor way; or (f) result in a reduction in water quality which would adversely affect the natural ecological functioning of the area; or (g) result in the deposition of material at levels which would adversely affect the natural ecological functioning of the area; or (h) provide or enhance opportunities for access by and establishment of pest species; or (i) be of a type or scale, or be located in a place, which would result in the fragmentation of the values of the area such that its physical integrity is destroyed.
Policy 10.4.8 Any cumulative adverse effects on the environment of new subdivision, use and development in the coastal marine area shall be avoided, remedied, or mitigated, taking into account the extent to which existing subdivision, use and development, either of the same or a different kind to that proposed, already has adverse effects, and the extent to which any new subdivision, use and development will exacerbate such effects.
Policy 10.4.9 In addition to Policy 10.4.8 cumulative adverse effects of subdivision, use and development on the values of the Coastal Protection Areas shall be avoided, taking into account: (a) the extent to which existing use and development already, and in combination with any proposal, impacts on the habitat, or impedes the operation of ecological and physical processes; and (b) the extent to which there are similar habitat types within other Coastal Protection Areas in the same harbour or estuary or, where the Coastal Protection Area is located on open coast, within the same vicinity; and (c) whether the viability of habitats of regionally or nationally threatened plants or animals is adversely affected, including the impact on the species population and location.
Policy 10.4.10 Occupation of the coastal marine area (in terms of section 12 (2) of the RMA) shall be considered inappropriate unless: (a) occupation is reasonably necessary for the proper functioning of the activity; and (b) adverse effects arising from space proposed to be occupied can be avoided where practicable, remedied or mitigated, having regard to the loss of public access to and along the coastal marine area.

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Policy 10.4.16 When assessing resource consent applications by stormwater or wastewater network utility operators to occupy and use the CMA, regard shall be had to the strategic importance of stormwater and wastewater networks to the Auckland region; and the operational necessity to locate components of those networks within the CMA.
Policy 11.4.1 Activities in the coastal marine area which are not permitted activities by this chapter shall generally be considered appropriate where: (a) (i) there is a functional need to undertake the activity in the coastal marine area; or (ii) they are ancillary to an activity which has a functional need to locate in the coastal marine area; or (iii) no reasonable or practicable alternative location exists including any location outside of the coastal marine area; or (iv) the activities are for the cultural and traditional needs of Tangata Whenua; and (b) any landward development associated with the activities in the coastal marine area can be accommodated; and (c) any adverse effects on the environment can be avoided, remedied or mitigated.
Policy 11.4.3 The relevant provisions of Part III: Values, Chapters 3 to 9 shall be considered in the assessment of any proposed activity (which is the subject of this chapter) in the coastal marine area.
Objective 12.3.1 To provide for appropriate structures in the coastal marine area, while avoiding, remedying, or mitigating adverse effects on the environment.
Policy 12.4.1 Subject to the limitations stated in Policies 12.4.2 to 12.4.14, structures in the coastal marine area shall generally be considered appropriate where: (a) (i) no reasonable or practicable alternative location exists having regard to the efficient use and development of natural and physical resources; or (ii) the structure is proposed for the cultural and traditional needs of Tangata Whenua; (b) the purpose for which the structure is required cannot reasonably or practicably be accommodated by existing structures in the coastal marine area; and (c) efficient use will be made of the coastal environment by using the minimum area of the coastal marine area necessary for the structure; and (d) the structure will not have a significant adverse effect on the adjoining land.
Policy 12.4.4 Structures for public or multiple use shall be considered more appropriate than the erection of new structures for individual use.
Policy 12.4.6 Any maintenance, repair or restoration of any structure listed in Cultural Heritage Schedules 1 or 2 shall, as far as practicable, be undertaken in a manner and in materials which are consistent with the style and design of the original structure and do not adversely affect its cultural and historical value.
Policy 12.4.7

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Structures in any Coastal Protection Area 1 may be considered appropriate if they are: (a) for scientific and research purposes or for public education, and will enhance the understanding and long term protection of the Coastal Protection Area; or (b) for navigation and safety; or (c) for habitat maintenance and enhancement; or (d) structures of benefit to the regional and national community and there are no reasonable or practicable alternatives to their location on land or elsewhere in the coastal marine area.
Policy 12.4.9 In assessing a resource consent application for a publicly owned structure in any Coastal Protection Area 1, regard shall be had to whether the structure is of benefit to the wider local community.
Policy 12.4.12 Structures shall be designed and located taking into account relevant dynamic coastal processes, including the possibility of sea level rise. The best available estimate of future long-term sea level rise for the locality in question shall be used as a guide in assessing the appropriateness of the proposed location and design of the structure.
Policy 16.4.1 Any activity other than dredging or extraction (as addressed in Chapters 14 and 15), including vegetation removal, which results in the disturbance of the foreshore and seabed shall be considered inappropriate unless: (a) it can be demonstrated that the disturbance is necessary to: ... (vi) enable the provision, operation, maintenance and use of lawful structures, infrastructure, such as roads, walkways and/or the efficient functioning of drainage systems, where there is no practicable alternative location outside of the coastal marine area that would achieve a better environmental outcome; or ...
Policy 16.4.3(a) Disturbance of the foreshore and seabed, other than dredging or extraction (as addressed in Chapters 14 and 15), shall be avoided where it will: (a) result in more than minor modification of, or damage to, or the destruction of the values of any Coastal Protection Area 1; or ...
Objective 20.3.2 To adopt the best practicable option for avoiding, remedying or mitigating the adverse effects from stormwater and wastewater discharges on the coastal environment.
Policy 20.4.3 Any proposal to discharge contaminants or water into the coastal marine area (unless the discharge is prohibited) shall be considered appropriate only if it can be demonstrated that it is the best practicable option (as defined in s2(1) RMA) in terms of preventing or minimising the adverse effects on the environment having considered whether: (a) it is practicable or appropriate to discharge to land above Mean High Water Springs; (b) there is a community discharge system in place that should be utilised; (c) the volume and level of contamination of the discharge has been minimised to the greatest extent practicable; (d) the receiving environment is able to assimilate the discharged contaminants and water, with any adverse effects being avoided where practicable, remedied or mitigated particularly within:

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(i) the areas identified in Tables 8.1 and 8.2 and Map Series 5, Sheets 1-4 (Degraded and Susceptible Areas and Areas of High Ecological Value Susceptible to Degradation) of the Auckland Regional Policy Statement; (ii) those Coastal Protection Areas, set out in this Plan, which are based upon ecological rather than geological values: (e) the adverse effects on the present and foreseeable use of the receiving waters have been avoided where practicable, remedied or mitigated, particularly in areas where there is; (i) high recreational use; (ii) relevant initiatives by Tangata Whenua (established under regulations relating to the conservation or management of fisheries) including Taiapure, rahui or Whakatupu areas; (iii) the collection of fish and shellfish for consumption; (iv) areas of maintenance dredging. (f) any adverse effects on people or communities have been avoided where practicable, or remedied or mitigated; (g) adverse effects on the present and reasonably foreseeable use of the receiving waters for recreational purposes and the suitability of fish and shellfish for consumption have been avoided, where practicable, or remedied or mitigated; (h) cleaner production methods which would result in the volume and level of contamination of the discharge being minimised, to the greatest extent practicable have been adequately investigated, and where practicable put in place; (i) the discharge after reasonable mixing, does not either by itself or in combination with other discharges, give rise to any or all of the following effects: (i) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials; (ii) any conspicuous change in the colour or visual clarity; (iii) any emission of objectionable odour; (iv) any significant adverse effects on aquatic life; (v) any significant adverse effects on aesthetics and amenity value. (j) the discharge complies with relevant, appropriate and accepted international or national Codes of Practice and Environmental Guidelines.
20.5.10 Subject to rule 20.5.11 the following activities undertaken by a stormwater or wastewater network utility operator: (a) The diversion of stormwater; (b) The discharge of stormwater; (c) The discharge of wastewater (via pumping station or network overflows); shall be assessed under the provisions, standards and terms of Rules 5.5.10 to 5.5.13 inclusive of the Operative or Proposed Auckland Regional Plan: Air, Land and Water as if those rules were rules contained in this chapter. In considering applications for resource consent for those activities, in addition to the policies in this chapter, Policies 5.4.6 – 5.4.15 of the Operative or Proposed Auckland Regional Plan: Air, Land and Water shall apply as if those policies were policies contained in this chapter. Note: This does not override rule 20.5.9.

National Policy Statement for Freshwater Management 2011
Policy A4 By every regional council amending regional plans (without using the process in Schedule 1) to the extent needed to ensure the plans include the following policy to apply until any changes under Schedule 1 to give effect to Policy A1 and Policy A2 (freshwater quality limits and targets) have become operative: *"1. When considering any application for a discharge the consent authority must have regard to the following matters:* *a. the extent to which the discharge would avoid contamination that will have an adverse effect on the life-supporting capacity of fresh water including on any ecosystem associated with fresh water and* *b. the extent to which it is feasible and dependable that any more than minor adverse effect on fresh water, and on any ecosystem associated with fresh water, resulting from the discharge would be avoided.* *2. This policy applies to the following discharges (including a diffuse discharge by any person or animal):* *a. a new discharge or* *b. a change or increase in any discharge –* *of any contaminant into fresh water, or onto or into land in circumstances that may result in that contaminant (or, as a result of any natural process from the discharge of that contaminant, any other contaminant) entering fresh water.* • 3. This policy does not apply to any application for consent first lodged before the National Policy Statement for Freshwater Management takes effect on 1 July 2011."
Policy B7 By every regional council amending regional plans (without using the process in Schedule 1) to the extent needed to ensure the plans include the following policy to apply until any changes under Schedule 1 to give effect to Policy B1 (allocation limits), Policy B2 (allocation), and Policy B6 (over-allocation) have become operative: *"1. When considering any application the consent authority must have regard to the following matters:* *a. the extent to which the change would adversely affect safeguarding the life-supporting capacity of fresh water and of any associated ecosystem and* *b. the extent to which it is feasible and dependable that any adverse effect on the life-supporting capacity of fresh water and of any associated ecosystem resulting from the change would be avoided.* *2. This policy applies to:* *a. any new activity and* *b. any change in the character, intensity or scale of any established activity –* *that involves any taking, using, damming or diverting of fresh water or draining of any wetland which is likely to result in any more than minor adverse change in the natural variability of flows or level of any fresh water, compared to that which immediately preceded the commencement of the new activity or the change in the established activity (or in the case of a change in an intermittent or seasonal activity, compared to that on the last occasion on which the activity was carried out).* *3. This policy does not apply to any application for consent first lodged before the National Policy Statement for Freshwater Management takes effect on 1 July 2011."*

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Objective 2.1.3.1 To sustainably manage the quality and diversity of Auckland's natural values by: (a) Maintaining areas of high environmental quality; (b) Remedying or mitigating adverse effects on degraded natural and physical resources where these cannot be avoided; (c) Enhancing degraded areas where practicable.
Objective 2.1.3.2 To preserve the natural character of wetlands, lakes and rivers and their margins by protecting them from inappropriate use and development.
Objective 2.1.3.3 To protect significant indigenous terrestrial and aquatic vegetation and the significant habitats of indigenous fauna, both terrestrial and aquatic from inappropriate use and development.
Objective 2.1.3.4 To maintain and enhance the quality of the Region's Permanent rivers and streams where practicable.
Policy 2.1.4.1 The natural character of wetlands, lakes and rivers and their margins shall be preserved and protected from inappropriate use and development by avoiding, remedying or mitigating adverse effects on the qualities, elements and features that contribute to the natural character of these areas.
Policy 2.1.4.2 In assessing the actual or potential effects of use and development on the natural character of wetlands, lakes, rivers and their margins, particular regard shall be had to: (a) Maintaining high levels of natural character in Natural Lake, Natural Stream and Wetland Management Areas; (b) Maintaining appropriate remaining elements of natural character in: (i) Other Permanent rivers or streams in rural areas; (ii) Permanent rivers and streams in Greenfield Areas that have been assessed as having high ecological, habitat or water quality values; and (iii) Urban Lake Management Areas. (c) Retaining as far as practicable remaining elements of natural character in other Type 2 and 3 Urban Streams, consistent with the management objectives for these streams in Section 3.6. (d) Protecting the natural character of wetlands and Permanent rivers and streams in Water Supply Management Areas as far as practicable, while providing for the use of these areas as water supply areas. When determining the qualities, elements and features that contribute to natural character for the purposes of Policy 2.1.4.2 (a) and (b), regard should be had to Policy 2.1.4.8. (See also Chapter 3: Management Areas, including Sections 3.2, 3.3 & 3.4)
Policy 2.1.4.3 When determining the qualities, elements and features that contribute to natural character for the purposes of Policy 2.1.4.1 and 2.1.4.2 (a) to (d), regard should be had to the matters listed in Policy 2.1.4.9.
Policy 2.1.4.4 When use and development gives rise to actual or potential adverse effects on the natural character of wetlands, lakes and rivers and their margins, where appropriate these effects shall be remedied or mitigated by restoration or rehabilitation of the natural character of these areas.

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Policy 2.1.4.5 In determining whether any adverse effects on natural character can be remedied or mitigated by restoration and rehabilitation that is to be carried out, regard shall be had to: (a) the extent to which the qualities and features of natural character in the area of the proposed use and development will be adversely affected, and the ability to restore or rehabilitate natural character in the area subject to the proposal; (b) where restoration or rehabilitation is not practicable in the area subject to the proposal, the potential to mitigate any adverse effects by the rehabilitation or restoration of natural character in another area of wetland, lake or river and their margins; (c) Where restoration plantings are carried out, preference shall be given to the use of indigenous species with a further preference for local genetic stock. When determining how rehabilitation or restoration of natural character should be carried out, regard should be had to Policy 2.1.4.9
Objective 2.2.3.1 To enable appropriate use and development of air, land and freshwater resources, while recognising the characteristics, constraints and availability of these resources.
Objective 2.2.3.2 To manage the use and development of natural and physical resources in a sustainable, efficient and integrated manner that is consistent with the strategic growth management provisions of the Auckland Regional Policy Statement and the Auckland Regional Growth Strategy.
Objective 2.2.3.3 To enable the use and development of air, land and water in a way that provides for the efficient use of land and supports increased urban densities within the Urban Areas.
Objective 2.2.3.4 To provide for the ongoing operation, maintenance, development and upgrading of physical infrastructure, in a manner that meets regional growth requirements and supports the economic, social and cultural wellbeing of the Region's people and communities and provides for their health and safety, while avoiding, remedying or mitigating adverse effects on the environment.
Objective 2.2.3.5 To protect network utility infrastructure from inappropriate use and development.
Policy 2.2.4.2 Use and development of air, land and water within Greenfield is appropriate where: (a) efficient use is made of available land; (b) Permanent rivers and streams with significant ecological, habitat and water quality values are maintained where practicable; (c) adverse effects on other Permanent rivers and streams and on water quality are remedied or mitigated.
Policy 2.2.4.3 District and regional planning and consent processes should be integrated as far as practicable to ensure full consideration of the matters outlined in Policy 2.2.4.2.

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Policy 2.2.4.4 The use, development, upgrading or maintenance of network utility infrastructure shall be considered appropriate where: (a) it is consistent with the strategic directions of the Auckland Regional Policy Statement; or (b) it is consistent with the Auckland Regional Growth Strategy; or (c) it is to improve environmental outcomes that result from the operation of this infrastructure; or (d) it is undertaken in an efficient and cost effective manner that recognises the community's ability to pay; and (e) significant adverse effects on natural and physical resources are avoided, remedied or mitigated.
Policy 2.2.4.6 Use and development of air, land and water shall avoid giving rise to reverse sensitivity conflicts, particularly in relation to effects on network utility infrastructure.
Policy 2.2.4.7 Use and development of air, land and water outside of Urban Areas is appropriate where: (a) it is necessary for rural production activities; or (b) it is for activities which require a rural location and which are consistent with the maintenance of rural character; or (c) it is for activities that are consistent with Policy 2.2.4.4; and (d) significant natural areas are protected consistent with Policies 2.1.4.1 to 2.1.4.8; (See Chapter 2.1: Natural Values) (e) significant adverse effects on natural and physical resources are avoided, remedied or mitigated.
Policy 2.2.4.8 The positive social, economic and cultural effects and benefits arising from any proposal for use and development shall be considered when assessing the overall effects of a proposal on air, land or water resources.
Policy 2.2.4.9 Cumulative adverse effects of new use and development of air, land and water bodies shall be avoided as far as practicable, or remedied or mitigated.
Policy 2.2.4.10 A precautionary approach shall be taken to proposals for use and development where there are potentially significant adverse effects, that cannot be fully assessed due to a lack of scientific or technical knowledge and where there is a threat of serious or irreversible harm to the environment. In assessing any applications, the ARC or its agents may consent to an application and impose conditions that will ensure that the effects of the activity are avoided, remedied or mitigated. These conditions may include but are not limited to any or all of the following: (a) That consent conditions be reviewed in order to avoid, remedy or mitigate any adverse effects that may be generated by the activity; and (b) That the consent holder be required to regularly monitor the effects of any activity at an appropriate frequency; and (c) That bonds be imposed to ensure that any works or actions required by any consent are undertaken; and (d) That the duration of any consent is limited to a period that is appropriate to the circumstances.
Policy 2.2.4.11 Proposals to use or develop air, land or freshwater resources shall have regard to: (a) The relevant provisions of the Auckland Regional Policy Statement; (b) The relevant provisions of the Auckland Regional Plan: Coastal where the proposal may directly affect the coastal marine area; (c) The relationship between the use of air, land and freshwater and the provisions of district plans and other relevant resource management strategies.

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Policy 2.3.4.4 Regional rules and decisions on resource consents which may affect matters of significance to tangata whenua, shall take into account the following: (a) Any relevant iwi planning document recognised by an Iwi Authority; (b) Measures required to address the issues specified in section 2.3.2.1; (c) The importance of Māori customary, cultural, or traditional knowledge.
Anticipated Environmental Result 2.2.5.3 Network Utility Infrastructure develops and operates in an efficient and cost effective manner, while avoiding, remedying or mitigating adverse effects on the environment.
Objective 4.3.1 To maintain air quality in those parts of the Auckland Region that have excellent or good air quality and enhance air quality in those parts of the Region where it is poor or unacceptable.
Policy 4.4.1 To have regard to the Objectives and Policies of Chapters 2.1, 2.2 and 2.3 in assessing any resource consent to discharge contaminants into air.
Policy 4.4.2 The relevant provisions of the Auckland Regional Plan: Coastal shall be considered in the assessment of any proposal to discharge contaminants into air within the Coastal Marine Air Quality Management Area.
Policy 4.4.3 Significant adverse effects from the discharge of contaminants into air from any source shall be avoided; where this is not practicable for the cumulative effects from small sources, the effects of such discharges shall be minimised. Explanation: Although many adverse effects can be avoided, for some activities for example motor vehicles and domestic fires, it is only practicable to minimise the discharge.
Policy 4.4.4 The discharge of contaminants into air that significantly compromises the Auckland Region's ability to meet the National Environmental Standards for Ambient Air Quality and the Auckland Regional Air Quality Targets shall be considered inappropriate. Explanation: In assessing individual activities that discharge contaminants into air consideration will be given to their impact on and relevant contribution to the National Environmental Standards for Ambient Air Quality and the Auckland Regional Air Quality Targets.
Policy 4.4.5 The discharge of contaminants into air shall be considered inappropriate where: (a) It causes, or is likely to cause, noxious, dangerous, offensive or objectionable odour, dust, particulate, smoke or ash, beyond the boundary of the premises on which the discharge is occurring; or (b) It causes, or is likely to cause, noxious, dangerous, offensive or objectionable visible emissions; or (c) It is a hazardous air pollutant and causes, or is likely to cause, adverse effects on human health or the environment, beyond the boundary of the premises on which the discharge is occurring; or (d) It causes, or is likely to cause, spray beyond the boundary of the premises on which the discharge is occurring (overspray) from the application of paint or powder coatings. Explanation: It is considered that to avoid significant adverse effects, activities should comply with this policy and this is the basis for permitting most activities on the proviso that they meet the conditions of Rule 4.5.1.
Objective 5.3.5 To prevent or minimise the adverse effects of stormwater and wastewater discharges.

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Objective 5.3.6 To achieve the integrated management of stormwater diversions and discharges, wastewater discharges and associated river and lakebed activities at a catchment or network wide level through Integrated Catchment Management Plans or stormwater and wastewater network resource consents.
Objective 5.3.7 To recognise and have regard to the significant contribution that stormwater and wastewater networks and other regionally significant infrastructure make to the sustainability of the Region's environment, including the health, safety, and economic, social and cultural wellbeing of the community.
Objective 5.3.9 To promote sustainable management practices that where practicable avoid discharges of environmentally hazardous substances from an Industrial or Trade Activity, and remedy or mitigate the effects of discharges where they cannot be avoided.
Objective 5.3.17 To maintain the instream and riparian habitat values and water quality of lakes, and Permanent rivers and streams by: (a) protecting existing areas of high value; and (b) enhancing degraded areas.
Objective 5.3.18 To avoid, remedy or mitigate the adverse effects of stock access to stream beds and margins including, movement, foraging and defecation, while enabling environmentally sustainable farming practices.
Policy 5.4.4 When processing consent applications for non network stormwater diversions and discharges under Rules 5.5.2 to 5.5.5 the ARC shall require the applicant to adopt the Best Practicable Option (BPO) for the diversion and discharge, which shall have regard to: (a) The BPO statutory criteria in the RMA; (b) That, outside Urban Areas, the scale and intensity of the development shall be consistent with the Regional Growth Strategy and Sector agreements or is part of the state highway network; (c) The level of adverse effects on the environment, including in particular adverse effects on: (i) the receiving environment due to the quality of the discharge; (ii) the health and safety of people and communities from flooding; (iii) aquatic habitat from erosion and sedimentation, particularly for Natural Stream Management Areas and Type 2 Urban Streams; and (d) The level of adverse effects arising from the cumulative effects of stormwater discharges and diversions at the discharge point(s) for existing and proposed land uses within the site or in the case of a State highway, that part of the highway within the same stormwater catchment. In particular, this includes any existing or redeveloped impervious areas, draining to the same discharge point as new impervious areas.
Policy 5.4.4A When processing consent applications for stormwater diversions and discharges under Rules 5.5.2 to 5.5.5 the ARC shall recognise the strategic importance of stormwater systems owned or operated as part of regionally significant infrastructure in achieving sustainable management and enabling people and communities to meet their needs for economic, social and cultural well-being. Explanation: The costs associated with regionally significant infrastructure installation, maintenance and refurbishment are high. Due regard needs to be given to the ability to fund such works.

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Policy 5.4.4B

In addition to the matters listed in Policy 5.4.4, consent applications for non-network stormwater diversions and discharges under Rules 5.5.2 to 5.5.5 will also be assessed against the following matters:

(a) The extent to which:
  (i) the scale and intensity of the land use activity is consistent with that provided for in the District Plan; or
  (ii) the application adopts the outcomes of any Structure Plan (that has been incorporated into a District Plan); or
  (iii) the application adopts the outcomes of any Integrated Catchment Management Plan (for the area within which the discharge occurs or will occur) to ensure an integrated approach; or

(b) Outside Urban Areas, whether the development is located in a growth area and is in accordance with the Regional Growth Strategy, and Sector agreements, or is part of the State highway network, including the timing of such development, so as to avoid cumulative adverse effects of stormwater discharges outside Urban Areas;

(c) The outcomes of any consultation undertaken with any potentially adversely affected parties;

(d) The extent to which a wide range of management options have been considered to prevent or minimise the adverse effects of any existing and maximum potential landuse and any consequential diversions and discharges, and associated river and lake bed activities to ensure the most appropriate option is selected;

(e) The level of stormwater quality management identified by the relevant Integrated Catchment Management Plan to prevent or minimise the adverse effects of stormwater contaminants;

(f) If an ICMP has not been prepared, the assessment criteria will include the extent to which stormwater quality management:
  (i) adopts the Best Practicable Option;
  (ii) adopts methods (source control, traditional or innovative) to prevent or minimise the adverse effects of contaminants on the receiving environment, including total suspended solids (TSS) loads anticipated to arise on a long term basis from the proposed impervious area;

(g) Whether the proposal:
  (i) avoids exacerbating or causing flooding of the floor level (authorised by a local authority) of a habitable building(s), or a State highway;
  (ii) avoids the use of flood storage volume below the 100 year ARI flood level;

(h) The extent to which there is the potential for local scour and downstream channel erosion, particularly for Natural Stream Management Areas and Type 2 Urban Streams and that this is managed to prevent or minimise adverse effects;

(i) The extent to which the activity incorporates low impact design and non-structural methods to prevent or minimise adverse effects (including minimising the extent of impervious area and stormwater runoff volumes);

(j) The extent to which operation and maintenance programmes are provided to ensure the effective ongoing functioning of the discharge;

(k) The extent to which stormwater quality treatment and quantity control are, or will be, provided for existing and proposed land uses within the same stormwater catchment or site to reduce existing and potential adverse effects. In particular, this includes any existing or redeveloped impervious areas, draining to the same discharge point as new impervious areas;

(l) Where assets are to be vested to another organisation, whether a financial bond is required (from the applicant to that other organisation) for the purposes of ensuring effective ongoing operation and maintenance of the stormwater management methods proposed;

(m) With respect to existing discharges and diversions, the extent to which any prioritised programme for implementing upgrades and improvements to infrastructure considers and balances environmental effects, operational needs, physical constraints, practicality, timing issues, and financial considerations; and

(n) Having regard to Policy 5.4.4C, the extent to which monitoring and reporting may be required.

(o) Explanation: One means of complying with Assessment Criteria (e), (f), (g) and (h) is to adopt the practices outlined in the ARC guideline document “Stormwater Management Devices: Design Guidelines Manual”, second edition, May 2003, Technical Publication 10

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Policy 5.4.4C Where the stormwater management methods proposed by an applicant are in accordance with the design methods in ARC Technical Publication 10: Stormwater Management Devices: Design Guidelines Manual second edition (May 2003) and address the matters listed in Policy 5.4.4, a detailed Assessment of Effects on the Environment (AEE) is not required to support a resource consent application under Rules 5.5.2 to 5.5.4 (but note excluding Rule 5.5.5). Alternatively, an applicant may prepare a detailed AEE, in accordance with the Fourth Schedule of the RMA, to address the adverse effects (including cumulative effects) arising from their activity and propose alternative management methods to avoid, remedy or mitigate those effects.
Policy 5.4.8 Stormwater and wastewater network utility operators and highway network operators shall adopt the Best Practicable Option (BPO) at a catchment or network level to prevent or minimise the actual or potential adverse effects on the environment from diversions and discharges from stormwater and wastewater networks (controlled by stormwater and wastewater network utility operators or highway network operators. The network operator shall specify the performance standards, works and other methods that make up the BPO. In determining the BPO for a network of a stormwater or wastewater network utility operator, or a highway network operator regard shall be had, but not limited to the following: (a) The nature of the discharges and the sensitivity of the receiving environment to adverse effects; (b) The management options available to prevent or minimise adverse effects on the environment, including methods to mitigate any significant unavoidable adverse effects; the effects of the selected option on the environment compared to other options; and the financial implications of the selected option; (c) The current state of technical and scientific knowledge and the likelihood that the selected option can be successfully implemented; (d) The timeframe within which adverse effects identified in (b) can be addressed, taking into account: (i) the scale and significance of environmental effects; (ii) the consequences of delay, compared to the consequences of delaying other works to the stormwater or wastewater network; and (iii) community priorities set following consultation on (a) and (b) where this is relevant to the responsibilities of the stormwater or wastewater network utility operator; (iv) funding available set following consultation on (a) and (b) where this is relevant to the responsibilities of the stormwater or wastewater network utility operator; (v) funding available to and priorities of the highway network operator; and (vi) opportunities to achieve better overall outcomes by taking an holistic approach and developing integrated local solutions; (e) The extent to which the stormwater or wastewater network utility operator or the highway network operator is responsible for or has the ability to manage the effects of diversions or discharges and the extent to which other parties may be responsible for or have the ability to manage such effects; (f) The benefits of maintaining and optimising existing infrastructure; In the case of stormwater or wastewater network utility operator the specific management requirements of the combined sewer system and the benefits of developing integrated solutions with the wastewater trunk system.
Policy 5.4.16 To manage the environmental risk of discharges of environmentally hazardous substances onto or into land or water occurring as a result of an Industrial or Trade Activity by: ... (j) requiring operators of Moderate and High Risk Industrial or Trade Activities to prepare and implement Environmental Management Plans that identify the environmentally hazardous substances associated with the Industrial or Trade Activity and set out the methods to be used to avoid discharges of those substances onto or into land or water where practicable, and to remedy or mitigate the adverse effects of discharges where they cannot be avoided.

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Policy 5.4.17 The implementation of Environmental Management Plans for Moderate Risk Industrial or Trade Activities shall be assessed on a regular basis (either by way of self assessment or independent assessment). The implementation of Environmental Management Plans for High Risk Industrial or Trade Activities may be assessed by way of self assessment or independent assessment with the agreement of the ARC on a case by case basis.
Objective 6.3.3 To maintain the quantity and levels of water in the Region's aquifers in the long term so as to safeguard spring flows, stream base flows, water quality, and geothermal temperature and amenity
Objective 6.3.8 To enable people and communities to divert groundwater while avoiding, remedying or mitigating adverse effects on groundwater regimes, surface water bodies, neighbouring structures and services and on people and communities.
Policy 6.4.50 Any proposal to divert groundwater for which a resource consent is required shall demonstrate that the diversion: (a) Ensures the flow regime required for the life supporting capacity of water bodies is provided for including: (i) low/minimum flows; (ii) levels and flows in wetlands; and (iii) lake levels; (b) Ensures existing lawful groundwater users are not adversely affected by the proposal; (c) Ensures that the proposal avoids, remedies or mitigates any ground settlement that may result in any adverse effects including: (i) damage to structures; (ii) damage to buildings; and (iii) damage to services (e.g. roads, pavements, power, gas, electricity, and fibre optic cables); (d) Ensures that the groundwater diversion does not cause or exacerbate any flooding; (e) Avoids any actual or potential adverse cumulative effects that may arise from the scale, location and/or number of groundwater diversions in the same area; (f) Avoids any actual or potential adverse effects of the discharge of groundwater containing: (i) sediment; (ii) contaminants; (g) Ensures that adverse effects on ecosystem habitat, both terrestrial and freshwater, are avoided, remedied or mitigated; and (h) Monitoring has been incorporated where appropriate, including but not limited to: (i) measurement and recording of water levels and pressures; and (ii) measurement and recording of the movement of ground, buildings and other structures.
Rule 6.5.76 The diversion of groundwater in an unconfined aquifer caused by changing the permeability of the aquifer at the location of the works by trenching, digging or tunnelling is a Permitted Activity, subject to the following conditions: (a) The diversion shall not change the water level regime or direction of flow of the aquifer after completion of the works; and (b) Any resulting settlement shall not cause adverse effects on buildings, structures and services.

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Objective 7.3.1 To maintain and enhance where practicable the natural characteristics of lakes and Permanent rivers or streams in the Auckland Region and to avoid, remedy or mitigate the effects of their modification by activities such as structures, disturbance, deposition, planting or reclamation and drainage and the diversion of surface water
Objective 7.3.2 To recognise and provide for structures in, on, under or over the beds of lakes and Permanent rivers or streams for regionally significant infrastructure where this comprises the best practicable option and is important for providing for the protection of the environment and for enabling people and communities to provide for their health and safety and their economic, social and cultural wellbeing.
Policy 7.4.1 To have regard to the objectives and policies of Chapter 2.1, 2.2 and 2.3, and to the Urban River and Stream Management Framework, and to the objectives and policies of Water Supply Management Areas in Chapter 3.5.3 and 3.5.4 where relevant, in assessing any resource consent for activities in, on, under or over the beds of lakes and Permanent rivers or streams.
Policy 7.4.3 Activities for which resource consent is required in, on, under or over the bed of any lake or Permanent river or stream shall be considered appropriate where: (a) No reasonable or practicable alternative method or location for undertaking the activity exists outside of the lake or Permanent river or stream; or (b) The use of an alternative method or location would have more significant adverse environmental effects than using the bed of the lake or Permanent river or stream; or (c) The purpose for which the activity is undertaken cannot reasonably or practicably be accommodated by existing activities or development in, on, under or over the bed of the lake or Permanent river or stream; and (d) Efficient use will be made of the bed of the lake or Permanent river or stream by using the minimum area necessary for the activity; and (e) Significant cumulative adverse effects of the activity on the bed of the lake or Permanent river or stream will be avoided; or (f) Significant cumulative adverse effects of the activity on the beds of Permanent rivers and streams in Urban Areas are avoided, remedied or mitigated consistent with the Urban River and Stream Management Framework.

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Policy 7.4.9 Applications for resource consent to undertake activities in, on, under or over the bed of any lake or Permanent river or stream shall demonstrate to the extent commensurate with the scale and significance of the potential adverse effects, that they will avoid where practicable, remedy or mitigate: (a) Significant adverse changes to lake or Permanent river or stream bed morphology and flow hydraulics; (b) Significant changes to natural water level fluctuations in lakes and associated wetlands unless this is for habitat establishment, enhancement or restoration, or for a dam or other impoundment structures and is consistent with the policies relating to these structures; (c) Significant erosion or deposition within the lake or Permanent river or stream bed, or on adjacent land; (d) Flooding of adjacent land or the exacerbation of existing flooding problems upstream or downstream; (e) (Explanation: this does not preclude appropriate stormwater treatment or detention structures); (f) Impediments to water flow during flood conditions, except where the purpose of any structure is for flood mitigation; (g) Significant adverse effects on aquatic flora and fauna, habitat values and riparian vegetation; (h) Permanent loss of any habitat of a rare or endangered species; (i) Localised turbidity or disturbance to the surrounding bed and permanent long-term adverse effects on the surrounding environment from the deposition of sediment; and (j) Significant adverse effects on the recreational and amenity values of the area, or other existing lawful users upstream or downstream of the activity, or be a hazard to navigation or to public health and safety. Where these effects cannot be avoided applications shall detail the remediation or mitigation measures to be undertaken. In considering the application of clauses (a) to (i) in Urban Area, regards shall be had to the Urban River and Stream Management Framework in Urban Areas and to the objectives and policies of the Water Supply Management Areas in Chapter 3: Management Areas where relevant.
Policy 7.4.10 The permanent diversion of an existing Permanent river or stream shall be considered inappropriate unless there is no practicable alternative method to the diversion, or the diversion will result in an overall net benefit to the environment, or it is consistent with the Urban River and Stream Management Framework.
Policy 7.4.14 The modification and loss of significant lengths of Permanent rivers or streams through infilling or piping (including the use of instream culverts, pipes and channel linings) shall generally be avoided. In applying this policy to Permanent rivers or streams within Urban Areas, particular regard shall be had to the Urban River and Stream Management Framework.
Policy 7 4 15 Structures and the diversion of surface water shall not cause more than a minor impediment to the passage of flood flows, and provision shall be made to pass such flows in a manner that protects public health and safety, the functioning of the State highway network and network utility infrastructure and avoids the inundation of habitable floors, in accordance with standards specified in this Plan or the relevant District Plan.
Policy 7.4.16 Structures in, on, under or over the beds of lakes and Permanent rivers or streams shall ensure that the passage of fish and other aquatic organisms both up and down stream is: (a) provided for and maintained when new structures are constructed, or (b) maintained where that passage currently exists in an existing structure.

Auckland Regional Plan: Sediment Control
Objective 5.1.1 To maintain or enhance the quality of water in waterbodies and coastal water.
Objective 5.1.2 To sustain the mauri of water in waterbodies and coastal waters, ancestral lands, sites, waahi tapu and other taonga.
Policy 5.2.1 Land disturbance activities which may result in the generation and discharge of elevated levels of sediment will be required to employ methods which avoid, remedy or mitigate adverse effects on the quality of water in waterbodies and coastal waters.
Policy 5.2.2 Land disturbance activities which may result in the discharge of elevated levels of sediment into waterbodies and coastal waters shall be considered inappropriate where they will have a significant adverse effect on:- (i) The qualities, elements and features which contribute to the natural character of areas of the coastal environment, (including the coastal marine area) wetlands, lakes and rivers and their margins; and which are identified in the Auckland Regional Policy Statement and the Auckland Regional Plan: Coastal as having outstanding or regionally significant ecological, landform, geological or landscape values. (ii) Outstanding and regionally significant natural features and landscapes as identified in the Auckland Regional Policy Statement and the Auckland Regional Plan: Coastal. (iii) Areas of significant indigenous vegetation and significant habitats of indigenous fauna as identified in the Auckland Regional Policy Statement and the Auckland Regional Plan: Coastal as having international, national and regional significance. (iv) Areas of significance to Tangata Whenua as identified in the Auckland Regional Policy Statement and the Auckland Regional Plan: Coastal. (v) Areas identified by Tangata Whenua in accordance with Tikanga Maori as being of special spiritual, cultural and historical significance. Unless the adverse effects can be avoided, remedied or mitigated. Operations that expose the soil or bare earth may also make that surface vulnerable to erosion and subsequent sediment discharge. While controls can be implemented for some of these operations, many take place without any specialist sediment control input. Depending on the location of these works, they can have a direct influence on the receiving environment, an effect that is compounded by the cumulative impact of many such operations. In almost all cases, this impact can be reduced or avoided by adherence to a number of common sense principles and design considerations which are easy to adhere to and inexpensive to implement.
Objective 7.1.1 To reduce the exposure of land to the risk of surface erosion leading to sediment generation.
Objective 7.1.2 To minimise sediment discharge to the receiving environment.
Method 7.3.1 The ARC will continue to develop and review, on an on-going basis, minimum earthworks strategies and initiatives which will include practices and techniques to minimise sediment generation associated with earthworks.
Method 7.3.2 These minimum earthworks strategies and initiatives will be developed by the ARC in consultation with all interested parties.

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Objective 5.3.1 To avoid the adverse effects of natural hazards on human life, property and the environment and, where this is not possible, to mitigate the effects of natural hazards.
Objective 5.3.2 To avoid natural hazards being exacerbated through changes to natural processes as a result of inappropriate subdivision, development and land use.
Policy 5.4.1 In areas prone to natural events caused by the weather, earth, water, or sea (including earthquake, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire or flooding), sensitive activities should, where possible, be avoided. New subdivision, use and development should be located and designed so that the need for hazard protection works is avoided. Where this is not possible, activities should ensure that any risk of loss of life or injury or environmental damage is minimised through appropriate mitigation measures.
Policy 5.4.2 Development, subdivision and land use activities, including: (a) vegetation clearance; (b) draining of wetlands; (c) changes in overland flow paths and stormwater; (d) earthworks; and (e) land reclamation; should be prevented if they are likely to significantly exacerbate any natural hazard on-site or off-site, unless it can be demonstrated that the adverse effects can be mitigated, remedied or avoided.
Policy 5.4.3 Natural systems should be used, maintained, managed, enhanced or protected where they make a significant contribution to avoiding or mitigating natural hazards, especially: (a) indigenous forest, and other vegetation, to limit flooding and erosion; (b) wetlands to manage the effects of flooding; (c) natural coastal features and beach systems such as sand dunes, saltmarsh and mangroves to limit coastal erosion; and (d) natural water bodies and watercourses to prevent flooding.
Policy 5.4.5 Where there is little information available about the hazard, including the effects of sea level rise and global climate change, a precautionary approach should be taken in avoiding, or mitigating the adverse effects of natural events caused by the weather, earth, water or sea (including earthquake, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire or flooding on development.
Objective 6.3.2 To maintain, manage, protect and enhance highly valued vegetation and wildlife habitats.

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Objective 6.3.3 To protect highly valued landscapes and geologically significant sites from inappropriate or insensitive building, development, subdivision and other land uses, and to enhance highly valued landscapes where practicable.
Policy 6.4.1 Subdivision, development and land use activities should avoid causing or creating any damage, destruction or long term disturbance to highly valued natural areas or resources. Where avoidance is not possible, remedial or mitigation measures should be undertaken, including restoration, enhancement or protection.
Policy 6.4.2 Highly valued natural areas, such as Significant Natural Areas (SNA), should be protected, enhanced, maintained and managed in a manner that ensures that: (a) habitats and ecosystems remain stable and resilient to stress; (b) species which occur naturally within the habitat or ecosystem, including sensitive species, are able to survive and thrive; (c) a wide representation of highly valued habitats and vegetation is maintained; (d) species diversity is maintained or enhanced by avoiding the adverse effects of noise, vibration, lighting, vegetation removal, earthworks, potential weed invasion, domestic animals and other animal pests.
Policy 6.4.3 Enhancement and restoration of Significant Natural Areas (SNA) should be undertaken when it would provide the following: (a) linkages between highly valued natural areas, such as Significant Natural Areas (SNA) (ie. ecological corridors); (b) enhancement of highly valued natural areas, such as SNA; (c) mitigation or remediation to offset the adverse effects of subdivision or development. Enhancement should include increasing plant diversity through plantings, where natural species diversity has been reduced, increasing the size of significant natural areas and reintroducing species likely to have occurred naturally in the area.
Policy 6.4.4 Highly valued landscapes should be protected, and enhanced where practicable, for their natural amenity, scenic and intrinsic values, and in particular, protected from the adverse effects of: (a) subdivision, including building site formation; (b) formation of access; (c) land development, including earthworks and vegetation removal; (d) built structures; and (e) land use activities requiring all or some of the above.
Objective 7.3.1 To maintain and enhance the rural character of the District.

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Objective 7.3.2 To enhance and protect the distinctive special character of parts of the District which have a high degree of naturalness and high landscape and amenity values which contribute to the identity of the District.
Objective 7.3.3 To maintain and protect the amenity values present in the rural parts of the District.
Objective 7.3.9 To maintain and protect the inherent physical, chemical and biological properties and the life supporting capacity of the soil resource as far as is practicable.
Objective 7.3.10 To avoid, remedy or mitigate the adverse effects of subdivision and land use, including vegetation clearance, earthworks, stormwater and wastewater treatment and disposal on water quality.
Objective 7.3.12 To promote the sustainable management of natural and physical resources in a manner which recognises and provides for the relationship of Maori and their culture and traditions with their ancestral lands, water, significant sites, waahi tapu and other taonga.
Policy 7.4.3 Subdivision, use and development of land should be undertaken in a manner which maintains and enhances the distinctive special rural character of parts of the District, this special character being a combination of a high degree of "naturalness" and high amenity values based on the existence of particular physical features such as beaches, ridgelines, estuaries, harbours, native bush, scrub and wetlands or similar unifying features.

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Policy 7.4.4 Subdivision and activities should be undertaken so that adverse effects, including cumulative effects, on amenity values are avoided, remedied or mitigated and in particular that: (a) buildings and service areas, such as those for parking, are sited and designed so as to maintain and protect visual and aural privacy for neighbouring sites; (b) buildings and service areas are sited and designed so as to maintain admission of sunlight to neighbouring sites; (c) activities occur without generating dust nuisance, objectionable or offensive odours, or glare or intrusion from exterior lighting; (d) activities occur without generating unreasonable noise and vibration which adversely affect the health, safety and enjoyment of people on neighbouring sites; (e) activities occur without generating drifts of chemical sprays across neighbouring sites; (f) buildings and land uses are sited and designed so that they do not detract from, or impact on, in any more than a minor way, any significant natural features, including ridgelines, headlands, beaches, and areas of significant native vegetation and significant wildlife habitats; (g) subdivisions and buildings are of a scale and intensity that enable a high proportion of open space to buildings to be maintained; (h) subdivisions, buildings and land uses are sited and designed so that they do not detract in any more than a minor way from both highly valued landscapes, or significant rural landscapes; (i) subdivisions and land uses do not adversely affect the safety and efficiency of the roading network; the safety and operation of airfields; or the amenity and use of adjacent land (i.e. split farms), through access design, location, number, frequency of use, parking provision, traffic volumes and traffic types generated, and the density of subdivision or intensity of land use; (j) subdivisions and land uses do not adversely affect water quality through landform modification, earthworks and vegetation removal and any other land use or associated activity; (k) activities do not generate adverse effects on the health and safety of people; (l) subdivision and activities do not unduly restrict or prevent public access to the coast or the margins of rivers or streams; (m) the removal, damage, destruction or modification of areas of native bush, scrub, wetlands, riparian vegetation and other significant trees and vegetation is avoided, remedied, or mitigated and these areas are managed, protected and enhanced as part of the design of the subdivision, or when any activity is carried out; (n) earthworks do not detract from visual amenity, particularly in areas containing significant natural features and vegetation.

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Policy 7.4.8 Subdivision, use and development of land should be undertaken in a manner which avoids, or where this is not practicable, remedies or mitigates adverse effects, including cumulative effects, on the natural environment and in particular that: (a) activities occur without adverse effects on the natural functioning of coastal processes; (b) activities occur without an adverse effect on the natural character of the coastal environment, significant natural features, including trees, bush, scrub, wetlands, dune areas, and significant native vegetation and wildlife habitat; (c) activities do not adversely affect water quality through landform modification earthworks, vegetation removal and wetland modification; (d) subdivision and development occur in a manner that retains overland flows at pre-development levels; (e) the removal, damage, destruction or modification of areas of native bush, scrub, wetlands, riparian vegetation and other significant native trees and vegetation is avoided, remedied and mitigated and these areas are managed, protected and enhanced as part of the design of the subdivision and development.
Policy 7.4.9 Subdivision, land use and development should be undertaken in a manner which is sympathetic to and supports the needs of native biodiversity and ensures that: (a) habitats and ecosystems remain stable and resilient to stress; (b) species which naturally occur within the habitat or ecosystem, including sensitive species, are able to survive; by avoiding the adverse effects of vegetation removal, earthworks, weed invasion, domestic animals and noise. Where avoidance is not possible, remediation or mitigation measures should be undertaken, including restoration or enhancement of ecosystems, and protection of natural areas.
Policy 7.4.10 Mitigation of the adverse effects of subdivision, development and land use activities should include the enhancement and restoration of native habitats and ecosystems and should be undertaken when it would provide the following: (a) significant linkages between large (significant) areas of native bush, wetland, scrubland and dunelands; and (b) significant enhancement of an area which is already significant in terms of bush or natural values; or (c) significant restoration or enhancement of areas which are largely depleted, highly modified or destroyed in terms of native biodiversity within the District; and (d) compensation, mitigation or remediation to off-set the adverse effects of subdivision or development; in circumstances where subdivision can occur without adverse effects on natural features, rural character, special character, or amenity values present in an area.

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Policy 7.4.11 The mitigation of adverse effects of subdivision and landuse should include the retention of existing native vegetation and the rehabilitation planting of degraded land, including: (a) unstable or potentially unstable hill country land; and (b) eroding or potentially eroding riparian margins; where the species used (either exotic or native species) will not create a weed problem or exacerbate natural hazards, such as flooding and over the long term will create a self sustaining ecosystem.
Policy 7.4.13 Subdivision and land use activities should be designed, sited, and operated in a manner which avoids the degradation of the soils physical, chemical or biological properties.
Policy 7.4.15 Subdivision and land use activities should be undertaken so that: (a) the area of exposed soils and the length of time they remain exposed during land modification is limited; (b) the clearance of vegetation on riparian margins, wetlands, steep slopes and soils prone to erosion or instability and visually significant and sensitive areas is minimised; (c) the scale and design of earthworks is such that any increase in the rate and volume of overland flows into waterways is minimised; (d) the scale and design of earthworks seek to minimise sediment discharges and dust nuisance; (e) effects of land uses on water quality, in particular waste water and stormwater treatment and disposal, are minimised; (f) the overland flows post development should be the same as pre-development (ie. hydrologically neutral). (g) the clearance of native vegetation and wildlife habitats should be avoided, or where this is not practicable, remedied or mitigated.
Policy 7.4.16 Subdivision, development and landuse should occur in a manner which does not have more than minor potential and/or cumulative adverse effects, including: (a) the effects of the proposed activity adding to or acting together with the effects of existing activities located in the area; (b) the effects of new activities that could reasonably be expected to establish in the future which will add to, or act together with the proposed activity; (c) the effects on highly valued natural resources, such as significant natural areas, and highly valued landscapes; on rural character and amenity values; including the effects of: (i) earthworks, vegetation removal and modification, and wetland modification; (ii) size, shape and location of sites and buildings. (iii) roading; (iv) provision of infrastructure.

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Policy 7.4.18 Subdivision and land use activities should be carried out in a manner which avoids, remedies or mitigates adverse effects on: (a) waahi tapu, wai tapu, taonga and other heritage resources considered to be significant by Tangata Whenua as identified through Iwi Management Plans or similar documents and / or consultation with the recognised Iwi organisation or listed or identified New Zealand Historic Places Trust registers, or the Heritage Inventory or related documents; (b) the coastal environment including ecosystems unique to the coastal environment and vulnerable to modification such as estuaries, coastal wetlands, mangroves and dunes; (c) the natural character of wetlands, lakes, rivers and their margins and mauri or life force of these areas; (d) traditional food gathering sites or localities; (e) the concept of kaitiakitanga / stewardship, recognising the view that people are guardians of the land and its natural resources and taonga, with the role of ensuring that all resource use is carried out on a sustainable basis.
Objective 10.3.3 To ensure that the natural character and the conservation values of open space along the coast, rivers and lakes, and within reserves with significant vegetation or wildlife values, within the District, are maintained, managed, protected and enhanced with minimum alteration, so they remain in a relatively natural unmodified state.
Policy 10.4.2 Activities, buildings and structures within areas of high conservation value and in areas where there is public access to and along the coastline, rivers and lakes, should not create adverse effects on the conservation values or natural character of the area, or public access to the area from: (a) the intensity of the activity; (b) the location, scale and external appearance of buildings and structures; (c) visual impacts; (d) obstruction along the foreshore; (e) vegetation removal and earthworks; (f) diversion or modification of any wetland or watercourse; (g) vehicles and carparking; or (h) the concentration and number of people in the area.
Objective 11.3.2 To maintain, enhance, manage and protect the fauna and flora values and ecosystems of inland waters, especially in those areas that are highly sensitive to human activities.
Objective 11.3.3 To preserve, maintain and enhance the natural character of the District's inland waterbodies.

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Policy 11.4.2 Activities, especially in areas of high ecological and wetland value, wildlife and habitat significance, should be designed, sited and operated in a manner that avoids, remedies or mitigates adverse effects, especially cumulative effects, on: (a) the natural functioning, ecological and wetland vegetation values and habitat values of waterbodies and their edges, including riverbank and shoreline vegetation; and (b) wildlife, especially during critical times such as the nesting and breeding seasons.
Policy 11.4.3 Where possible and necessary, inland waters should be enhanced, to return them to the condition that would be characteristic of the waterways if they were functioning in their natural state, in order to remedy and mitigate the adverse effects of activities, to create additional habitat for aquatic and terrestrial wildlife or to mitigate the adverse effects of natural hazards.
Policy 11.4.4 Structures should be designed, sited and operated in a manner that avoids, remedies or mitigates the adverse effects, especially cumulative effects, on the natural character of inland waters and landscape features.
Policy 11.4.6 Activities and development should be designed, sited and operated in a manner that avoids, remedies or mitigates adverse effects on the cultural values of inland waters, including the mauri (life sustaining capability) of wetlands, lakes, rivers and their margins; and on traditional food gathering sites for domestic use and traditional plant gathering sites for domestic, craft and medicinal use.
Objective 17.3.1 Avoid, remedy or mitigate adverse effects on a diverse and representative range of the District's Cultural Heritage Resources.
Policy 17.4.1 Recognise and protect the heritage values of the District's Cultural Heritage Resource.
Policy 17.4.2 Structures, fixed objects, trees and landscapes that are significant Cultural Heritage Resources of the District should not be modified or altered in way that results in significant loss of or damage to their heritage value.
Policy 17.4.3 Destruction, damage or modification of archaeological, historic or waahi tapu sites should not be undertaken where there are adverse effects, including effects on spiritual values, that cannot be avoided, remedied or mitigated.
Policy 17.4.5 The heritage value of Cultural Heritage Resources should be protected, where possible, by ensuring that the adverse effects of surrounding development on these values are avoided, remedied or mitigated.
Policy 17.4.8 Discussions should be held with iwi representatives to work out a process for protecting sites of significance to Māori.

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Objective 20.3.1 To avoid, remedy or mitigate the adverse effects of the use, storage, transportation and disposal of hazardous substances on human health and safety, and on physical resources and property.
Objective 20.3.2 To avoid, remedy or mitigate the adverse effects of the use, storage, transportation and disposal of hazardous substances on land, air, water, and natural ecosystems.
Objective 20.3.3 To avoid, remedy or mitigate the adverse effects on human health and safety, economic and social wellbeing, physical resources and property, natural ecosystems and land, air and water created by the hazardous substances present on contaminated sites.
Policy 20.4.1 Hazardous facilities and sub-facilities should be located and designed, and procedures for handling materials and dealing with emergencies should be such, that the use, storage, disposal and transport of hazardous substances do not give rise to levels of risk to human health, safety and property that are incompatible with the way in which surrounding land is used or may be used or developed.
Policy 20.4.2 Hazardous facilities and sub-facilities should be located and designed, and the procedures for handling materials and dealing with emergencies should be such, that the potential of the storage, use, disposal and transport of hazardous substances to lead to the contamination of water, soil and air, and the bio-accumulation of contaminants in plants, animals and ecosystems is avoided, remedied or mitigated.
Policy 20.4.3 All contaminated sites in the District should be managed in such a way that their actual and potential adverse effects on human health and soil and water quality are avoided, remedied or mitigated.
Objective 21.3.1 To minimise the adverse effects of the development, operation and maintenance of the transport system on the natural environment.
Objective 21.3.2 To minimise the adverse effects of the development, operation and maintenance of the transport system on the health and safety of the community.
Objective 21.3.3 To avoid, remedy or mitigate any adverse effects from the transport network on the amenity values of adjoining areas.
Objective 21.3.4 To ensure that a transport network is provided that enables the safe, efficient and convenient movement of people and goods and which is not adversely affected by land use activities.

Auckland Council District Plan – Operative Rodney Section 2011
Policy 21.4.1 The transport network should be designed, constructed, operated and maintained to minimise adverse effects on the natural environment including: (a) minimising adverse effects on water quality particularly during transportation network construction; (b) designing new urban areas so that the adverse effects of stormwater runoff from roads and parking areas are minimised; (c) minimising disturbance to and severance of highly valued natural resources and landscapes and as far as practicable, restoring areas which have to be modified; (d) avoiding or minimising the effect on cultural heritage sites.
Policy 21.4.2 The transport network should be designed, constructed, operated and maintained so that adverse effects on amenity values are minimised, including ensuring that: (a) noise and vibration levels do not have significant adverse effects on the health and well-being of occupants or on the amenity values of an area; (b) visual amenity values, including the streetscape, are maintained or enhanced; (c) air quality is maintained or enhanced; (d) traffic movement and parking do not congest local streets; (e) severance of communities by roads is minimised but where they are severed, connections between parts of communities are provided; and (f) safe traffic movement occurs and people's safety is not compromised.
Policy 21.4.3 The roading network should be designed, constructed, operated and maintained to ensure the safe and efficient movement of people, goods and services, taking into account: (a) carriageway and intersection design; (b) traffic management; (c) signage; (d) provision for pedestrians, cyclists, the disabled and emergency vehicles; (e) provision for public transport; (f) provision for network utilities; and (g) surrounding land use activities.