Transmission Gully Project - Urban & Landscape Design Framework

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LANDSCAPE ARCHITECTURE I URBAN DESIGN

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Document Acceptance

Action	Name	Signed	Date
Prepared by	Lucie Desrosiers and Paul Roper-Gee (Beca) Gavin Lister and Wade Robertson (Isthmus)		29/7/2011
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on behalf of	Beca Infrastructure Ltd (Beca)		

Contents

Figure 1.1: Wider Context: The Wellington Northern Corridor Road of National Significance

1 Introduction

1.1 Wellington Northern Corridor

1.1.1 Roads of National Significance (RoNS)

The Government has identified a suite of 'roads of national significance' and set priority for investment in these as New Zealand's most important transport routes. The RoNS are critical to ensuring that users have access to significant markets and areas of employment and economic growth.

The Wellington Northern Corridor i.e. State Highway 1 between Wellington Airport and Levin is identified as a RoNS and comprises eight projects:

- Airport to Mt Victoria Tunnel
- Transport improvements around the Basin Reserve
- Terrace Tunnel duplication
- Ngauranga to Aotea Quay
- Transmission Gully
- MacKays to Peka Peka Expressway
- Peka Peka to Otaki Expressway
- Otaki to Levin

The Transmission Gully Project is one of the eight segments forming the Wellington Northern Corridor (Figure 1.1). Once completed, it will consist of 27km of new highway linking MacKays Crossing and Linden.

The projects which together form the Wellington RoNS need to be designed in a coordinated manner to provide their users a seamless, coherent and legible road corridor.

1.1.2 Wellington RoNS character sectors

The Wellington RoNS corridor passes through four distinct environments:

- Kapiti Coast (the 'Coastal' sector)
- Rough hill-country of the Akatarawa Ranges (the 'Steep Country' sector)
- Urban motorway on approach to Wellington City (the "City Gateway' sector)
- Wellington City streets (the 'Inner City' sector)

The design of the Wellington RoNS corridor shall:

- Reinforce the travel sequence of the Coast, Steep Country, City Gateway and Inner City as per the four corridor sectors;
- Generally seek to achieve consistency of design within each character sector; and
- Introduce variations within sectors where these help orientation or respond to specific local conditions.

1.1.3 Corridor-wide urban design principles

The NZTA's Urban Design Policy is the foundation for a set of corridor-wide principles that guide the urban and landscape design aspects of the Wellington RoNS projects. These principles are:

Design in context:

- Minimise the adverse effects of the project on the surrounding communities and environments.
- Design the highway including its horizontal and vertical alignments, cross sections, structures and interchanges to respond to the specific natural and built environments it traverses.
- Design the highway including the location and design of interchanges to respond to the strategic policy context within which it sits.
- Design the highway with consideration to the needs and amenity of the local community including maintaining or enhancing the usability and amenity of public open spaces.

Respect for heritage:

- Design the highway so as to a) maintain where practicable natural, cultural and built heritage features, b) ensure the relevance of heritage features through access and/or interpretation, and c) promote historical and cultural narratives through the detailed design.

Identity and distinctiveness:

- Design the highway to respond and contribute to the identity of the area.
- Design the highway to create legible entry and exit points to and from urban areas with consideration of driver experience across the whole Wellington RoNS corridor.
- Design highway structures to contribute positively to the environment, integrate functionality with elegant design and help orientation.

Connectivity:

- Design the highway to maintain or enhance the connectivity, usability and amenity for pedestrian, cycle, public transport and local road links which adjoin or cross the road corridor.
- Design the highway to reconnect public open spaces and recreational corridors severed by the Project.
- Design the highway to maintain or enhance access to waterways, the coast, open spaces and recreational activities.

Respect for the natural environment:

- Design the highway to retain where practicable key landscape and ecology features.
- Prioritise low impact design and environmentally responsive solutions.
- Design the highway to contribute to ecological sustainability and biodiversity

Quality Design:

- Design and build structures and surrounding spaces to a high standard.

Safety and security:

- Design the highway to assist safe driver behaviour with designed-in speed management and safety measures.
- Consider CPTED (Crime Prevention Through Environmental Design), road safety, noise exposure and accessibility for the mobility impaired in the selection and development of design solutions.

Development opportunities:

- Design the highway to maintain where practicable the development potential of the adjacent land.
- Where appropriate, design the new highway with consideration of the role of the old highway corridor in contributing to local accessibility for public transport, cycle and walking networks.
- Design the highway to avoid the creation of isolated pockets of land and not preclude use or development of sites in the future.

Value for money:

- Consider 'whole of life' and use cost effective design solutions.
- Consider resource efficiency and sustainability opportunities and innovations in the design, construction, operation and/or maintenance phases of the highway.

Users' experience:

- Design the highway to provide road users with a coherent, interesting and pleasant experience.
- Design the highway to preserve distinctive local and distant views to aid orientation and enhance sense of place.

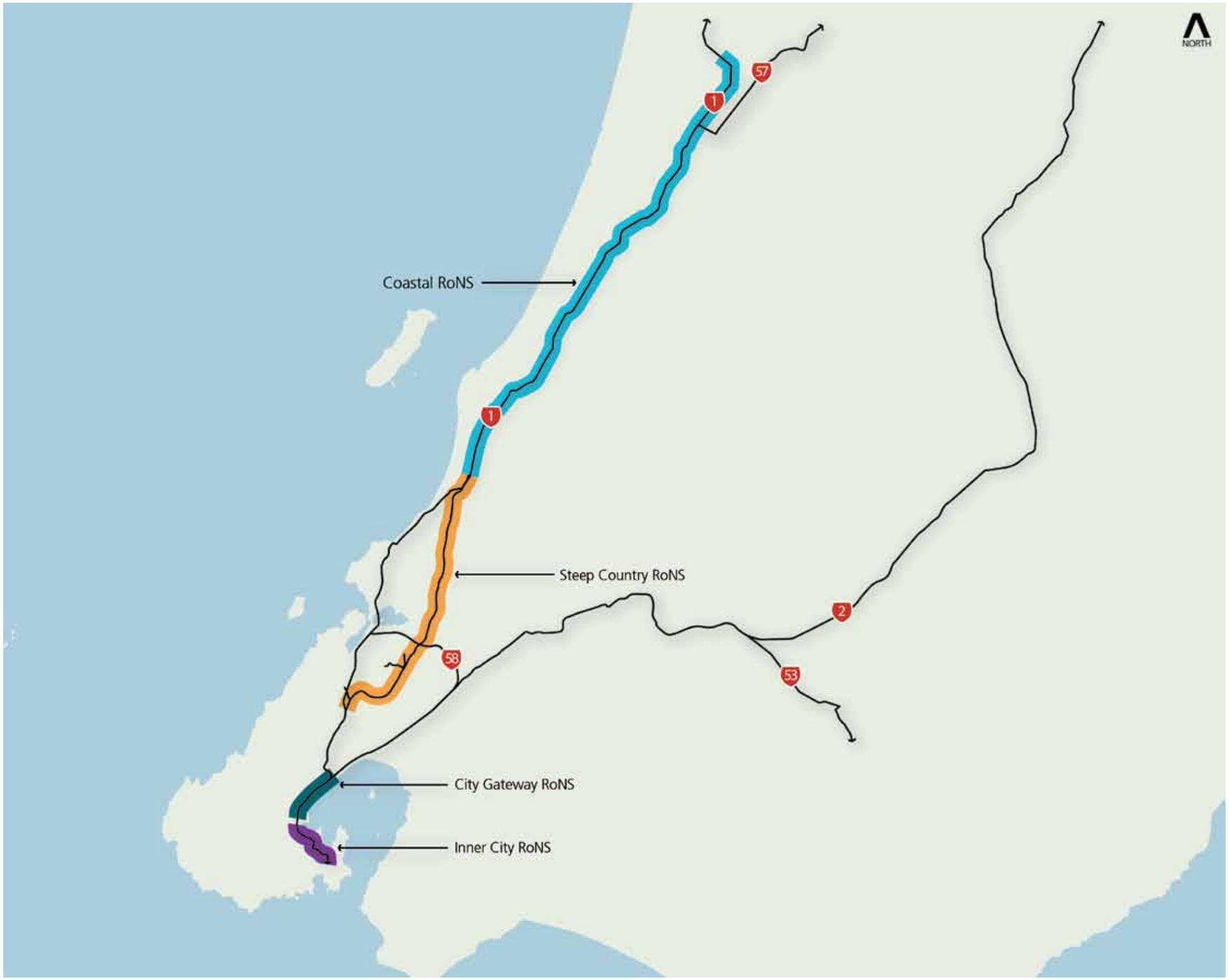

Figure 1.2: Wider Context: The Wellington RoNS Character Sectors

1.2 NZTA Policy Requirements

The key documents and policies of relevance to urban design in NZTA projects are:

- Land Transport Management Act 2003
- Transit Environmental Policy 2004
- New Zealand Urban Design Protocol (MfE, 2005)
- Transit Urban Design Policy 2007
- Transit Environmental Plan 2008
- Urban and Landscape Design Frameworks - Highways and Network Operations guideline 2009

1.2.1 Land Transport Management Act 2003

The Land Transport Management Act 2003 (LTMA) requires NZTA to "exhibit a sense of social and environmental responsibility" in meeting the statutory objective of operating a state highway network that contributes to an integrated, safe, responsive and sustainable land transport system.

1.2.2 Transit Environmental Policy (2004)

This policy is a commitment by the NZTA to improve the contribution of state highways to the environmental and social well being of New Zealanders by:

- Protecting and enhancing the natural and physical environment including the quality of life in urban areas.
- Avoiding adverse effects of state highways construction and operation on communities and the environment.
- Using and managing resources efficiently and helping reduce New Zealand's greenhouse gas emissions.
- Considering environmental issues early in network planning, design and maintenance.
- Contributing to sustainable outcomes by working with central government, local government, communities, Maori and transport providers.
- Continually improving environmental performance including environmental sustainability and public health.

1.2.3 New Zealand Urban Design Protocol (MfE, 2005)

The New Zealand Urban Design Protocol aims to ensure New Zealand's towns and cities are successful places for people. The Protocol is a voluntary commitment by central and local government, property developers and investors, design professionals, educational institutes and other groups to undertake specific urban design initiatives. The NZTA (then Transit) was one of the first organisations to become a signatory of the Protocol in 2005.

1.2.4 Transit Urban Design Policy (2007)

As a signatory of the Urban Design Protocol, NZTA is committed to quality urban design outcomes. This commitment is implemented through the Urban Design Policy which aims to:

- ensure state highways contribute to vibrant, attractive and safe urban and rural areas; and
- achieve integration between state highways, local roads, public transport, cycling and walking networks and the land uses they serve.

More specifically, this is a commitment by the NZTA to ensure that:

- Roads fit in sensitively with the landform and the built, natural and community environments through which they pass;
- All systems of movement along and across the corridor are integrated into the design of projects with good connections and access to communities; and,
- The design contributes to the quality of public space and the road user's experience.

1.2.5 Transit Environmental Plan (2008)

The Environmental Plan specifies how the Agency's staff and suppliers who plan, design, build, maintain and operate the state highway network are expected to address key social and environmental effects including social responsibility; culture and heritage; and visual quality.

The relevant objectives are as follows:

Effect	Objective(s)
Social responsibility	■ To enhance and contribute to community cohesion.
Culture and heritage	■ To proactively limit the disturbance of significant cultural and heritage features along state highways. ■ To show respect for historic buildings we own to maintain their integrity.
Visual quality	■ To incorporate multi-purpose landscaping as an integral part of all new state highway construction projects. ■ To improve the visual quality of the existing state highway network.

1.2.6 Urban and Landscape Design Frameworks - Highways and Network Operations Guideline (2009)

The Guideline outlines the requirement for, purpose and content of Urban and Landscape Design Frameworks (ULDF) and Urban and Landscape Design Master Plans (ULDMP).

The purpose of an ULDF is to ensure that the urban and landscape design concepts of the project are appropriately defined, developed and implemented. The ULDF describes and explains the various design elements of a project and ensures that the design proposals from various disciplines within the project are integrated.

1.3 Purpose of the Urban and Landscape Design Framework

The purpose of the Urban and Landscape Design Framework (ULDF) is to demonstrate how the design of the Transmission Gully Project satisfies NZTA's Urban Design Policy Requirements. In order to do so, the ULDF includes:

- An appreciation of the policy and physical contexts to the route;
- The identification of urban design issues and opportunities within the Project or in the Project's immediate surroundings; and
- Design objectives and principles to guide the development of specific aspects of the road alignment and road components.

The process of preparing the framework has ensured that ULDF design drivers have been integrated across the many work streams.

1.4 Relationship of ULDF to Consent Application Documentation

The framework describes the design concepts of the Transmission Gully Project, complementing Technical Report 1: Road Design Philosophy. The framework provides a vision for the road in the form a series of design principles (see section 4). Subsequent sections of the report identify detailed design issues and explain how these might be resolved in accordance with the design principles.

In order to implement the vision, the Urban Design and Landscape Framework will be used to inform the preparation of detailed landscape and urban design masterplans for the corridor and Site Specific Environmental Management Plans.

1.5 Methodology

The ULDF is an umbrella document which contains recommendations from a number of disciplines. The methodology for the preparation of the ULDF is based on a multi-disciplinary approach to the refinement of the horizontal and vertical alignment and design of highway elements.

In summary, the methodology included:

- **Site visits:** These included visits to the proposed highway corridor, surrounding landscape and adjoining urban areas.
- **Document review:** Relevant background, historical and policy documents were reviewed.
- **Identification of design issues:** This was undertaken through a series of area specific workshops attended by representatives of the urban design, landscape and visual assessment, roading design, bridge design, ecology, planning (social and community impacts), hydrology and noise assessment teams. In addition, meetings with representatives of Greater Wellington Regional Council, Wellington City Council, Porirua City Council and Kapiti Coast District Council were held to identify and address specific issues (pedestrian and cycle movement, and link roads junction design).
- **Refinement of highway alignment:** The Scheme Assessment Report preferred highway alignment was refined through workshops involving primarily the landscape and visual assessment, roading design, ecology, geotechnical engineering and urban design teams.

Figure 1.3: Project context

- **Development of project-wide principles:** The urban design and landscape and visual assessment teams worked together and in consultation with other disciplines to develop design principles for the whole project.
- **Design of road elements:** The urban design and landscape and visual assessment teams worked with the relevant specialists to develop design principles on earthworks, structures, pedestrian and cycle links, stormwater treatment devices, planting, highway furniture, and noise barriers.
- **Noise mitigation:** The noise mitigation options were subject to a multi-disciplinary assessment (assessment matrices and workshop).
- **Bridge design:** Initial guidance on bridge form and aesthetics was provided to the bridge designers by the urban design team at the start of the Project. This was followed by reviews of preliminary and final designs.

1.6 Structure of the Urban and Landscape Design Framework

The ULDF is structured as follows:

Chapter 2 Policy Context: summarises key transport and land use policies which have been taken into consideration in the design of the Transmission Gully Project.

Chapter 3 Corridor Context: provides a summary of the main features of the Project area.

Chapter 4 Corridor Design: sets out corridor-wide design concepts and principles.

Chapter 5 Sections Design: provides a summary of the key features of each section of the corridor followed by the identification of design issues and associated objectives and proposals.

Chapter 6 Conclusion

1.7 Project objectives

The Transmission Gully Project objectives are:

- To provide an alternative strategic link for Wellington that improves regional network security;
- To assist in remedying the safety concerns and projected capacity problems on the existing State Highway 1 by providing a safe, reliable and more responsive route between Linden and MacKays Crossing in an environmentally sustainable manner;
- To assist in enabling wider economic development by providing a cost-optimised route that better provides for the through movement of freight and people; and
- To assist in the integration of the land transport system by enabling the existing State Highway 1 to be developed into safe and multi-functional alternative to the proposed new strategic link.

1.8 Project description

The Transmission Gully Project (the Project) consists of three components:

- The Transmission Gully Project Main Alignment (the Main Alignment) involves the construction and operation of a State highway formed to expressway standard from Linden to MacKays Crossing. The NZ Transport Agency (NZTA) is responsible for the Main Alignment.
- The Kenepuru Link Road involves the construction and operation of a road connecting the Main Alignment to existing western Porirua road network. The NZTA is responsible for the Kenepuru Link Road.
- The Porirua Link Roads involves the construction and operation of two local roads connecting the Main Alignment to the existing eastern Porirua road network. Porirua City Council (PCC) is responsible for the Porirua Link Roads.

Transmission Gully Project Main Alignment

The Main Alignment is a proposed 27km inland State highway between Wellington (Linden) and the Kapiti Coast (MacKays Crossing). Once completed, the Main Alignment will become part of State Highway 1 (SH1). The existing section of SH1 between Linden and MacKays Crossing will likely become a local road. The Main Alignment is part of the Wellington Northern Corridor (Wellington to Levin) road of national significance (RoNS).

The key design features of the Main Alignment are:

- Four lanes (two lanes in each direction with continuous median barrier separation);
- Rigid access control;
- Grade separated interchanges;
- Minimum horizontal and vertical design speeds of 100 km/h and 110km/hr respectively; and
- Maximum gradient of 8%;
- Crawler lanes in some steep gradient sections to account for the significant speed differences between heavy and light vehicles.

The Main Alignment consists of nine sections (Figure 1.3) numbered from north to south as follows:

Section 1: MacKays Crossing

This section is approximately 3.5km long, and extends from the tie-in at the existing MacKays Crossing Interchange on SH1 to the lower part of the Te Puka Stream valley. The Main Alignment will connect to the existing SH1 at approximately 00700m. The first 700m is the existing State Highway 1 alignment which is a grade separated interchange providing access across the North Island Main Trunk rail line (NIMT). Any alteration to the MacKays Crossing Interchange will be minimal.

This section of the Main Alignment will provide for three lanes in the northbound carriageway from 00700m and from 02100m in the southbound carriageway. Southbound traffic will be able to exit the Main Alignment at approximately 01250m. This exit will pass under the Main Alignment at approximately 01800m and will connect to the existing SH1 heading south towards Paekakariki. Traffic heading northbound from Paekakariki will be able to join the Main Alignment from a connection at approximately 01200m.

A subway at 01990m will provide vehicular access across the state highway to three properties. This subway will also provide access across the Main Alignment for pedestrians, cyclists and stock. For the rest of this section heading south, the carriageway will be three lanes in both directions and rises up the Te Puka Stream valley. At approximately 02900m there will be an arrestor bed adjacent to the northbound carriageway for any out of control vehicles heading downhill. The section finishes at 03500m.

Section 2: Wainui Saddle

Section 2 starts at approximately 03500m and will continue climbing for about 2km to the top of the Wainui Saddle at approximately 262m above sea level (at about 05500m). This will be the highest point of the Main Alignment. Just south of the Wainui Saddle peak at about 05600m there will be a brake check area for both northbound and southbound carriageways. Slightly further south, at approximately 06000m, three lanes in each direction will be reduced to two lanes in each direction. Section 2 finishes at 06500m.

Section 3: Horokiri Stream

This section is approximately 3km long and extends from the southern end of the Wainui Saddle to the northern end of Battle Hill Farm Forest Park. For the entire length of this section, the Main Alignment will run generally parallel to the Horokiri Stream. From 06500m to approximately 08550m the Main Alignment will be to the west of the Horokiri Stream, while from 08550m to 09500m it will be to the east of the stream. As the Main Alignment runs parallel to the stream it will cross a number its minor tributaries which generally run perpendicular to the Horokiri Stream and the Main Alignment.

Over this section, the Main Alignment will cross the Horokiri Stream once with a bridge at 08540m. The section finishes towards to northern boundary of the Battle Hill Farm Forest Park (BHFFP) at approximately 09500m.

Section 4: Battle Hill

This section is approximately 3km long and extends from the northern boundary of the BHFFP to the Pauatahanui Golf Course. Shortly after the Main Alignment enters the BHFFP from the north it crosses over the Horokiri Stream with a bridge at approximately 09720m. Over the remainder of this section heading south the Main Alignment will follow the Horokiri Valley floor which widens from north to south through the BHFFP.

Access across the Main Alignment for park users will be provided by a subway located at approximately 10500m. This will provide a connection between the eastern and western part of the park for pedestrians, cyclists and stock. The Main Alignment will continue south from the BHFFP boundary towards the Pauatahanui Golf Course. At about 11750m it will crosses an unnamed stream with a bridge. Access across the Main Alignment will be available underneath this bridge. The section finishes at 12500m where there will be a subway providing pedestrian and stock access across the Main Alignment.

Section 5: Golf Course

This section is approximately 3km long, and extends from north to south through rural land adjacent to the Pauatahanui Golf Course and Flighty's Road. The Main Alignment will cross a number of small tributaries along this section but there will be no major stream crossings requiring bridges.

Section 6: State Highway 58

This section is approximately 3km long and starts at 15500m. The SH58 / Pauatahanui Interchange will be located at approximately 17500m. At this interchange the Main Alignment will be elevated above a roundabout which will provide access to and from the Main Alignment for traffic travelling in both directions on existing SH58. Immediately south of this interchange, at approximately 17660m, there will be a bridge across the Pauatahanui Stream.

At approximately 18250m the Main Alignment will widen to provide three lanes in each direction. This section finishes at approximately 18500m.

Section 7: James Cook

This section starts just south of the State Highway 58/ Pauatahanui Interchange, at approximately 18500m. Three lanes will be provided for both the northbound and southbound carriageways. The James Cook Interchange will be located at approximately 19500m. This will be a dumbbell interchange with the Main Alignment being elevated above the local road connections. These roads will provide access to the Main Alignment in both directions to and from the Porirua Link Roads. In the vicinity of this interchange, the number of lanes in each direction will be reduced from three to two. This will occur at approximately 18900m in the northbound carriageway and at 19500m in the southbound carriageway. From the James Cook Interchange, the Main Alignment will continue southwards for a further 2km. This section finishes at approximately 21500m.

Figure 1.4: Transmission Gully Project Sections

Section 8: Cannons Creek

This section begins at 21500m and is approximately 3.4 km long. Throughout this section the Main Alignment will run along the eastern side of Duck Creek valley, and across an undulating, weathered greywacke plateau between Duck and Cannons Creeks.

There will be four bridges in this section:

- A 140m long bridge starting at 21555m, crossing a tributary of Duck Creek;
- A 150m long bridge starting at 21845m, crossing a tributary of Duck Creek;
- A 160m long bridge starting at 22780m, crossing a tributary of Duck Creek;
- A 260m long bridge starting at 23550m, crossing Cannons Creek.

These bridges will follow the horizontal alignment of the Main Alignment. This section finishes at 24900m.

Section 9: Linden

This southernmost section is approximately 2.8km long. From the start of the section at approximately 24900m, a third lane will be provided in the northbound carriageway heading uphill.

There will be two bridges:

- A 50m long bridge starting at 25790m, crossing an unnamed stream that flows into the Onepotu arm of the Porirua Harbour;
- A 90m long bridge starting at 26010m, crossing an unnamed stream that flows into the Onepotu arm of the Porirua Harbour.

The Kenepuru Interchange will be located at approximately 26700m. This interchange will involve the Main Alignment being elevated above a roundabout which will connect to the Kenepuru Link Road.

South of the Kenepuru Interchange, the Main Alignment will continue downhill to where it will tie into the existing SH1 along the Tawa straight. For traffic joining the Main Alignment in a northbound direction, the carriageway will be elevated and will pass over the existing southbound SH1 carriageway. Traffic continuing to Porirua will be able to do so by taking the left lane exit from the existing SH1.

Note: For the purpose of this Framework, the link roads will be addressed together with the Main Alignment Section they connect to.

Kenepuru Link Road

The Kenepuru Link Road will provide a connection from the Main Alignment to western Porirua. This link road will provide a connection from the Kenepuru Interchange to the existing Kenepuru Drive and will be approximately 600m long. There will be a roundabout at the intersection with Kenepuru Drive. The Kenepuru Link Road will be a State highway designed to the following standards:

- Two lanes (one in each direction);
- Design speeds of 50 km/h;
- Maximum gradient of 10%; and
- Limited access only.

The Kenepuru Link Road will run under existing SH1 and will be bridged over the NIMT.

Porirua Link Roads

The Porirua Link Roads will connect the Main Alignment to the eastern Porirua suburbs of Whitby and Waitangirua. The Porirua Link Roads will be local roads designed to the following standards:

- Two lanes (one in each direction);
- Design speeds of 50 km/h;
- Maximum gradient of 10%; and
- Some side access will be permitted.

The Waitangirua Link Road will be approximately 2.5km long will run from the James Cook Interchange to the existing intersection of Niagara Street and Warspite Avenue. This will be a signalised intersection. The Waitangirua Link Road will cross five waterways. The most significant of these will be a crossing of Duck Creek requiring a culvert. The Waitangirua Link Road will link into the western side of the James Cook Interchange.

The Whitby Link Road will be 0.9km long and will run from the existing roundabout at the intersection of James Cook Drive and Navigation Drive to the Waitangirua Link Road. The new intersection of the proposed Waitangirua and Whitby link roads will be an unsignalised T-intersection with traffic from the Whitby Link Road giving way to Waitangirua Link Road traffic.

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2 Policy Context

The design of the route has been informed by a number of policy documents which are particularly relevant as they contain key drivers for change in the Project area. The relevant policies from these documents are summarised below.

This summary is not intended to be a comprehensive summary of all policy documents; this can be found in the Assessment of Environmental Effects report.

The proposed route passes through four Territorial Authorities (TAs): Wellington City, Porirua City, Upper Hutt City and Kapiti Coast District (Figure 2.1 Territorial Authority Boundaries). Only a small section of the route is in Wellington City, being the interchange with existing State Highway 1 at Linden and part of Belmont Regional Park. An even smaller section is in Upper Hutt City, being a very small section at Wainui Saddle. The majority of the route (21km of 27km) is in Porirua City with the remainder at the northern end being within Kapiti Coast District.

2.1 Planning policy

2.1.1 Wellington Regional Strategy (2007)

The Wellington Regional Strategy (WRS) is a sustainable growth strategy covering all of the Region's nine districts. The ultimate aim of the WRS is to make Greater Wellington 'internationally competitive', that is, a region which offers a great lifestyle and job opportunities, supported by a strong economy.

The Strategy highlights the importance of a secure and efficient route along Wellington's western corridor.

One aspect of the WRS which is of particular relevance to the Transmission Gully Project is its focus on Good Regional Form. The Strategy identifies eight 'change areas', including:

- **Pauatahanui:** *"Due to its close proximity to the Transmission Gully and State Highway 58 interchange, the Pautahanui area will likely come under increased pressure for development. This development has the potential to undermine the region's quality of life objectives, especially given the ecological importance of the Pautahanui Inlet. In this location, less rather than more development is likely to be appropriate."*
- **Aotea to Linden:** *"This area incorporates significant development opportunities at several adjoining sites including the Aotea Block, the old Porirua hospital land, Porirua city centre and industrial estates at Elsdon and Kenepuru Drive. All of these areas are potentially impacted by the Transmission Gully Linden interchange and Porirua Rail Station upgrade."*

Furthermore, in relation to the Transmission Gully Project the WRS notes:

- The need to ensure that the proposed Transmission Gully Project links effectively with the Hutt Valley as well as with Wellington City; and
- Transmission Gully Project and the interchange with State Highway 58 could increase the east-west connection between State Highways 1 and 2.

2.1.2 Proposed Regional Policy Statement (2009)

The Greater Wellington Regional Council's proposed Regional Policy Statement (PRPS) for the Wellington region was publicly notified in 2009. The document is still under appeal and therefore not yet fully operative.

The Regional Policy Statement identifies the regionally significant issues around the management of the region's natural and physical resources and sets out what needs to be achieved (objectives) and the way in which the objectives will be achieved (policies and methods). The Plan covers Wellington City, Porirua City, Porirua City, Lower Hutt City, Upper Hutt City, Kapiti Coast District and Wairarapa District.

The Transmission Gully Project is not specifically referenced in the Proposed Regional Policy Statement. However, of relevance to the Project are the specific sections, objectives and outcomes related to:

Landscape

The regionally significant resource management issue for landscape is identified as "inappropriate modification and destruction of outstanding natural features and landscapes, and significant amenity landscapes".

Regional form, design and function

The document recognises that the region has a strong corridor pattern that reinforces local centres, supports passenger transport, reduces energy use and makes services more accessible. The importance of the role of State Highway 1 is also recognised.

The Plan promotes compact urban form that makes best use of transport and supports existing centres. It also promotes travel demand management and discourages housing development in rural locations, due to their relative inaccessibility to facilities.

The regionally significant resource management issues for regional form, design and function are identified as:

- Poor quality urban design
- Sporadic and uncoordinated development
- Integration of land use and transportation

Central Wellington is identified as the central business district for the region, also identified are a number of regionally significant centres that are an important part of the region's form. These are Upper Hutt, Lower Hutt, Porirua, Masterton, Paraparaumu, Petone, Johnsonville and Kilbirnie. Intensification of both housing, commercial activity and local employment in these areas is seen as an opportunity.

A number of development strategies and/or frameworks for growth and development already exist within the region, and the PRPS notes the role of any structure plans in being able to deliver high quality urban design outcomes. Eight areas predicted to come under significant development pressure in the future are identified as Focus Areas in both this Plan and the Wellington Regional Strategy, and the two relevant to this Project are Pauatahanui and Aotea to Linden.

The Plan also contains urban design principles for the region, based on the seven design qualities described in the New Zealand Urban Design Protocol.

Figure 2.1: Territorial Authority Boundaries

2.1.3 Porirua City District Plan

The largest section of the Transmission Gully Project sits within Porirua City. The use of land in the area is controlled under the Porirua City District Plan (PCDP). The route (including the link roads) traverses a number of zones:

- Industrial Zone
- Suburban Zone
- Rural Zone
- Landscape Protection Area
- Whitby Landscape Protection Area
- Judgeford Hills Zone (Operative Plan Change 6)
- Recreation Zone (Operative Plan Change 8)
- Public Open Space Zone (Operative Plan Change 8)

The majority of the route is in the 'Rural' zone, with small sections in the 'Industrial' and 'Suburban' zones. The principal activity in the 'Rural' zone is pastoral farming. The zone permits primary production activities and harvesting of up to one hectare of forestry per annum except in landscape protection areas. Subdivisions of a minimum lot area of 40 ha are allowed as a controlled activity. Subdivisions for lots of between 5 ha and 40 ha are a discretionary activity within this zone.

The Judgeford Hills zone (Figures 2.2 and 2.3) allows the creation of up to 40 houses within five separate clusters. The Structure Plan for the zone was developed on the basis that the Transmission Gully Project will effectively form the western boundary of the area. Zone provisions make specific reference to the landscape and visual impacts of the Transmission Gully Project. There will be no direct vehicular access from the newly developed zone onto the Transmission Gully Project and all highway access will be provided by an extension to Bradey Road. Provision is made for public pedestrian access to Belmont Regional Park via the Structure Plan area. The zone provisions also cover reverse sensitivity from the Transmission Gully Project, especially with regard to noise and require dwellings constructed near the route to limit noise levels within habitable rooms.

The Recreation Zone and Public Open Space Zone were developed to clarify and simplify the activities that could be undertaken as of right on public and private recreation and public spaces. The alignment passes through both zones in places. The objectives and policies note that recreation and public open spaces can host a range of activities including network utilities and transport corridors. The provisions recognise that the existing Transmission Gully Motorway (TGM) designation (K0405) running through Belmont Regional Park and Battle Hill Farm Forest Park forms part of the existing environment, as well as being regionally and nationally significant. The existing TGM designation forms the eastern boundary of the area of Battle Hill Farm Forest Park zoned Public Open Space.

Part of the route also runs through the Landscape Protection Area and the Whitby Landscape Protection Area (WLPA). The overall objective for these areas is the sustainable management of landscape and ecological systems. Of specific relevance to the Transmission Gully Project is the protection of the Belmont Scarp and Eastern Porirua Ridge. Specific mention of the landscape values of the WLPA and Duck Creek is also made and the need to avoid an adverse landscape effect on the WLPA.

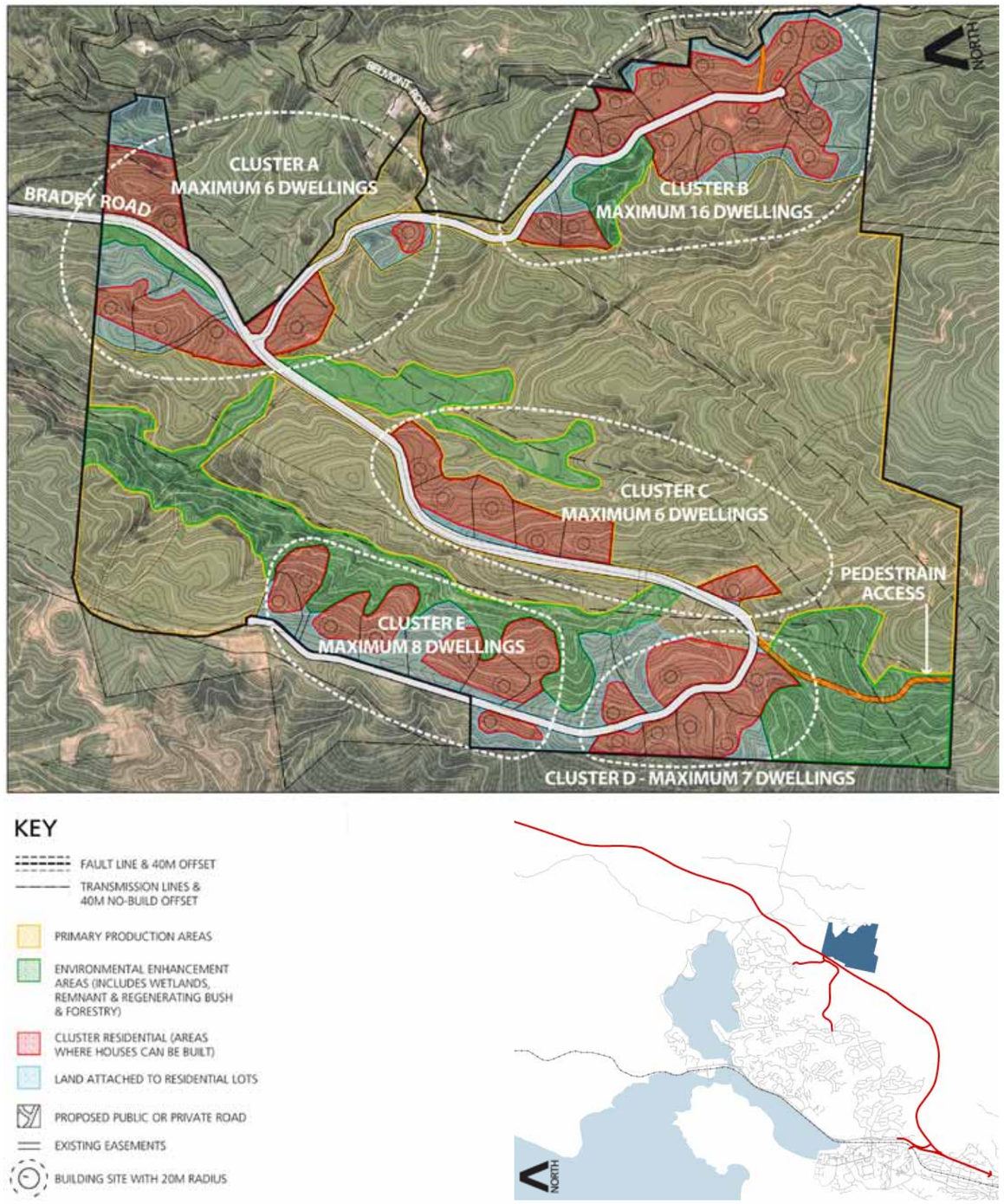


Figure 2.2: Judgeford Hills Structure Plan (PCC)

Figure 2.3: Location of Judgeford Hills Structure Plan

2.1.4 Porirua Development Framework

The Porirua Development Framework (Figure 2.4) is a non-statutory document guiding how Porirua City will grow and develop in the future. It has been developed within the context of the Wellington Regional Strategy and the Regional Land Transport Strategy.

The Framework objectives include, amongst others:

- Maximise business opportunities created by the Transmission Gully Project or other large infrastructural developments through and around the city, thus supporting economic development and employment growth.

It is noted that the timing and development of the Transmission Gully Project will have an influence on the location, rate and form of development. The key development areas in proximity to the Transmission Gully Project main alignment and link roads are:

- The Judgeford Hills area which is identified as a potential rural residential growth area. The Framework states that *"the area has desirable characteristics for rural residential living, with easy access to State Highways 1 and 58 and all of the Wellington region's urban centres, and proximity to Pauatahanui Inlet and the Transmission Gully Motorway. However, this is an area that is environmentally significant and sensitive, and one that provides a significant landscape backdrop for the wider Porirua City area"*;
- Whitby shops and surrounds including Duck Creek which are identified for comprehensive development including more intensive housing;
- Eastern Porirua, where Housing New Zealand has initiated a redevelopment programme for part of its housing estate including Cannons Creek and Waitangirua, involving redevelopment of housing for the elderly, housing for larger families and medium density development;
- Potential Industrial / Business Growth Area at Elsdon / Porirua Hospital land / Broken Hill Road / Kenepuru area in the vicinity of the Kenepuru link road where more intensive commercial or mixed use development will be encouraged; and
- Two Possible Industrial / Business Growth Area at Judgeford and around the intersection of State Highway 58 and the Transmission Gully Project (these areas do not include Lanes Flat). The Framework states that these locations *"may or may not be suited for very long term strategic industrial/business development purposes."* The Framework makes it clear that these areas are not considered suited to larger scale retail developments. It is also noted that Council will not support industrial/business growth within these areas in the absence of a comprehensive structure plan. Council accepts that the outcome of the structure planning process could be one that entirely discounts the possibility of these areas being used as active industrial/business areas.

The Framework also identifies a 'Green Network' which comprises the city's existing large-scale public reserves, its pathways network and possible extensions to that network. The Framework map shows one arm of the Green Network linking Pauhatahanui Inlet to the Transmission Gully Project alignment via Whitby Village centre. The Framework map is conceptual in nature but suggests that the green corridor follows Duck Creek and leads to the southern end of the Judgeford Structure Plan area, crossing the proposed Waitangirua link road.

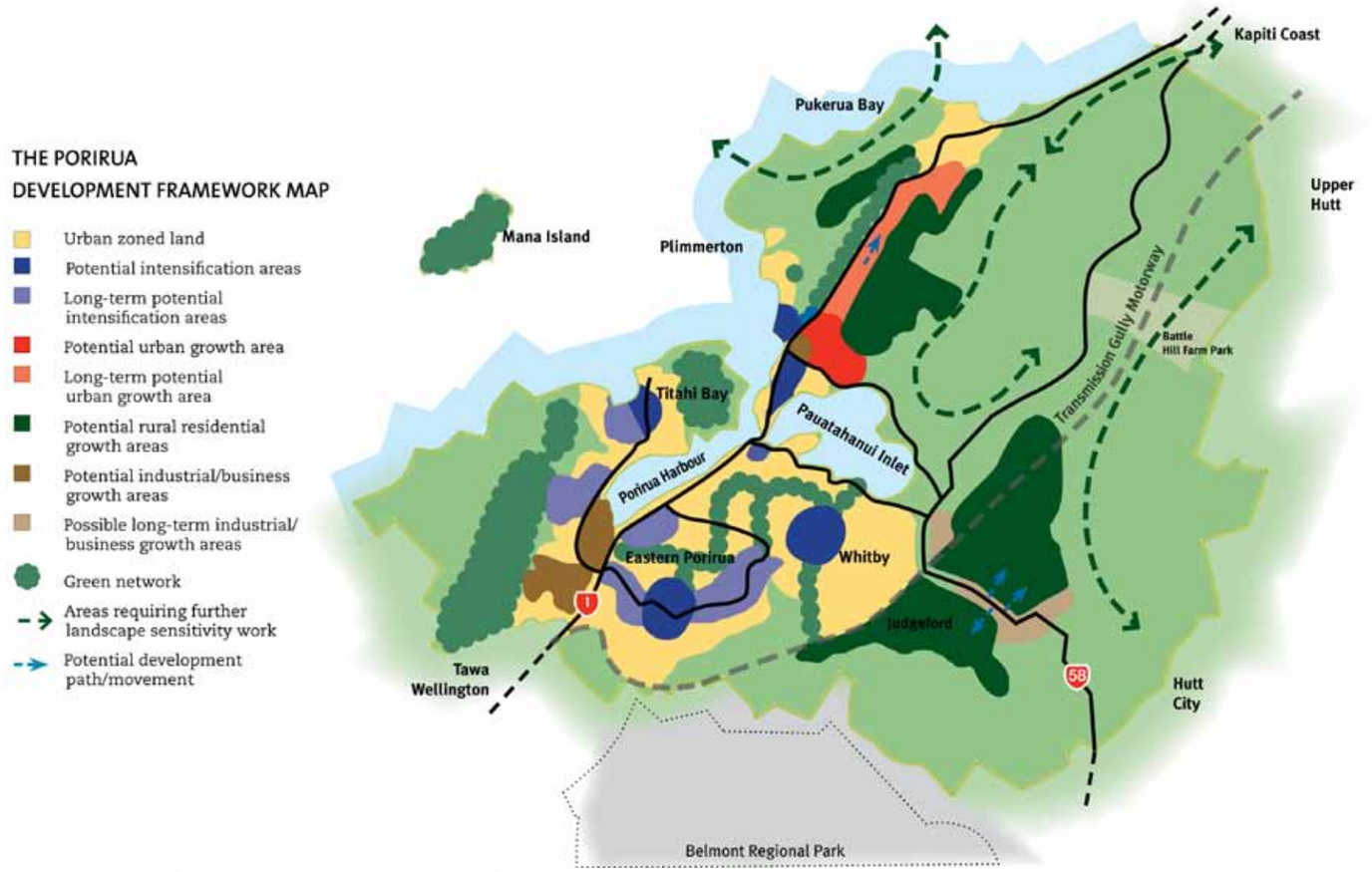


Figure 2.4: Porirua Development Framework Map (PCC)

2.1.5 Wellington City District Plan

The Wellington City District Plan (WCDP) controls land use in Wellington City. Most of the relevant provisions in the WCDP relate to effectively managing effects associated with amenity, such as noise and visual impacts (particularly in relation to the Belmont Hills).

The proposed route involves land in the 'Outer Residential' and 'Rural' zones. Within the 'Rural' zone, rural (excluding some factory farming) and residential activities are permitted provided they comply with certain conditions.

The WCDP also notes the importance of ensuring safe and efficient access to properties and managing the road system in accordance with the road hierarchy.

2.1.6 Kapiti Coast District Plan

The northern section of the route is in the Kapiti Coast District. This section is zoned 'Rural' under the KCDP. This zone is further divided into three policy areas. The Transmission Gully Project alignment traverses all three policy areas as follows:

- The 'Coastal Dune' environment comprises the sand country including the coastal foredune, consolidated sanddunes, interdune sandplains and wetlands. Development at a density of 4ha per dwelling in the form of hamlet or farmlet is a discretionary activity within this zone;
- The 'Alluvial Plains' comprises typically flat terrain consisting of alluvial plains, terraces and valley floors. The land contains the district's most versatile soils and supports much of the district's horticulture and intensive agriculture activities. This zone allows for rural subdivision of a minimum size of 4ha; and
- The 'Hill Country' comprises the foothills of the Tararuas and downlands. The land is very steep and is the most visible landform in the district and most vulnerable to change. Subdivision to a minimum lot area of 20ha is permitted within this zone.

The Plan main provisions relate to managing adverse effects, particularly in relation to the District's outstanding landscape. There is one outstanding landscape near the route, "the foothills of the Tararua Ranges", which on the District Plan's map includes the hills framing the entrance to Te Puka Stream and part of the lower valley traversed by the alignment. This area is to be protected from inappropriate subdivision, use and development.

2.1.7 Upper Hutt City District Plan

Only a very small area of the route is in Upper Hutt City. This area is forested rural land. The District Plan contains general provisions in relation to managing the potential adverse effects of land use activities on rural amenity and landscape values.

Future land issues influencing the design

The Project runs alongside areas identified for urbanisation, in particular at Judgeford Hills and Whitby. The Project will provide alternative and improved access to Eastern Porirua and Whitby, both identified by PCC as key development areas.

2.2 Transport policy

2.2.1 Regional transport policy

The construction of the Transmission Gully Project has been identified at a regional level as the preferred option for addressing transport congestion between Porirua and Paekakariki. The alternative option is to upgrade the existing coastal route (SH1). The preference for a new inland route is reflected in the Western Corridor Transport Study (WCTS) and the Wellington Regional Land Transport Strategy (WRLTS).

2.2.2 Regional Cycling Plan 2008 (GWRC)

The Regional Cycling Plan was adopted in December 2008. It responds to the policy framework for cycling set out in the Wellington Regional Land Transport Strategy (WRLTS). It sets out an action plan with a series of high level initiatives aimed at contributing to the outcomes of the WRLTS. A number of agencies are responsible for delivering the Cycling Plan, including the NZTA. The NZTA's role is to carry out improvements to the cycling network where appropriate and feasible on or across the state highway network and to assist Territorial Authorities (TA's) make improvements broadly parallel to state highways. The NZTA is also identified as providing funding support for a number of the initiatives in the Cycling Plan.

The Regional Cycling Network map identifies the core strategic routes which link the region's centres and should provide an acceptable level of services. In the vicinity of the Transmission Gully Project, these include:

- State Highway 58
- Kenepuru Drive / Main Road between Mungavin Avenue and Takapu Road
- Along State Highway 1 in the vicinity of Paekakariki and MacKays Crossing

In addition, it is expected that each TA in the region will identify their important cycle routes through development of their local cycling strategies.

2.2.3 Porirua Transportation Strategy Stage 1 2008 (PCC)

This report provides the scope for a full transportation strategy and defines strategies for walking, cycling and travel demand management. The 'Cycling & walking Strategy' section, states that there are no dedicated on-road cycle lanes within Porirua District. A north-south cycle-walking 'spine' route runs through the District following State Highway 1/railway corridor. This route connects the coastal section of State Highway 1 north of Pukerua Bay with Tawa to the south, and provides connectivity to Pukerua Bay, Plimmerton, Mana/Paremata and the Porirua CBD areas. The Strategy sets a target of 20kms of on-road cycle lanes by 2016, from 0km in 2008 and identifies a number of specific projects. The Projects of relevance to the Transmission Gully Project are:

- *Liaise with Transmission Gully Motorway design team to ensure that design facilitates under/over passes for cycling and walking traffic, especially in Battle Hill and Belmont Park areas.*
- *Advocate Transit (now NZTA) for the provision of cycle lanes on SH58 between Pauatahanui and Haywards, with cycle warning signs.*
- *Formalise a walk / cycle track connection between Kenepuru Station and Linden Park (following Porirua Stream) to link with the WCC network and the Tawa-Porirua streamside walkway / cycleway.*

2.2.4 Cycleways, Walkways & Bridleways Strategy 2004 (KCDC)

The purpose of the Strategy is to set a clear strategic vision for cycling, walking and horse-riding on the Kapiti Coast. The development of an inter-connected network of cycle, walking and horse-riding routes across the District is a key action identified by the Strategy. In the vicinity of the Transmission Gully Project, this includes:

- A coastal walkway / cycleway from Paekakariki to Otaki (now completed from Paekakariki to Peka Peka; and
- Relatively easy 'middle height' access along the coastal escarpment and lower hills, east of SH1.

The Strategy identifies a number of issues for cyclists, pedestrians and horse-riders in Kapiti noting that a major disincentive to cycling is the perception of danger from cars. It also states that personal security should be an important consideration in both route planning and detail design, e.g. avoid hidden areas, dark corners.

A revised Strategy was adopted by the Council in October 2009 and is awaiting publication.

2.2.5 Towards a Sustainable Transport System – A Strategy for Managing Transport on the Kapiti Coast 2008 (KCDC)

This document provides a long-term strategy for transport by all modes. Of particular relevance to the ULDF is the focus on walking and cycling. The first Community Outcome underpinning the Transport Vision is:

"That Kapiti Coast becomes nationally famous for an extensive walkway, cycleway and bridleway system [which provides, amongst others,] a coastal walkway and cycleway from Paekakariki to Otaki and north; safe cycling commuter links between communities, from Paekakariki in the south to Otaki in the north; and relatively easy 'middle height' access along the coastal escarpment and lower hills."

Connectivity issues influencing the design

The Project has the potential to affect existing local connectivity. The Project uses design solutions for the main alignment and link roads (including road alignment, junction type, provision of cycle and pedestrian facilities) which maintain or enhance local connectivity for pedestrians, cyclists, public transport and private vehicles.

The Project provides opportunities to improve or open up access to previously inaccessible areas. The design of the Project maintains the possibility for others to introduce tramping tracks within parts of the designation corridor where connections between existing tracks are missing.

The Project crosses or meets the regional cycle network at Kenepuru Drive, SH58 and SH1 at MacKays Crossing. The Project provides opportunities for localised improvements to the regional cycle network.

Figure 2.5: Location of Waitangirua Community Park

2.3 Village Plans

2.3.1 Waitangirua Village Planning

Following extensive community engagement, part of the existing carparking area in front of the Waitangirua Mall has been converted into a new Community Park which will include a childrens' playground, open green space, performance stage, a picnic area and pedestrian promenades (Figures 2.5 and 2.6).

The northeastern corner of the Community Park is at the intersection of Warspite Avenue and Niagara Street. The proposed Waitangirua link road will connect to this intersection from the east.

Figure 2.6: Waitangirua Community Park - Proposed design (PCC)

2.3.2 A Framework for the development of Pauatahanui Village 2009 (PCC)

The Pauatahanui Village Plan sets out the views of the community as captured in a series of workshops late in 2008 and outlines the tasks required to retain, restore or improve the elements of the village that are most important to the community. The Plan focuses on issues such as traffic safety, ecology, sewage and reclaiming lost character.

Of particular relevance to the Transmission Gully Project are the following points:

- Statement that Lanes Flat forms the major part of a buffer between the village and Whitby. The residents consider it important to retain this as a green area. The area is owned by the NZTA and the Plan recommends that any area which becomes surplus to the NZTA's requirements after the Transmission Gully Project is built should become a public space / reserve and be protected from development. The Plan also notes that this area is part of the estuary flood plain and considered unsuitable for residential, commercial or industrial development; and
- Proposal to investigate options for creating a pathway on the north side of the road between the village and SH58 roundabout.

Village issues influencing the design

The Waitangirua Link Road will meet the local street network directly opposite the new Community Park at the heart of the Waitangirua neighbourhood. The design of the junction between the Link Road and Warspite Avenue reflects this location and cater for pedestrian and cycle movement.

The Project skirts Lanes Flat at the SH58 Interchange. The design of the landscape treatment and the provision of pedestrian paths around this interchange provide opportunities to support the Pauatahanui Village Plan's initiatives.

2.4 Greater Wellington Parks Network Plan (2011)

Greater Wellington Regional Council finalised the Greater Wellington Parks Network Plan in December 2010 and it became operative on 1 January 2011. This is the first-ever consolidated plan for managing regional parks and forests. The Parks Network Plan replaces the management plans for Battle Hill Farm Forest Park (2008), Belmont Regional Park (1996), Queen Elizabeth Park (2006), and also the Regional Forest Lands Management Plan (2006) and the Regional Park network management plan (2003).

The over-arching vision of the Parks Network Plan is:

"To enrich lives by connecting people with healthy natural places."

The plan contains eighteen 'Guiding principles for management' and a number of general management objectives and policies covering biodiversity and ecosystems, landscape and geological features, cultural heritage, land management, visitor services, park infrastructure, partnership in parks, research and monitoring, and land tenure, acquisition and disposal.

The plan also contains specific objectives for each of the regional parks covered by the plan. Four of these are relevant to the Transmission Gully Project (Figure 2.7), with specific mention of the project mainly being found in these sections.

Belmont Regional Park

The following matters are included amongst the projected changes identified for the park and relevant to this Project:

- Identify known traditional trails through the park, and develop interpretation at identified sites;
- Link the park's track network to complement, and where possible connect to other open space areas. For instance, the Hutt River Trail, the Western Hills, and Wellington City's 'Outer Green Belt';
- Work with community groups to identify options for providing mountain biking opportunities in the park; and to restore ecological areas within the park;
- Encourage and provide public access tracks and recreational corridors into the Park from land in the vicinity of the Park, e.g., Newlands/Horokiwi, Porirua East – Porirua Park and Warspite Avenue link road, Whitby/Pauatahanui; and
- Work with New Zealand Transport Agency and other agencies to ensure access links across the park are maintained.

Battle Hill Farm Forest Park

The following matters are included amongst the projected changes identified for the park and relevant to this Project:

- Work towards better recreational linkages between Queen Elizabeth Park, Akatarawa Forest and Belmont Regional Park through Battle Hill Farm Forest Park; and
- Work with the New Zealand Transport Agency and other agencies to ensure access links across the park and advocate for a non-motorised/shared track from the park towards Haywards Hill Road (SH58).

The Plan identifies that the proposed Transmission Gully Project effectively cuts the park in two, separating the farm and forest remnant from the production forest. This is considered to potentially generate a major impact on some park users, as well as the leasehold viability of the farm. The Plan notes that Greater Wellington wishes to ensure that access to both future areas of the park will be retained for farming, operational and recreational activities.

Queen Elizabeth Park

The following matters are included amongst the projected changes identified for the park and relevant to this Project:

- Develop Wainui, Whareroa and particularly MacKays as the main focal points for visitor activity and key development nodes for locating facilities and activities that are family friendly and focused on heritage;
- Work with community groups and other agencies to implement a cycle plan to link Raumati South and Paekakariki with better opportunities both for commuter and recreation cycling; and
- Work with New Zealand Transport Agency (NZTA) and other agencies to maximise recreational opportunities from any proposed roading developments by NZTA.

Akatarawa Forest Park

Akatarawa Forest Park has a management focus divided into two priority streams.

The primary focus to ensure that:

- The water resource within the future water collection area is healthy and that its potential as a sustainable source of secure, fresh, clean water for the region in the future is protected; and
- There is provision for water supply infrastructure as required.

The secondary focus will ensure:

- The native forest vegetation is protected;
- The forestry production is managed on a rotational basis;
- A range of back-country recreation experiences are offered;
- The current network of tracks continues to be the main location for motorized recreation; and
- Wind energy development on selected ridgelines.

Projected changes identified for the park and relevant to this Project include the need to:

- Work with the Department of Conservation and other landowners to develop recreational links to the Kapiti Coast and Queen Elizabeth Park.

Regional Parks issues influencing the design

The Project runs through parts of both Battle Hill Farm Forest Park and Belmont Regional Park, severing some existing tracks. The design of the Project maintains connectivity and accessibility for all park users across the alignment.

The Project will increase the visibility of the Regional Parks to the public. The design of the Project maintains visual, pedestrian, cycle and vehicular connections to Belmont Regional Park and Battle Hill Farm Forest Park from the wider area.

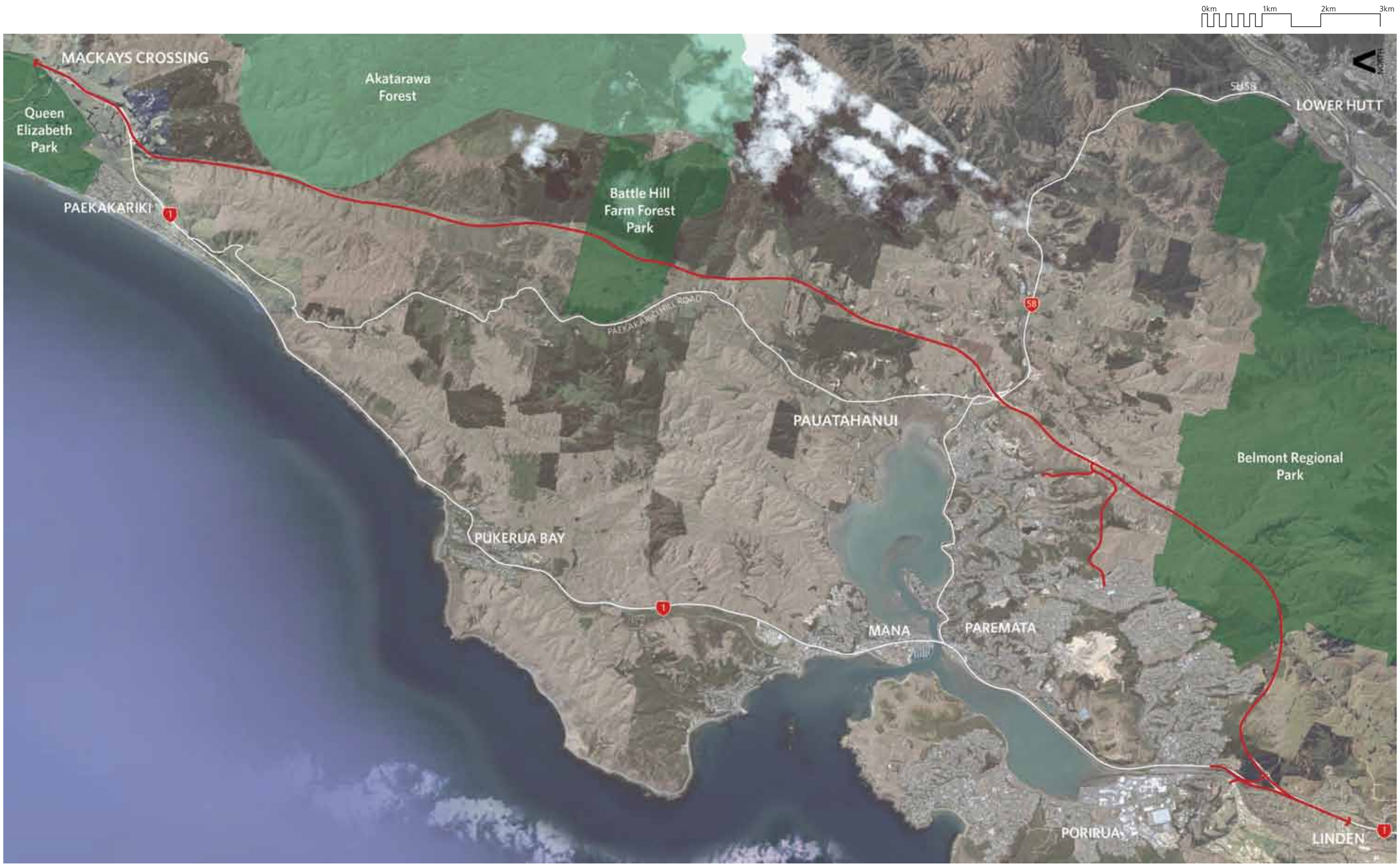


Figure 2.7: Locations of Regional Parks and Forests

3 Corridor context

This chapter provides a summary of the main features of the highway corridor and highlights the key issues influencing the design of the Project.

3.1 Landform

Wellington's landscapes are characterised by a regional pattern of parallel hill ranges oriented on a NE-SW alignment, separated by the region's main faults. The main ranges of hills are tilted so that they typically have steeper escarpments on their south-eastern flanks and more gradually dipping slopes on their north-western flanks. There is a secondary pattern of splinter faults and folding on a north-south axis within the ranges of hills, which results in a finer scale pattern of north-south valleys and basins such as those occupied by Porirua Harbour, Pautahanui Inlet and Wellington Harbour.

The proposed alignment of the Transmission Gully Project responds to this geomorphic pattern. Travelling from the north the existing State Highway 1 (SH1) follows an NE-SW alignment along the edge of the coastal plain at the toe of the Ohariu Fault escarpment to the vicinity of MacKays Crossing, from where the proposed new highway will be parallel to the Ohariu Fault up the Te Puka Stream valley and over the Wainui Saddle. From the Wainui Saddle the route then follows a splinter fault on a north-south alignment as far as the James Cook Interchange. The Horokiri Stream and the upper sections of Ration Stream follow the splinter fault. From the James Cook interchange the proposed alignment follows the Moonshine Fault along the Duck Creek valley on a NE-SW alignment to the vicinity of the Takapu Substation, before swinging to the north-west across the grain of the landscape around the southern perimeter of the Porirua Basin. The route rejoins SH1 at Linden where it picks up the Ngauranga Fault, another splinter fault on the north-south alignment.

Figure 3.1 illustrates the topography in the Project area.

Figure 3.2 illustrates the landform in the Project area.

Geotechnical issues influencing the design

The presence of fault lines and secondary splinter faults along and across the alignment and variations in substrate limit the potential engineering solutions. The Project balances the development of appropriate engineering solutions, including the need to provide route security (a primary objective of the Project), with potential bio-physical, visual and experiential impacts.

It is desirable to achieve a corridor-wide balance between the amounts of cut and fill resulting from construction earthworks. The Project develops earthworks solutions that minimise earthworks quantities. Where surplus fill needs to be disposed of, sites have been selected that will have the least impact on landscape character and ecology.

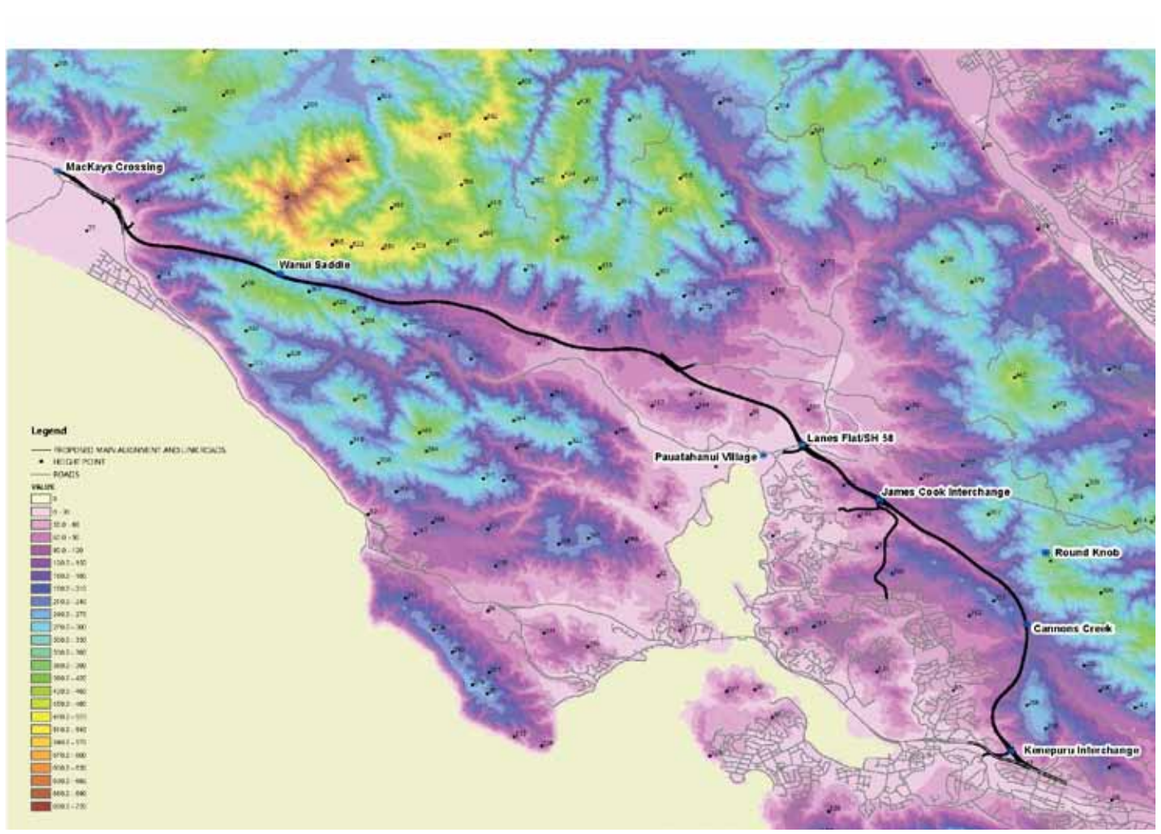


Figure 3.1: Topography

Figure 3.2: Landform

3.2 Hydrology

Stream patterns in the area respond to the tectonic patterns. The main streams in the area traversed by the proposed alignment –Te Puka Stream, Horokiri Stream and Duck Creek- follow faults and splinter faults and consequently have relatively straight valleys on either NE-SW or north-south alignments. The tributary streams, on the other hand, tend to follow more meandering courses with inter-leaved spurs. Those tributary streams on the fault escarpments, such as the western tributaries of Te Puka Stream, Horokiri Stream and Duck Creek, are shorter and steeper while the tributaries on the more gently sloping dip-slopes are longer and have larger catchments.

Two thirds of the proposed Transmission Gully Project route traverses catchments that converge on Pauatahanui Inlet, including the catchments of Horokiri Stream, Ration Stream, Pauatahanui Stream and Duck Creek, and the Onepoto Arm of the Porirua Harbour. Most of the rest of the route drains into the southern arm of Porirua Harbour by way of tributaries of Kenepuru Stream. Only the northernmost 5km encompassing Te Puka Stream catchment does not drain toward Porirua Harbour, instead flowing across the narrow coastal plain through Queen Elizabeth Park to a stream mouth north of Paekakariki.

Figure 3.3 illustrates the main streams and catchment areas.

Hydrological issues influencing the design

The Project follows Te Puka and Horokiri streams and requires re-alignment of several stream segments. The narrow nature of the Horokiri and Te Puka stream valleys either side of Wainui Saddle means that the alignment overlies the streams in several locations and requires the re-alignment of several segments of the streams.

Through Battle Hill Farm Forest Park and the SH58 area the terrain is flat enough for the consideration of grassed swales and wetlands to be used for the collection, conveyance and treatment of highway stormwater runoff.

Lanes Flat is part of the estuary flood plain and requires careful consideration.

Figure 3.3: Hydrology

3.3 Existing vegetation and land use patterns

The area traversed by the route has mostly been cleared and converted to exotic vegetation including pasture and pine plantation. There are occasional remnant pockets of indigenous vegetation, mainly in the upper reaches of Te Puka Stream valley, areas of regenerating forest such as Cannons Creek, and areas of regenerating former pasture characterised by gorse, tauhinu and mahoe. The area surrounding the proposed Transmission Gully Project alignment is characterised by the following land use patterns:

- **Extensive pastoralism:** Areas of extensive grazing land are located on the steeper hill country in Te Puka Stream and Horokiri Stream area and the Duck Creek Catchment south of SH58. It also includes the lower lying valley occupied by Battle Hill Regional Park;
- **Indigenous Bush:** There are remnant patches of indigenous bush, including areas in Te Puka Stream and Duck Creek tributaries. There are areas of regenerating second growth bush, notably in the Cannons Creek catchment. There are also extensive areas of former pasture that are reverting to natural vegetation largely characterised by gorse, tauhinu and other small leafed species such as twiggy coprosma, manuka and kanuka. The other notable indigenous vegetation is the wetland area (wildlife refuge) at the head of Pauatahanui Inlet adjacent to Pauatahanui village;
- **Exotic Plantation:** There are extensive areas of commercial pine plantation on the hills east of Horokiri Stream (Akatarawa Forest), and smaller areas scattered through the remainder of the route;
- **Rural lifestyle:** This is located in the middle part of the route accessed mainly from Flightys Road, Paekakariki Hill Road, and Bradey Road. The area has a more gently rolling topography and is characterised by a closer settlement pattern; a patchwork pattern of boundary shelter planting and differing land management; a wide variety of vegetation including exotic shelter trees, small plantations, amenity trees, and areas of native re-vegetation;
- **Rural Village:** Pauatahanui located adjacent to the alignment at SH58 is a small rural village at the head of Pauatahanui Inlet. It has a linear form, strung out along SH58 and the Paekakariki Hill Road. There are a number of historic buildings and sites. (Further discussion on the history of the settlement is included in Chapter 3.5);
- **Urban Periphery:** The area between Linden and the Cannons Creek bridge comprises rural fringe land. The hills form the backdrop to the Porirua East urban area, and comprise a mosaic of former pasture that has reverted to gorse and mahoe shrubland; rough pasture on the ridgelines; small pine plantations; areas of remnant or regenerating indigenous forest; and peri-urban activities;
- **Urban Areas:** Only the southern most connections to the existing SH1, and the connecting link roads, traverse urban areas; and
- **Peri-urban Activities:** The area is also characterised by activities typically found on the outskirts of urban areas, including the Pauatahanui Golf Course, the two regional parks (Battle Hill and Belmont), the Porirua Gun Club, and a regional electricity substation at Takapu Road (as well as the smaller substation at Pauatahanui).

Figure 3.4 illustrates the existing vegetation and land use patterns.

Land use issues influencing the design

The route passes through existing rural and rural-residential areas potentially severing existing land use and impacting on amenity values. The Project seeks to minimise the overall footprint of the route; maintain and/or reinstate existing adjacent land cover and land use opportunities; and develop design responses that address amenity effects on adjacent properties.

The main alignment and link roads either skirt or run near to existing and planned urban areas. The road components (earthworks, structures, interchanges, noise barriers, etc) have the potential to negatively impact on the amenity of these areas. The design seeks to minimise the visual, noise and air quality effects of the road on the surrounding communities, and to maintain the usability and amenity of public open spaces, pedestrian, cycle and vehicle links which adjoin or cross the highway corridor.

Vegetation/Ecology issues influencing the design

The Project requires some vegetation removal for road construction and operation. This has the potential to change the landscape character and ecology values of parts of the route. The design seeks to minimise the removal of indigenous vegetation through sensitive route alignment and construction methodology, including the careful location of haul roads and construction tracks.

The Project has the potential to impact on the natural environment including: ecologically important vegetation communities; habitat for terrestrial fauna; high value streams; and neighbouring estuarine environments. The Project seeks to support natural processes by:

- Designing planting to improve water quality and habitats along streams
- Designing stormwater flow and treatment devices to minimise impact on water quality
- Restoring connections between areas of native vegetation to increase habitat and biodiversity levels
- Making use of natural regeneration processes

The Project requires stream works including culverting and diversions which may alter some of the existing stream habitat. The Project seeks to minimise the loss of in-stream habitat through sensitive route alignment and to provide for fish passage through appropriate design of culverts and stream diversions.

Figure 3.4: Existing vegetation and land use patterns

3.4 Landscape character

The route traverses nine landscape character units:

Unit 1 Kapiti Coastal Plains: Characterised by the alignment of SH1 along the toe of the fault escarpment and inland dune fields.

Unit 2 Te Puka and Horokiri Stream Valleys: Comprising Te Puka Stream, Wainui Saddle and the upper part of Horokiri Stream. The area has a wilderness character typified by the steep narrow valley and 'mountain' stream; steep hill faces; and lack of human settlement. Land use comprises extensive (i.e. low intensity) stock grazing, exotic pine forest, regenerating native forest and fragmented native and exotic scrub.

Unit 3 Battle Hill Farm Forest Park: The lower valley of the Horokiri Stream within the Battle Hill Park has a softer rural character. The valley is wider and has more rolling topography and higher quality pasture. The Horokiri Stream follows a more meandering course along its small flood plain which is used for crops such as hay. The land use patterns are expansive, comprising broad scale pasture on the west bank of Horokiri Stream and extensive plantation forest on the steeper backdrop hills on the east bank, but also including areas of native restoration.

Unit 4 Pauatahanui Rolling Hill Country (Flightys Road Lifestyle Area): The area between Battle Hill Farm Forest Park and SH58 has a 'lifestyle' landscape character including lifestyle properties and the Pauatahanui Golf Course. It has a more fragmented rolling topography and a complex patchwork of property boundaries; diversity of rural land uses; wider range of trees including a high proportion of exotic trees; and a relatively close settlement pattern. It is a semi-enclosed landscape.

Unit 5 Pauatahanui Stream Flats: Formerly the inland extent of the Pauatahanui Inlet, the valley now forms a flood plain for an extensive catchment of the Belmont and Akatarawa hills. Pauatahanui Village is located adjacent to the Pauatahanui Stream bridge downstream from the proposed Transmission Gully Project alignment. Otherwise the valley floor has an open pasture character with some artificial drains. The enclosing hills include a stand of kanuka, the suburban fringes of Whitby, and lifestyle properties.

Unit 6 Bradey Road Lifestyle Area: The area between Pauatahanui Valley and the proposed James Cook Interchange has a 'lifestyle' character. As with the Flightys Road area, it is characterised by fragmented rolling topography and a complex patchwork of property boundaries; diversity of rural land uses; wider range of trees; and a relatively close settlement pattern clustered along Bradey Road. The main difference is that the edge of the Whitby suburban area (Silverwood subdivision) is subject to a wide viewing audience extending to the top of the hills on the west overlooking the lifestyle area.

Unit 7 Duck Creek Valley (Belmont Hill Country): The valley has a remote character. It is characterised by the strong topographic patterns of the Moonshine Fault escarpment on Duck Creek's west bank and the bold hills of Belmont Regional Park to the west; steep gullies, round spurs and footslopes; simple land use pattern of expansive pastoralism, and the absence of human settlement. As with Te Puka Stream / Upper Horokiri Stream, the area has a relatively wild and dramatic natural character. The most prominent structures are transmission lines converging on the Takapu Road substation.

Unit 8 Porirua East Basin: The area between the Linden connection and Cannons Creek bridge forms a backdrop to the urban basin. It is characterised by reasonably bold topography and a mosaic of pine plantation, rough pasture, and areas of reverting gorse/mahoe shrubland. Structures are limited to occasional buildings and transmission lines.

Unit 9 Linden: The small area between the Linden connection and the tie-in to the existing SH1 is the only urban section of the route. Aside from the large pine plantation forming a backdrop on the hills, the area is characterised by its residential suburban character and the existing motorway and rail corridors.

Figure 3.5 illustrates the landscape character units and key features.

Landscape issues influencing the design

There are significant earthworks, structures, carriageways and road furniture that will impact on landscapes of various character and quality along the route. The Project seeks to integrate the road with the surrounding landscape, principally through:

- Recognition of and reference to key natural landscape patterns;
- Selection of a road alignment that retains key features (e.g. landform, waterways, vegetation, historic sites, etc) along the route.;
- Consideration of the natural topography in the development of cut and fill profiles; and
- Selection of design treatments (e.g. materials) that reinforce landscape character and limit visual effects.

The strongest characteristics of the area traversed by the alignment are the expressive landforms (bold hills, sharp escarpment, straight fault-line valleys) resulting from active tectonic processes, and a natural remoteness. The design seeks to reflect these characteristics and allow road users to experience and appreciate the expressive landform and natural characteristics of the Project area.

The Project will create previously unobtainable, new public views to isolated and remote areas and the broader landscape. The design seeks to ensure distinctive views from the highway to the Kapiti Coast and Kapiti Island, to Pauatahanui Inlet and hill backdrop, Wainui Saddle and Belmont Hills are not lost.

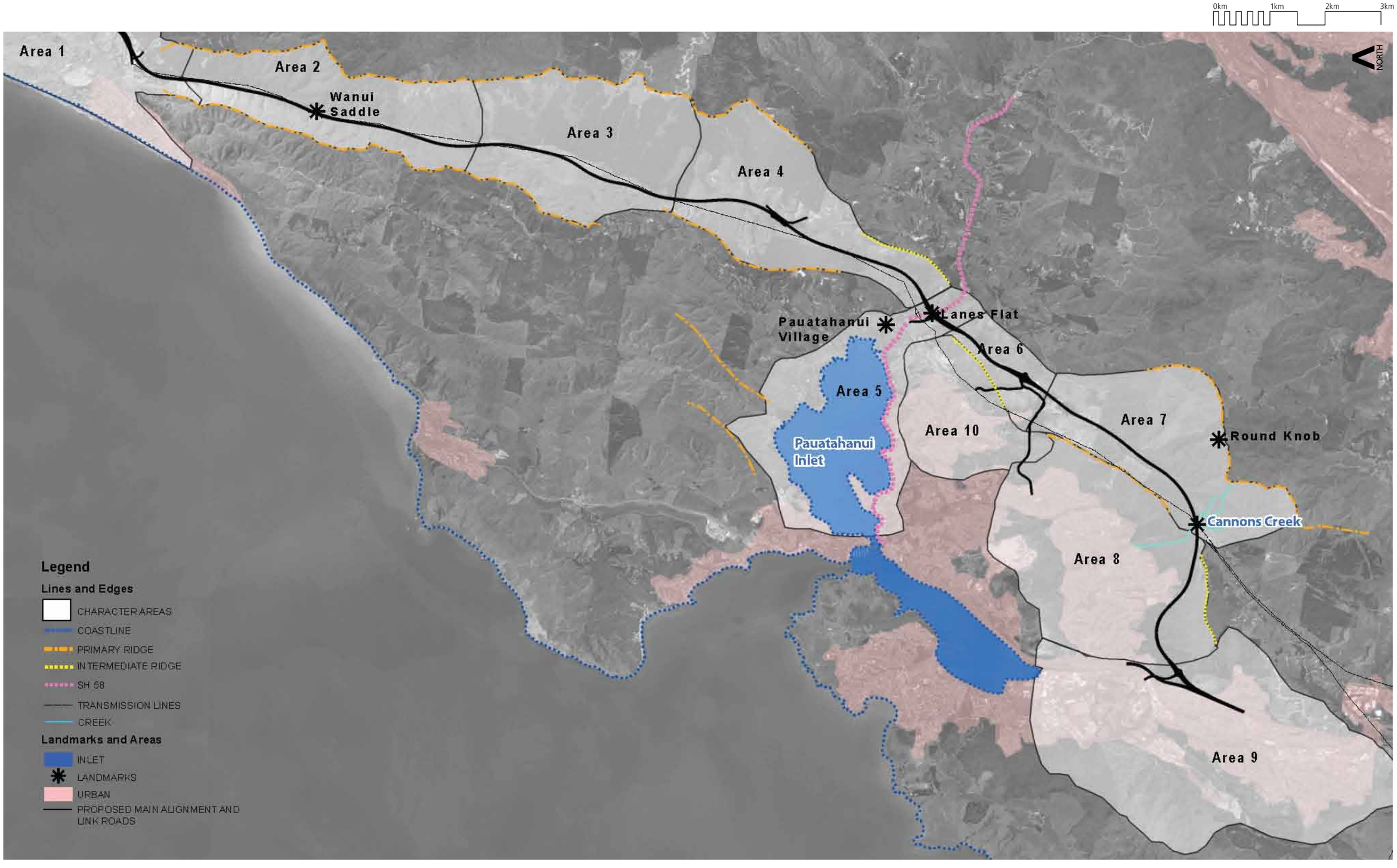


Figure 3.5: Landscape character units

3.5 History

The following elements along the route are of historical value:

- The northern end of the route is rich in cultural heritage for Europeans and Maori alike. Maori occupied both Queen Elizabeth Park (QEP) and Whareroa Farm, where Pa were established after the Battle of Waiorua in 1824. European cultural presence in the park is also strong, it having been a site where early settlement, particularly sealers and whalers, took place. For many, the most notable reminder of European activity is that of the US Marines at Camp Paekakariki and Camp Russell during 1942 and 1943 (Photo 3.1). The camp was divided into three sections and was located on flat land now within Queen Elizabeth Park and on the coastal terrace above and to the west of SH1. Another point of cultural significance is the Tramway Museum in QEP which commemorates the importance of this type of transportation to the region;
- Battle Hill was the last engagement of a series of skirmishes fought during 1846 in Wellington Region as part of the New Zealand Wars. Ngati Toa chief Te Rangihaeata had built a pa, Matautaua, at Pauatahanui commanding the Pauatahanui Inlet. However it was vulnerable to overland attack from the rear and was abandoned following an attack by Governor Grey with British troops. Te Rangihaeata retreated and built a pa on a spur above the Horokiri Stream from where he fought a rear-guard action over several days before abandoning the site and withdrawing to the north. The battle site is on a ridge approximately 1km west of the proposed Main Alignment;
- Pauatahanui has a rich history. British troops established a garrison settlement on the site of Te Rangihaeata's pa immediately following the action in 1846 discussed above. Troops then constructed the Paekakariki Hill Road for military purposes, after which Pauatahanui became an important coaching and staging settlement on the main road north from Wellington. The route north from Tawa was by way of the southern shores of the inlet and the Paekakariki Hill Road. The heyday of the village was during the 1870s and 1880s when it supported a range of businesses, the settlement gradually declining after it was bypassed first by the railway (1886) and eventually the coastal main road route (1939). As well as its garrison and staging history, Pauatahanui acted as a service centre for surrounding rural areas, supported a sawmilling industry at one time, experienced a minor gold rush, and was a service centre for military camps located in the surrounding area during the Second World War. There are a number of historic buildings and sites, most of which are within the village precinct west of the proposed Transmission Gully Project alignment. St Joseph's Catholic Church (Photo 3.3) and historic cemetery is on a hill immediately east of the proposed SH58 interchange;
- Whitby is a comprehensively planned suburb built in the 1970s to an innovative and high quality design. The suburb has a high level of amenity, extensive walkways and bush and open space reserves. A feature of its identity is the street naming derived from a nautical theme associated with Cook's voyages; and
- At the southern end of the route, Porirua is a planned post World War II urban development. The proposed Transmission Gully Project alignment circles the Porirua East basin (i.e. south of Ranui Heights, Cannons Creek and Waitangarua) which was developed as a state housing area.

Two recognised buildings of cultural heritage value are in close proximity to the Project:

- St Joseph's Church near Pauatahanui registered category I with the New Zealand Historic Places Trust
- Petrol storage tank listed on the KCDC District Plan. This brick structure (Photo 3.2) was built during WW2 and is one of three in the country according to KCDC heritage building list. It is the only intact surviving American built structure from the period of the American camps.

Source: *Transmission Gully Project: Built Heritage (2010)*

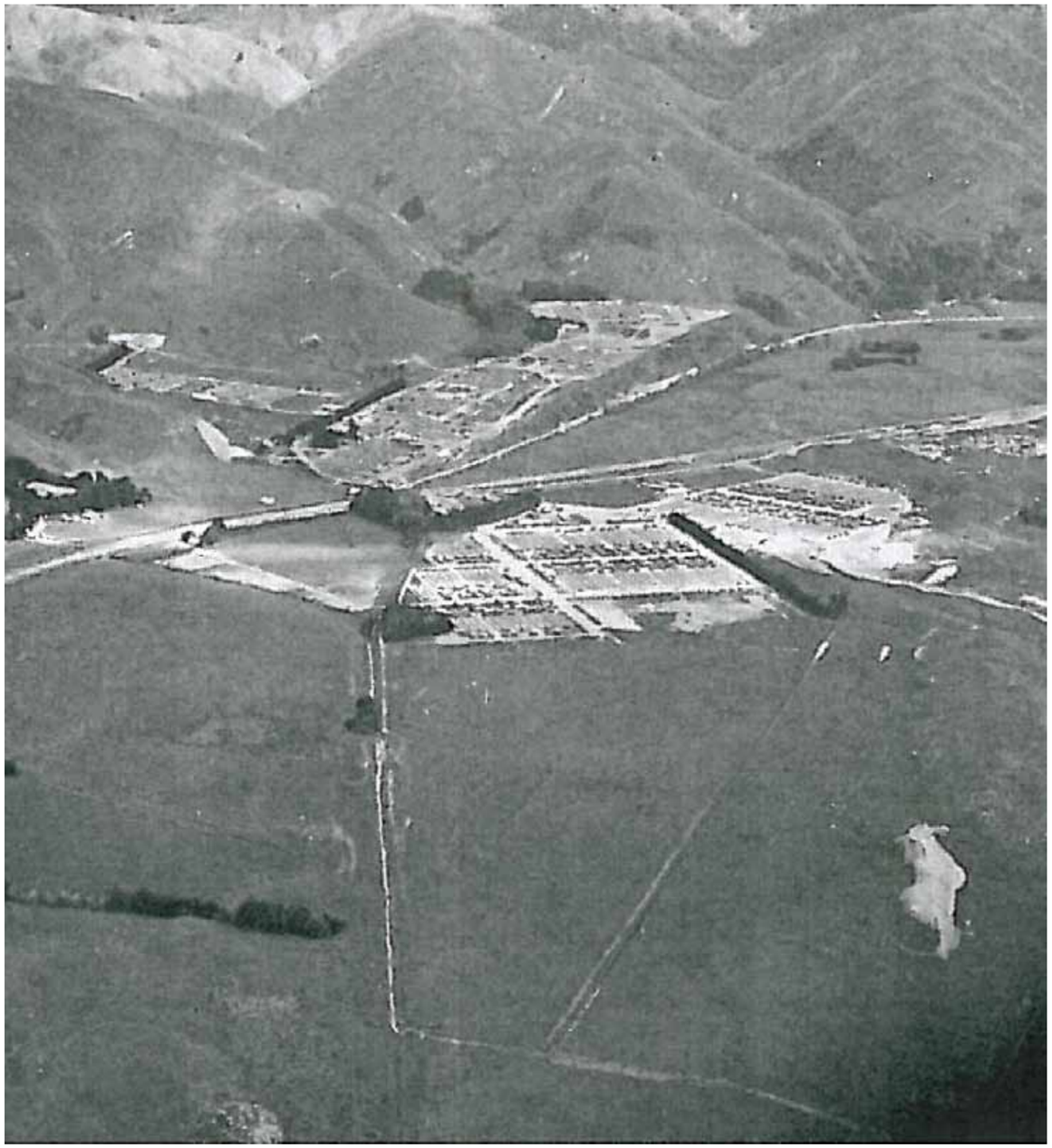


Photo 3.1: Detail of aerial photo of US Servicemen's camps at MacKays Crossing, Nov 1943
Alexander Turnbull Library: PAColl-0783-2-0288

Photo 3.2: WW2 Petrol storage tank

Tangata Whenua issues influencing the design

- Large earthworks and the associated need for sediment control in order to prevent significant sedimentation entering watercourses which could affect aquatic life and ecosystems (ie. the mauri of the stream);
- Request to limit diversions because of concerns about loss of habitat and effect on the mauri of the streams
- Biodiversity in particular maintaining fish passage, protecting water quality and restoring habitats where stream diversions occur;
- Habitat protection including planting of native species, particularly in riparian margins, and re-planting of areas of indigenous forest which need clearing to reinstate habitat for native birds; and
- Sites of cultural significance in close proximity to the route.

Photo 3.3: St Joseph's Church

Historical issues influencing the design

The Project passes near several areas with rich and diverse human history. However, the Project does not directly impact any of the historical sites and there are no known archaeological sites within the proposed road alignment itself.

The Project seeks to respond to its local context. In some areas, this may involve selecting detailed design solutions which suit the historical context in which it sits.

3.6 Value to Tangata Whenua

Archaeology

The vast majority of evidence for Maori occupation around the Project area is along or near the coastal edge, reflecting the importance of the coast for both resources and transport. Maori fished in the sea, and gathered shellfish from the beaches. The coast has always been important for Maori, as a route for travelling, as a source of kaimoana, and as a cultural and spiritual reference point. They also utilised the coastal swamps for eels, birds and flax, and planted crops in the friable coastal soils. This subsistence pattern is especially prevalent along the Kapiti Coast, but can also be seen further south around the Porirua Harbour and Pauatahanui inlet. The hills immediately adjacent to the coastal flats were used for crop storage and for the strategic advantage their height allowed. South of Pauatahanui, very little information about the Maori occupation and use of the area has been identified. This is consistent with the focus of Maori settlement along the coast.

Source: *Transmission Gully: Archaeological Assessment of Proposed Roadway (2010)*

Iwi values

The predominant Iwi with Tangata Whenua status in the Transmission Gully Project area is Ngati Toa Rangatira.

Ngati Toa Rangatira had settlements at either end of the Transmission Gully Project, at Whareroa in the north and Pauatahanui in the south. However Ngati Toa Rangatira settled predominantly in coastal locations, such as Wainui (Paekaakaariki), Pukerua, Taupo (Plimmerton), Paremata and Porirua. The environs of the Pauatahanui Inlet and Porirua Harbour also provided attractive locations for settlement and facilitated access to the coast for fishing and gathering kaimoana.

The importance of the Transmission Gully Project to Ngati Toa Rangatira was primarily as an area of plentiful natural resources that were vital to the Iwi's health and cultural wellbeing. Large areas of forest sustained important native plants that were used for medicinal purposes as well as food sources. The catchment is characterised by a network of streams that feed into the Pauatahanui Inlet. These streams supported significant populations of native fish and were highly valued by Ngati Toa Rangatira as important sources of kaiawa. The Inlet itself was a key attraction to the area given its close resemblance to the estuary at Kawhia which sustained Ngati Toa Rangatira for generations prior to their migration to the Cook Strait region.

Ngati Toa Rangatira's main issue of concern in relation to the Project is the discharge of large volumes of sediment to the environment and the potential effects on waterways, the Pauatahanui Inlet and Porirua Harbour. They are also concerned about adjacent sites of cultural significance including Queen Elizabeth Park (early settlement, urupa, pa and kainga sites), Whareroa Farm (early settlement and urupa), Battle Hill Farm Forest Park (site of 1846 battle and grave site), Pauatahanui Wildlife Reserve, Horokiri Wildlife Reserve (early Ngati Ira settlement and pa) and Porirua (Onepoto) Harbour (early settlements, pas and kainga sites).

Source: *Transmission Gully: Cultural Impact Assessment Report (2010)*

4 Project-wide design principles

4.1 Urban and landscape design concept

The overall concept underpinning the urban and landscape design of the Transmission Gully Project is to:

- Create an 'open sky' highway with expansive views of the surrounding landscape unobstructed by structures - a result of the main alignment sitting above all interchanges and local roads;
- Emphasise the linear character of the highway as a landscape 'fault line' – a reflection of underlying geomorphology and reinforcement of the road as a continuous landscape element and experience in its own right;
- Emphasise the existing landscape patterns perpendicular to the highway – a reflection of existing natural landscape patterns and sense of place, and reinforcement of the road as providing connection with the broader landscape;
- Emphasise the interchange with SH58 with a landscape treatment incorporating new wetlands and tree planting; and
- Celebrate the threshold between the hill country and the urban area at the southern end of the route through sculptured earth form and a gateway underpass design.

The concept is supported by a number of design principles which are presented in the following sections.

4.2 Landscape design principles

Highway Principles

- Design the highway and associated elements to emphasise the highway's linear character, horizontal lines and sharp edges;
- Minimise the overall construction and final footprint of the road;
- Select a coherent suite of highway furniture, using a common language and consistent scale, form, materials, colours and spatial arrangements; and
- Minimise visual clutter of highway furniture elements:
  - Limit the variety for each type of element (for instance by limiting types of safety barrier);
  - Limit the materials and colours for the range of elements;
  - Use recessive colours;
  - Avoid ornamentation;
  - Configure elements to a consistent spatial pattern (for instance the location of sign posts relative to the carriageway); and
  - Use earth contouring and clear zones where practicable in order to reduce the extent of barriers.

Landscape Principles

- Restore vegetation in a bold manner using limited species palettes and broad spatial patterns in order to fit the scale of the landscape;
- Design re-vegetation to be contiguous with vegetation patterns beyond the corridor;
- Emphasise the underlying topography, for instance by establishing riparian vegetation along streams and retaining intervening spurs in pasture; and
- Reinforce the experience of the landscape traversed by road users:
  - Emphasise the contrasting character areas through vegetation selection and response to the topography and adjacent land uses;
  - Create a pattern of enclosure or openness that reflects the adjacent landscape character;
  - Highlight local materials such as greywacke rock and native vegetation;
  - Ensure that the opportunities to provide key landscape views for road users are not lost by poor detailing; and
  - Maintain where practicable adjacent landscape patterns across the highway.

Connection between Highway and Landscape

- Limit the 'in-between' space between the highway and adjacent landscape, and strengthen the extent to which the highway sits within the landscape;
- Create a hard / sharp edge between the shoulder and adjacent vegetation, bringing the existing and re-instated vegetation right up to the road where practicable (i.e. avoiding an in-between strip of ground) and reducing the need for herbicide maintenance;
- Extend adjacent land use and vegetation patterns as close to the highway shoulder as possible consistent with safety requirements; and
- Continue underlying landscape patterns on both sides of the highway so that the highway is not a boundary between different landscape patterns.

-

4.3 Earthworks design principles

General principles

The design of earthworks should:

- Minimise the overall footprint of the road;
- Minimise the visual effects of earthworks;
- Avoid or minimise encroachment into water courses and bodies and areas of indigenous vegetation; and
- Seek to respond to, and reinforce the adjacent natural landscape and landform taking into consideration soil and rock types, fault lines, route security and existing services.

Cut batters – Steep Topography (sections 2,3,7,8 and 9)

The cut batters are a significant design issue because of their size in some locations, (particularly at Te Puka Stream / Horokiri Stream in the north and Porirua East / Linden in the south), and the fact that benching is required in order to maintain route security. The underlying rock is not stable enough to enable steep rock faces and benching is also considered beneficial in arresting rock fall onto the road. Alternatively, to avoid benching by adopting a shallower batter slope angle is not desirable given the very steep hill faces in parts of the route.

The following design principles are recommended to reduce the visual impact of the batters:

- Minimise the number of benches;
- Maximise the height from the road to the lowest bench (for instance >15m);
- Maximise the height between the top bench and the top of the cutting (for instance by grading top batter into adjoining slope and/or extending the top batter to >15m in order to avoid short terraces near the top of the cutting);
- Round the perimeter of the cutting (top and sides) to avoid sharp angles and avoid frittering of soil from the edges;
- Round the front edges of benches;
- Align the benches horizontally rather than parallel to the carriageway surface; and
- Promote re-vegetation of batters with techniques including hydro-moss and hydro-seeding in order to reduce prominence and geometric appearance of benches and to assist in mitigating potential stability and rock fall issues. Where appropriate implement a staged re-vegetation by establishing a grass cover initially, followed by longer term plants once a biological layer is established.

Cut Batters – Rolling topography (sections 1,4,5 and 6)

Where terrain is rolling with reduced batter heights, the best landscape option is to flatten the batter slope so that earthworks merge with adjacent terrain and so that cut batters can be re-topsoiled and re-vegetated:

- Grade batters to a slope of 20-30 degrees in rolling terrain where the batter height does not exceed 20m;
- Scarify cut face to assist retention of topsoil; and
- Re-spread topsoil and re-vegetate as appropriate in order to match adjacent land use.

Fill Batters – Steep topography (sections 2,3,7,8 and 9)

Apply the following principles in areas such as the Duck Creek section of the route, and/or where there are other environmental constraints, for instance in order to avoid encroaching into Te Puka and Horokiri Streams:

- Maximise the fill batter slope in order to reduce the footprint of earthworks and to reflect the steepness of adjacent natural slopes. For instance 1H:1V fill batter slopes achieved by use of reinforced earth batters;
- Re-grass or re-plant fill batter slopes to match adjacent landuse; and
- Install special engineering to further steepen batter faces where necessary to avoid encroaching into natural stream beds or significant vegetation.

Fill Batters – Rolling topography (sections 1,4,5 and 6)

In locations where fill batters do not extend into streams or ephemeral watercourses:

- Minimise fill batter slope in order to merge with surrounding terrain, and to facilitate re-vegetation to merge with surrounding land use.

Photo 4.1: Steep mono-slope without bench

Photo 4.2: Benching

Spoil Disposal Sites

- Locate spoil disposal on areas near watersheds such as broad spur summits, plateaux and natural benches, and shallow basins at the heads of catchments. Avoid locating spoil disposal sites in stream or ephemeral watercourse valleys;
- Locate spoil disposal preferably on areas of pasture so as to avoid areas of native bush or other significant vegetation as much as possible;
- Maintain low profile by restricting spoil disposal to a maximum 3m depth with rounded edges. It is preferable to occupy a larger footprint with low profile landforms on less sensitive sites than to create deep disposal sites in sensitive areas; and
- Strip, stockpile and re-spread topsoil over completed spoil disposal sites and re-plant with species that reflect original vegetation patterns and merge with adjacent land-use.

Slope Stabilisation

Given variations in geology along the length of the Project route there may be instances where localised slope stabilisation measures are required. Such measures may include (but not be limited to) reinforced soil embankments, rock bolts and anchors; soil nails; shotcrete; dental concrete and mesh.

- Limit the use of these measures and ensure they are as visually recessive as possible;
- Avoid a high number of interventions creating visual anomalies along the route. Large sections of visually prominent stabilisation structure should also be avoided if alternatives that satisfy both structural and visual parameters are practicable;
- The use of shotcrete should be avoided if other practicable alternatives exist. Where shotcrete is required then methods such as pigmentation and surface treatment should seek to mimic adjacent natural material;
- Where mesh, wire baskets, hydroseed and other materials can be used to provide medium for plant growth on stabilised slopes, they should be preferred over concrete finishes.

Rock Fall Protection

The primary focus is to achieve passive rock fall protection through cut face configuration and vegetation in the longer term. There will be instances along the Project route where localised rock fall structures will be required to ensure safety and route security issues are addressed.

- In the first instance draped netting should be used to address rock fall, allowing the surface profile of the cut face to be retained and becoming visually recessive over time through the inclusion of vegetation;
- Where rock fall fences are required at road level they should be:
  - incorporated into any safety barrier;
  - located on the same alignment as other furniture such as light poles or signs;
  - constructed of similar materials to adjacent road elements; and
- Where rock fall fences are required on benches they should be constructed out of 'light' materials and set back from the front edge of the bench to reduce visual prominence. The focus should be on visual continuity and rock fall fences being part of a suite of road side furniture that promote visual continuity along the route.

4.4 Structures design principles

4.4.1 Bridges

Bridge designs conform with the Structure Design Philosophy which is influenced by a number of key factors including:

- Cost efficiency with consideration for whole of life cost: Wherever possible bridges have been avoided in preference to embankments due to the disproportionate cost of structures when compared to earthworks;
- Regional network security in the event of a large earthquake: Highly redundant bridge forms and seismically proven MSE retaining walls and 45 degree reinforced soil slopes have been selected for the Project;
- Environmental and social considerations: In some locations bridges have been selected instead of culverts to minimise the structure's footprint, sediment movement and flow velocity and to maintain fish passage. Aesthetics considerations have informed bridge designs. The number of construction tracks has been minimised through careful choice of structural form;
- Durability and maintenance: High durability, long lasting coating systems (up to 40 years to first maintenance) have been assumed in the costing of steel bridges. Concrete elements in bridges and retaining walls will be designed for a 100 year design life and will require little if any maintenance; and
- Aesthetics and visual effects: Clear structural lines and unadorned, neat concrete finishes have been selected. Bridges with fewer larger piers have been selected over solutions with many smaller elements to minimise the visual and physical effect of the bridges on the landscape. Superstructures which provide elegant uncluttered solutions have been selected in highly visible or landscape sensitive locations. A consistent treatment of abutment wrapped with MSE walls is the preferred approach to provide continuity of design through the Project.

More detailed bridge design principles are listed below.

Where bridges are visible from surrounding communities, regional parks or the highway itself, the following design principles apply:

- Bridges should complement their context. This means considering factors such as, but not limited to, the topography, location of watercourses, the rural or urban setting, the bridge visibility, presence of valuable vegetation or ecology features, proximity to houses or open spaces and the presence of pedestrian or cycle paths across or in the vicinity of the bridge;
- Design bridges to be recognisable as part of the Transmission Gully Project 'family', with individual variations reflecting the requirements of their specific setting;
- The relative proportion of structural elements should be carefully considered to minimise the bridge profile, achieve balance, and create a simple, elegant whole. Seek to equalise or balance spans;
- A play of light and shadow on a bridge can reduce the apparent mass and bulk of the structure and balance its vertical and horizontal proportions. Sloping all or part of the outer face of the side barrier inwards to catch the sunlight, extending the barrier down past the deck and recessing beams to create a shadow line, will reinforce the horizontal lines of the bridge;
- Barriers depth should be carefully proportioned in relation to the deck and superstructure. Barriers should be extended well past abutments to anchor the bridge in the landscape. Sloping the top of the barrier inwards towards the deck will minimise water staining on the outer face of the barrier. Barriers should have minimum embellishments, with any surface treatment used only to reinforce the clean lines of the bridge;
- Design bridge barriers with a skirt to conceal the full depth of the deck (girder and rc slab deck) and drainage pipes;
- Where the road corridor is constrained, closed (vertical) abutments should be carefully designed and detailed to present a high quality finished appearance. Along Collins Avenue, where the abutments will be seen at close range by pedestrians, cyclists and motorists, their design should incorporate finer grain details, textures, artwork or colour scheme;
- Structures that eliminate the need for cap beams (headstocks) and enable simple, elegant girder to pier connection are preferred. Where cap beams are required, minimise length of cap beam beyond last girder;
- Where practicable, the preference is to drop the pile to column connection to be fully below ground;
- Where a bridge crosses over a local road or pedestrian / cycle path, to provide a light well in the median if practicable;
- Any bridge lighting and drainage should be integrated with the structure, leaving the external surfaces of the bridge free of drainage pipes or services. Lighting design and selection should incorporate protection against vandalism;
- Locate highway lighting columns to respect the visual rhythm of the bridge. This can be achieved by aligning the columns with bridge piers or laying them out symmetrically on either side of the piers;
- Select durable materials and finishes that do not significantly degrade in appearance over time; and
- If required, a clear, matte anti-graffiti coating should be applied to the full extent of piers, MSE walls and barriers at the bridge construction phase to prevent patchy application and appearance at later stages.

All the bridges within this Project were assessed early on to determine the appropriate level of aesthetic treatment required, if any. The bridges were classified based on their visibility for road users and the local community. Those bridges which will be visible from the surrounding communities, Regional Park tracks or the highway itself are subject to aesthetic considerations as outlined in this Framework. The considerations are of two types:

- The bridges which will be visible from a long distance are subject to design principles relating to their overall form.
- The bridges which will be visible at close range by pedestrians, cyclists, residents and road users are subject to design principles relating to their detailed design and finishes.

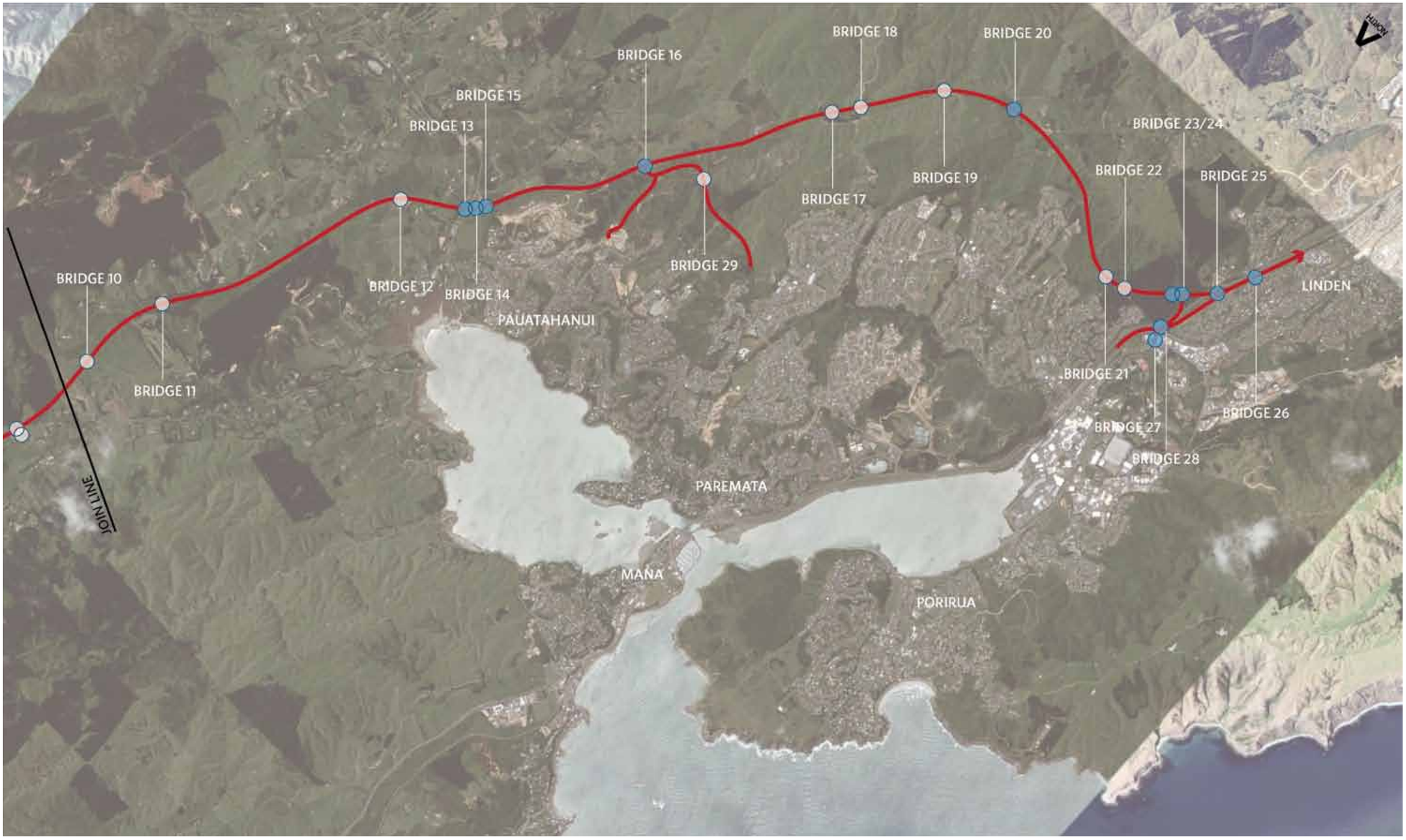
The bridges which are subject to aesthetic considerations are highlighed on Figure 4.2.

Photo 4.3: Feature lighting for gateway location

Photo 4.4: Elegant profile: Twin haunched girder bridges

Photo 4.5: Bridge barrier extends down to conceal girder

Figure 4.1: Location of bridges along the Transmission Gully Route


BRIDGE 10
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BRIDGE 16
BRIDGE 17
BRIDGE 18
BRIDGE 19
BRIDGE 20
BRIDGE 21
BRIDGE 22
BRIDGE 23/24
BRIDGE 25
BRIDGE 26
BRIDGE 27
BRIDGE 28
BRIDGE 29
JOIN LINE
PAUATAHANUI
PAREMATA
MANA
PORIRUA
LINDEN

4.4.2 Underpasses

Where underpasses accommodate public pedestrian and cycle access the following design principles apply:

- Underpasses should offer a straight route so that one end of the underpass is visible from the other. Bends and angles in the underpass should be avoided as they create hidden places which encourage vandalism, crime and anti-social behaviour;
- The walls of the underpass should not have recesses where litter might accumulate or someone might hide;
- Underpasses should be as wide and high as possible to maximise light penetration, visibility and amenity;
- The underpass should have appropriate internal lighting levels. Median skylights should be provided where practicable. Artificial lighting should be provided where natural light is insufficient;
- The underpass should be at grade with the surrounding land. Alternatively, the approach ramps should be gradual enough to accommodate pedestrians and cyclist safely and provide sufficient forward visibility;
- Planting around the underpass entrances should not obscure sightlines to and from the underpass;
- Feature paving, wall and ceiling treatments, lighting and artworks should be considered to create a pleasant environment in the underpass and should complement any external components;
- Robust, long-life, vandal-proof materials and lighting should be used in the underpass to minimise maintenance; and
- Adequate drainage systems should be provided in the underpass to allow for satisfactory disposal of run-off and prevent flooding and pooling.

Photo 4.6: High quality wing wall treatment

Photo 4.7: Feature wall and ceiling treatment

Photo 4.8: Median skylight provides daylighting

4.4.3 Culverts

Where culverts will be visible to the surrounding communities, regional parks visitors or highway users, the following design principles apply:

Headwalls

- Minimise culvert length by maximising fill batter gradient for fill embankments across streams and ephemeral watercourses. Preferable gradients are 1H:1V achieved by reinforced earth techniques;
- Construct sloping culvert portals to the same gradient as adjacent fill batters; and
- Where armoring is required use local materials where practicable, and techniques that blend in with the surrounding landscape. Preference is for a natural finish.

Energy Dissipation and Fish Passage

Construct culverts to 'fish friendly' principles: [in accordance with ecological report]

- Set culvert as shallow gradient;
- Install below natural bed of stream to enable natural material to build up on base of culvert;
- Insert natural durable rock within base of culvert to assist build up of natural material and to provide fish passage following storms;
- Construct rock ladders below downstream portal to prevent scouring and to avoid perched culverts; and
- Use sprat thread where appropriate.

4.4.4 Retaining walls

- As a first preference in rural sections of the alignment, use engineered fill vegetated to match adjacent land-use instead of retaining wall;
- Where vertical structures are required use concrete slabs (MSE panels) with exposed greywacke rock surfacing;
- The top of individual MSE panel units should be cast with former inserts to follow the slope of the bridge deck above or soil behind and achieve a neat straight line. Avoid stepping top of MSE wall down or cutting units on site to achieve a consistent slope as this rarely results in a neat finish. Avoid bulky edging units;
- When wrapping an MSE retaining wall around a bridge abutment, the gap between the structure and MSE wall should be minimised, subject to constructability and cost considerations; and
- When wrapping an MSE retaining wall around a bridge abutment, the top of the MSE wall should line up with the top of the abutment cap.

Photo 4.9: Vertical MSE retaining wall wrapped around bridge abutment

Photo 4.10: Neat finish of angled top of MSE wall

Photo 4.11: Feature MSE wall panels for high visibility location

4.5 Planting design principles

General

- Design planting to emphasise the underlying landscape and reflect adjacent land use and vegetation patterns;
- Emphasise underlying topography, for instance by establishing riparian planting along margins of streams but leaving spurs in open pasture;
- Plant in a bold manner using restricted species palettes and broad spatial patterns in order to suit the scale of the landscape;
- Design vegetation within the corridor to achieve continuity with vegetation and land use patterns beyond the corridor;
- Replant cut and fill batters with simple palette of pioneer shrubland species;
- Ensure that underlying landscape patterns continue on both sides of the highway. The highway should not create a new boundary between different land uses or vegetation patterns;
- Plant in a way that creates a sequence of enclosure and openness that reflects the surrounding landscape;
- Extend land use and vegetation patterns as close to the carriageway as practicable;
- Design the highway (including storm water infrastructure and highway furniture) and so that there is a sharp edge between highway and adjacent landscape. Avoid in-between space between highway and adjacent land use and vegetation patterns; and
- Design planting to reflect character areas as follows:

Streams

- Re-vegetate margins of all streams crossed by the highway in order to emphasise natural topography, enhance habitat and improve water quality;
- Use riparian and margin species indigenous to the area; and
- Extend planting to the embankment fill batters at all stream crossings. Use species that are appropriate for the conditions on fill batters and that merge with the character of the adjacent stream planting. Use low species at the top of embankments in order to maintain views along stream valley.

Cut Batters

- Re-vegetate cut batters with a simple palette of low-growing pioneer shrubland species where practicable;
- Select species to respond to adjacent landscape character; and
- Establish pasture between top bench and top of cut batter (fence on top bench) where such pasture merges with adjacent land use.

Fill Batters

- Rehabilitate fill batters to merge with surrounding landscape patterns;
- Merge re-vegetation on fill batters with adjacent riparian planting at stream crossings; and
- Overfill and re-grass fill batters where they merge with existing pasture. In such instances the fence-line might be located inside the designation so that the adjacent land use appears to extend as far as the road corridor.

4.6 Noise barriers design principles

The location, type and height of noise barriers required to mitigate the operational noise effects of the Project have been determined in accordance with New Zealand Standard 6806 'Acoustic – Road Traffic Noise – New and Altered Roads'. The standard assists with the determination of best practicable noise mitigation options by adopting a multi-disciplinary approach. Specific urban design, landscape and visual effects criteria were included in the assessment of noise mitigation options as follows:

- Maintenance or enhancement of visual amenity for surrounding residents;
- The extent to which the mitigation option promotes integration and establishes visual coherence and continuity of form, scale and appearance of structures and landscape proposals along the route;
- Road users' views to the surrounding landscape and key features / locations;
- Utilisation of materials that reflect the character of the location and reduce the use of non-renewable materials;
- Maintenance or enhancement of the convenience and attractiveness of pedestrian and cycle networks;
- Maintenance or enhancement of safe routes to school;
- Impact (land take, amenity and usability) on community facilities (reserve, school, playground, playing field, etc);
- Public access to coastal marine areas, streams or lakes; and
- Public safety and security.

In applying the above criteria, consideration was given to the potential for noise walls to over-shadow properties, block sight lines for surveillance purpose or block significant views of the surrounding area both towards and from the road. In selecting the appropriate wall height, the multi-disciplinary team aimed to strike a balance between noise mitigation and the visual impact of the wall. Where appropriate, earth bunds and other noise control methods such as low noise road surfaces and solid safety barriers have been selected in preference to noise walls. Long sections of noise wall on both sides of the road have been kept to a minimum.

The following principles should guide the detailed design of the noise barriers:

- The slope and landscape treatment of noise bunds should integrate with the surrounding landform and landscape character;
- Noise walls should integrate with the corridor-wide landscape concept and complement the road structures, landscape treatment and safety barriers;
- Noise walls should be designed as three-dimensional objects with two faces performing different functions. The road face is viewed at speed by road users. Their perception is fleeting and only bold designs, geometric patterns and the overall shape of the wall will be viewed. The road face should not have intricate detail that could distract drivers. The outer face is viewed from the surrounding area as a static, permanent feature in the environment and depending on the proximity of viewers, construction and design details may be visible and should be a of high quality;
- To minimise the visual impact of noise walls, minimise changes to the horizontal alignment and balance changes to the vertical alignment to create regular steps or a single sloping line joining the tops of the wall units. Separate and overlap walls to accommodate any necessary changes in height, horizontal and vertical alignment, form or material. Consider tapering the ends of walls into adjacent landforms;
- In areas where noise walls are recommended on both sides of the road, both sides should be designed together as an overall composition;
- Planting should be used to deter graffiti, help integrating the wall with the surrounding landscape or provide an attractive interface to nearby properties, reserves (such as Mahoe and Arthur Carman parks in Linden) and paths. Planting should allow for access to the wall for maintenance;
- Materials should be of high quality and long-lasting to minimise on-going maintenance costs; and
- The overall shape of the noise wall, the finer detail of its alignment and the surface colour and texture are the key aspects to be addressed at the detailed design stage.

Photo 4.12: Noise bund planted with native species

Photo 4.13: Simple wall profile through sloped area

Photo 4.14: Amenity planting in front of noise wall

4.7 Pedestrian and cycle links design principles

The Transmission Gully Project Main Alignment will be a motorway under section 71 of the Government Roading Powers Act 1989 (GRPA). Consequently, no pedestrian or cycle path will be provided alongside the Main Alignment. Some pedestrian and cycle links will however be provided in areas where the Project crosses or joins the local road network, as may be appropriate.

Shared and cycle paths

- Shared paths are for use by pedestrians and low speed recreational cyclists. Path gradients will be consistent with NZ accessibility standards where possible;
- Cycle path gradients should be 10% or less where possible;
- Shared and cycle paths should be continuous and link with existing and planned open space and pedestrian / cycle networks;
- Shared and cycle paths should be direct and convenient to use, with vertical and horizontal alignment variations 'smoothed out';
- Shared and cycle paths should provide good amenity with adequate path width and separation from carriageways. The berm should be wide enough to accommodate landscape treatment;
- Locate and design paths and adjacent landscape treatment to allow informal surveillance between the path and adjacent road or land use activity;
- Design paths to maximise forward visibility and minimise the potential for pedestrian-cyclist conflicts; and
- Any drainage grates should be designed and located to minimise hazard risk to cyclists and pedestrians.

Cycle lanes

Any cycle lane proposed as part of the Transmission Gully Project should follow NZTA's guidelines for cycle lanes. As a minimum they should comply with the following:

- The width of the cycle lane will vary with the speed limit of the adjoining road. GTEP Part 14 NZ Supplement states minimum widths of 1.5m, 1.9m and 2.5m for speed limits of 50kph, 70kph and 100kph respectively;
- Cycle lanes should have an even and continuous sealed surface;
- Cycle lanes should be identified by cycle pavement marking symbols. Other distinguishing features such as coloured surface may also be used; and
- Audio-tactile pavement marking should be used to make the edge of the carriageway unless this is precluded because of proximity to adjacent residential properties.

Tramping tracks

The Project provides opportunities for new tramping tracks to be provided by other organisations along or across the Project corridor to connect existing tracks and create a continuous route. A potential track spanning the entire Project corridor is illustrated on Figures 4.2 and 4.3. The following design principles would apply:

- Tramping tracks generally follow the lie of the land. The detailed alignment of the track will preferably follow the less steep grounds along ridges and spurs and provide adequate visual and physical separation from the highway;
- Tracks surfaces will generally be the natural ground;
- Some vegetation can be cleared to ensure there are clear passage and a clear view of track markers. Native vegetation removal will be avoided or, if unavoidable, minimised;
- Direction signs are to be placed at all track entrances, and at junctions or crossings point where there is a risk of getting lost; and
- Watercourses should be bridged where no reasonable alternative safe wet weather track exists.

Photo 4.15: Informal shared pedestrian and cycle path

Photo 4.16: Shared walking and horse riding track

Photo 4.17: Footpath separated from road by grassed berm

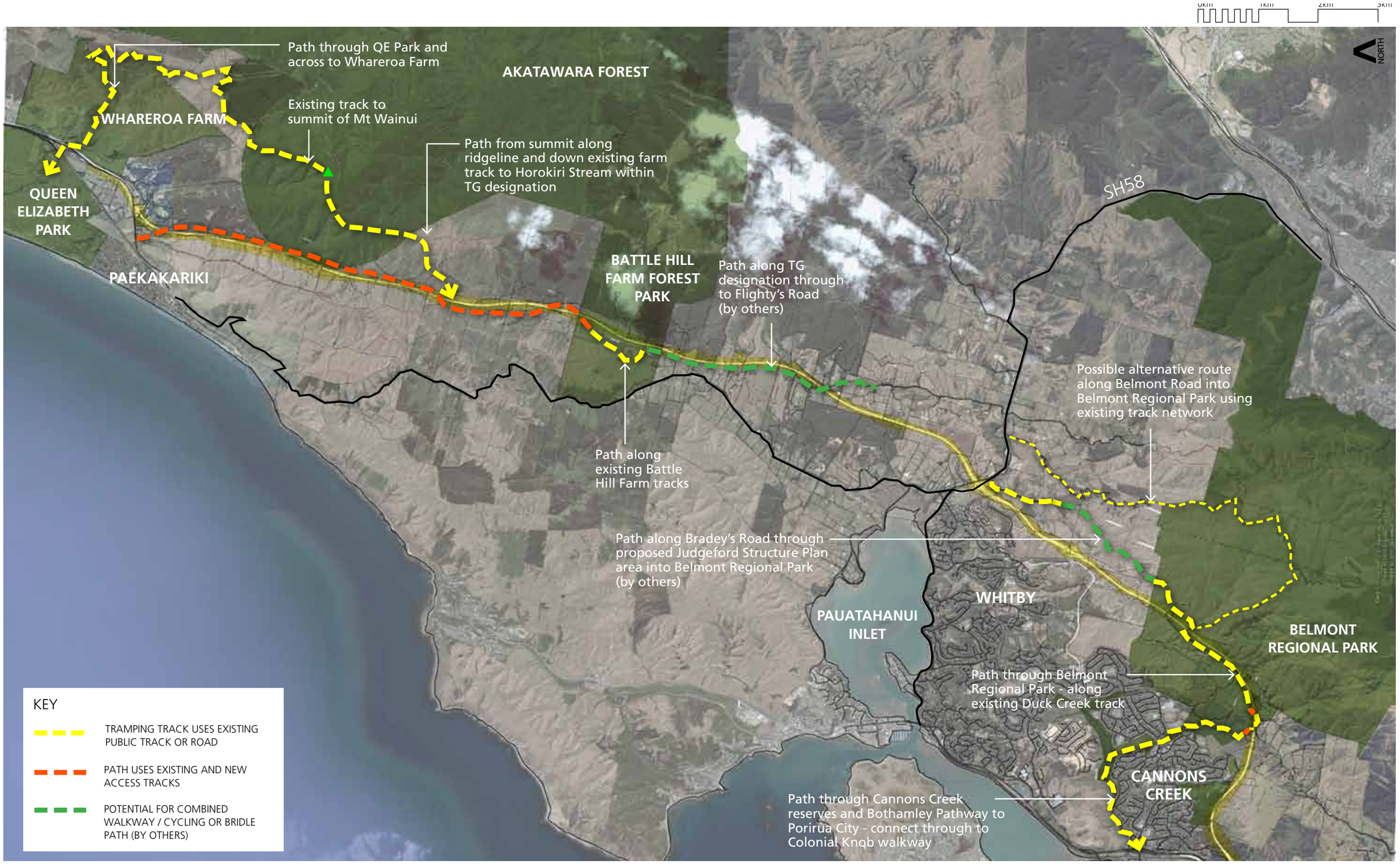

Figure 4.2: Route of possible tramping track - Overall route from Queen Elizabeth Park to Belmont Regional Park

Figure 4.3: Route of possible tramping track between Mt Wainui, Battle Hill and SH58

4.8 Stormwater devices design principles

Stormwater 'treatment trains' combine the functions of two or more different stormwater treatment methods to provide improved treatment capabilities, to reduce the risk of environmental impacts if one part of the system fails or is being maintained and to achieve other objectives such as flood mitigation and aquatic ecosystem protection. A common treatment train combines sumps (to trap gross pollutants) swales and wetlands. Treatment trains including swales and wetlands have been recommended along this alignment wherever the site conditions (primarily topography and soil type) are suitable. The location of wetlands and swales is shown on Figure 4.4.

Wetlands

- Wetlands are preferred over deeper ponds as they minimise drowning hazards and have better overall water quality treatment;
- Wetlands should be designed with the multiple roles of stormwater treatment, landscape amenity feature and ecological habitat;
- Optimise the natural character of wetlands through their shape, edge profile and landscape treatment;
- Integrate recommended wetlands with the surrounding pedestrian and cycle networks;
- Design the edge of wetlands to be shallow and vegetated so as to prevent accidental access whilst reducing the need for fencing; and
- Integrate recommended wetlands with natural stream environments to connect them visually and ecologically, if not hydrologically.

Roadside drainage

- Swales will need to include vegetation to assist with storm water treatment and should utilise concrete beam adjacent to the edge of the carriageway and greywacke armouring where appropriate. Vegetation within swales will create a backdrop to side barriers and emphasise the horizontal line of the highway; and
- Use kerb and channel in locations where space is constrained.

Photo 4.18: Boardwalk along wetland

Photo 4.19: Wetland at MacKays Crossing

Photo 4.20: Wetland at MacKays Crossing

Figure 4.4: Road catchment suitable for treatment by wetland and swales

4.9 Highway furniture principles

4.9.1 Side barriers

The use of side barriers should, in the first instance, be avoided through the overfilling of fill batters.

Where side barriers are required (excl. bridges) for safety reasons either low earth mounds or steel (w-section and or thrie-beam) barriers should preferably be used:

- The height of all barriers should be kept to a minimum to retain views beyond the carriageway;
- Where short sections of barrier are required (i.e. between cut faces) earth mounds are the preferred option. Short sections of steel barrier should be avoided;
- Where barriers are required on both sides of carriageway they should be the same;
- The profile and surface treatment (e.g. vegetation or grass) of earth mounds should be consistent with adjacent land forms and treatments (e.g. cut batters) and should transition smoothly into these features or finished ground level. Abrupt and hard ends to barriers should be avoided; and
- Where both noise mitigation structures and safety barriers are required they should be integrated so they appear as a common element ensuring visual coherency and limiting visual clutter.

Where side barriers are required on bridges, the preference is that these should:

- Be concrete.
- If TL5 standard is required use Texas HT profile with elliptical top rail, as per RoNS Guidelines;
- The barrier length should be at least as long as the bridge span;
- Where earth mounds or cut faces are located adjacent to the end(s) of a bridge the concrete side barrier may extend a short distance beyond the bridge footprint and tie back to finished ground level to provide a smooth transition;
- Where steel barriers are located adjacent to the end(s) of a bridge the transition should be concrete/ thrie bean/ w-section tying into finished ground level; and
- Whilst coloration of concrete barriers is acceptable it should be subdued. Other surface decoration such as application of motifs etc should be avoided.

Where side barriers are required on underpasses and culverts, the preference is that these should:

- Be steel (w-section and or thrie-beam);
- Where barriers need to extend beyond the footprint of the underpass/ culvert they should be kept to a minimum and tie into finished ground level; and
- Where the underpass/ culvert is of a suitable span a thrie-beam barrier should be used transitioning into a w-section beyond the footprint and tying into natural ground level.

4.9.2 Median barriers

- It is not proposed to provide a grassed central median, as this would require widening the footprint and would result in much greater earthworks given the steep topography;
- Preference is for a consistent concrete barrier along the length of the highway (incl bridges, overpasses and culverts). Wire rope should be avoided, except where viable alternatives do not exist; and
- Whilst coloration of concrete barriers is acceptable it should be subdued. Other surface decoration such as application of motifs etc should be avoided.

Photo 4.21: Neat transition from steel barrier to concrete

Photo 4.22: Concrete median barrier

Photo 4.23: Lightweight steel barrier supports

Photo 4.24: Railing on top of concrete barrier

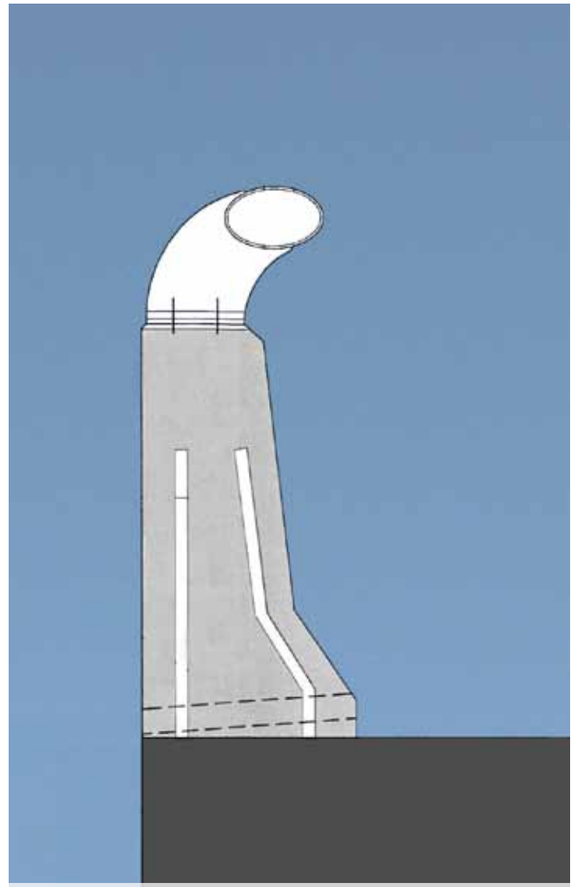

Photo 4.25: TL5 bridge barrier with elliptical top rail

4.9.3 Lighting Columns

Lights are not required for the majority of the Main Alignment, which will reduce the potential visual clutter and night-time light effects. Lights are only recommended in the vicinity of the interchanges and the short section of the Main Alignment between the SH58 and James Cook Interchanges. In these areas:

- Design light standards as part of a coherent suite of highway furniture, and to be visually recessive;
- Adopt steel light standards with a plain galvanised finish;
- Preference is for light standards with either a sharp angle between pole and arm, or fix fittings directly to the pole;
- Use consistent heights within each group of light standards (for instance within each interchange) in order to reduce visual clutter; and
- Adopt consistent column design for CCTV cameras.

4.9.4 Protection of Roadside Furniture

- Configure edge barriers in such a way to avoid the need for additional protection of structures or utilities adjacent to the highway; and
- Use frangible elements in any locations where there are no edge barriers to provide protection.

4.9.5 CCTV

- Adopt design for CCTV camera standards that is either combined or consistent with light standards.

4.9.6 Sign Gantries and Signage Posts

- Construct gantries so that beams and pillars join at right angles. Preference is for square box section, I beams and flat steel components.
- Construct pillars to prevent unauthorised access without the need for such secondary fittings as barbed wire;
- Use simple steel posts for smaller signs installed adjacent to highway;
- Paint gantries a metallic colour that complements weathered galvanised steel;
- Where possible, signage should be visually contained within the depth of the spanning girder, through integrated design of girders and signage panels.
- Signage for road users is not permitted to be mounted on pedestrian overbridges (if present).

Photo 4.26: Simple orthogonal light standards

Photo 4.27: Orthogonal signage gantry

Photo 4.28: Orthogonal signage post

Photo 4.29: Single support signage at off-ramp

Photo 4.30: Well integrated girder and signage panels

Photo 4.31: Light columns mounted to side of bridge