Report

MacKays to Peka Peka Scoping Report

Prepared for the NZ Transport Agency

By MacKays to Peka Peka Alliance

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NZ TRANSPORT AGENCY
WAKA KOTAHI

1 MacKays to Peka Peka Expressway

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List of Abbreviations & Acronyms

BCR: Benefit Cost Ratio

CAS: Crash Analysis System

CWB: Cycling, Walkways and Bridleways Strategy (KCDC)

EEM: Economic Evaluation Manual (NZTA)

EMU: Electric Multiple Units

GPS: Government Policy Statement on Land Transport Funding 2009

GWRC: Greater Wellington Regional Council

KCDC: Kāpiti Coast District Council

KTM: Kāpiti Traffic Model

LTMA: Land Transport Management Act

MTRIP: Medium Term Rail Improvement Plan (GWRC)

NIMT: North Island Main Trunk railway

NZTS: New Zealand Transport Strategy

NRS: National Rail Strategy

NSHS: National State Highway Strategy (NZTA)

PPFM: Planning Programming and Funding Manual (NZTA)

PPL: Paraparaumu Line Service

SH1: State Highway 1

RLTS: Regional Land Transport Strategy (GWRC)

RMA: Resource Management Act

RoNS: Roads of National Significance

RRP: Wellington Regional Rail Plan 2010 – 2035 (GWRC)

RPTP: Regional Passenger Transport Plan (GWRC)

TDM: Travel Demand Management

TT: Travel Time

VOC: Vehicle Operating Costs

WRRP: Wellington Regional Rail Plan (GWRC)

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Executive Summary

An Alliance has been formed to facilitate the delivery of an expressway between MacKays Crossing and Peka Peka. The project is part of the Wellington Northern Corridor (SH1 from Levin to Wellington Airport), an identified "road of national significance" (RoNS) in terms of the 2009 Government Policy Statement. The preferred route option for this project was identified in 2009 based on the results of the Kāpiti SH1 Strategy Study (2009) and subsequent consultation. The selected route followed the existing Western Link Route designation over much of the project length.

A key feature of the road network in Kāpiti is that SH1 is the only north-south route and provides for both local and inter-regional movements. Currently vehicles on SH1 face delays in Paraparaumu and Waikanae, making journey times slow and unreliable. By creating an expressway, journeys will be faster and safer, and will contribute to productivity and economic growth.

Scoping work for the MacKays to Peka Peka Expressway has involved technical development and evaluation of connectivity and alignment options. Initial discussions have been held with key stakeholders and feedback received from visitors to the project Information Centre. Assessment of the 2009 consultation and engagement noted above has also been carried out.

A range of options with varying connectivity in terms of the number of interchanges and the inclusion of a local road Waikanae River crossing have been considered. A range of alignment options were also studied and evaluated including alignments outside the existing designation over some local sections of the project.

These options were evaluated using a multi criteria analysis (MCA) and the short list of options considered appropriate for further investigation identified. These options are in summary:

Connectivity Options

Interchanges adjacent Paraparaumu Town Centre and the vicinity of Te Moana Road, (together with south facing ramps at Poplar Avenue and north facing ramps at Peka Peka), as follows:

- 3 – Interchanges at Kāpiti Road and Te Moana Road
- 3B - Interchanges at Ihakara Street extension and Te Moana Road
- 3C – Full interchange at Te Moana Road and split interchange between Ihakara Street extension and Kāpiti Road (with one way auxiliary lanes between Kāpiti Road and Ihakara Street).

Alignment Options

Southern Connection to SH1 (Sector 1):

- Through QE Park and east of Steiner School
- North of Poplar Avenue.

Ihakara Street (Sector 2):

- East of existing designation near Ihakara Street.

Waikanae (Sector 3):

- Crosses Waikanae River near existing designation, runs east of urupa, west of Maketu Tree and touches corner of wāhi tapu area
- Crosses Waikanae River east of existing designation, runs east of urupa and Maketu.

Peka Peka (Sector 4):

- Mostly outside designation north of Smithfield Road
- Mostly within designation north of Smithfield Road.

These options are illustrated in the figure below.

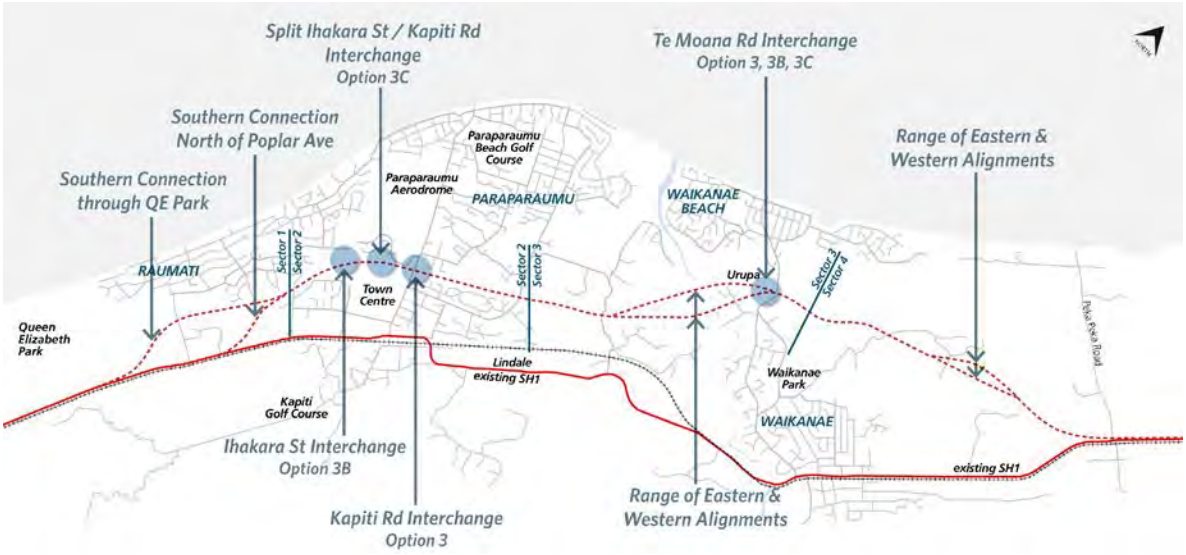
The Sector 3 and 4 options described above represent the most western and eastern of a range of alignment options that should be further investigated.

The interchange connectivity options noted above satisfy the RoNS guidelines in terms of levels of service, design and spacing of interchanges. They also provide more favourable MCA outcomes than options involving a local road Waikanae River crossing.

The assessed expected project cost in current prices and excluding GST is $580-600m depending on the alignment options selected, and the BCR is 1.0.

It is recommended that:

- The short listed options described above are taken forward to the Scheme Assessment Stage for further development and the selection of a preferred option
- Consultation proceeds using the options described above as the basis for seeking views from the Kāpiti Communities and various stakeholders.


Split Ihakara St / Kapiti Rd
Interchange
Option 3C
Te Moana Rd Interchange
Option 3, 3B, 3C
Southern Connection
North of Poplar Ave
Southern Connection
through QE Park
Paraparaumu
Beach Golf
Course
Paraparaumu
Aerodrome
PARAPARAUMU
WAIKANAE
BEACH
Range of Eastern &
Western Alignments
RAUMATI
Sector 1
Sector 2
Sector 2
Sector 3
Sector 3
Sector 4
Urupa
Town
Centre
Queen
Elizabeth
Park
Lindale
existing SH1
Waikanae
Park
Peka Peka Road
Kapiti
Golf Course
WAIKANAE
Ihakara St Interchange
Option 3B
existing SH1
Kapiti Rd Interchange
Option 3
Range of Eastern &
Western Alignments

1 Introduction

1.1 Purpose of the Report

This Scoping Report has been prepared by the MacKays to Peka Peka Alliance to identify and describe the conceptual options that have been developed and assessed via a multi-criteria analysis process to determine the environmental, social and economic consequences of each option. The purpose of this assessment is to enable the identification of a 'short list' of options – those which best meet the project objectives - to be taken forward for further refinement and detailed assessment in the scheme assessment stage.

A basis is provided for the New Zealand Transport Agency (NZTA) to confirm options considered suitable to take forward for public engagement and consultation in 2010 and to confirm the shortlisted options to be further developed in the Scheme Assessment Report stage.

The Scoping Report is an input and precursor to more detailed technical work and additional public consultation required over the next 12 months prior to lodging Notice of Requirement and Consent applications for this project.

The Scoping Report is guided by NZTA's four assessment categories of social and environmental, Land Transport Management Act 2003 (LTMA) compliance and economic, and to address the aspirations of the territorial local authorities.

1.2 Approach

In exploring options the Scoping Report draws on historical information previously undertaken, including:

- public consultation and engagement already undertaken by NZTA and Kāpiti Coast District Council (KCDC)
- existing technical evaluations and reports on a wide range of transportation, economic, social, environmental and cultural matters relevant to the Expressway.

Feedback obtained by the Alliance team from Expressway specific discussions with key stakeholders and the members of the public visiting the Information Centre has also been taken into account when developing these options.

The Scoping Report also draws on the specialists' and other technical work (including ecologists, landscape and urban designers, social impact advisors, archaeologists and cultural advisors, air quality experts and the stormwater designers) completed by the Alliance to date, including:

- Outputs from the workshops undertaken to develop the long-list of options for the alignment (refer Section 5 - Option Development)
- Traffic assessment and economics (completed for the base-options) (refer Section 6)
- Cost estimate and risk assessment (refer Sections 7 and 8 respectively)
- Design considerations prepared by the design team (refer Section 9)
- Output from the evaluation workshops undertaken to assess options (refer Section 10).

Paraparaumu Town Centre

1.3 Background

The MacKays to Peka Peka Expressway forms an approximately 18 kilometre length section of the Wellington Airport to Levin 'Road of National Significance'. It is identified as a priority project within the New Zealand Transport Agency's National Land Transport Programme, and is aligned with the direction of the 2009 GPS on Transport.

Figure 1 - Wellington Northern Corridor

The Project Alliance has been engaged to deliver the Expressway, and is tasked with finding solutions that:

- achieve the intent of NZTA's RoNS Design Guidelines and Standards
- are responsive in terms of function and design to aspirations of the Kāpiti communities spanned by the Expressway
- provide long term solutions to transport and land use growth pressures in Kāpiti and the wider region.

The Kāpiti Coast is one of the fastest growing districts in New Zealand, growing nearly 10% in five years to a population of 46,000 as at 2006. Its proximity to Wellington and high volumes of traffic for commuter, business and recreational purposes mean the Kāpiti highway often operates beyond its capacity and can become severely congested at peak times.

The NZTA is developing the expressway so that efficient access to and from the local road network is also provided. This is a challenging task on the Kāpiti Coast where an effective, parallel local road network does not exist.

The proposed expressway will depart from the existing SH1 alignment over most of its length and, where this occurs, the existing highway will become a local arterial road.

Local supporting roads that provide improved access for communities away from the highway are also an important component of the NZTA's investigations.

The NZTA identifies the project objectives in summary form as:

- To remove congestion points for through-traffic
- To improve journey time reliability through the Kāpiti Coast
- To improve safety.

The full set of Project Objectives is provided at Section 1.6 in Table 2.

1.3.1 Expressway Corridor Timeline

There has been a significant amount of historical work undertaken on the expressway corridor route. A brief summary of key decision dates outlined in Table 1 below.

Table 1 - Key Decision Dates for Expressway over time

Date	Decision
1954	Centre line alignment for a Wellington to Foxton motorway declared by the then Ministry of Works.
1956	Motorway centreline proclamation for proposed Wellington to Foxton Motorway
Early 1990s	Various studies and discussions take place about whether the Western Link Road route should become a state highway or a local arterial road. It is decided the route will be used to provide a local arterial route – however, due to land requirement issues and funding limitations, the project was not progressed further than the design.
March 2009	Transport Minister Steven Joyce announces the seven roads of national significance, including the Wellington Northern Corridor, and plans to substantially complete these projects in the next 10 years.
August/October 2009	NZTA carried out consultation with the community on three possible route options. The outcome of the consultation identified the Western Link Road (Sandhills) option as the preferred route (refer Section 10 for further detail on consultation undertaken).
December 2009	The Western Link Road (Sandhills) option is chosen as the preferred route by the NZTA and communicated to the communities of Kāpiti. Steps to develop the Expressway for statutory approvals are initiated.

1.3.2 Previous Studies

The importance of an efficient highway corridor through the Kāpiti District has been highlighted in several studies. In particular the:

- Kāpiti Strategic Study Scoping Report, July 2008 (Opus International Consultants Ltd)
- Kāpiti SH1 Strategy Study Technical Report, August 2009 (Opus International Consultants Ltd).

These highlighted that the current configuration of SH1 through Kāpiti faces a number of issues, including:

- safety concerns
- congestion problems
- the need to create more efficient journeys for both local and state highway traffic.

1.4 Process for Choosing the Expressway Corridor

Four route options were considered:

- Current SH1 alignment option: Four-laning SH1 on its current route. This option was rejected early because the current alignment has too many curves, and providing access to all the properties along the route would be costly and challenging. The option did not improve local traffic options.
- Western option: SH1 Expressway avoiding Waikanae town centre with local supporting roads. This was rejected as it offered fewer compelling benefits than the following two options.
- Eastern option: SH1 Expressway following rail corridor with local supporting roads. This option was seriously considered however, the benefits it would bring did not outweigh the greater cost and land requirement compared with the following option.
- Western Link Road (Sandhills) option: SH1 Expressway following the Western Link Road Corridor. This route was chosen as the preferred route because it best balances the needs of the Kāpiti community with those of the Wellington region and the country as a whole.

1.5 Western Link Road Corridor

The choice of corridor for the Expressway, largely following the previous Western Link Road designation, was driven by:

- Minimising the effect on local residents and properties compared with the other options and having properties already acquired for much of the route
- Avoiding impacts on Waikanae and Paraparaumu town centres
- Overall project cost.

The route provides a completely new link through the Kāpiti region. This will allow the use of the existing highway as a local arterial road, efficiently separating highway and local traffic, allowing safer and more efficient traffic movements.

In making its decision the NZTA Board Chair Mr Brian Roche noted:

> *"After careful consideration the Board had selected the Sandhills (Western Link) route as the preferred option.*
>
> *"We are keenly aware that this is a very significant decision for the Kāpiti community, and this was not an easy decision for the Board. The Sandhills option is the least expensive, it will deliver the best results alongside continuing investment in local roads and public transport, it will require the purchase of the smallest number of private homes, and it also avoids town centres.*
>
> *"After carefully considering all three options and the feedback from the community on each we came to the conclusion that this route best balances the needs of the Kāpiti community with those of the Wellington region and the country as a whole. This new route will help ensure that Kāpiti continues to contribute to and benefit from economic growth in the Wellington region."*

1.6 Project Objectives

Project Objectives have been developed to reflect NZTA requirements for the Levin to Wellington Airport RoNS, and to be responsive to aspirations of Kāpiti communities.

The draft project objectives for the MacKays to Peka Peka Expressway are outlined below in Table 2.

Table 2 - MacKays to Peka Peka Project Objectives

Draft MacKays to Peka Peka Expressway Project Objectives
1) To enhance inter regional and national economic growth and productivity by establishing a cost-optimised route between MacKays Crossing and Peka Peka that enables more efficient movement of freight and people from, to and through the Kāpiti District
2) To improve access to Wellington's CBD, key industrial and employment centres, port, airport and hospital by developing a state highway to expressway standards between MacKays Crossing and Peka Peka that improves regional and national network security and reliability
3) To provide relief from severe congestion on the state highway and local road networks by improving the efficiency, reliability and level of service offered by SH1 between MacKays Crossing and Peka Peka, and appropriately balancing the competing functional performance requirements of inter-regional and local traffic movements, recognising that modal and route choice opportunities need to be provided that enable local facilities and amenities in the Kāpiti District to be efficiently accessed

Draft MacKays to Peka Peka Expressway Project Objectives
4) To improve the journey time reliability of travel on the section of SH1 between Levin and the Wellington airport by increasing the efficiency of through traffic movement between MacKays Crossing and Peka Peka
5) To improve the safety of travel on State highways by enhancing the level of safety and personal security experienced by local and inter-regional users of the state highway network between MacKays Crossing and Peka Peka
6) To provide a project which addresses relevant social, cultural, land use and environmental matters.
7) To integrate the state highway into the urban form of the Kāpiti District by providing a road design and alignment which takes into account the physical characteristics of current and appropriate future settlement patterns.

2 Project Description

2.1 Introduction

SH1 is the only continuous north-south arterial between MacKays Crossing and Peka Peka and it is the only road crossing of the Waikanae River. It also provides a high degree of local connectivity. The absence of a north-south local arterial, the significant amount of local access from SH1, and the lack of an additional Waikanae River crossing contribute to a significant amount of local traffic on SH1. In this sense, SH1 performs a local road function which erodes its ability to effectively perform its role of a National State Highway and Road of National Significance.

The geometry of SH1 is currently substandard with out of context curves and an inconsistent speed environment. The high degree of side access and local road connections create side friction which slows traffic on the highway and creates crash risks and other safety issues.

The majority of movement within the district is via private vehicles. With the significant growth expected to occur in Kāpiti over the next twenty years, private vehicle use is expected to grow. This is especially the case for movement within Kāpiti for which rail travel is not a realistic choice.

The demand for road-based freight movement is expected to grow significantly in the coming years, both as through traffic and within Kāpiti, particularly with the anticipated development of the Paraparaumu Airport Business Park. Stop-start conditions along the existing SH1 increase the operating costs for freight providers. The large amount of road freight movement contributes to a degraded urban environment in Paraparaumu and Waikanae.

SH1 between MacKay's Crossing and Peka Peka has a significant crash history with 399 crashes reported over the five year period 2005 to 2009 including four fatalities. A significant portion of these crashes are loss of control / head on in midblock locations, likely attributable to the substandard geometry and inconsistent speed environment on the existing highway. Intersections between SH1 and key local arterials have a history of vehicles failing to give way resulting in injury crashes, contributing to SH1's poor crash history.

2.2 Existing Road Network

2.2.1 State Highway 1

SH1 from MacKays to Peka Peka forms part of the Wellington Northern Corridor Road of National Significant (RoNS). The Wellington Northern Corridor is one of seven RoNS announced by Government in the 2009 GPS. The GPS identifies that seven RoNS as:

> *"The most essential routes that require significant development to reduce congestion, improve safety and support economic growth."*

In 2007 Transit (now NZTA) published its National State Highway Strategy (NSHS). The NSHS classified SH1 as a National State Highway, recognising its strategic purpose of connecting:

> *"Places of national significance: major cities of 30,000 people, international ports handling more than 500,000 tonnes and airports with passenger numbers of over 500,000 per year or regular international flights. They facilitate the long-distance inter-regional movement of people, goods and services throughout the country…"*

The existing SH1 between MacKays Crossing and Peka Peka traverses mostly flat terrain and passes through a variety of both rural and urban environments. SH1 generally runs parallel to the North Island Main Trunk Railway (NIMT) and crosses the rail corridor twice (excluding MacKays Crossing); once in Paraparaumu where the highway crosses over the railway on a narrow bridge, and once just south of the Waikanae River where the highway narrowly goes under a railway bridge.

SH1 provides a high degree of local connectivity. There are currently 31 local road intersections with SH1 between MacKays Crossing and Peka Peka. Nine of these intersections connect with SH1 in a 100 kph speed environment and seven in a 70 / 80 kph speed environment. The high degree of local access contributes to the poor crash history on the existing SH1. The proposed expressway, with no direct side access or at-grade intersections, will remove the risk of crashes from side access points.

SH1 is the only continuous north-south arterial between MacKays Crossing and Peka Peka and it is the only road crossing of the Waikanae River. The absence of a north-south local arterial, the significant amount of local access from SH1, and the one crossing of the Waikanae River

contributes to a significant amount of local traffic on SH1. At the Waikanae River Crossing, approximately 30% of traffic on SH1 is "through traffic" (vehicles travelling on SH1 between MacKays Crossing and Peka Peka without starting or stopping their journey in between). In this sense, SH1 performs a local road function which erodes its ability to effectively perform its role of a *National State Highway and Road of National Significance*.

Between MacKay's Crossing and Poplar Avenue, SH1 is a four-lane median divided highway with a 100kph speed limit. Access is generally restricted, although however, there is currently one intersection at Waterfall Road. NZTA and OnTrack will be closing this intersection as part of the double-tracking of the railway to Waikanae, and construction has started on a new road to connect with Waterfall Road from the MacKay's Crossing interchange via Emerald Glen. Through this area SH1 is bounded by the NIMT on the east side and Queen Elizabeth Park on the west side.

At Poplar Avenue, the two northbound lanes merge into one lane. Between Poplar Avenue and Coastlands SH1 has two southbound lanes and one northbound lane. The speed limit drops to 70kph south of Ihakara Street and again to 50kph as SH1 enters the Paraparaumu urban area. SH1 is bounded by the NIMT on the east side. On the west side SH1 provides access to a number of residential and commercial properties, as well as the intersections with Leinster Ave, Raumati Road, and Ihakara Street.

Just north of the signalised intersection with Kāpiti Road, SH1 reduces to one lane in each direction with a 50kph speed limit. Through the Paraparaumu urban area (generally between Kāpiti Road and Ruahine Street) SH1 provides direct access to many private properties. The SH1 rail overbridge (highway over rail) is between Amohia Street and Buckley Grove. The overbridge and approaches are particularly narrow with little or no shoulders and a poor geometry.

North of the intersection with Ruahine Street, SH1 increases to 70 kph and traverses the Ventnor Drive grade-separated intersection which provides access to the Lindale tourist centre. Between Lindale and north of Otaihanga Road, the speed limit is 80 kph. A northbound passing lane north of Lindale was recently removed and now SH1 is a two-lane highway through this section. SH1 provides access to a number of rural residential properties along this stretch.

There is a stop-controlled intersection at Otaihanga Road and SH1 is posted as 80kph through this intersection. North of Otaihanga Road, SH1 increases to 100kph and then widens to four lanes to accommodate a passing lane in each direction. Just south of Kebbell Drive, the passing lanes end and SH1 resumes as a two-lane highway. SH1 passes under the rail overbridge (rail over highway) just south of the Waikanae River Bridge. A number of rural residential properties are accessed via SH1 in this area.

At the north end of the Waikanae River Bridge, SH1 reduces to 50kph as it enters Waikanae Town Centre. Here SH1 re-joins with the NIMT which runs along the eastern side of SH1. There are two

signalised intersections in Waikanae, one with Te Moana Road and another with Elizabeth Street. Between the two roads SH1 is five lanes wide to accommodate two lanes in each direction with a centre right turn lane / median. North of Ngaio Road SH1 reduces to two lanes (one lane in each direction with a flush median). The speed limit increases to 70kph around Martin Street and increases again to 100kph north of Hemi Street as SH1 leaves Waikanae Town Centre.

Between Waikanae Town Centre and Peka Peka SH1 is a 100kph two-lane two-way highway. A southbound passing lane was recently constructed south of Peka Peka Road. The NIMT bounds SH1 on the eastern side, with rural land on the western side of SH1.

Table 3 below summarises the average annual daily traffic volume for various locations of SH1.

Table 3 - Traffic Volumes on SH1

Count Location on SH1	Average Annual Daily Traffic Volume (2009)	Percent Heavy Vehicles
Marycrest (north of Peka Peka)	16,268	8%
North of Elizabeth Street (Waikanae)	21,458	6.5%
North of Ihakara Street (Paraparaumu)	25,744	6.5%
South of MacKays Crossing	24,708	7.8%

The traffic growth rate on SH1 in Paraparaumu was just under 1% per year during the five year period 2005 to 2009.

2.2.2 Local Road Network

Major local links which connect to SH1 or perform a significant function in the local road network between MacKays Crossing and Peka Peka include:

Kāpiti Road

Kāpiti Road is the major east-west link in Paraparaumu that connects the commercial area of Paraparaumu to Paraparaumu Beach. The intersection of SH1 and Kāpiti Road is signalised. Kāpiti Road has a 50kph posted speed limit for most of its length; however, it increases to 70kph west of Te Roto Drive to east of Hurley Road (approximately the frontage of Paraparaumu Airport). The land use varies along Kāpiti Road with primarily commercial uses at the eastern end, near SH1, and residential at the western end. There are pockets of commercial activity along Kāpiti Road such as around the Te Roto Drive / Milne Drive area. Kāpiti Road is also the main access to Paraparaumu Airport.

Kāpiti Road is generally a two lane road (one lane in each direction) with a flush median. West of Rimu Road, Kāpiti Road had a recorded daily traffic volume of approximately 24,500 vehicles per day in 2010.

Te Moana Road

Te Moana Road is a two-lane road (one lane in each direction) that connects Waikanae Beach with Waikanae Town Centre. It has a posted speed limit of 50kph. The intersection of Te Moana Road and SH1 is one of a pair of signalised intersections in Waikanae Town Centre. West of Marae Lane, the adjoining land use is primary residential, and east of Marae Lane is predominantly commercial. Te Moana Road had a recorded daily traffic volume of approximately 8,600 vehicles per day in 2009, at a location approximately 500 metres west of SH1.

Elizabeth Street

Elizabeth Street is a two-lane road (one lane in each direction) that connects Waikanae Town Centre with the Waikanae community to the east of the NIMT and also Reikorangi. It is the only crossing of the NIMT in Waikanae, and as such provides the only vehicular access to this community from Waikanae Town Centre. The intersection of Elizabeth Street and SH1 is one of a pair of signalised intersections in Waikanae Town Centre. Elizabeth Street has a posted speed limit of 50kph and had a recorded daily traffic volume of approximately 6,770 vehicles per day in 2010, approximately 40m east of SH1.

Poplar Avenue

In Raumati South, Poplar Avenue is a two-lane road (one lane in each direction) beginning at SH1 in the east and running to the west, ending at Raumati South Beach. The intersection of Poplar Avenue with SH1 is priority controlled. It is bounded on its southern side by Queen Elizabeth Park. On its northern side it primarily provides access to residential land uses and also the Te Ra School. Poplar Avenue has a posted speed limit of 50kph for most of its length and increases to 80kph near the intersection with SH1. Poplar Avenue had a recorded daily traffic volume of approximately 3,000 vehicles per day in 2010 at a location approximately 1km west of SH1.

Raumati Road

Raumati Road is a two-lane road (one lane in each direction) running from SH1 in the east to Raumati Beach in the west. It has a 50kph posted speed limit. The intersection of Raumati Road with SH1 is priority controlled. The adjoining land uses are predominantly residential and it also serves as a key route to access Kāpiti College, which is located near the western end of Raumati Road. The daily traffic volumes vary significantly along the length of Raumati Road. Just west of SH1 Raumati Road had a recorded daily traffic volume of approximately 5,600 vehicles per day in

2007. West of the Rimu Road intersection Raumati Road had a recorded daily volume of approximately 10,000 vehicles per day in 2006.

Ihakara Street

Ihakara Street is a 50kph two-lane road (one lane in each direction) providing access to predominantly commercial and light industrial land uses in central Paraparaumu. It also serves as a southern entrance to the Coastlands shopping centre. Ihakara Street begins at SH1 in the east and currently ends west of Rimu Road. The intersection of Ihakara Street and SH1 is priority controlled. Ihakara Street is proposed to be extended to the west, around the Paraparaumu Airport to connect to Kāpiti Road near Hurley Road, as part of the Paraparaumu Airport development. A recent traffic count on Ihakara Street, east of Rimu Road was not available at the time of writing this Scoping Report.

Rimu Road

Rimu Road is a 50kph two-lane road (one lane in each direction) running between Raumati Road in the south and Kāpiti Road in the north. Between Raumati Road and Ihakara Street, Rimu Road the adjoining land uses are predominantly residential. North of Ihakara Street, Rimu Road provides access to the Coastlands shopping centre which adjoins Rimu Road on its eastern side. On the western side of Rimu Road, north of Ihakara Street the land uses are partly commercial and partly rural (although zoned as part of the Paraparaumu Town Centre development). KCDC offices are located on the eastern side of Rimu Road. In 2010, Rimu Road had a recorded daily traffic volume of approximately 13,600 south of Kāpiti Road.

Otaihanga Road

Otaihanga Road is a two-lane road (one lane in each direction) beginning at SH1 in the east and ending at the Waikanae River in Otaihanga settlement. It has a posted speed limit of 80kph from SH1 to Ratanui Road where it reduces to 50kph. The intersection of Otaihanga Road and SH1 is stop-controlled. Between SH1 and Ratanui Road, Otaihanga Road has no footpath and a number of sharp bends are signposted with advisory speed signs. This section of Otaihanga Road provides access to a number of rural residential properties along with the Kāpiti Landfill (now closed except for cleanfill) and Southwards Car Museum. North of Ratanui Road, Otaihanga Road provides direct access to residential properties. In 2010, it had a recorded traffic volume of nearly 6,000 vehicles per day east of Ratanui Road and 1,800 vehicles per day west of Ratanui Road.

Arawhata Road

Arawhata Road is a two-lane road (one lane in each direction) with a posted speed limit of 50kph. It begins at Kāpiti Road in the south and becomes Mazengarb Road at its northern end. The intersection of Arawhata Road with Kāpiti Road is stop-controlled (with Kāpiti Road as the major

movement). The adjoining land uses are primarily residential. In 2009 it had a recorded daily traffic volume of approximately 6,800 vehicles.

Mazengarb Road

Mazengarb Road is a two-lane road (one lane in each direction) with a posted speed limit of 50kph. It begins at Te Kupe Road in Paraparaumu Beach and becomes Arawhata Road in Paraparaumu. Significant intersections along Mazengarb Road include Guildford Drive (just west of Paraparaumu College) and Ratanui Road (east of Paraparaumu College and the Mazengarb Reserve). The traffic volume on Mazengarb Road was recorded as approximately 8,000 vehicles per day in 2010. Mazengarb Road provides access to residential properties as well as Paraparaumu College and the Mazengarb Reserve recreational area, both west of the intersection of Ratanui Road.

Ratanui Road

Ratanui Road is a two-lane road (one lane in each direction) which begins at the intersection with Otaihanga Road in the north and ends at Mazengarb Road in the south. It has a posted speed limit of 80kph near Otaihanga Road and reduces to 50kph as it enters the Paraparaumu urban area north of Mazengarb Road. Ratanui Road provides access to rural residential properties and Killalea Place in the 80kph area and residential properties in the 50kph area. The most recent traffic count on Ratanui Road was in 2004 when approximately 6,500 vehicles per day were recorded.

2.3 Other Transport Systems

In addition to the road transport network there are other transport modes which operate on the Kāpiti Coast including rail, bus, and pedestrian and cycling routes.

2.3.1 Rail

a. Existing Services

Three passenger rail services operate within the Kāpiti district. Two of these are long-haul services, namely the Overlander and the Capital Connection, both of which are operated by Tranz Scenic. The third, the Paraparaumu Line service (PPL), is a commuter service operated by Tranz Metro (part of Kiwirail). This service is proposed to extend to Waikanae in 2011.

i. Tranz Metro Service

Tranz Metro's Paraparaumu Line service provides a commuter service between Paraparaumu and Wellington Railway Station. In the AM and PM peak periods, the service generally operates a 20 minute frequency as an express service (no stops between Porirua and Wellington during the peaks). In the off peak and weekends, the service generally operates on a 30 minute frequency stopping at all stations on the line.

ii. Capital Connection

The Capital Connection is a commercial service that runs between Palmerston North and Wellington during the weekdays. Within the Kāpiti District it stops at Ōtaki, Waikanae and Paraparaumu. The 45-55 minute journey departs Waikanae at 7:26am and Paraparaumu at 7:35am during weekday mornings. The return journey departs Wellington at 5:17pm, arriving at Paraparaumu at 6:06pm and Waikanae at 6:14pm.

iii. The Overlander

The Overlander runs daily between Auckland and Wellington and stops at Paraparaumu within the Kāpiti District. An evening service into Wellington departs Paraparaumu at 6:15pm, arriving into Wellington at 7:25pm. An outbound morning service to Auckland departs Wellington at 7:25am and arrives into Paraparaumu at 8:20am.

b. Existing Demand

According to the *2008/2009 Annual Monitoring Report on the Regional Land Transport Strategy* (Monitoring Report), the 2006 Census indicated that within the Greater Wellington Region, rail accounted for 7.4% of journey to work trips in 2006 and bus mode share was 9.5%[1]. Public transport accounted for 30% of journey to work trips to the Wellington CBD.

Further detailed breakdown of rail travel for journey-to-work commuters, is provided in *GWRC's Kāpiti Railway Stations Concept Design – Scoping Report* (Rail Scoping Report), which assumes based on analysis of 2006 Census data and platform boarding surveys that 13% of Kāpiti commuters travel by rail (87% by private motor vehicle)[2] which equates to passenger 892 trips per peak hour for all three rail stations in Kāpiti (Waikanae, Paraparaumu, and Paekakariki).[3]

c. Existing Capacity

i. Capital Connection

The Rail Scoping Report states that the morning service of the Capital Connection has a total train capacity of 512 seated passengers, provided by eight carriages, each with a seating capacity of 64. The report highlights that only five of the eight carriages are available for boarding at Waikanae due to the staggered platform configuration. [4]

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[1] 2008/2009 Annual Monitoring Report on the Regional Land Transport, p.12

[2] 2008/2009 Annual Monitoring Report on the Regional Land Transport, p.19

[3] 2008/2009 Annual Monitoring Report on the Regional Land Transport, p.21

[4] Wellington Regional Rail Plan, p.24

ii. Tranz Metro Paraparaumu Line

GWRC's *Wellington Regional Rail Plan* (WRRP), provides an existing peak inbound seating capacity on the Paraparaumu Line as at October 2008, of 4,292 passengers between 7am and 9am.[5]

iii. The Overlander

As Tranz Scenic's Overlander service departs Paraparaumu for Wellington at 6:15pm, it does not provide additional capacity for the vast majority of journey-to-work commuters travelling from Kāpiti to Wellington.

d. Rail Stations

i. Waikanae Station

Waikanae station is located on eastern side of SH1, approximately 55km from Wellington. Free Park and Ride facilities are available for 74 cars parked to the rear of the station platform [6] and are accessed directly from SH1. Additional unrestricted on-street parking is also available on Pehi Kupa Street, accessed via Elizabeth Street.

As Waikanae Station does not form part of the Tranz Metro Paraparaumu service, the only passenger rail service that operates from the station is the Tranz Scenic's Capital Connection, running between Palmerston North and Wellington.

Full integration of bus and rail services does not currently take place on-site at Waikanae Station, however, bus route 280 running between Waikanae Beach and Paraparaumu, operated by Mana Coach Services utilises a bus stop on nearby Ngaio Road and is scheduled such that it coincides with the Capital Connection Service.

Greater Wellington Regional Council's Rail Scoping Report states that during a survey undertaken on 28th November 2007, approximately 95 passengers boarded the Capital Connection service. This figure was confirmed by the station manager who stated that between 90 and 100 passengers are observed boarding on most journeys.

ii. Paraparaumu Station

Paraparaumu station is located on eastern side of SH1, approximately 48km north of Wellington. The station is located south of the Kāpiti Road level crossing and is bounded to the east by

[5] Wellington Regional Rail Plan, p.24

[6] Wellington Regional Rail Plan, Appendix B.4.2 Stations

Hinemoa and Epiha Streets. Free Park and Ride facilities are available at Paraparaumu Station for 360 cars, plus an additional 160 bays are available at the southern end of Epiha Street[7] . Both car parks are accessed via Hinemoa Street off Kāpiti Road and Ruapehu Street.

Compared to Waikanae station, Paraparaumu Station is well served by integrated bus services, with a bus terminal located immediately to the west of the station in a dedicated drop off/ pick up area on the eastern side of SH1.

From the bus terminal, it is possible to catch the majority of bus services that are provided within the Kāpiti District, along with catching the services to Hawke's Bay, Auckland and Wellington.

The Rail Scoping Report states that during surveys undertaken during February 2008 there were approximately 40 passengers boarding the 7:35am Capital Connection service.

The Rail Scoping Report also states that during a November 2006 survey, the total number of boardings at Paraparaumu for the three Tranz Metro's Paraparaumu Line services at 7:00am, 7:18am and 7:40am to be in the order 620 passengers, with the 7:18am being the most popular with 261 boarders. The report calculates that this equates to 52% of the available seat capacity for these services being utilised at the initial boarding point.

Total inbound morning peak capacity (defined as services arriving at Wellington between 7am and 9am), between Paraparaumu and Wellington is 1,776 passengers.

e. Planned Rail Improvements

In July 2009, Greater Wellington Regional Council published its Wellington Regional Rail Plan 2010 -2035 (RRP) in conjunction with Kiwi Rail, the Ministry of Transport, On Track and NZTA[8], with the aim of providing for a long term, 25 year, development plan for the region's rail network.

The RRP states that it "supports the broader objectives of national and regional transport strategies including the NZTS, the Government Policy Statement 2008 (GPS), the National Rail Strategy to 2015 (NRS) and the Regional Land Transport Strategy (RLTS) 2007. In particular, the plan focuses on achieving RLTS key outcomes and the transport targets in the Regional Passenger Transport Plan (RPTP) [9] within the RLTS."

Table 4 below summarises the RLTS outcome target for 2016 in relation to public transport.

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[7] http://www.gw.govt.nz/assets/Transport/Public-transport/Docs/RegionalRailPlan.pdf

[8] http://www.gw.govt.nz/assets/Transport/Public-transport/Docs/RegionalRailPlan.pdf

[9] http://www.gw.govt.nz/assets/Transport/Regional-transport/RLTS/RegionalPassengerTransportPlan.pdf

Table 4 - RLTS – Key Public Transport Outcome Targets for 2016

Key Outcome	2016 Target
1.1 Increased peak period passenger transport mode share	▪ Passenger transport accounts for at least 25 million peak period trips per annum (18.3 million in 2005/06) ▪ Passenger transport accounts for at least 21% of all region wide journey to work trips. (17% in 2006)
1.2 Increased off-peak passenger transport use and community connectedness	▪ Passenger transport accounts for at least 25 million off peak period trips per annum. (16.7 million trips in 2005/06)
1.3 Improved passenger transport accessibility for all, including disabled people or from low income groups	▪ 80% of passenger transport services are guaranteed to be wheelchair accessible. (11.8% in 2005/06) ▪ Most of the region's residents live within 400m (5 minutes walk) of a bus stop or train station with a service frequency of at least 30 minutes. ▪ Passenger transport services in the highest deprivation areas are more affordable.
1.4 Reduced passenger transport journey times compared to travel by private car	▪ Peak period PT journey times are equal to or better than a similar journey undertaken by a private car for key selected corridors.
1.5 Increased passenger transport reliability	▪ Nearly all bus and train services run on time

During July 2007, the Crown and GWRC approved a $500m investment package for the Wellington suburban rail network to provide a 5 year Medium Term Rail Improvement Plan (MTRIP) designed to improve reliability and capacity. In addition to new rolling stock and infrastructure compliance (eg signalling and overhead power upgrades), the following improvements occur within or affect the Paraparaumu Line:

f. Track Upgrades

i. Double Tracking and Electrification to Waikanae

- to improve infrastructure reliability, provide greater corridor capacity beyond MacKays Crossing, extension of the suburban network, and ensure maximum reliability benefits are garnered from the new Electric Multiple Units (EMUs).

ii. Wellington Station Approaches (Kaiwharawhara)

- to enhance 'through capacity', improve journey times and enable frequency improvements on all lines.

iii. Alignment Improvements between North and South Junction

- improvements between Paekakariki and Pukerua Bay, to improve service reliability, capacity and journey times.

g. Station Upgrades

i. New and Upgraded Kāpiti Railway Stations

- to provide for the extension of double tracking and electrification to Waikanae, improve capacity, community amenity and accessibility. Currently proposals for new stations at Raumati and Lindale are on hold, and improvements to Waikanae and Paraparaumu are proceeding.

ii. Network Wide Station Upgrades

- primarily focusing on Park & Ride and general security improvements, these works will be undertaken following completion of the work needed to upgrade platforms to accommodate the new EMUs.

2.3.2 Bus

a. Existing Services

There is a network of local bus services on the Kāpiti Coast that connect communities to the Paraparaumu Rail Station. At the time of writing the Scoping Report, there are bus routes servicing Raumati South (Route 250), Raumati Beach (Route 260), Paraparaumu Beach (Routes 258, 259, and 262), Paraparaumu East (Route 270), Waikanae Beach (Route 280), and Ōtaki (Route 290). There is also an off-peak service which runs a loop between Paraparaumu Rail Station, Paraparaumu Beach, and back (Routes 265 and 266). The bus routes include the Paraparaumu Rail Station. Bus services generally run at 20 minute frequencies during the peak periods and are timed to connect to trains. On weekends the bus routes operate on a one hour frequency.

i. Kāpiti Commuter

The Regional Council operates a commuter bus service between Waikanae Beach and Wellington. There are two services in the morning, leaving Waikanae Beach at 5:25am and 5:50am and arrive at Wellington (Courtenay Place) at 7:00am and 7:30am, respectively. There are two outbound services in the weekday evening peak leaving Wellington (Courtenay Place) at 4:15pm and 4:45pm and arrive at Waikanae Beach at 6:03pm and 6:33pm, respectively.

ii. School Bus Services

School bus services are operated directly by Mana Coach Services. School bus services include Kāpiti and Paraparaumu Colleges along with Kāpiti Coast primary schools.

b. Existing Patronage

GWRC staff indicate that existing bus patronage in the Kāpiti area, (encompassing services within Paraparaumu, Waikanae and Ōtaki) for the six months from July 2009 to December 2009 was 336,000 passengers.

2.3.3 Pedestrians and Cyclists

In 2009, KCDC adopted its Cycling, Walkways and Bridleways (CWB) Strategy which is an update of the previous 2004 strategy. The vision for the 2009 CWB Strategy is:

"The Kāpiti Coast is renowned for cycling walking and horse riding"

The 2009 CWB Strategy retains the core network features of the 2004 strategy including:

- Good access to the Tararua Ranges
- A coastal walkway / cycleway from Paekakariki to Ōtaki and north
- Relatively easy access along the coastal escarpment and lower hills
- Extensive linkages through built up areas to key natural features eg rivers and native bush
- Good local linkages to schools and centres.

Figure 2 illustrates the key pedestrian and cycling routes in Raumati, Paraparaumu, and Waikanae. Since the map was published, KCDC has constructed a second pedestrian/cycling crossing of the Waikanae River (the "Te Arawai footbridge") at Jim Cooke Park.

Figure 2 - Walking and Cycling Routes in Raumati, Paraparaumu, and Waikanae

2.4 Travel Demand Management

In the Wellington Region, Travel Demand Management (TDM) is offered through the provision of public transport. In Kāpiti, passenger rail and bus services are provided to Wellington offering transport mode choice to commuters. The Rail Scoping Study indicated that 13% of Kāpiti commuters travel by rail. The suburban passenger rail service is currently being extended to Waikanae and services are expected to commence in 2011.

The Regional Land Transport Strategy has a TDM Action Plan to be implemented by Greater Wellington Regional Council (GWRC), local authorities and NZTA. Specific TDM measures in the Action Plan include:

- Optimise use of the existing road network through improving the road network efficiency and parking management
- Encouraging sustainable and efficient travel choices
- Promoting land use that supports sustainable travel options through influencing the Regional Policy Statement, District Plans, and Structure Plans
- Advocate for measures to improve transport network efficiency and sustainability
- Collecting and sharing information to support sustainable transport options.

The Action Plan is intended to reduce the number of vehicular trips, especially in the peak hours, to reduce congestion and emissions.

2.5 Freight

2.5.1 Regional Freight Plan

In 2007 GWRC published the Regional Freight Plan (RFP). The RFP highlights the importance that freight movement plays in the regional and national economy and notes that there is a direct relationship between freight growth and economic growth Based on the Wellington Region's growth trends, freight volumes are expected to grow by more than 50% over the next ten years. The region's transport network will need to accommodate the increased freight traffic demand.

To help cater for the increased freight demand, the RFP includes a number of policies such as:

- Support rail freight initiatives where benefits exceed those of road freight
- Provide an appropriate transport network for freight and commercial needs
- Protect and develop rail infrastructure, wagons and facilities for freight and forestry links between Masterton and Wellington
- Support the protection of the rail corridor to Gracefield/Seaview.

Outcomes for freight movement in the Wellington Region include:

- Improved level of service for freight
- Improved freight linkages
- Improved rail and road freight efficiency.

2.5.2 Roads of National Significance

The RFP places an emphasis on the movement of freight by rail. Since the RFP's publication, the 2009 GPS on Land Transport Funding was published which announced the RoNS and emphasised the need for efficient road transport links to move freight and encourage economic development.

Within Kāpiti, SH1 provides the backbone for freight movement. Currently 6.5% of traffic on SH1 in Paraparaumu is heavy vehicles and the volume of truck traffic is expected to increase. The Kāpiti District is expected to experience significant growth over the next twenty years. The redevelopment of the Paraparaumu Airport is a key development area and will generate an increased demand for freight movement within Kāpiti and beyond.

There are a number of issues associated with freight traffic on SH1. Between MacKay's Crossing and Peka Peka SH1 passes through the urban areas of Paraparaumu, and Waikanae. All intersections with SH1 between MacKay's Crossing and Peka Peka are at-grade including one signalised intersection in Paraparaumu (Kāpiti Road) and two signalised intersections in Waikanae (Te Moana Road and Elizabeth Street) which require SH1 traffic including freight to stop, resulting in increased operating costs. The operating cost for trucks increases with congestion, particularly as a result slowing and stopping at intersections and of stop-start driving.

2.6 Crashes

NZTA's Crash Analysis System (CAS) was interrogated to determine the reported crash history for the five year period 2005 to 2009 along SH1 from MacKay's Crossing to Peka Peka and at each of the key intersections within the project area. The results of this assessment are summarised below. The CAS crash data is included in Appendix A.

2.6.1 Crashes on SH1 from MacKays Crossing to Peka Peka

The tables below summarise the reported crash history on SH1 from MacKay's Crossing to Peka Peka.

Table 5 - Annual Distribution of Crashes on SH1 MacKays Crossing to Peka Peka

Year	Fatal	Serious	Minor	Non-Injury	Total
2005	1	6	20	56	83
2006	2	6	20	47	75
2007	1	3	14	67	85

Year	Fatal	Serious	Minor	Non-Injury	Total
2008	0	2	17	55	**74**
2009	0	2	15	65	**82**
TOTAL	**4**	**19**	**86**	**290**	**399**

Table 6 - Crash Type SH1 MacKays Crossing to Peka Peka

Crash Type	Number of Reported Crashes	Percentage of Reported Crashes
Overtaking Crashes	35	9%
Straight Road Lost Control/Head On	53	13%
Bend - Lost Control/Head On	45	11%
Rear End/Obstruction	109	27%
Crossing/Turning	129	32%
Pedestrian Crashes	6	2%
Miscellaneous Crashes	22	6%
TOTAL	**399**	**100%**

In the five year period 2005 to 2009 a total of 399 crashes were reported on SH1 between MacKay's Crossing and Peka Peka. Four of the crashes resulted in fatalities, 19 resulted in serious injury, and 86 resulted in minor injuries. One of the fatal crashes occurred at the SH1 / Hadfield intersection, just north and opposite of the Peka Peka intersection and involved a vehicle failing to give way. Two of the fatalities occurred at midblock locations and involved loss of control or crossing / turning. One of the fatalities involved a rear-end collision with another vehicle south of Poplar Avenue.

Of the 19 serious injury crashes, seven involved right turn against and turning movements and seven involved loss of control. There were also three head-on collisions, two overtaking, one rear-end and one merging crash resulting in serious injuries.

The majority of the minor injury crashes involved loss of control. Many other minor injury crashes involved right turn against / turning collisions and rear-ending.

2.6.2 Crashes at Intersections

The reported crash history was analysed for significant intersections along SH1 between MacKay's Crossing and Peka Peka and the results of the assessment are presented below.

Poplar Avenue / SH1

For the five year period 2005 to 2009, a total of 9 crashes were reported within a 200m radius of the SH1 / Poplar Avenue intersection. The following tables summarise the CAS output data.

Table 7 - Annual Distribution of Crashes at the SH1/Poplar Avenue Intersection

Year	Fatal	Serious	Minor	Non-Injury	Total
2005	0	0	0	1	1
2006	0	1	0	2	3
2007	0	0	0	1	1
2008	0	0	0	2	2
2009	0	0	1	1	2
TOTAL	**0**	**1**	**1**	**7**	**9**

Table 8 - Crash Type at the SH1 / Poplar Avenue Intersection

Crash Type	Number of Reported Crashes	Percentage of Reported Crashes
Overtaking Crashes	0	0%
Straight Road Lost Control/Head On	3	33%
Bend - Lost Control/Head On	4	44%
Rear End/Obstruction	1	11%
Crossing/Turning	1	11%
Pedestrian Crashes	0	0%
Miscellaneous Crashes	0	0%
TOTAL	**9**	**100%**

Of these reported crashes, one resulted in a serious injury and one resulted in a minor injury. The predominant crash type was loss of control/head on which accounted for 77% of all reported crashes. The serious injury crash involved a vehicle turning right into Poplar Avenue failing to give way to a northbound vehicle moving straight through the intersection. There were no reported pedestrian or cyclist crashes within the five year period.

Raumati Road / SH1

For the five year period 2005 to 2009 a total of 19 crashes were reported within a 200m radius of the SH1 / Raumati Road intersection. The following tables summarise the CAS output data.

Table 9 - Annual Distribution of Crashes at the SH1 Raumati Road Intersection

Year	Fatal	Serious	Minor	Non-Inj	Total
2005	**0**	**1**	**0**	**0**	**1**
2006	**0**	**1**	**4**	**1**	**6**
2007	**0**	**0**	**0**	**0**	**0**

Year	Fatal	Serious	Minor	Non-Inj	Total
2008	0	0	2	2	4
2009	0	0	1	7	8
TOTAL	0	2	7	10	19

Table 10 - Crash Type at the Raumati Road Intersection

Crash Type	Number of Reported Crashes	Percentage of Reported Crashes
Overtaking Crashes	1	5%
Straight Road Lost Control/Head On	3	16%
Bend - Lost Control/Head On	2	11%
Rear End/Obstruction	2	11%
Crossing/Turning	10	53%
Pedestrian Crashes	0	0%
Miscellaneous Crashes	1	5%
TOTAL	**19**	**100%**

Of these reported crashes, two resulted in serious injuries and seven resulted in minor injuries. The predominant crash type was crossing/turning which accounted for 53% of all reported crashes. The majority of all injury crashes were attributable to vehicles failing to give-way when turning at the intersection. The CAS crash list detail report indicated that failing to give-way was a factor in 67% of crashes reported at the intersection. There were no reported pedestrian or cyclist crashes within the five year period.

Kāpiti Road / SH1

For the five year period 2005 to 2009 a total of 62 crashes were reported within a 100m radius of the SH1 / Kāpiti Road intersection. The following tables summarise the CAS output data.

Table 11 - Annual Distribution of Crashes at the SH1 Kāpiti Road Intersection

Year	Fatal	Serious	Minor	Non-Injury	Total
2005	0	0	2	8	10
2006	0	1	3	7	11
2007	0	0	1	7	8
2008	0	0	1	12	13
2009	0	0	5	15	20
TOTAL	**0**	**1**	**12**	**49**	**62**

Table 12 - Crash Type at the SH1 Kāpiti Road Intersection

Crash Type	Number of Reported Crashes	Percentage of Reported Crashes
Overtaking Crashes	5	8%
Straight Road Lost Control/Head On	2	3%
Bend - Lost Control/Head On	1	2%
Rear End/Obstruction	14	23%
Crossing/Turning	36	58%
Pedestrian Crashes	4	6%
Miscellaneous Crashes	0	0%
TOTAL	**62**	**100%**

Of these reported crashes, one resulted in a serious injury and 12 resulted in minor injuries. The predominant crash type was crossing/turning which accounted for 58% of all reported crashes. The serious injury crash involved a vehicle losing control when slowing down for a red traffic signal. The majority of minor injury crashes involved vehicles failing to give way when turning at the intersection.

There were four reported crashes at the intersection involving pedestrians and cyclists within the five year period. Two of the crashes involved pedestrians crossing heedless of traffic and both resulted in minor injuries. Two of the crashes involved cyclists failing to give way at the intersection and both resulted in minor injuries.

Otaihanga Road / SH1

For the five year period 2005 to 2009 a total of 23 crashes were reported within a 200m radius of the SH1 / Otaihanga Road intersection. The following tables summarise the CAS output data.

Table 13 - Annual Distribution of Crashes at the SH1 Otaihanga Road Intersection

Year	Fatal	Serious	Minor	Non-Injury	Total
2005	0	2	1	3	6
2006	0	0	3	3	6
2007	0	0	1	2	3
2008	0	2	1	2	5
2009	0	0	0	3	3
TOTAL	0	4	6	13	23

Table 14 - Crash Type at the SH1 Otaihanga Road Intersection

Crash Type	Number of Reported Crashes	Percentage of Reported Crashes
Overtaking Crashes	0	0%
Straight Road Lost Control/Head On	1	4%
Bend - Lost Control/Head On	6	26%
Rear End/Obstruction	8	35%
Crossing/Turning	8	35%
Pedestrian Crashes	0	0%
Miscellaneous Crashes	0	0%
TOTAL	**23**	**100%**

Of these reported crashes, four resulted in serious injuries and six resulted in minor injuries. The most frequent crash types were loss of control/head on (30%), rear end/obstruction (35%) and crossing/turning (35%). Two of the serious injury crashes involved vehicles failing to give way at the intersection, one of the serious injury crashes involved loss of control, and one of the serious injury crashes involved illness. The majority of the minor injury crashes involved vehicles failing to give way at the intersection. There were no reported pedestrian or cyclist crashes within the five year period.

Te Moana Road / SH1

For the five year period 2005 to 2009 a total of 31 crashes were reported within a 100m radius of the SH1 / Te Moana Road intersection. The following tables summarise the CAS output data.

Table 15 - Annual Distribution of Crashes at the SH1 Te Moana Intersection

Year	Fatal	Serious	Minor	Non-Inj	Total
2005	0	0	0	5	5
2006	0	0	1	8	9
2007	0	0	1	7	8
2008	0	0	0	4	4
2009	0	0	0	5	5
TOTAL	**0**	**0**	**2**	**29**	**31**

Table 16 - Crash Type at the SH1 Te Moana Intersection

Crash Type	Number of Reported Crashes	Percentage of Reported Crashes
Overtaking Crashes	1	3
Straight Road Lost Control/Head On	1	3
Bend - Lost Control/Head On	2	6
Rear End/Obstruction	9	29
Crossing/Turning	17	55
Pedestrian Crashes	0	0
Miscellaneous Crashes	1	3
TOTAL	**31**	**100**

Of these reported crashes, two resulted in minor injuries of which one was due to a vehicle failing to give way and the other was due to overtaking at the intersection. The predominant crash type was crossing/turning which accounted for 55% of all reported crashes. There were no reported pedestrian or cyclist crashes within the five year period.

Elizabeth Street / SH1

For the five year period 2005 to 2009 a total of 19 crashes were reported within a 100m radius of the SH1 / Elizabeth Street intersection. The following tables summarise the CAS output data.

Table 17 - Annual Distribution of Crashes at the SH1 Elizabeth Street Intersection

Year	Fatal	Serious	Minor	Non-Inj	Total
2005	0	0	0	3	3
2006	0	0	0	1	1
2007	0	0	1	4	5
2008	0	0	0	4	4
2009	0	0	1	5	6
TOTAL	**0**	**0**	**2**	**17**	**19**

Table 18 - Crash Type at the SH1 Elizabeth Street Intersection

Crash Type	Number of Reported Crashes	Percentage of Reported Crashes
Overtaking Crashes	1	5%
Straight Road Lost Control/Head On	1	5%
Bend - Lost Control/Head On	0	0%

Crash Type	Number of Reported Crashes	Percentage of Reported Crashes
Rear End/Obstruction	9	47%
Crossing/Turning	8	42%
Pedestrian Crashes	0	0%
Miscellaneous Crashes	0	0%
TOTAL	**19**	**100%**

Of these reported crashes, two resulted in minor injuries of which one involved a vehicle failing to give-way and the other involved an inattentive driver. The most frequent crash types were rear-end/obstruction (47%) and crossing/turning (42%). There were no reported pedestrian or cyclist crashes within the five year period.

3 Site Description & Constraints

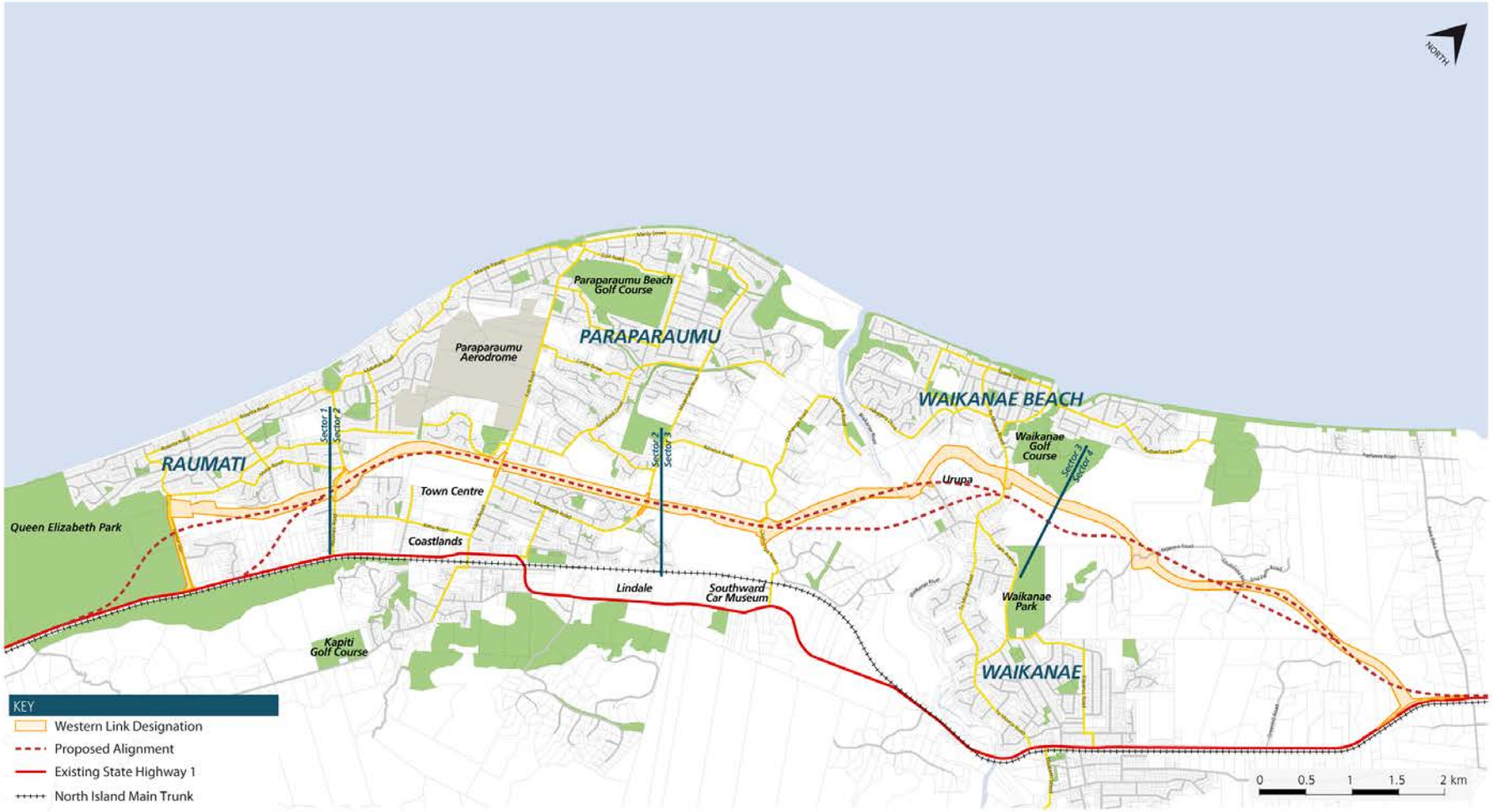
3.1 Existing Environment

The MacKays to Peka Peka Expressway route covers a length of approximately 18km. The total project area has been split into a number of sectors to recognise the differing community and environmental characteristics in identifying and assessing options. Each of the sectors covers a geographic area that has been divided into the following sections:

- Sector 1 – Raumati South: from MacKays Crossing to just north of Raumati Road
- Sector 2 – Raumati/Paraparaumu: from north of Raumati Road to north of Mazengarb Road
- Sector 3 – Otaihanga/Waikanae: from north of Mazengarb Road to north of Te Moana Road
- Sector 4 – Waikanae North: from north of Te Moana Road to Peka Peka

The sectors for the project are shown in Figure 3.

Figure 3 - MacKays to Peka Peka Sector Diagram



The existing environment presents a number of constraints that influenced the development of project options. These constraints fall into the following areas:

- Cultural and archaeological
- Environmental (including air quality and ecological constraints)
- Land use (including District Plan and Regional Plan constraints)
- Urban design
- Social and Community
- Landscape and visual
- Geology and ground conditions
- Stormwater and Hydrology.

A brief summary of the key constraints that apply to each sector is outlined in Table 19 below. For purposes of clarification, a constraint has been considered a feature that was needed to be taken into account when considering alignment options. Depending on the significance of the constraint compared with other constraints, alignment options generally sought to avoid key constraints as far as feasible.

Table 19 - Constraints Identified by Sector

Constraint Area	Sectors			
	1	2	3	4
Cultural/Archaeological	▪ Potential for unknown sites in QE Park, further work required to investigate ▪ Wetlands and streams	▪ Potential for unknown sites in this sector, further work required to investigate ▪ Wetlands and streams	▪ Maketu Tree, registered wāhi tapu site, Takamore urupa, Taku Rakau Village site, and a range of other sites and localities of cultural significance ▪ Wetlands and streams, including wetlands west of Takamore urupa	▪ Potential for unknown sites in this sector, further work required to investigate ▪ Wetlands and streams, with Harakeke and Kawakahia wetlands of particular cultural importance to iwi
Environmental	▪ Air Quality concerns relating to schools being located in close proximity to expressway for QE Park alignment option ▪ Ecology – there are a number of wetlands and peatland areas with moderate ecological values through this sector	▪ Air Quality – retirement village located approx. 200m from proposed alignment in this sector only known sensitive receptor ▪ Ecology – four wetland areas, Wharemauku Stream, ‘Drain 7’ and Mazengarb Stream which provide habitat for native	▪ Air Quality – limited constraints in this sector ▪ Ecology – significant number of ecological areas in this sector	▪ Air Quality – limited constraints in this sector ▪ Ecology – significant number of ecological areas in this sector

Constraint Area	Sectors			
	1	2	3	4
		fish species		
Land use & Planning	▪ Existing designations for schools, QE Park and Western Link Road ▪ QE Park gazetted 'reserve' under Reserves Act ▪ Ecological areas identified on District Plan maps	▪ Existing designations for Western Link Road, Paraparaumu Sewage Treatment Plant, Otaihanga Landfill and Plantation Reserve ▪ Andrews Pond (wetland) is an identified ecological area noted on District Plan maps ▪ Paraparaumu Town Centre development ▪ Paraparaumu Airport development – Plan Change 73	▪ Heritage items including Greenaway homestead and Maketu grave site ▪ Existing designations including the Western Link Road, Otaihanga Landfill ▪ Several ecological areas noted in this sector ▪ QEII covenants ▪ Plan Changes 79 and 80 – set urban 'edges' for future growth of the district and provide for neighbourhood and hamlet style residential development	▪ Existing designations including the Western Link Road ▪ Ecological areas identified on District Plan maps ▪ Outstanding landscape areas identified on District Plan maps ▪ QEII covenants ▪ Plan Changes 79 and 80 – set urban 'edges' for future growth of the district and provide for neighbourhood and hamlet style residential development
Urban Design	▪ Existing designation has formed a barrier between east-west communities; the Expressway may represent an opportunity to connect these neighbourhoods	▪ Council development plans for the Town Centre ▪ Paraparaumu Airport proposed development; ▪ Residential and commercial areas	▪ This sector is predominantly rural-urban therefore urban design constraints limited	▪ This sector is predominantly rural-urban therefore urban design constraints limited

Constraint Area	Sectors			
	1	2	3	4
		constrain the designated route on both sides		
Social and Community	▪ The proximity of schools and residential areas in this area results in moderate to significant social constraints on the project ▪ Social constraints in relation to property acquisition and associated displacement effects	▪ The proximity of the residential areas to the expressway alignment	▪ Social constraints in relation to property acquisition and associated displacement effects ▪ Recreational values associated with the river corridor	▪ Social constraints in relation to property acquisition and associated displacement effects
Landscape & Visual	▪ The existing designation currently runs along the sand dunes through this sector. Any excavation works on the dunes will modify the visual landscape ▪ QE Park is an open 'undeveloped' area, this forms a distinct change from the residential area to the north of Poplar Ave	▪ Existing designation located along the top of a 10-20m high sand dunes. These currently screen the residential area (located east of the Airport) from the designated route	▪ Dunelands through this sector ▪ Low lying Waikanae River corridor and recreational corridor	▪ Dunelands through this sector

Constraint Area	Sectors			
	1	2	3	4
Geology and Ground Conditions	▪ Thick peat (4 – 6m deep) can be found from the edge of the foothills and across QE Park ▪ Sand dunes located between Poplar Ave and Raumati Road – peat is located at the base of the sand dunes	▪ Isolated peat pockets found between the sand dunes ▪ High sand dunes ▪ Alluvial deposits found near Wharemauku Stream ▪ Historic landfill located adjacent to alignment – limited information currently available	▪ Shallow peat deposits ▪ Sand dunes ▪ Waikanae River corridor has low-lying alluvial terraces on either side	▪ Limited investigations undertaken in this sector previously. Site walkovers indicate the geology is most likely to be peat and sand similar to the other sectors ▪ Fault Hazard – identified at the northern end of this sector
Stormwater/ Hydrology	▪ Drain 7 and Poplar Ave flood levels constrain development levels of the Expressway ▪ Existing secondary flow paths constrain development as these need to be maintained to ensure adjacent areas do not flood ▪ Groundwater levels – high ground water levels will affect runoff treatment opportunities	▪ Existing flood levels are a constraint for further development ▪ Existing secondary flow paths ▪ Wharemauku and Mazengarb Streams - will be required to maintain flood flow levels ▪ KCDC identified flood storage area ▪ High groundwater levels –	▪ Existing flood levels are a constraint for further development ▪ Bridge waterways – Waikanae River with an active bed (creating a scour risk) ▪ Existing secondary flow paths ▪ KCDC identified flood storage area ▪ High groundwater levels	▪ Existing flood levels are a constraint for further development ▪ Existing secondary flow paths ▪ High groundwater levels ▪ Flat longitudinal gradients constrain potential flood discharge levels

Constraint Area	Sectors			
	1	2	3	4
		particularly in areas where grade separation is proposed to separate Expressway and local roads ■ Flat longitudinal gradients constrain potential flood discharge levels	■ Interaction of stormwater with Otaihanga Landfill – will constrain stormwater infiltration in this area	

These constraints have been considered when assessing the various options using the Multi Criteria Analysis (refer Section 11).

4 Statutory and Policy Context

4.1 Land Transport Management Act

The Land Transport Management Act (LTMA) provides the legal framework for managing and funding land transport activities. The purpose of the LTMA is to contribute to the aim of achieving an affordable, integrated, safe, responsive and sustainable land transport system. The LTMA:

- provides an integrated approach to land transport funding and management
- improves social and environmental responsibility in land transport funding, planning, and management
- provides the NZTA with a broad land transport focus
- improves long-term planning and investment in land transport, including planning and investment in coastal shipping and rail
- ensures that land transport funding is allocated in an efficient and effective manner
- improves the flexibility of land transport funding by providing for alternative funding mechanisms.

The LTMA also defines the function of the NZTA and the roles of:

- regional councils, for land transport planning, programming and funding
- regional transport committees (and their composition).

The LTMA also provides for:

- the development of a National Land Transport Strategy
- regional land transport strategies
- a Government policy statement on land transport funding 2009/10-20018/19 (GPS).

4.2 New Zealand Transport Strategy

The New Zealand Transport Strategy (NZTS) sets out the Government's vision for transport to 2040 and the strategic approach to be taken. The vision is that: 'People and freight in New Zealand have access to an affordable, integrated, safe, responsive, and sustainable transport system.'

The vision is supported by five transport objectives:

- ensuring environmental sustainability

- assisting economic development
- assisting safety and personal security
- improving access and mobility
- protecting and promoting public health.

The NZTS states that a 'business-as-usual' approach will not be adequate to achieve that vision and sets out seven key components where increased emphasis needs to be applied. These will need to guide how transport is planned and delivered. The seven key components are:

- integrated planning
- making best use of existing networks and infrastructure
- investing in critical infrastructure and the transport sector workforce
- increasing the availability and use of public transport, cycling, walking and other shared and active modes
- considering options for charging that will generate revenue for investment in transport infrastructure and services
- using new technologies and fuels
- maintaining and improving international links.

4.3 Government Policy Statement on Land Transport Funding

The Government Policy Statement on Land Transport Funding (GPS) sets out the Government's priorities for expenditure from the National Land Transport Fund over the next 10 years. It sets out how funding is allocated between activities such as road safety policing, state highways, local roads and public transport.

Under the LTMA:

- The NZTA must give effect to the GPS in developing the National Land Transport Programme and take account of the GPS when approving funding for activities
- Regional Land Transport Strategies must take account of the GPS
- Regional Land Transport Programmes must be consistent with the GPS.

The LTMA requires the GPS to contribute to the aim of achieving an affordable, integrated, safe, responsive and sustainable land transport system, and also to the five transport objectives of the LTMA.

The GPS contains a number of short to medium term goals to contribute to economic growth and productivity including:

- Improvements in the provision of infrastructure and services that enhance transport efficiency and lower the cost of transportation through:
- improvements in journey time reliability
- easing of severe congestion
- more efficient freight supply chains
- better use of existing transport capacity
- better access to markets, employment and areas that contribute to economic growth
- a secure and resilient transport network
- reductions in deaths and serious injuries as a result of road crashes
- more transport choices, particularly for those with limited access to a car where appropriate
- reductions in adverse environmental effects from land transport
- contributions to positive health outcomes.

In the GPS, the Government has listed seven initial Roads of National Significance (RoNS) as a statement of national road development priorities. This statement serves as a focus for investment to achieve economic growth and productivity. The GPS names the RoNS as New Zealand's most essential routes that require significant development to reduce congestion, improve safety and support economic growth. The Wellington Northern Corridor (SH1 from Levin to Wellington Airport) is one of the seven RoNS.

4.4 Resource Management Act

The Resource Management Act (RMA) promotes the management of the use, development and protection of natural and physical resources in a way, or at a rate, that enables people and communities to provide for their social, economic and cultural wellbeing and for their health and safety, while:

- sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations
- safeguarding the life-supporting capacity of air, water, soil and ecosystems
- avoiding, remedying or mitigating any adverse effects of activities on the environment.

The RMA sets out the functions, powers and duties of local government, and the resource consent and designation process. When building or maintaining state highways, the RMA requires the NZTA to avoid, remedy or mitigate adverse environmental effects caused by the highway infrastructure.

4.5 Regional Land Transport Strategy

The upgrading of SH1 from MacKays Crossing to Peka Peka, as well as its connections with the local road network forms part of the Western Corridor Plan within the Wellington Regional Land Transport Strategy (RLTS). This corridor generally follows the line of SH1 and the North Island Main Trunk railway from Ōtaki to Ngauranga. The RLTS describes the long term vision for the Western Corridor as:

> *"Along the Western Corridor from Ngauranga to Ōtaki, State Highway 1 and the North Island Main Trunk railway line will provide a high level of access and reliability for passengers and freight travelling within and through the region in a way which recognises the important strategic regional and national role of this corridor. These primary networks will be supported effectively by local and regional connector routes. A high quality rail service will accommodate the majority of people using passenger transport to commute along this corridor during the peak period. Comprehensive bus services and adequate park and ride facilities will provide additional access for the community. Traffic congestion on State Highway 1 will be managed at levels that balance the need for access against the ability to fully provide for peak demands due to community impacts and cost constraints. Maximum use of the existing network will be achieved by removal of key bottlenecks on the road and rail networks. Effective safety measures on the road and rail networks will ensure that no one is killed or injured as a result of network deficiencies when travelling in this corridor. East-west connections between this corridor and other corridors and regional centres will be efficient, reliable and safe."*

The Western Corridor Plan, which sits alongside this strategy, identifies the needs and proposed actions specific to this corridor. The action programmes within this corridor plan are multimodal and include consideration of land use integration. Key features of the existing Western Corridor Plan include:

- Rail improvements, including the extension of rail services north and increased service frequencies
- Construction of Transmission Gully
- Motorway within ten years
- Construction of Kāpiti Western Link Road in the short term
- Upgrading east-west connections.

The Western Corridor Plan was developed prior to the identification of the Wellington Northern Corridor (SH1 Levin to Wellington Airport) as one of the Government's Roads of National Significance.

5 Option Development

5.1 Development of Options Long-list

A series of workshops were held with the project team to develop and refine all the options that were viable along the route. Attendees at these workshops included members of the project team representing the various technical disciplines involved in the project, including specialists in ecology, social impact, cultural and heritage and archaeology.

In order to develop these options the project area was broken into a series of 'sectors', these are described in Section 3 (refer Figure 2 for sector boundaries). The options were developed in two main areas:

- Base-options – these are the high level options which detail the number and geographical location of interchanges and key connections over the length of the project
- Sub-Option alignments – these are options which are developed for each 'sector' of the project. Each sector may have several sub-option alignments. These detail the actual alignment of the route and are developed based on the constraints associated with each sector.

A summary of these workshops and the outcomes from each are briefly described below.

5.2 Options Description

As discussed above, the alignment options were split into base-options and sub-options depending on the level of investigation being assessed. A total of 12 base-options and 24 sub-options were included on the finalised long-list. A brief description of each of these is provided below.

5.2.1 Base-options (Connectivity Option Development)

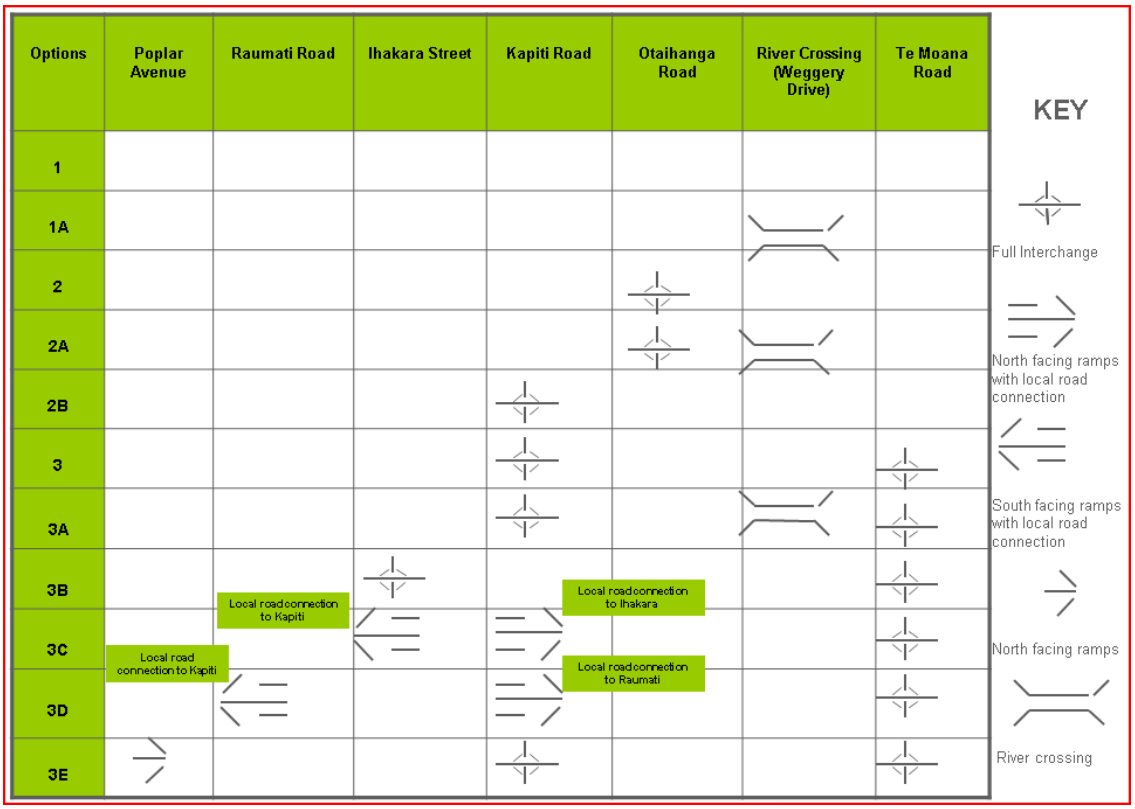
The Base-options were developed to consider connectivity options along the full length of the project. These options fall into three general categories:

- Option 1 – north and south connections to the existing SH1 but no intermediate interchanges
- Option 2 – north and south connections to SH1 plus one intermediate interchange
- Option 3 – north and south connections to SH1 plus two intermediate interchanges.

In addition, the scenario of adding a local road crossing of the Waikanae River was included for each base-option. A separate report titled 'Preliminary Waikanae River Crossing Study' has been prepared for these options and shows that the cost of such a local road crossing and associated road upgrading ranges between $50M and $80M, significantly more than the $20M for an additional interchange.

The twelve base-options identified provide a range of connectivity to the local street network which has been modelled to indicate the effectiveness of each of the scenarios. The list of base-options considered is shown in Figure 4 below.

Figure 4 - Base-option Diagram



5.3 Sector Options Development, (Sub-options)

5.3.1 General

As discussed above, a range of sub-options were identified in each sector of the proposed route. There were 24 sub-options included on the long-list for the route.

Concept drawings and a comprehensive list of sub-options are included in Appendix C.

5.3.2 Sector 1

The sub-options identified within sector one include four basic alignments with interchanges/local road connections in a range of locations. Parts of three of these alignments are through the QE Regional Park, (sub-options A-C), while the fourth ties into the existing SH1 just north of Poplar Ave, sub option D). Interchange configurations were considered for each of the alignments, some requiring additional work on local roads, such as Poplar Ave. The most western alignment which links the existing designation directly to MacKay's Crossing through QE Park did not progress past the 2nd workshop due to the significant severance and environmental effects on QE Park. The

project team believed that the negative impact significantly outweighed the benefits of the alignment being located in this position.

The option that ties in north of Poplar Ave requires an additional local road connection to allow convenient access to and from Raumati and the existing state highway north.

5.3.3 Sector 2

The sub-options identified within sector two (four in total), focus on interchange locations, split interchanges, and a slight alignment shift east of the Western Link Road designation mid-way between Raumati Road and Kāpiti Road (adjacent to the potential Ihakara Street Extension). KCDC intends to extend Ihakara Street through to link with Waikare Road, which will provide an additional east-west link, assisting with easing traffic congestion on Kāpiti Road. Sub-options within this sector need to integrate where possible with KCDC's town centre plans.

5.3.4 Sector 3

The sub-options identified within sector three focus on alternative routes to minimise impacts on either the wāhi tapu area or private property. Five routes were identified: three passing through the wāhi tapu area, one passing over the eastern corner of the wāhi tapu, and one to the east of the wāhi tapu through residential properties. The eastern sub-option would sever properties on Kauri and Puriri Roads and thus a new local connecting road would be required.

A sub-option consisting of a near straight line from Otaihanga Road to near Peka Peka has been discarded as the impact on private property and ecological areas was considered too significant to proceed further.

5.3.5 Sector 4

The sub-options identified within sector four focus on avoiding ecological areas in particular QE II Covenant sites. Six options in total were developed some being discarded early as they severed properties for no additional benefit. As no property is currently owned by the crown in this sector, apart from adjacent to Peka Peka Road, options have been considered that do not remain within the existing designation. These alignments also had to tie into the project to the north for which the current designation is not appropriate. Another constraint on the expressway in sector four is the location of transmission power lines which cross the alignment at an acute angle.

5.4 Option Workshops

5.4.1 Workshop 1: 14th July 2010

Workshop 1 included members from all of the project disciplines to identify and assess all the relative constraints that needed to be considered across the project area and introduce the project team to the various features of the route.

Following the constraints identification, the project team identified potential sub-options for each of the sectors.

All of the options were captured on the plans included in Appendix B.

5.4.2 Workshop 2: 3rd August 2010

The second workshop presented the schematic drawings of all options that had been developed during Workshop 1 to the project team. The purpose of this workshop was for the project team to review these options, challenge their integrity and brainstorm any additional options that had not yet been considered.

The initial results of the traffic modelling were presented at this workshop and further constraint identification presented to the project team from various technical disciplines.

The outcome of this workshop was the development of the long-list of options. Subsequently, the project team removed a number of options from the list from further consideration for the following reasons: options that had significant environmental, cultural, social or cost implications for the project with no added benefit.

For the purposes of clarity, the deleted options have been retained on the long-list for the duration of the option development process with notes detailing why they were not carried forward for further investigation.

The Long list of base-options and sub-options and associated plans are included in Appendix C.

5.4.3 Workshop 3: 18th August 2010

The final long list of options was presented to the project team along with new information from the various technical disciplines. Additional geometric design work had been undertaken on the alignment to provide a better indication of the 'footprint' several of the options would require. This allowed more specific detail to be provided from the technical disciplines of the level of effect or impact each option may have.

At this workshop a preliminary evaluation of the options without cost or BCR information was also carried out as part of developing appropriate and robust assessment criteria.

5.5 Option Refinement – Final Long List

From the work undertaken at the 3rd Workshop further refinement of options has been undertaken plus several sub-options were removed from the long list. This work is described below:

Sector 1

Sub option (S1Dii) – further work identifying full impact of alignment on private property has been undertaken. Also alternative options for ramps and local road connections have been considered.

The sub-options in Sector 1 which were located within the designation at Poplar Ave (S1B options) have been deleted. These sub-options were not progressed due to two factors:

- the alignment passed very close to two schools
- the options substantially bisected QE Park for no real additional benefit.

Sub-option S1Di that required a local access road parallel to the existing highway on the western side to provide connectivity has been deleted. This option required additional property purchase for no real benefit.

Sector 2

The Kāpiti interchange has been redesigned with retaining walls to reduce the footprint and impact on adjoining properties

Sub-option S2Biii – which included an interchange at Mazengarb Road was removed as there would be significant dis-benefits in having an interchange in a residential area, against the limited benefits of an interchange at this location on the local road network.

Sector 3

The most eastern sub-option (S3E) required an additional access roads to address the potential severance of Puriri Road caused by this expressway alignment.

Sector 4

Further design of the northern termination at Peka Peka has been undertaken following discussion with the project team working on the Peka Peka to Ōtaki Project.

Sub-option S4A located within the existing designation. This option would impact on the QEII Covenant sites north of Te Moana Road and therefore is not considered viable. However, north of Smithfields Road the alignment could possibly remain in the designation as the wetlands are less significant and unregistered. Options have been considered that skirt these moving the alignment slightly east. Geotechnical considerations may provide some further reason to locate the alignment in a particular location, but this information will not be available until the after the completion of this report.

6 Traffic and Economics

6.1 Traffic Assessment of Options

6.1.1 Introduction

A traffic assessment of the base-options was undertaken for the purpose of comparing the performance of the options with each other and also against the 'Do-Minimum'. The key purpose of the assessment was to understand, at a network level, the effects of different connectivity scenarios between the proposed expressway and the local road network.

Key performance criteria used were travel time and travel distance. The assessment considers the travel time savings expected for through traffic as well as local traffic.

The traffic model used for the assessment was the Kāpiti Traffic Model (KTM) developed by Opus International Consultants (Opus) for Kāpiti Coast District Council (KCDC) and the NZTA. The primary purpose of this model was assessing the Western Link Road proposal. The KTM sits under the regional Wellington Transport Strategy Model (WTSM), using the same base year of 2006 (the most recent census year) and forecast years of 2016 and 2026. KCDC and the NZTA granted access to the KTM to the Alliance for the purpose of assessing the MacKay's Crossing to Peka Peka Expressway. The Alliance has generally used the KTM as it was delivered, with only minor changes made to the base year network to better reflect its operational behaviour. As the project progresses it is expected that refinements will be made to the KTM as required.

6.1.2 The Do-Minimum

The Do-Minimum traffic demands developed by Opus for the KTM for 2016 and 2026 are based on the WTSM medium growth scenarios for those years from the WTSM Do-Minimum model. These WTSM demands include growth consistent with the Regional Growth Strategy (WRS).

To account for specific large scale developments proposed for the district, additional traffic demands from these developments have been included, increasing the growth beyond that predicted by WTSM. These specific developments are:

- KCDC Paraparaumu town centre development demands
- Property Ventures Paraparaumu town centre development demands
- Aerodrome development demands
- Waikanae North development demands.

The future year Do Minimum KTM networks have been developed by Opus to include local road schemes expected to be in place by the forecast years. These are listed in the table below.

Table 20 - Schemes Included in Do-Minimum Networks

Scheme	2016	2026
Kāpiti Road/ Rimu Road signalisation	✓	✓
Raumati Road/Rimu Road upgraded to roundabout	✓	✓
Ihakara Road extended to Paraparaumu Beach	✓	✓
Airport accesses added from Kāpiti Road	✓	✓
Paraparaumu town centre development links added	✓	✓

6.1.3 Travel Time Savings

a. Through Traffic

In July 2008, travel time surveys on SH1 between Poplar Avenue and Peka Peka Road were undertaken by Opus as part of the KTM model validation process. According to the travel time surveys, the average travel time in the weekday morning peak (southbound) on SH1 between Peka Peka Road and Poplar Avenue was approximately 11.5 minutes. The average travel time in the weekday evening peak (northbound) between Poplar Avenue and Peka Peka Road was approximately 13 minutes.

The KTM predicts that under the 2026 Do-Minimum scenario, travel times on SH1 southbound in the weekday morning peak will increase to approximately 17.5 minutes (an increase of six minutes compared to the 2008 surveys) and in the weekday evening peak northbound will increase to approximately 22.5 minutes (an increase of 9.5 minutes compared to the 2008 surveys).

The KTM was interrogated to determine travel time savings for through traffic with the Expressway in place. Through traffic was considered as all trips which enter the project area from MacKay's Crossing and exit the project area at Peka Peka (and vice versa) without stopping in between.

The travel time savings compared to the 'Do-Minimum' in the peak direction (southbound in the morning and northbound in the evening) for through traffic in the year 2026 is predicted to be approximately:

- A reduction of seven minutes in the 2026 weekday morning peak, resulting in a travel time of approximately 10.5 minutes
- A reduction of twelve minutes in the 2026 weekday evening peak, resulting in a travel time of approximately 10.5 minutes.

All of the base-options will have significant travel time savings for through traffic. The KTM results indicate that the all of the base-options perform similarly for through traffic and offer the same degree of travel time savings.

b. Local Traffic

The KTM model predicts that the base-options will have differing impacts on local traffic travel times. For the purpose of this study, local traffic was considered to be any vehicle trip which begins and ends within the study area (between MacKay's Crossing and Peka Peka). Three local trip journeys involving a generally north-south movement were assessed to determine the travel time savings for local traffic in the peak direction (southbound in the morning and northbound in the evening):

- Between Waikanae Beach and Coastlands
- Between Waikanae Beach and Paraparaumu Beach
- Between Waikanae Township and Coastlands.

The travel times predicted by the KTM for the above three local trip journeys under the 2026 Do-Minimum Scenario are summarised in the table below.

Table 21 - 2026 Do-Minimum Scenarios

Local Trip Between:	2026 Do-Min AM Peak Travel Time (Minutes)	2026 Do-Min PM Peak Travel Time (Minutes)
Waikanae Beach and Coastlands	20	24.5
Waikanae Beach and Paraparaumu Beach	24.5	25.5
Waikanae Township and Coastlands	14.5	15.5

The figures below summarise the projected travel time savings (in minutes) compared to the Do-Minimum in 2026 during the weekday morning and evening peaks for the three local trip journeys.

Figure 5 - Travel Time Saving (Minutes): 2026 AM Peak

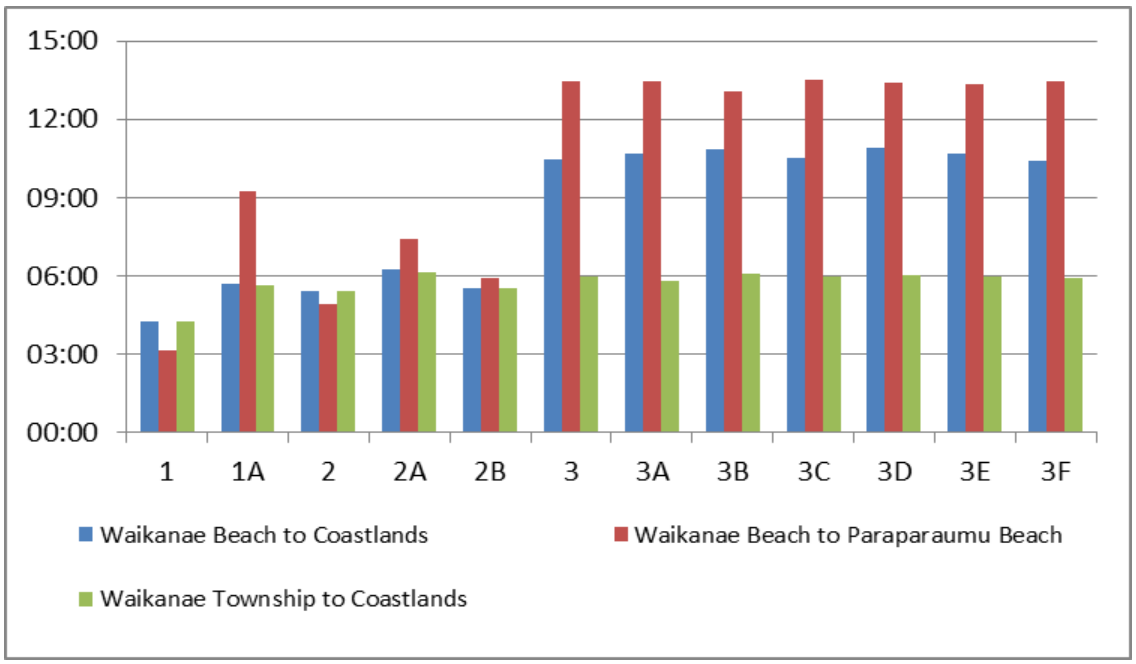
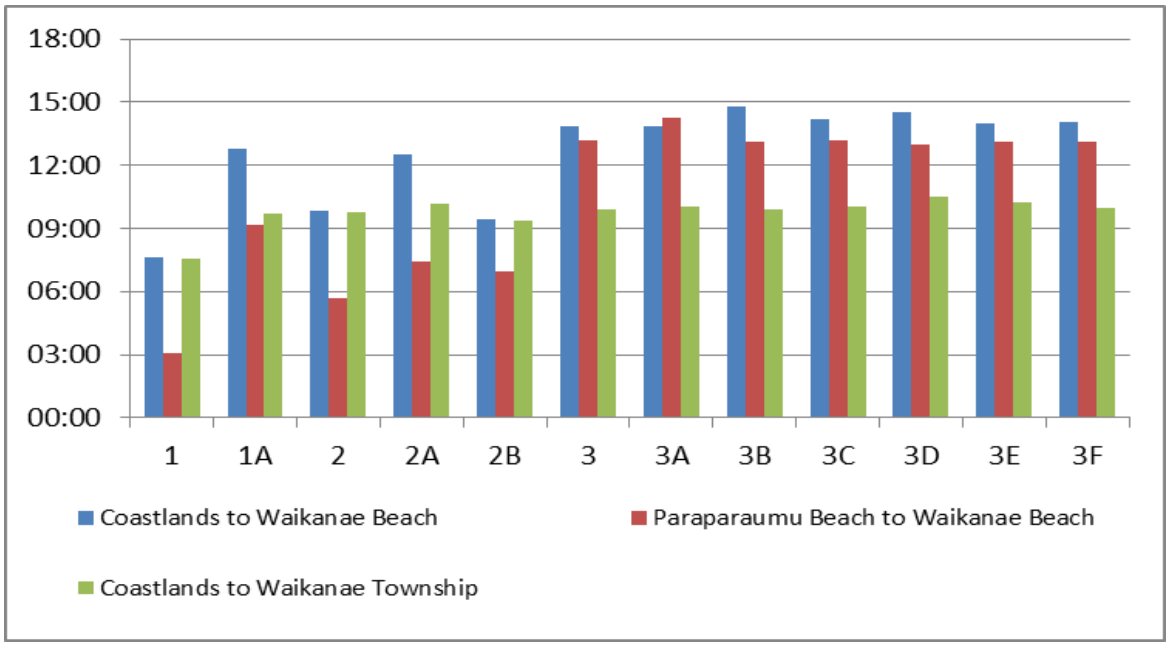


Figure 6 - Travel Time Saving (Minutes): 2026 PM Peak



As summarised in the figures above, the Expressway will result in travel time savings for north-south local traffic movements which for some options will be greater than the travel time savings for through traffic. For instance, Option 1 which has no connectivity between the Expressway and local network in Paraparaumu and Waikanae offers the least amount of north-south local traffic travel time savings. Options which provide connectivity in both Paraparaumu and Waikanae offer the greatest amount of north-south travel time savings for local traffic.

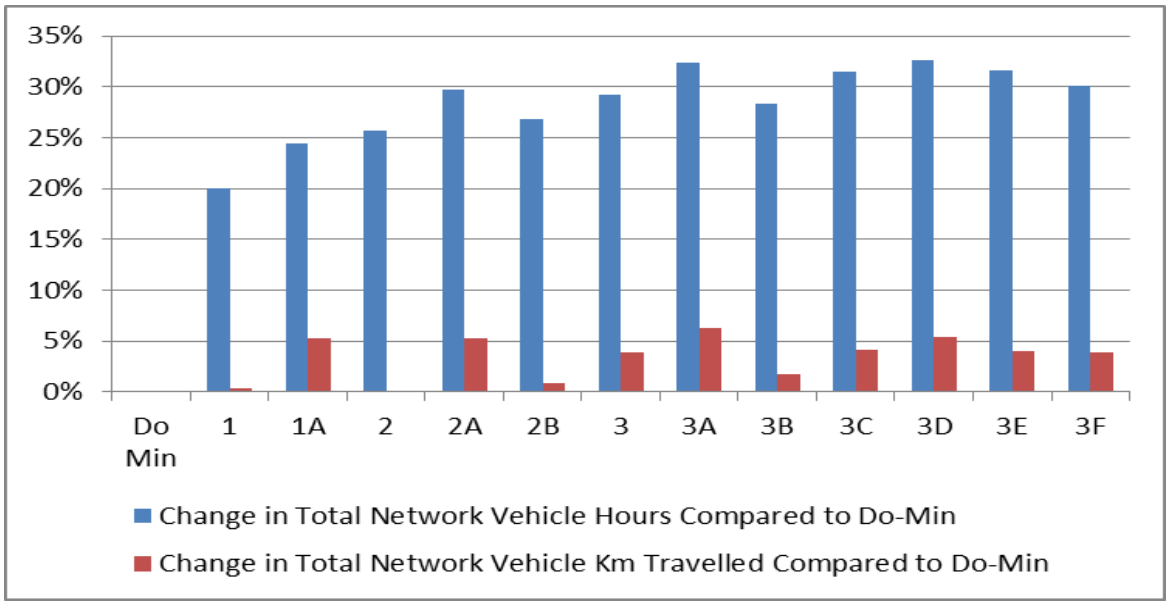
The east-west movement between Paraparaumu Beach and Coastlands was also assessed to determine the difference in travel time between the 2026 Do-Minimum Scenario and the base-options. The KTM predicts that under the 2026 Do-Minimum Scenario, the travel time between Paraparaumu Beach and Coastlands will be approximately 5.5 minutes in the weekday morning peak and approximately 6.5 minutes in the weekday evening peak.

The KTM model predicts that most options will have a negligible effect on travel times between Paraparaumu Beach and Coastlands compared to the Do-Minimum. Options 3B and 3C are predicted to add an additional half minute to the travel time between Paraparaumu Beach and Coastlands in both the weekday morning and evening peaks, caused by additional delay at intersections on Kāpiti Road in Paraparaumu town centre from vehicles routing to and from the interchange at Ihakara Street.

6.1.4 Network Travel Time and Distance

The figure below illustrates the percentage reduction in total network travel time (vehicle hours) and total network travel distance (vehicle kilometres travelled) for each option relative to the Do-Minimum.

Figure 7 - 2026 Reduction in Total Network Travel Time and Distance Relative to Do-Min



Option 1, which has no connectivity to the local network in Paraparaumu or Waikanae, results in an approximate 20% reduction in total network travel time and a minor decrease in total network travel distance compared to the Do-Minimum. When additional connectivity is provided to the expressway, further reductions in total network travel time and distance are achieved. For example, Option 3 (which has interchanges in Paraparaumu and Waikanae), provides close to a 30% reduction in total network travel time compared to the Do-Minimum, or a further 10% network travel time reduction compared to constructing the Expressway, but providing no connectivity (Option 1).

6.1.5 Projected Traffic Volumes on Waikanae River Crossing

SH1 currently provides the only crossing of the Waikanae River. The proposed expressway will provide a second crossing of the Waikanae River. Three of the options (1A, 2A, and 3A) also include a new local road across the Waikanae River at Weggery Drive.

The figures below summarise the volume of traffic crossing the Waikanae River in both directions on each of the three routes in the weekday morning and evening peaks in 2026 for each of the expressway options.

Figure 8 - Traffic Volume Across Waikanae River: 2026 AM Peak

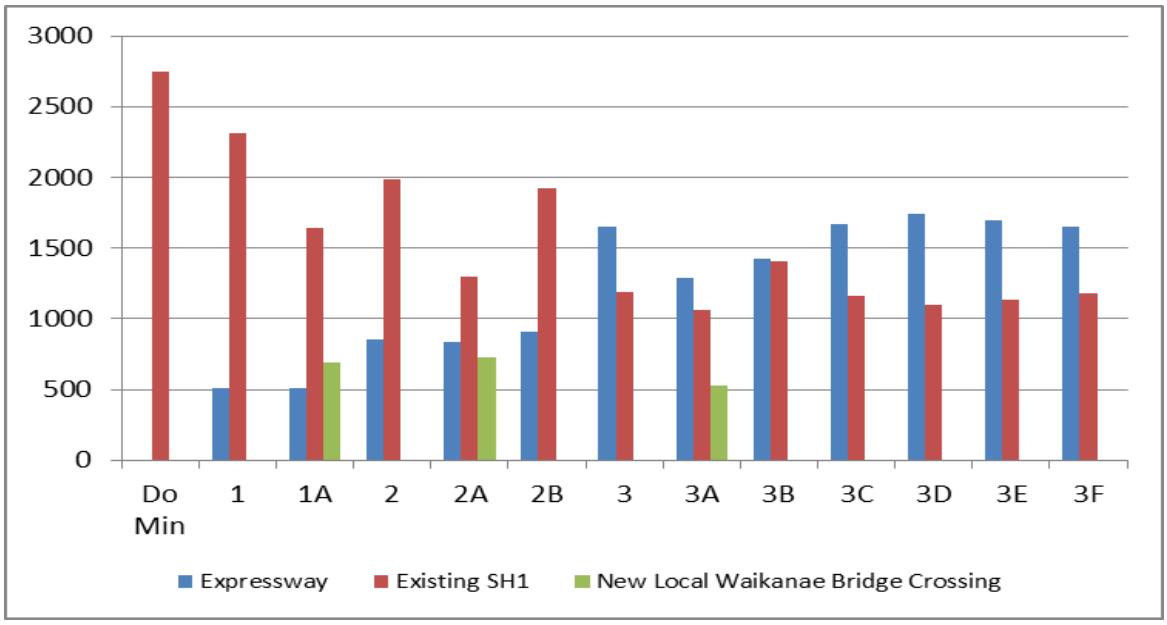
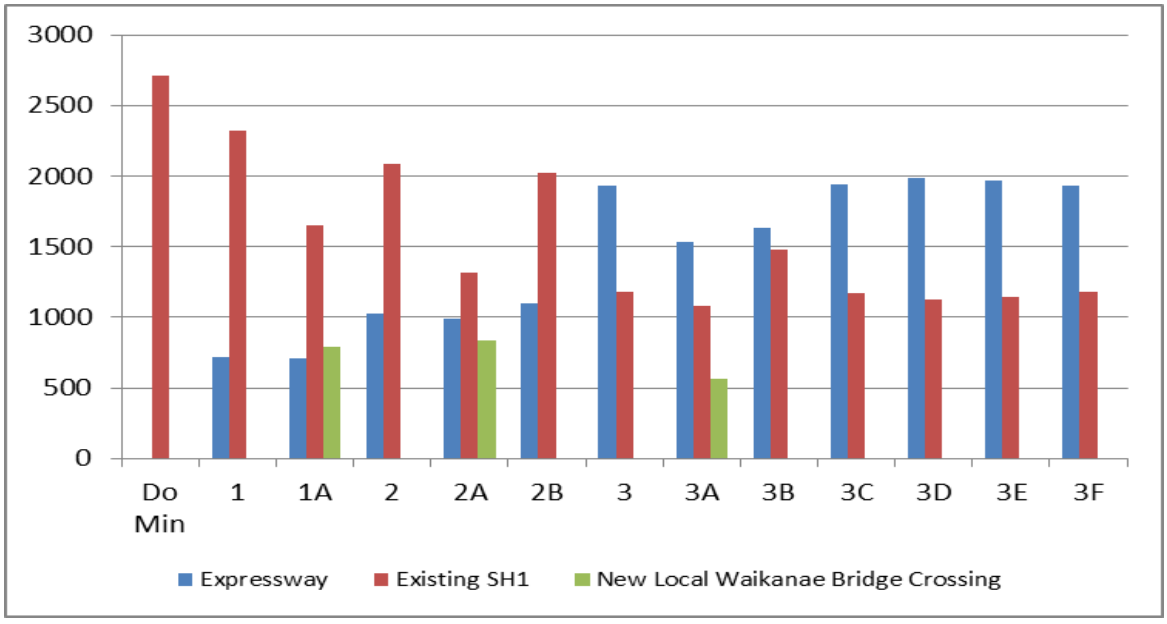


Figure 9 - Traffic Volume Across Waikanae River: 2026 PM Peak



As summarised in the figures above, the volume of traffic expected to use the expressway varies for each of the options. The amount of traffic which will use the expressway is dependent on the number and location of interchanges with the local network. For example, Option 1 which provides no connections to the local road network in Paraparaumu and Waikanae results in the least amount of traffic using the expressway, with local trips remaining on the local network (including the existing SH1).

Options which provide no connectivity to Paraparaumu and Waikanae and options with only one interchange on the Expressway at either Otaihanga Road (Options 2 and 2A) or Kāpiti Road (Option 2B) result in less traffic using the Expressway than the old state highway. Options which provide connections in Paraparaumu and Waikanae have the opposite effect and result in more traffic using the expressway than the old state highway. This indicates that the expressway is being used as a local connection between Waikanae and Paraparaumu.

Options 1A, 2A and 3A include a new local crossing of the Waikanae River at Weggery Drive (refer Appendix B for drawings). The new local crossing attracts some 500 to 850 vehicles in the peak hour across the new link. The majority of this traffic then uses Otaihanga Road and Ratanui Road to travel between Paraparaumu and Waikanae Beach. The significant additional traffic on Otaihanga Road and Ratanui Road is expected to cause excessive delays at the Ratanui Road / Otaihanga Road intersection and the Ratanui Road / Mazengarb Road intersection. These intersections will require upgrading (to roundabouts or traffic signals) to accommodate the additional volume of traffic.

6.1.6 Summary

The following is a summary of the traffic assessment of the base-options:

- All of the options are expected to result in travel time savings for through traffic of approximately seven minutes in the weekday morning peak and twelve minutes in the weekday evening peak in 2026
- All of the options are expected to result in travel time savings for north-south local traffic journeys. Providing Expressway interchanges in Paraparaumu and Waikanae will further increase the travel time savings for north-south local traffic journeys (Options 3 to 3F)
- The construction of the Expressway is expected to significantly reduce total network travel time. The total network travel time further decreases when the connectivity is improved between Paraparaumu and Waikanae. The greatest total network travel time saving is achieved when Expressway interchanges are provided in Paraparaumu and Waikanae (Options 3 to 3F)
- The amount of traffic the Expressway will attract from the old state highway is dependent on the degree of connectivity between the Expressway and the local road network. At the Waikanae River Crossing, the Expressway will carry more traffic than the old state highway if connections are provided in Paraparaumu and Waikanae (Options 3 to 3F)

- A new local crossing of the Waikanae River in Options 1A, 2A, and 3A, is predicted to attract some 500 to 850 vehicles in the peak hour, the majority of which will use Otaihanga Road and Ratanui Road to travel between Waikanae Beach and Paraparaumu. Upgrades to Otaihanga Road and Ratanui Road will be required to accommodate the increase in traffic under these options.

An economic assessment of the base-options is reported in Section 6.2.

6.2 Economic Assessment

6.2.1 Analysis Method

The Economic Evaluation has been carried out in accordance with the NZTA Economic Evaluation Manual Full Procedures. The Benefit Cost Ratio (BCR) calculated below is a preliminary BCR focussed on option selection rather than an absolute BCR for a detailed scheme assessment or business case. The following assumptions were used:

- The base year is 2010 and time zero is 2011
- It is assumed that the opening year will be 2016
- The crash history was analysed for the period 2005 to 2009
- Assuming update factors of 1.25 for Travel Time (TT), 1.00 for Vehicle Operating Costs (VOC) and 1.19 for Crash Costs to adjust to July 2010 in accordance with the EEM
- The economic benefits calculated include; Crash costs, Travel Time (TT), and Base Vehicle Operating Costs (VOC) and CO2
- A high-level crash analysis was undertaken. Crash costs will be calculated using accident by accident analysis for the Do-Minimum and options for routes with no fundamental change
- Travel Time (TT) and base Vehicle Operating Costs (VOC) were estimated using the total travel time, vehicle kilometres travelled, and overall network mean speed taken from the Kāpiti Transport Model for forecast years 2016 and 2026. For the economic analysis, road user costs from the modelled outputs were interpolated for years between 2016 and 2026, and extrapolated prior to 2016 and beyond 2026
- CO2 benefits were taken as 4% of VOC benefits
- An 8% discounting factor will be applied to discount cost back to the present day value
- A 30 year analysis period will be applied.

During this preliminary scoping phase, the following benefits have not been assessed for each option:

- Congestion relief
- Trip reliability

- Route security.

These three benefit streams would be expected to increase the benefits currently calculated.

The KTM model has been used as supplied, with only minor network changes. As a consequence, this preliminary assessment still includes development patterns and traffic predicated on the current District Plan and Plan Changes, all based around the implementation of the Western Link Road. These are likely to change with the changed use of the WLR corridor.

Additionally, the same trip numbers and patterns have been used for the Do Minimum and Expressway options assessments ie a fixed matrix approach. Given future expected increases in the level of congestion in Kāpiti, current EEM guidance is that a variable matrix approach should be used. As implementation of a variable matrix approach is computationally complex, it is generally only used during scheme assessment and business case analysis. Normally a reduction in the benefits from the fixed matrix assessment would be made to account for the likely variable matrix effects. In this instance, as there are a number of benefits which have not been included, no reduction in the net present value of benefits has been made.

6.2.2 Crash Analysis

A high-level crash analysis was undertaken for the scoping stage economic analysis. Locations with a poor crash history which will experience a change in traffic volumes were included in the analysis. The crash analysis included the following seven existing intersections with SH1 in the accident by accident analysis. Each intersection has more than ten reported crashes within 50m of the intersection in the five year period 2005 to 2009 and at least one serious or minor accident.

- Kāpiti Road
- Te Moana Road
- Otaihanga Road
- Elizabeth Street
- Amohia Street
- Raumati Road
- Ngaio Road.

The accident by accident method included the following existing SH1 mid-block sections, which covers the non-urban areas of SH1 within the project.

- MacKays Crossing and Waterfall Rd
- Waterfall Rd and Poplar Ave
- Nikau Palm Road to Otaihanga Road
- Otaihanga Road and Te Moana Road

- Hemi St and Peka Peka Rd.

The 2010 volumes at each of the existing intersections and mid-block sections were taken from existing count information. The expected volumes for 2016 and 2026 were taken from the SATURN models. The crash rate for 2010, 2016, and 2026 was calculated using the general crash models found in the EEM. The crash costs for existing intersections were calculated for each option by scaling the 2010 Do Min accident costs by the calculated crash model crash rate for both the 2016 and 2026 scenarios. Scaling the Do Min crash costs was favoured to using Accident Rate models as it was expected that the volumes will fall outside the acceptable limits for the "general" models.

6.2.3 Benefit Cost Ratio of Options

The BCR for each of the base-options are summarised in the table below.

Table 22 - Base-option Benefit Cost Ratios

Option	NPV Benefits ($M)	NPV Costs ($M)	BCR
1	$270	$425	0.64
1A	$400	$458	0.87
2	$328	$429	0.77
2A	$442	$461	0.96
2B	$379	$427	0.89
3	$429	$438	0.98
3A	$474	$470	1.01
3B	$376	$439	0.86
3C	$424	$446	0.95
3D	$439	$452	0.97
3E	$438	$431	1.02
3F	$427	$431	0.99

As summarised above, there is a range of benefits achieved by each of the options. Option 1 with no connections to Paraparaumu and Waikanae is the least performing option and achieves $270M in transport benefits. The options with the highest benefits are those with multiple connections from the Expressway to the local road network. Options 2A, 3, 3C, 3D, and 3F have BCR's close to 1.0.

Options 3A and 3E have BCR's over 1.0. The economic analysis summary sheets are included in Appendix D.

An incremental analysis was performed using the procedures in the EEM. The incremental BCR indicates whether the incremental cost of higher-cost options is justified by the incremental benefits. Incremental analysis will also identify whether a lower-cost option that realises proportionally more benefits is a more optimal solution. The results of the incremental analysis indicate that Option 3E has the highest incremental BCR. It has proportionally more benefits than the next cheaper option (2B) and no other option has proportionally more benefits than cost compared to Option 3E.

6.3 Transport Policy Assessment

6.3.1 Land Transport Management Act Assessment

The Land Transport Management Act (LTMA) provides the legal framework for managing and funding land transport activities. The purpose of the LTMA is to contribute to the aim of achieving an affordable, integrated, safe, responsive and sustainable land transport system. Transport projects must be assessed against the LTMA and the five objectives from the New Zealand Transport Strategy (NZTS) as outlined below.

- Ensuring environmental sustainability
- Assisting economic development
- Assisting safety and personal security
- Improving access and mobility
- Protecting and promoting public health.

An LTMA assessment was completed for the base-options and is presented below.

Economic Development

The proposed Expressway forms part of the Wellington Northern Corridor RoNS, which the Government identified as one of seven most essential routes to support economic growth and productivity. By reducing travel times and congestion the project is expected to assist in stimulating economic growth and productivity.

Options which provide legible and convenient access from the Expressway to growth areas (Paraparaumu Town Centre, Paraparaumu Airport, and Waikanae North) will further assist economic development regionally and locally. In this regard, an Expressway interchange at Kāpiti Road or Ihakara Street is favourable in Paraparaumu and an Expressway interchange at Te Moana Road is favourable in Waikanae. Expressway options which provide no connectivity to Paraparaumu or Waikanae will be least favourable for economic development.

Assist Safety and Personal Security

The existing SH1 from MacKays to Peka Peka has a significant crash history with 399 reported crashes during the five year period from 2005 to 2009 including four fatalities, 19 serious injury crashes and 86 minor injury crashes. The fatalities and the majority of injury crashes occurred as a result of right-turn against movements at-grade intersections and loss of control / cross centreline crashes. These types of crashes occur on the existing highway because of the abundance of local access, out of context curves and an inconsistent speed environment.

The proposed Expressway will meet modern design standards and will offer significantly improved geometry compared to the old highway. The absence of at-grade intersections will eliminate the risk of right-turn accidents, whilst the presence of a central median will eliminate the risk of cross centreline/ head-on crashes.

The Expressway will reduce the volume of traffic and the crash risk on the old state highway including at its intersections with other local roads, improving safety on the old highway which will become a local road.

Improve Access and Mobility

The development of an Expressway will significantly improve access and mobility for through traffic and will improve access and mobility for local traffic to varying degrees depending on the option. Options which provide two interchanges (one in Paraparaumu and one in Waikanae) will result in the greatest improvements in access and mobility. Options which do not provide connections to Paraparaumu and Waikanae will have the least improvements to access and mobility.

There are options which improve the connectivity between Waikanae Beach and Paraparaumu by providing a second crossing of the Waikanae River at Weggery Drive. This will improve access and mobility for trips between Waikanae Beach and Paraparaumu. However, the benefits of the local crossing should be weighed against the impacts (transport and other impacts) to other local roads which will carry higher traffic volumes as a result of building the local crossing.

This will enable the local network to operate more efficiently in fulfilling its function in serving local traffic, thereby increasing accessibility and mobility within Kāpiti through time and cost savings for travel by both private car and other modes.

Protect and Promote Public Health

Specialised noise and environmental assessments will be completed during the scheme assessment phase.

Ensure Environmental Sustainability

Specialist environmental assessments will be completed during the scheme assessment phase.

6.4 Government Policy Statement Assessment

Under the LTMA, the NZTA must give effect to the Government Policy Statement on Land Transport Funding (GPS) in developing the National Land Transport Programme and take account of the GPS when approving funding for activities. The LTMA requires the GPS to contribute to the aim of achieving an affordable, integrated, safe, responsive and sustainable land transport system, and also to the five transport objectives of the NZTS.

The Wellington Northern Corridor is one of seven RoNS outlined in the 2009 GPS. SH1 from MacKays to Peka Peka forms part of the Wellington Northern Corridor RoNS. The Wellington Northern Corridor is one of seven RoNS announced by Government in the 2009 GPS. The GPS identifies that seven RoNS as:

"The most essential routes that require significant development to reduce congestion, improve safety and support economic growth."

As part of a RoNS, the MacKay's Crossing to Peka Peka Expressway is a significant component in achieving the GPS. The GPS also contains a number of short to medium-term impacts that the Government expects to be achieved through the use of the National Land Transport Fund which contribute to economic growth and productivity including:

- Improvements in the provision of infrastructure and services that enhance transport efficiency and lower the cost of transportation through:
  - improvements in journey time reliability
  - easing of severe congestion
  - more efficient freight supply chains
  - better use of existing transport capacity
- better access to markets, employment and areas that contribute to economic growth
- a secure and resilient transport network.

Other short to medium-term impacts that the Government expects are:

- reductions in deaths and serious injuries as a result of road crashes
- more transport choices, particularly for those with limited access to a car where appropriate
- reductions in adverse environmental effects from land transport
- contributions to positive health outcomes.

Each of the base-options are assessed against the short to medium term GPS targets below.

Improvements in the provision of infrastructure and services that enhance transport efficiency and lower the cost of transportation.

The proposed Expressway will enhance transport efficiency and lower the cost of transportation by reducing travel times and congestion for both commercial and non-commercial traffic.

Better access to markets, employment and areas that contribute to economic growth

The reduction in congestion and travel times will enhance access to markets, employment and economic growth areas both within Kāpiti and inter-regionally.

A secure and resilient transport network

The Expressway will provide a second crossing of the Waikanae River. This will improve the security and reliance of the transport network. Connections to the Expressway in Paraparaumu and Waikanae will increase the security and reliance benefits by allowing the second crossing of the Waikanae River to be of more use to traffic travelling between the two communities.

Reductions in deaths and serious injuries as a result of road crashes

As discussed under the LTMA assessment, the proposed Expressway will meet modern design standards and will offer significantly improved geometry compared to the old highway. The absence of at-grade intersections will eliminate the risk of right-turn accidents, whilst the presence of a central median will eliminate the risk of cross centreline/ head-on crashes.

More transport choices, particularly for those with limited access to a car where appropriate

While the provision of the Expressway will improve transport for private vehicle users, the provision of the Expressway is not expected to improve transport choices for non-private vehicle users.

Reductions in adverse environmental effects from land transport

Specialist environmental assessments will be completed during the scheme assessment phase.

Contributions to positive health outcomes

Specialist assessments will be completed during the scheme assessment phase.

6.5 Planning Programming and Funding Manual Assessment

The Planning Programming and Funding Manual (PPFM) requires than an assessment profile is created for any project seeking funding from the NZTA. The assessment profile is made up of three factors:

- **Strategic fit** of the problem, issue or opportunity that is being addressed
- **Effectiveness** of the proposed solution
- **Economic** efficiency of the proposed solution.

In November 2009, the NZTA Board endorsed the Wellington Northern Corridor RoNS funding for investigation, design and property purchase in its resolution 09/11/6c. NZTA assessed the Strategic Fit, Effectiveness and Economic Efficiency of the Wellington Northern Corridor RoNS and gave the RoNS a High Strategic Fit, High Effectiveness and Low Economic Efficiency rating. A copy of the NZTA assessment is contained in Appendix E.

7 Cost Estimate and Risk Assessment

7.1 Cost Estimate Results and Approach

The costs have been prepared by estimating the value of 13 individual elements of work with the addition of Limb2 costs, risk and property costs. The cost estimates of each element of work have been calculated from recently tendered rates and using measured quantities from a high level design. A base line option has been costed in detail and estimated costs of each option and sub-option have been calculated as variations to the baseline.

For each element a high level design package has been prepared using the information currently available. Quantities for each element have been defined in line with the detail provided for each design package and these reflect the level of risk in each element. For the Ground Improvements element, alternative proposals have been prepared and costs estimated to allow comparison to be made over the cost range and the level of risk of the proposal assessed.

The cost estimates for all options have been based on the following assumptions;

- No specific architectural treatments to bridges or structures
- Two additional pedestrian footbridges across the expressway
- Preloading in Sectors 1 and 4, Excavate and replace peat in sectors 2 and 3
- Use of culverts rather than bridges for stormwater
- Cycleway between MacKays to Te Moana Road
- Lighting to cycleway from Poplar Avenue to Mazengarb Road
- Kāpiti Road on bridge over Expressway and Expressway at grade
- Street lighting at interchanges only.

Rates for all elements have been calculated from the baseline of the recently submitted Tauranga Eastern Link (TEL) tender submission from Fletcher Construction. The TEL is an Expressway of similar length, with similar structures and ground conditions and, although not the lowest total price, the rates are appropriate. However, when assessing the rates, consideration has been given to any differences between TEL and the Mackay's to Peka Peka expressway identified in the design briefings.

The extent and appropriate level of risk for each element has been determined at a Risk Workshop. The risks associated with each estimating element have been assessed and used to determine the expected estimate. Section 8 – Risk details the outcome of the Risk Workshop.

Property cost for the total length of expressway has been taken from the estimated total cost of property included in the Opus, SH1 Kāpiti Study (August 2009). When considering local sub-

options the purchase price of each individually effected property has been assessed from an NZTA database of property prices defined in 2003, with an increase of 80% calculated from the Real Estate Institute of New Zealand (REINZ) published figures for Wellington.

The cost estimates also include allowances for the following items although the funding of some or all of these may not be covered by this project;

- Relocation of Te Ra School, (sub option S1Ciii) $2.0M
- Overbridge/ mitigation at wāhi tapu, (sub option S3D) $10M
- Treating existing SH1, (all options) $0.5M per km.

A value of 15% has been added to all cost estimates for Overheads and Profit along with 4% for construction risks. Both these values have been determined from recently secured Alliance contracts.

The cost estimates have been prepared at September 2010 prices and do not include any allowance for cost escalation. The details of the estimate are included in Appendix F.

Table 23 - Cost Estimates for Shortlisted Options

Option	Description	Project Expected Estimate (P50) ($M)
3	Intersections at Te Moana Road and Kāpiti Road	580
3B	Intersections at Te Moana Road and Ihakara Street	580
3C	Intersections at Te Moana Road and split at Ihakara Street and Kāpiti Road	590
Sub Option		Additional Cost to Option 3
S1Ciii	Intersection south of Poplar Ave, through QE Park	Nil
S1Dii	Intersection north of Poplar Ave, through 200 to 282 Main Road South	+10
S3D	East of designation and Urapa, west of Maketu	Nil

Option	Description	Project Expected Estimate (P50) ($M)
S3E	East of designation, Urapa and Maketu through Puriri Drive	+10

As shown in the table above the expected estimate (50th percentile, or P50) for Base-option 3 is assessed as $580M. The 95th percentile (P95) estimate for Option 3 is $700M.

The cost of the project will also be affected by the choice of the sub-option through Sectors 1 and 3. As can be seen from the table above this could increase the expected estimate for the project.

It is assessed that the expected estimate for the scoping stage of the project is likely to be in the range of $580M to $600M.

7.2 Comparison to PFR Cost Estimate

A comparison has been undertaken with the Opus, SH1 Kāpiti Study (August 2009) as this was the project estimate and where increases or decreases have occurred reasons have been given. The estimates detailed in the report were based on parametric costs collated from a number of schemes.

Item	Description	$M	Opus		M2PP		Comments
1.0	**Mackays to Kapiti**						M2PP
1.1	2 Lane Rural	$ 4.0	0.00	$ -	3.65	$ 14.6	Rural 4 Lane Expressway from
1.2	4 Lane Rural	$ 8.0	2.71	$ 21.68	1.60	$ 12.8	MacKays to Poplar Ave
1.3	2 Lane Urban	$ 20.0	0.00	$ -	1.70	$ 34.0	and Urban 4 Lane Expressway
1.4	4 Lane Urban	$ 25.0	1.92	$ 48.00	3.50	$ 87.5	from Poplar to Kapiti
1.5	Grade Seperated Interchange	$ 15.0	1.00	$ 15.00	0.00	$ -	
1.6	2 Lane Bridge	$ 4.5	3.00	$ 13.50	2.00	$ 9.0	
1.7	4 Lane Bridge	$ 8.5	0.00	$ -	2.00	$ 17.0	
2.0	**Kapiti to Otaihanga**						M2PP
2.1	2 Lane Rural	$ 4.0	0.00	$ -	0.00	$ -	Grade seperated interchange
2.2	4 Lane Rural	$ 8.0	1.24	$ 9.92	0.00	$ -	at Kapiti Rd
2.3	2 Lane Urban	$ 20.0	0.00	$ -	1.00	$ 20.0	
2.4	4 Lane Urban	$ 25.0	1.59	$ 39.75	2.90	$ 72.5	
2.5	Grade Seperated Interchange	$ 15.0	1.00	$ 15.00	1.00	$ 15.0	
2.6	2 Lane Bridge	$ 4.5	0.00	$ -	0.00	$ -	
2.7	4 Lane Bridge	$ 8.5	2.00	$ 17.00	1.00	$ 8.5	
3.0	**Otaihanga to Peka Peka**						M2PP
3.1	2 Lane Rural	$ 4.0	0.00	$ -	5.50	$ 22.0	Urban 4 Lane Expressway from
3.2	4 Lane Rural	$ 8.0	8.06	$ 64.48	8.70	$ 69.6	Otaihanga to Te Moana
3.3	2 Lane Urban	$ 20.0	0.00	$ -	0.00	$ -	and Rural 4 Lane Expressway
3.4	4 Lane Urban	$ 25.0	0.00	$ -	0.00	$ -	from Te Moana to Peka Peka.
3.5	Grade Seperated Interchange	$ 15.0	1.00	$ 15.00	1.00	$ 15.0	Grade seperated interchange
3.6	2 Lane Bridge	$ 4.5	1.00	$ 4.50	6.00	$ 27.0	at Te Moana
3.7	4 Lane Bridge	$ 8.5	0.00	$ -	0.00	$ -	
3.8	River Crossing	$ 10.0	1.00	$ 10.00	1.00	$ 10.0	
	Sub Total			$ 273.83		$ 434.50	
	Professional Services	15%		$ 41.07		$ 65.18	Assumes 15%of Construction Costs
	Property			$ 67.70		$ 67.70	
	Sub Total			**$ 382.60**		**$ 567.38**	
	Cost Fluctuations	1.69%		**$ 6.47**		**$ 9.59**	Aug. 2009 to Sept. 2010
	Total			**$ 389.07**		**$ 576.96**	

It is understood that a cost allowance of $20M for a second grade separated interchange was made separately which would increase Opus's estimate to $409M at September 2010 prices.

The rates for the comparison purposes have been increased by 1.69% to reflect cost fluctuations August 2009 to September 2010 calculated using Appendix F, NZS 3910:2003 Conditions of Contract for Building and Civil Engineering Construction including labour and products.

Table 9.2.1 details both the Opus and M2PP cost estimates at September 2010 rates using Opus's parametric estimate rates. The difference in cost is as a result of the change in scope of work. The MacKays to Peka Peka Expressway is approximately 2.6km longer than the Sandhills Expressway with a tie in at MacKays Crossing to the south and Te kowhai Road at the north. The cost impact of this additional length is $75M. The MacKays to Peka Peka Expressway also includes a number of local roads which will need to be upgraded, adding a further $99M.

The Opus cost estimate for the Sandhills Expressway, included only one grade separated interchange and allowed for two lane bridges to take the local roads over the expressway. The cost estimate for the Mackay's to Peka Peka Expressway includes two grade-separated interchanges and the use of two lane and four lane bridges with the local roads passing both over and under the expressway. This has added a further $18M to the cost estimate.

8 Risk and Opportunities

8.1 Risk Management Process

A formal and structured risk management procedure has been applied to the MacKays to Peka Peka Alliance Project to produce a project Risk Register and Risk Assessment. The methodology adopted for this work utilised the best practice procedures detailed in the New Zealand Transport Agency's (NZTA) Risk Management Process Manual and ISO 31000: 2009 Risk Management Standard.

This report is limited to the risk management aspects for the project as known at the time of the facilitated workshop held 22 September 2010, when members of the Project Team identified risks and opportunities and provided a qualitative assessment of the risks. During the facilitated workshop the following objectives were agreed:

- To identify significant project threat and opportunities and assess their probability and consequence rating
- To develop treatment strategies to these threats and opportunities that are key to the development of this project
- To undertake a risk assessment and calculate the cost impact of a number of these risks to form the basis of an assessed cost estimate contingency and funding risk.

8.2 Risk Identification

The focus of the risk workshop was to identify risks and uncertainties surrounding the process. At the workshop, the risk facilitator explained the risk management framework and described the process to be followed. The attendees were asked to consider risks under the following categories:

Table 24 - Risk Categories

Session 1	Session 2
Earthworks	NZTA Processes
Ground Improvements	Contract and Commercial
Groundwater	Alliance relationships
Landowner	Cultural
Property	Environmental
Consents / BOI	Urban Design
Geometrics / traffic	Stormwater
Traffic Management	Services
Pavements	Structures

From the risk management workshop, 49 risks or opportunities were identified and have been prioritised in accordance with NZTA's risk management process as:

- 10 High Threats
- 20 Very High Threats
- 12 Extreme Threats
- 2 High Opportunities
- 3 Very High Opportunities
- 2 Extreme Opportunities.

8.3 Risk Assessment

Upon completion of the Risk Identification workshop a further session was held with the design team around work scope and uncertainties. A summary of the risks identified is set out below and the initial risk register in included in Appendix F :

Property

1. Property purchase process takes longer than assumed.
2. Property purchase costs are greater than allowed for.

Environmental Compliance

1. Additional treatment of water from excavations in peat prior to disposal.
2. Additional treatment for dust, sand and methane than assumed.

Bridges

1. Piles may be bigger and/or longer than assumed.
2. Urban design scope of works may increase from that assumed.
3. Scour depths may greater than assumed.
4. Change in slope profile may increase length of bridges.
5. Additional structures may be required by KCDC.
6. Mix of over bridges verses under bridges may change from that assumed.

Earthworks

1. Excess peat and other excavated material may need to be disposed of offsite.
2. Source of imported material may be further away from site than assumed.

Ground Improvements

1. The location and profile of peat may be different than assumed.
2. Limited geotechnical investigation carried out to date and therefore ground conditions may be different than assumed.
3. The nature of the peat material and settlement profile may be different than assumed.

Pavement and Surfacing

1. Subgrade may require treatment over and above assumed design assumptions.
2. May require structural asphalt in certain areas which has been excluded from the scope.
3. Median may require to be surfaced.

Drainage

1. Culverts may change to bridges.
2. Scope of works required for amenity wetlands may increase.
3. Design development and scope creep from concept to detailed design.

Landscaping

1. Cycleway / bridle way scope of work may increase.
2. Mitigation works to existing highway may be greater than assumed.
3. Landscaping requirements may increase due to an increase in stakeholder requirements.
4. Mitigation works outside the scope of QE Park may increase.
5. Landscaping scope of works around Waikanae crossing increases from that assumed.

6. Landscaping mitigation works fall outside assumed designation / project footprint.

Retaining Walls

1. The extent and height of walls may increase from that assumed.
2. The type of retaining walls may change from that allowed for.
3. Extent of walls required at interchanges may change following design development around the form of the interchange from concept to detailed design.

Services Relocation

1. Unforeseen services.
2. Extent of assumed protection of existing services is greater than assumed.
3. May need to relocate transmission lines due to change in alignment.

These risks were considered for each of the categories noted above and risk factors estimated. After reviewing these it was assessed that appropriate risk percentage factors to be applied to the option Base Estimates were a contingency of 10% (to bring it to P50), and a further 20% for funding risk (to bring it to P50) due to the early concept stage.

This is based on the Alliance team's experience of the potential cost consequence of risks such as design development and scope creep that occurs between the concept and detail design phases of projects such as this.

The Alliance recommends the following:

1. The mitigation measures identified in this report for the very high and extreme risk categories are progressed in a timely fashion and that a proactive management approach to these and other risks are maintained.
2. Regular review and updating of the risk assessment as the project proceeds is highly recommended.
3. Further consideration is required to be given to geotechnical issues, which have been identified as key risks to the project.
4. A full risk identification and risk analysis is undertaken at the next stage of the design process.

8.4 Opportunities

Opportunities were identified as part of the risk assessment process. A number of opportunities were recorded that could potentially reduce the project cost significantly. and will be investigated

further during the work on the short listed options. These are listed in the table below, the potential savings for items 1 to 5 ranging between $10 and $30 million depending on the extent to which they can be realised.

Table 25 - Opportunities to be Investigated

Item	Description
1	Use alternative surfacing to OGPA surfacing in rural areas where noise mitigation is not required
2	Rehabilitate existing highway MacKays to Poplar Ave. This will require reduced median and clear zone but maybe considered a value for money decision
3	Dispose of peat on site, ie avoid carting it off site
4	Reduction of median generally saving cost on earthworks and allow construction of single bridge structure rather than separate bridges
5	Adjust vertical alignment to reduce material that has to be imported
6	Minimise number of properties impacted on by expressway
7	Resale of surplus NZTA properties
8	Minimise works on existing state highway

9 Design Considerations

9.1 Standards/Requirements

A Design Philosophy Statement has been prepared setting out the design standards and guidelines that will be used for this project. Central to this is the 'Roads of National Significance Design Standards and Guidelines' which has been prepared to ensure consistency throughout the RoNS. While these standards and guidelines will be the starting point for design there may be situations that require them to be challenged and/or reduced. In such situations a value for money/ consistency review will be undertaken and a submission prepared for consideration of the VAC.

9.2 Geotechnical

9.2.1 Geotechnical Appraisal

A preliminary geotechnical appraisal has been undertaken for the proposed expressway project, (Refer to MacKays to Peka Peka Expressway Preliminary Geotechnical Appraisal Report, which is appended to this Scoping Report). A summary of the key geotechnical considerations is provided within this section.

9.2.2 Geotechnical Design Considerations

The key geotechnical considerations that have been identified for this project are outlined below. For a detailed description of these considerations, with respect to the differences between options and sub-option, refer to the Preliminary Geotechnical Appraisal.

- The presence of peat deposits across the site, and associated embankment settlements and stability
- The high seismic hazard and known active faults (refer Section 6 of the Preliminary Geotechnical Appraisal)
- The presence of relatively loose saturated sand deposits with the potential to liquefy during the design seismic events. Liquefaction induced slope instability and settlements
- Founding conditions for bridge structures comprising alluvial deposits to depth, predominately interbedded dense sands and gravels
- Potential effects on the shallow unconfined aquifer system, which is used for irrigation and feeds ecologically valuable wetlands. Potential groundwater effects may result from changes in permeability of the near surface material.

The geotechnical aspects are of particular relevance to the following proposed scheme features:

- Proposed earthworks including cuts up to 20m high and embankments up to 8.5m high

- Proposed bridge structures, including foundations and ground improvements.

9.2.3 Peat Deposits and Settlements

The presence of peat deposits across the site is a key geotechnical aspect for this project. Key considerations associated with construction of a road embankment over weak peat deposits include:

- Settlement of these underlying deposits. Post construction settlements and potential differential settlements will impact on the performance of the Expressway, resulting in poor rideability and increased maintenance
- Stability of embankments constructed on weak foundations, in particular the temporary stability case
- Potential settlement of services beneath the embankment and adjacent structures and property.

Ground improvement treatments to address the peat and expected settlements are outlined below. The treatment adopted will vary across the route depending on the depth and extent of the peat expected to be encountered, sensitivity of adjacent infrastructure, and cultural sensitivity of the area.

Excavate and Replace:

In general, peat deposits less than 3m are to be excavated along the Expressway alignment. In removing the peat, the risk of poor long-term performance resulting from settlement is eliminated; however, this is considered a high cost treatment option. Environmental considerations associated with this treatment include disposal of peat and effects on groundwater.

Pre-load and Surcharge:

Where the peat deposits are greater than 3m thick, excavation and replacement is not considered a feasible treatment, in terms of both constructability and effects from dewatering. The proposed treatment for these areas comprises construction of a stiff gravel raft and pre-loading/ surcharging the underlying peat. This will limit the post construction settlement; however, there is a risk of long-term differential settlements. Measures will need to be incorporated into the design to limit post-construction settlements to an acceptable level for serviceability and on-going maintenance.

The ongoing settlement and consequential maintenance requirements are key design aspects and will significantly affect the project capital and whole of life costs.

9.2.4 Seismic Design

The site is located in a highly seismic area. Loose to medium dense sand deposits are present within the sand dunes, and underlying marine and alluvial deposits. A significant seismic event, such as the ultimate design event, is expected to result in:

- Liquefaction of these sand deposits, where saturated
- Settlement of these sand deposits, as a result of densification in the dry sands and liquefaction induced settlements in the saturated sands
- Seismic induced slope instability and horizontal movements of existing sand dunes and new embankments constructed over these deposits
- Potentially lateral spreading or flow failure of existing sand dunes, new embankments, and the new approach embankments for the Waikanae River Crossing
- The seismic performance may be improved by ground improvement techniques or removal and replacement of these deposits.

The seismic performance of the expressway, during and post seismic design events is a key design aspect. The acceptable level of damage, emergency access and post-earthquake repair requirements under design events needs to be considered by NZTA, and balanced against the economics and risk profile.

9.2.5 Groundwater

The site is underlain by a series of shallow unconfined aquifers, with high connectivity. The groundwater level is close to the existing ground level in the low lying areas and wetlands. The shallow aquifers feed the wetland areas, which are considered to have high ecological value. Shallow residential bores target this aquifer for irrigation purposes. Changes in permeability and groundwater flow resulting from the expressway construction need to be considered and affects assessed.

9.2.6 Earthworks

The project earthworks involve:

- Cuts through sand dunes, up to approximately 20m high
- Fill embankments across low lying areas, up to approximately 8m high

Cut Slopes

Design considerations for cut slopes within the sand dunes include:

- The cut slope profile required is likely to be approximately 3H:1V. A benched profile and drainage measures may be required for stability of large cut slopes
- There are a number of existing cuts in the area. These cuts need to be inspected and the performance taken into consideration when assessing the stability of the proposed cuts
- The dune sands are prone to erosion, by both wind and water. Water will be required during construction to control dust. Erosion control measures, such as re-vegetation of slopes, will need to be implemented immediately after construction.

Embankments

Design considerations for embankments include:

- The presence of peat deposits, and associated stability and settlement issues
- The material cut from the sand dunes is suitable for use as cut to fill, and is likely to be used for embankment construction. Additional water may need to be added to achieve the required compaction
- The embankment profile is expected to be approximately 3H:1V. This may be steepened depending on fill material type selected or use of reinforcement
- The erosion control measures discussed above are also applicable for embankments constructed using dune sands.

9.2.7 Bridge Foundations

There are a number bridge structures required for interchanges, and local road and river/ stream/watercourse crossing along the expressway. The Waikanae River crossing is a major river crossing, and the structure is expected to be approximately 200m in length to bridge across the flood plain. The structures required for each option are detail Section 11.3.

For each bridge structure, piled foundations and approach abutments are expected to be required. Ground improvements will be required below the approach embankments for seismic performance, based on high seismicity and liquefaction potential.

9.3 Structures

9.3.1 General

The structures that have been identified for the various alignment options include:

- Underpasses (Local Road is under Expressway)
- Overpasses (Local Road and streams are over Expressway)
- A river crossing of the Waikanae River.

There are also other structures which may include all or some of the following:

- Floodway structures
- Pedestrian/cycle bridges
- farm access or pedestrian underpasses, culverts
- retaining walls and sign gantries
- possibly ‘landbridge’ type structures.

The structures identified vary slightly between options as described in the tables in Appendix H – Principal Structures. These tables cover major bridges only and exclude culverts, retaining walls, pedestrian bridges, farm access or pedestrian underpasses and sign gantries which are yet to be determined. Major culverts are described in the stormwater section and major retaining walls in the geotechnical section.

Description of Structural Types

a. Overpasses

Overpasses are provided at locations along the route to allow the local roads to pass over the expressway. The form of overpass is envisaged as a three or four span structure with open side spans with piers located behind the shoulder and for highly skewed crossings within the median. Piers will be protected from vehicle impact by traffic barriers.

Typical main spans of around 30m are suitable for 1200mm deep Super-Tee girders which will provide an economic and elegant solution. Pier shapes will be developed in accordance with urban design requirements along with treatment of retaining walls and edge barriers which are assumed to be concrete TL5 Texas HT barriers.

b. Underpasses

Underpasses are provided to allow local roads and streams pass under the Expressway. The form of Underpass is envisaged as a three, four or five span structure with open side spans with piers located behind the footway. Some of the underpasses also span over adjacent streams as well the local road. Piers will be protected from vehicle impact by traffic barriers.

Typical main spans of between 20m and 30m for local road crossings are suitable for 1000mm or 1200mm deep Super-Tee girders which will provide an economic and elegant solution. Pier shapes will be developed in accordance with urban design requirements along with retaining walls and edge barriers which are assumed to be concrete TL5 Texas HT barriers.

For stream crossings, main spans of approximately 20m will be suitable for hollow core deck units supported by reinforced concrete abutment walls on piled foundations.

Bridge widths will be 30m where a 6m median is required and two separate bridges of 14m and 17m will be provided where the median increases to 9m, with a structural gap between the two bridges.

c. Waikanae River Bridge

The Waikanae River Bridge will carry the Expressway over the Waikanae River and flood plain between stop banks, as well as possibly providing for an access road to the El Rancho property for options located near to El Rancho.

The overall bridge length will be approximately 200m with six approx.35m spans required which will be suitable for 1500mm deep Super-Tee girders. Pier locations will need to be selected to be clear of the main river channel and to avoid the gas pipeline that crosses the Waikanae River in the vicinity of some of the proposed alignment options. The level of the deck soffit will be determined to suit flood levels and the required hydraulic capacity of the river. Piled foundations, of sufficient depth for scour risk, and ground improvement measures for liquefaction at abutments are envisaged.

d. Kāpiti Road Interchange Bridges

The form of Kāpiti Road Interchange is subject to further development to suit urban design considerations and KCDC requirements for Kāpiti Road. It is envisaged at this stage that Kāpiti Road will be taken over the Expressway which will be depressed approximately 1m below existing ground levels, as limited by groundwater levels. This will reduce the height of the bridge above the surrounding ground level. A three span bridge is envisaged with a main span of 31m which will be suitable for 1200mm deep Super-Tee girders. The bridge is envisaged as 30m wide to suit the proposed upgrade of Kāpiti Road to provide a four lane highway with right turning bays, a median, cycle lanes and footways. If a closed-up diamond interchange is provided, retaining walls will be required to support the filled approach ramp embankments, and the bridge could be reduced to a single span of about 30m between the retaining walls.

Options that further depress the Expressway below existing ground levels will need to be designed for potential flooding in this area from the Wharemauku Stream immediately south of the interchange which may require stop banks, retaining walls or tanking to prevent inflows during a flood event.

Te Moana Road Interchange bridge is likely to be a similar structure to Kāpiti Road Bridge

9.4 Stormwater and Flood Risk Management

Due to the environment and topography the expressway alignment passes through stormwater run off and flood risk management will require detailed investigation and design to ensure that any adverse effects are addressed. There are three key factors that influence the management of stormwater and flood risk.

- Significant parts of the expressway route traverse low-lying flood prone land and flood flow paths, with the potential for the expressway to have an adverse effect on flood risk to other property. This will be mitigated by providing for conveyance of flood water (via bridges and culverts), including provision for flood plain capacity and secondary flow paths. It will also be necessary in some areas to offset the existing flood storage lost due to expressway footprint, by excavating additional flood storage areas. Where possible, the expressway footprint should be kept small within flood storage areas, and some options that have interchanges or large fills over such areas will have a greater land requirement to provide for offset storage.
- The stormwater discharges will, in many cases, be to small streams with moderate to high ecological value, in a context where KCDC has in place policies to protect those environments from adverse effects of stormwater discharge. The stormwater from the expressway will need to be treated to remove contaminants, and flood peak attenuation will be required to achieve hydraulic neutrality, which will need to be demonstrated by modelling. There is little difference between options in regard to these works.
- There is a proposed bridge crossing in the Waikanae River. This will need to be long enough (about 200m) to span the main river channel (with piers outside the main waterway), the flood plain and the riverbank walkways. Bridge length, flood capacity and scour effects will need to be confirmed by modelling.

These three factors affect all options to some degree, however, some specific areas are addressed below:

- Wharemauku Stream and the town centre. This general area is flood prone, and flood risk will be increased by both the expressway and by the proposed development of the town centre by KCDC and others. Offset flood storage will be required for all expressway options, but those that involve interchanges in the vicinity of Wharemauku Stream and Ihakara Street will have a larger land footprint and therefore greater effect. NZTA will need to obtain sufficient land in this area to provide for this storage, well beyond the expressway formation footprint.
- Kāpiti Road interchange / crossing. There are potential issues with flood risk and groundwater level in this area that arise due to grade separation and a desire from KCDC to avoid high road levels. Any lowering of the expressway to a greater depth than approximately 1m below the current Kāpiti Road level will require flood protection banking or walls, and deepening of open drains leading to the Wharemauku Stream, with a likelihood of the expressway runoff needing to be pumped. If the expressway is cut more than about 2.5m below ground level, then “tanking” of the cut to avoid groundwater ingress will also be necessary.
- Te Moana Road crossing. This is a flood prone area, adjacent to the Waimeha Stream and within a possible flood overflow path from the Waikanae River. Grade separation will mean that embankments will block existing flow paths, and sufficient flood conveyance will need to be created with bridges and / or large culverts.

9.5 Pavements

9.5.1 General

Pavement design for the project has to consider a range of issues that will both be a requirement forced on the project eg noise mitigation and also value for money considerations.

The current pavement design takes into account the following:

- Subgrade differential settlement issues
- Rehabilitation of existing pavements
- Construction methodology and impact on existing traffic
- Surfacing considerations
- Value for money.

9.5.2 Expressway Pavement

The general philosophy has been to use granular subbase and base layers with additives to improve the strength and durability of the pavement.

It is proposed to modify the upper subbase layer with lime and use foam bitumen in the base layer. While this approach does not provide a premium structural pavement it does provide a more flexible pavement that is suitable for the environment the expressway passes through. It also allows for simpler rehabilitation if required in the future.

9.5.3 Expressway Surfacing

It is expected that noise mitigation will be required for sections of the expressway passing through residential areas. An Open Graded Porous Asphalt (OGPA) will be required from opening day in areas it is deemed necessary. The Foam bitumen base allows the construction of an OGPA surface from day one. Consideration will be given to alternatives to OGPA surfacing for the rural areas where noise mitigation is not an issue as this will provide significant cost savings.

At higher stress areas such as on interchange ramps Stone Mastic Asphalt, (SMA) has been allowed.

9.5.4 Local Road Pavements

Generally local road pavements will be granular base with chipseal and asphalt/SMA surfacing. However, on some of the more heavily trafficked roads a faster repair maybe appropriate, in such instances a structural asphaltic concrete, (AC) pavement could be used.

10 Stakeholder Management and Consultation

There has been a significant amount of previous consultation undertaken by NZTA and KCDC in relation to the MacKays to Peka Peka Expressway. The Alliance is building on the information previously gathered through consultation undertaken with Kāpiti communities and key stakeholders. Specific information on the expressway was obtained by KCDC in early 2010, and earlier material gathered by NZTA in 2009.

Further to the information previously gathered a Stakeholder Management and Communications Plan has been prepared to outline the consultation proposed by the Alliance for this phase of the project.

A brief description of the historical consultation and the methodology proposed by the Alliance is outlined below.

10.1 MacKays Crossing to Peka Peka Community Engagement Report

NZTA undertook consultation in August 2009 to ascertain residents' current views on expressway options from MacKays Crossing to Peka Peka. The consultation period ran for 10 weeks from 24 August to 30 October 2009, submitters provided feedback on the following points:

- Which expressway option they preferred or if they had ‘other’ views
- Whether they believed that their property would be affected by the expressway options
- Whether they believed they lived near a proposed expressway
- Whether they represented an organisation that had an interest in the expressway options and to include contact details
- If they did not live near the proposed route but were still interested in the proposals for other reasons.

The NZTA received a high level of response from the community with 4446 submissions on the expressway options. The feedback favoured the Western Link Road option – the breakdown of the respondents’ preferences is outlined below:

- 1041 (23.4%) preferred the eastern option
- 619 (13.9%) preferred the western option
- 1609 (36.2%) preferred the Western Link Road option
- 1177 (26.5%) referred to alternative transportation options such as the Western Link Road or improved public transport services.

Input from Kāpiti residents was taken into consideration when the NZTA Board made its decision. Feedback from the community confirmed the preferred option is the Western Link Road (Sandhills) route. Other key themes of the submissions included:

- Construction effects
- Cost of building the expressway
- Effects of the expressway on character, amenity and the local economies of the Paraparaumu and Waikanae Town Centres
- Location and the number of interchanges – submissions focussed mainly on interchanges located in central Paraparaumu an Te Moana Road
- A desire for work to start as soon as possible
- Traffic effects during construction
- The desire for faster journey times and reduced congestion
- Environmental effects
- Potential effects resulting from community severance that might occur as a consequence of constructing an expressway option.

The consultation also identified the need for good local links between communities both sides of the highway.

10.2 KCDC Engagement Objectives

Following the NZTA consultation process outlined above, NZTA invited KCDC to be a member of the project Alliance. KCDC agreed to become a member of the Alliance subject to NZTA agreement on a number of criteria – the first of which were a set of objectives that had been developed by the council following wide consultation with the community.

During mid-2010, NZTA was in discussions with KCDC about these objectives, and on the 17th September 2010 KCDC announced it would join the Alliance based on agreement that these objectives would become “guiding objectives for the Project Alliance Board”. KCDC’s Chief Executive, Pat Dougherty has been authorised to represent the Council on the Alliance Board.

10.3 MacKays to Peka Peka Alliance Stakeholder Management and Consultation

The Alliance has prepared a Stakeholder Management and Communications Plan (SMCP). The objectives the SMCP aim to achieve are as follows:

- To comply with statutory requirements related to the planning and implementation of this project
- Raise stakeholder awareness and understanding of the project
- Engage early and effectively with iwi, key stakeholders and communities to enable them to communicate their concerns and objectives in order to inform the design and development of the expressway
- Ensure stakeholders are advised as quickly as possible on all new developments, key milestones and planned activities on the project
- Work with potentially affected property owners and occupiers in a sympathetic and fair manner at all times
- Maintain regular contact with stakeholders in order to continue to be aware of and address any potential issues.

10.3.1 Consultation Undertaken to Date

To date the Alliance has carried out the following consultation and stakeholder management activities:

- Opened an Information Centre in the Coastlands Shopping Centre – members of the public can visit and speak with a member of the project team about the project. A series of displays details the project and the process the Alliance team will follow to deliver the MacKays to Peka Peka Expressway
- Stakeholder Engagement discussions have commenced with the following parties/organisations:
  - Iwi
  - KCDC
  - Historic Places Trust
  - Greater Wellington Regional Council
  - Public and stakeholder meetings as necessary.

10.3.2 Public Expo's

The SMCP outlined two key public engagement opportunities in the development of the proposed alignment. The first series of Expo's will be held on the 7th November 2010 and the short-listed base-option and sub-options will be presented to the public and key stakeholders for comment. This Scoping Report summarises the alignment options to be presented to the public in November 2010.

A second series of Expo's will be held early to mid-2011 when the preferred alignment will be presented to the public and key stakeholders.

11 Options Assessment

A Multi-Criteria Assessment (MCA) framework was developed to assess the relative merits of the identified options. For the scoping stage of the investigation, the intention of the MCA framework is to determine at a high-level the merits of each option and in particular to determine any key positive or negative differentiators between the options. The outcomes of the MCA are then used to identify the shortlist of the most favourable options.

11.1 Multi-Criteria Analysis

The MCA framework used for this project was developed to ensure a comprehensive option assessment that appropriately takes account of the following:

- The Draft MacKays to Peka Peka project objectives set out in Section 1.6 of this Report
- The requirements of the statutory and policy context summarised in Section 4 of this Report
- Outcomes sought by key stakeholders and project partners, such as Greater Wellington Regional Council and iwi.

The following project outcomes formed the key assessment criteria for non-cost outcomes of the MCA framework:

Outcome	Non Cost Assessment Criteria Criteria Descriptor
Movement	*The project provides for people to move efficiently, conveniently and safely throughout the Kāpiti District as pedestrians, cyclists or in vehicles.*
Built Environment	*The project provides for the integration of infrastructure in the urban environment. The design does not significantly detract from the urban form and the adverse effects on the urban form and features are no more than minor.*
Cultural / Heritage	*The project traverses areas with significant heritage and cultural values. The design does not significantly impact on areas of significance.*
Natural Environment	*The project integrates well with the environment and any adverse environmental effects on natural resources and systems such as land, air and water are no more than minor.*

Outcome	Non Cost Assessment Criteria Criteria Descriptor
Social/Community	*The project provides for people's well-being and health and promotes the safe and efficient movement to and from community health and emergency services*
Economic	*The project promotes national, regional and local economic growth.*
Implementation Timeframe	*The project is able to be consented and implemented within the project timeline.*

The merits of each option are first considered against these assessment criteria. Each outcome has a number of sub-criteria to more fully define the criteria for assessment (shown on the MCA table attached at Appendix I). The method of ranking is discussed in section 11.2

In addition, the options were assessed using their costs and BCRs as comparative criteria.

The following project outcomes formed the assessment criteria for the cost/BCR outcomes of the MCA framework.

The options were evaluated taking into account all the outcomes of the MCA, 'non cost', cost and BCR.

11.2 Options Assessment and Ranking

At the workshop on the 15th September 2010 the final options assessment, comparison and ranking was carried out. Key inputs for the workshop were the preliminary outcomes of the non-cost assessment from the 18th August workshop together with base-option/sub-option costs, and benefit costs ratios (BCR) for the base-options. New alignment information was also presented identifying option foot prints in more detail. Prior to the workshop the evaluation spread sheets had been circulated to each of the 'outcome' champions to re-evaluate, score and note reasons for their scoring. These were presented to the team at the evaluation workshop. The scoring was challenged and debated, allowing a robust review of the work that had been undertaken.

Once the marking of the base-options and sub-options was completed the results were tabulated and sensitivity testing carried out. The outcomes for the base-options are summarised in Table 26.

Options 3, 3B and 3C were the highest scoring base-options for 'non-cost' outcomes. To 'test' the sensitivity of the evaluation the 'non-cost' outcomes 'movement' and 'economics' were doubled as it was considered their weighting should be increased for such a comparison. This comparison also confirmed them as the highest scoring options.

The non-cost outcomes were then compared to the costs and BCR's for each base option and the results are presented in the table below.

Table 26 - Base-options

Base-option	Non-Cost Outcome	Costs $ millions	BCR
1	-5	560	0.6
1A	-5	600	0.9
2	-6	560	0.8
2A	-5	600	1
2B	-1	560	1
3	6	580	1
3A	1	620	1
3B	3	580	0.9
3C	3	590	1
3D	1	590	1
3E	2	570	1
3F	1	570	1

In order to effectively combine the cost and BCR outcomes into the evaluation process, graphs of the 'non cost' outcomes plotted against cost and against BCR were prepared. These are presented in Figures 10 and 11 below and indicate that Options 3, 3B and 3C fall into the most favourable area and are thus the highest ranked options for this project.

The evaluation process clearly showed option 3 to be the highest ranked option for the project with option 3B and 3C next. It was agreed to carry these 3 options forward on the short list.

Figure 10 - Cost/Non Cost Comparison

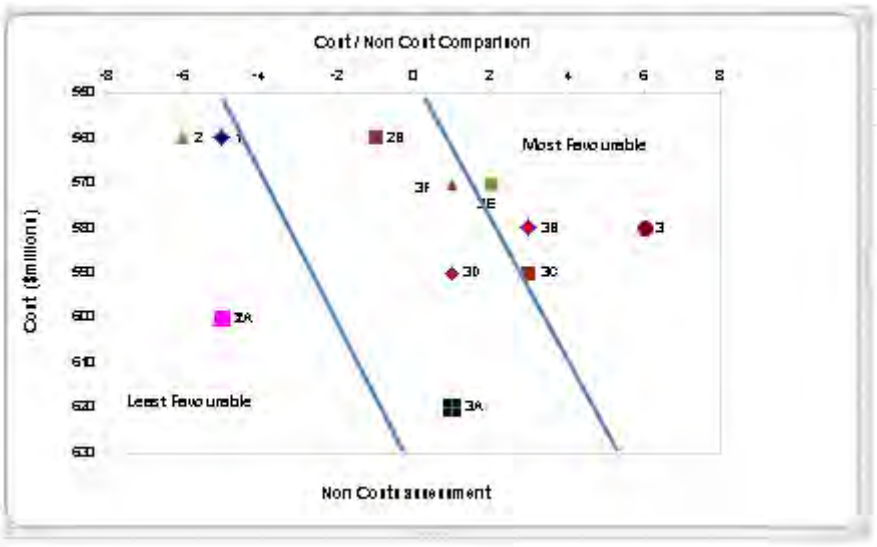
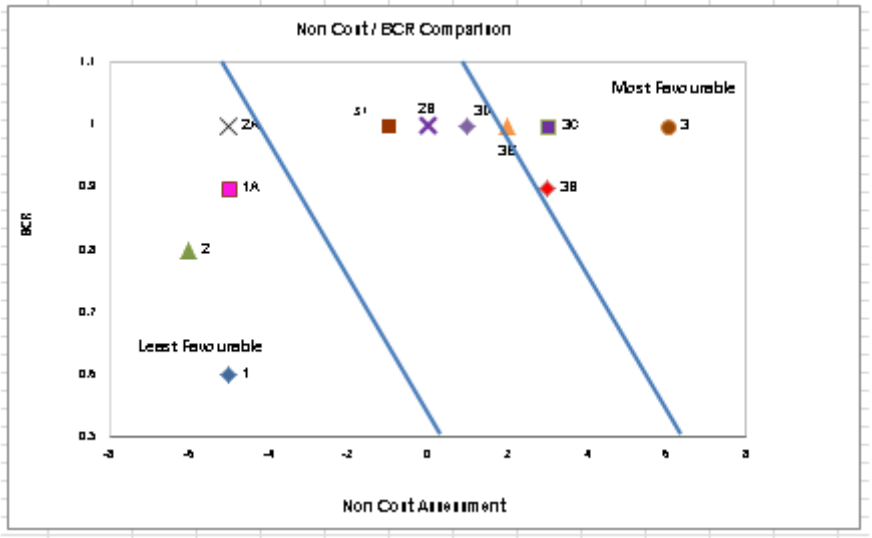


Figure 11 - Non Cost/BCR Comparison



The sub-options were evaluated on the 'non cost' and cost outcomes only, BCR's were not evaluated.

The sub-options which had the most favourable outcome to be taken forward to the short list include:

- Two sub-options at the southern tie-in in sector 1
- One sub-option in sector two to move alignment slightly east of the current designation near Ihakara Street Extension
- Two sub-options between Otaihanga Road and Te Moana Road in sector 3

- Two sub-options in sector four, one within the designation north of Smithfield Road and one located outside the designation away from some wetlands.

For the two sub-options in Sector 1, sub-option S1Dii (south connection north of Poplar Avenue) scored highest in the non-cost outcomes while scoring lower in the cost outcome (ie had a higher cost) due to the additional cost of property purchase and it was agreed both sub-options for the southern connection should be included on the short list.

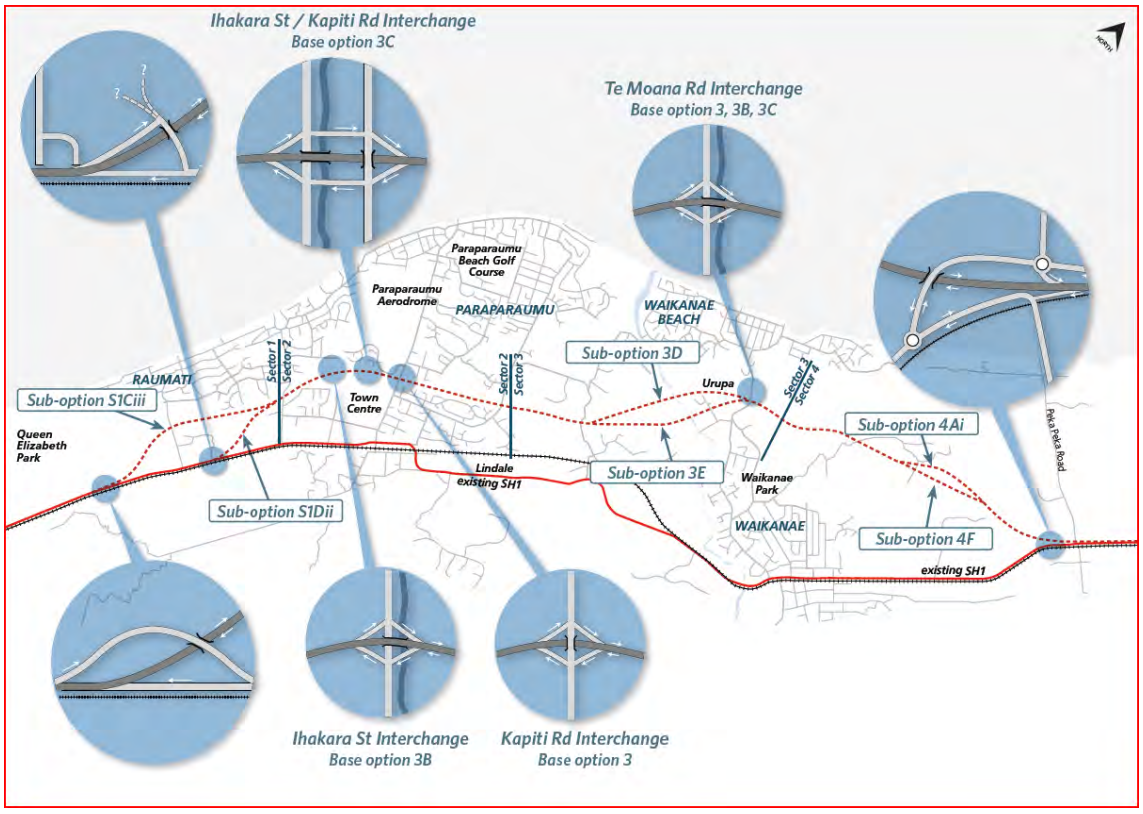
In sector 3, sub option S3D, which is the western option, scored highest in non costs and is the less expensive option. Sub-option S3E, the eastern option, impacts on more property and the costs are higher. It should be noted that at the time of writing this report, further sub-options in sector 3 are still being developed and evaluated and may be added to the short list early in the next stage of the project.

11.3 Options Shortlist

This section describes the base-options and sub-options that have been taken forward to the short list. Key features are identified and more detailed plans have been provided in appendix J (short listed option plans.

Figure 12 shows the short listed base-options and sub-options.

Figure 12 - Short Listed Base-options and Sub-options



The base-options and sub-options selected are shown in the table below.

Base-option	Description
3	South-facing ramps south of Poplar Ave, north-facing ramps at Peka Peka. Interchanges at Kāpiti Road and Te Moana Road.
3B	South-facing ramps south of Poplar Ave, north-facing ramps at Peka Peka. Full interchanges at Ihakara Street extension and Te Moana Road.
3C	South-facing ramps south of Poplar Ave, north-facing ramps at Peka Peka. Full interchange at Te Moana Road. Split interchange, with south facing ramps at Ihakara Street extension and north facing ramps at Kāpiti Road with one way auxiliary lanes between Kāpiti Road And Ihakara Street
Sub-option	**Description**
S1Ciii	South facing ramps, south of Poplar Road, including local road over bridge in QE park. Alignment located east of Steiner school
S1Dii	Ties in North of Poplar Ave, (approx.200 Main Road). North bound off ramp on local road between Main Road and possibly Poplar Ave.
S2Bi	Alignment east of existing designation. With or without Interchange at extended Ihakara Street.
S3D	Crosses Waikanae river near existing designation - east of urupa, west of Maketu (straighter north/south alignment), crosses corner of wāhi tapu area.
S3E	Crosses Waikanae river east of current designation, straighter north/south alignment. East of wāhi tapu including urupa/Maketu but does sever Puriri Road
S4F	Alignment avoids QEII covenant sites and other wetland areas. Crosses additional property north of Maypole boundary on Ngarara Road.
S4Ai	Alignment within designation north of Smithfield Road.

11.3.1 Base-option 3 - Interchanges at Kāpiti and Te Moana Roads

Key features of Base-option 3 are listed below:

- Commencing just north of MacKays Crossing the typical section along the Raumati Straight allowing for the construction of a 9 metre median, this pushes the north bound lanes into QE Park and onto deep peat
- South facing ramps just south of Poplar Avenue

- Two 820 metre radius curves transition the alignment to just east of the Te Ra school Steiner School) on Poplar Road
- Expressway over Raumati Road
- Expressway over Ihakara Street Extension and Wharemauku Stream
- Full interchange at Kāpiti Road, (Kāpiti Road over)
- Expressway over Mazengarb Road
- Otaihanga Road over Expressway
- Bridge over Waikanae River
- Full interchange at Te Moana Road, (expressway over)
- Expressway over Ngarara Road
- North facing ramps near Peka Peka Road.

11.3.2 Base-option 3B - Interchanges at Ihakara Street and Te Moana Road

Key features of Sub-option S3E are listed below:

Base-option 3B is similar to option 3 above except for the changes noted below:

- The full interchange at Kāpiti Road is deleted
- Kāpiti Road over expressway
- Full interchange at Ihakara Street Extension, (Expressway over).

11.3.3 Base-option 3C – Split Ihakara/Kāpiti Interchange plus Te Moana Road

Key features of Sub-option S3E are listed below:

A Base-option 3C is similar to Base-option 3 above except for the changes noted below:

- The full interchange at Kāpiti Road is deleted
- North facing ramps at Kāpiti Road, (Kāpiti Road over)
- South facing ramps to Ihakara Street Extension, (Expressway over)
- One way link roads between Ihakara Street and Kāpiti Road either side of expressway.

11.3.4 Sub-option S1Ciii – Southern tie in through QE park

Key features of Sub-option S3E are listed below:

- This southern connection to the existing highway forms part of Base-option 3
- North bound off ramp in QE Park with over bridge connecting to existing highway
- South bound on ramp on existing highway just south of Poplar Avenue
- Poplar Ave is realigned slightly south of its current location to allow property access on the northern side

- Poplar Ave over Expressway
- Possible relocation of Te Ra School.

11.3.5 Sub-option S1Dii – Southern tie in north of Poplar Ave

Key features of Sub-option S3E are listed below:

- This southern connection to the existing highway is located north of Poplar Avenue
- A possible new local road crosses over the expressway connecting Poplar Ave to the existing highway is required. The north bound off ramp joins this local road. The location and connectivity of this local road needs to be discussed with KCDC
- Approximately 14 houses, (20 properties) are impacted by this option
- Leinster Avenue and Poplar Avenue eastern ends are severed by the expressway.

11.3.6 Sub-option S2Bi – Alignment east of designation at Ihakara Street

Key features of Sub-option S3E are listed below:

This options realigns the expressway slightly east outside the designation near the location of the proposed Ihakara Street extension. This allows more of the dune landscape to be maintained and moves the expressway away from the residential properties.

11.3.7 Sub-option S3D – Western option between Otaihunga Road and Te Moana Road

Key features of Sub-option S3D are listed below:

- This alignment sub-option forms part of Base-option 3
- This option does not follow the existing Western Link Road, (WLR) designation
- The alignment is just west of the existing designation as it crosses the Waikanae River thus encroaching on the El Rancho property
- This sub-option crosses the wāhi tapu site at the south eastern corner between the Maketu Tree and the urupa
- Approximately 8 houses, (14 properties) are impacted by this option.

11.3.8 Sub-option S3E – Eastern option between Otaihunga Road and Te Moana Road

Key features of Sub-option S3E are listed below:

- This option does not follow the existing Western Link Road designation
- From the WLR designation at Otaihanga Road the alignment moves east to cross the Waikanae River and Puriri Road avoiding the registered wāhi tapu site completely
- Approximately 24 houses, (31 properties) are impacted by this option

- As this alignment severs Puriri Road a new access road is required to service affected properties.

11.3.9 Sub-option S4F – Outside designation north on Smithfield Road

Key features of Sub-option S4F are listed below:

- This option does not follow the existing Western Link Road designation
- Just north of Te Moana Road the alignment is located east of the current WLR designation to avoid registered archaeological sites and QE II covenant sites
- North of Smithfield Road the alignment again is located to the east of the WLR designation to avoid some potential wetland areas.

11.3.10 Sub-option S4Ai – Inside designation north on Smithfield Road

Alignment Sub-option S4Ai is located within the existing WLR designation just north of Smithfield Road.

12 Scheme Assessment Option Development and Selection

This project is now moving into the 'option' phase. Work will progress on all fronts on the short listed options to provide the detail required to select the preferred option.

The identified work required includes the following:

- Traffic modelling of intersections and lane arrangements as part of further developing the design. Detailed economic analysis will be undertaken on the short listed options.
- Alignment design and topographic modelling will be undertaken using recently completed aerial mapping to allow accurate integration of the expressway and associated infrastructure into the ground model. Detailed modelling of impact on properties, local roads and utility services will be undertaken.
- Geotechnical work is set out in the preliminary Geotechnical Appraisal Report attached to this document.
- Drainage and hydrology work will include refinement of the stormwater designs for the short listed options, including preliminary modelling of stormwater management performance and adjacent flood risk. Identification of expected land/property areas needed to provide offset flood storage and treatment wetlands will be undertaken along with clarification of KCDC & GWRC's positions for requiring the use of box culverts or bridges. Specialist River Engineering input to outline the Waikanae River bridge waterway and abutment protection requirements, for both permanent and temporary bridges will also be carried out.
- Structures design will focus on structure form and layout and on confirming the location and number of structures required. Alternatives of whether the expressway is over or under the local road will be investigated in more detail for each local road crossing and typical arrangements will be developed for each bridge type. Overall dimensions will be confirmed to suit the road geometry. The urban design and architectural inputs will commence during this stage to identify the preferred bridge form, and foundation types and scope of ground improvements will be investigated as ground conditions are better understood from the site investigation information obtained from site drilling. Assumed design standards for bridges, including road geometrical standards on bridges such as vertical clearances and shoulder widths, will be confirmed.
- Ecological investigations will confirm extent of indigenous vegetation in the shortlisted options and the likelihood of distinct sites providing habitat for fauna. As part of the geotechnical, hydrology and drainage work, consideration will also be given to ensuring hydrological and habitat connections where these maintain existing ecological values.
- Urban design work will have particular focus around two areas:

- Understanding of the potential development area north of Poplar Avenue, particularly opportunities for residential development and ecological enhancement, as well as local connection needs and opportunities.
- Further work with KCDC and other larger land holding owners around Paraparaumu Town Centre with respect to the interchange design, the integration with flood storage design, access to new town centre local road connections, and implications for Kāpiti Road and Ihakara St traffic modelling.

13 Summary and Recommendations

The matters set out in this scoping report are to inform the development of route alignment and connection options within the MacKays to Peka Peka Expressway corridor.

The MacKays to Peka Peka Expressway project forms part of the Wellington Northern Corridor (SH1 from Levin to Wellington Airport). This corridor is an identified road of national significance (RoNS) in terms of the 2009 Government Policy Statement on Land Transport Funding. The Government's priority for RoNS is based on their importance in supporting New Zealand's productivity and economic growth.

Further development of other sections of the Wellington Northern Corridor is concurrently being progressed and includes projects already committed to by the Regional Transport Committee and NZTA for investigation, design or construction. The Wellington Northern Corridor and the other six RoNS across the country are to be substantially progressed in the next 10 years. Consistent objectives for the Wellington Northern Corridor RoNS have been developed and applied to the MacKays to Peka Peka project.

Currently vehicles on State Highway 1 between MacKays Crossing and Ōtaki face delays in Paraparaumu, Waikanae, and Ōtaki, making journey times slow and unreliable. By creating an expressway, journeys will be faster and safer, and will contribute to productivity and economic growth.

The preferred route option for this project was identified in 2009 based on the Kāpiti SH1 Strategy (2009) and subsequent consultation. The selected route follows the existing Western Link Route designation over much of the project length.

Scoping work for the MacKays to Peka Peka Expressway has involved technical development and evaluation of connectivity and alignment options. Initial discussions have been held with key stakeholders and feedback received from visitors to the project Information Centre. Assessment of the 2009 consultation and engagement noted above has also been carried out.

A range of options with varying connectivity in terms of the number of interchanges and the inclusion of a local road Waikanae River crossing have been considered. These connectivity options have been described as base-options. A range of alignment options were also studied and evaluated including alignments outside the existing designation over some local sections of the project. These alignment options have been designated as sub-options.

These base-options and sub-options were evaluated using a multi criteria analysis (MCA) and the short list of options considered appropriate for further investigation identified. These options are in summary:

Base-options (Connectivity Options)

- 3 – Interchanges at Kāpiti Road and Te Moana Road
- 3B - Interchanges at Ihakara Street extension and Te Moana Road
- 3C – Full interchange at Te Moana Road and split interchange between Ihakara Street extension and Kāpiti Road (with one way auxiliary lanes between Kāpiti Road and Ihakara Street).

Note: Options 3, 3B and 3C have south facing ramps at Poplar Ave and north facing ramps at Peka Peka.

Sub-options (Alignment Options)

Southern Connection to SH1 (Sector 1):

- S1Diii – Southern connection through QE Park. Alignment located east of Steiner School
- S1Dii – Southern connection north of Poplar Ave (approx. 200 Main Road).

Ihakara Street (Sector 2):

- S2Bi – Alignment east of existing designation near Ihakara Street.

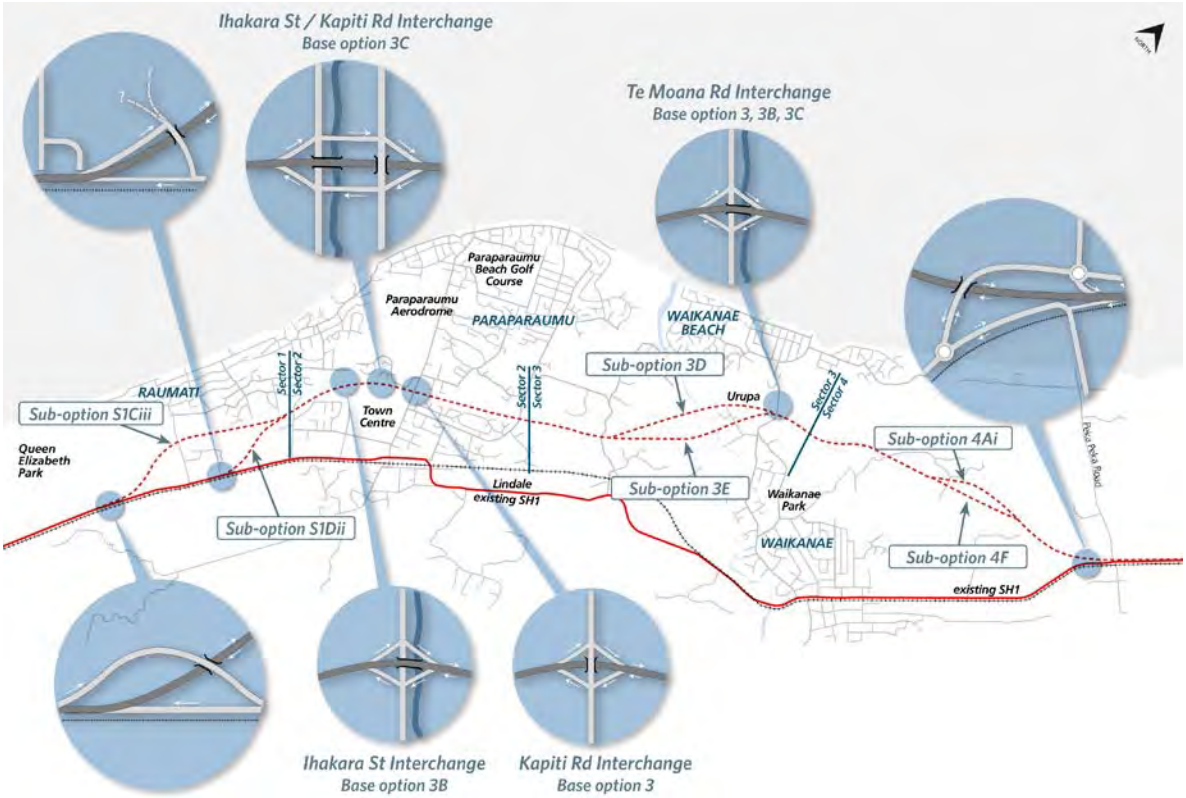
Waikanae (Sector 3):

- S3D – Crosses Waikanae River near the existing designation – east of the urapa, west of Maketu, touches corner of wāhi tapu area
- S3E – Crosses Waikanae River east of current designation. East of wāhi tapu including urupa/Maketu.

Peka Peka (Sector 4):

- S4F – Alignment mostly outside designation north of Smithfield Road
- S4Ai – Alignment mostly within designation north of Smithfield Road.

These options are illustrated on the attached figure.



Key findings of the scoping phase are:

- Alignment options have been identified that satisfy the RoNS guidelines and associated standards in terms of levels of service, design and spacing of interchanges.
- The optional outcome for base-options is the provisions of Paraparaumu Town Centre and in the vicinity of Te Moana Road, together with south facing ramps connecting the Expressway and SH1 near Raumati and north facing ramps connecting the Expressway and SH1 near Peka Peka. These base-options provide more favourable multi-criteria analysis outcomes than options involving a local road crossing of the Waikanae River.
- Of the two southern options, the option north of Poplar Ave has fewer environmental implications than the option through QE Park (a gazetted reserve), but has greater property acquisition requirements and resultant cost.
- The choice of location and form of the interchange at the Town Centre will require careful consultation and coordination with the developments planned in the adjacent area.
- Difficult choices remain for determining the best option for a suitable alignment to the immediate north of the Waikanae River. The options in these locations require private property to be acquired and have associated environmental, social or cultural effects.

Further work is required to develop the short listed options and the various sub-options. It is proposed that the short listed options are taken forward to the Scheme Assessment Report stage for further development.

The Sector 3 sub-options described in this report represent the most western and eastern of a range of alignment options that are still being developed and evaluated and it is possible that the number of sub-options in this sector taken to the next stage of the project will increase.

The assessed expected project cost in current prices (and excluding GST) is $580-600M depending on the alignment option selected, and the BCR of 1.0.

It is recommended that:

- The short listed options described above are taken forward to the Scheme Assessment Stage for further development and the selection of a preferred option
- Consultation proceeds using the options described above as the basis for seeking views from the Kāpiti Communities and various stakeholders.