Detailed Business Case for Ara Tūhono - Pūhoi to Wellsford: Stage II - Warkworth to Wellsford

Detailed Business Case for ROUTE PROTECTION

October 2019

More information

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APPROVAL

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Contents

GLOSSARY OF TERMS

Abbreviation	Term
AEE	Assessment of Effects on the Environment
BCR	Benefit-cost ratio
CAPEX	Capital expenditure
CEMP	Construction environmental management plan
D&C	Design and Construct
EEM	*Economic evaluation manual*
EPA	Environmental Protection Authority
ERUC	Electronic Road User Charge
GPS	Government Policy Statement
HCV	Heavy Commercial Vehicle
HNZPT	Heritage New Zealand Pouhere Taonga
ILM	Investment logic map
LTMA	Land Transport Management Act
NAL	North Auckland Line
NEAP	Northland Economic Action Plan
NLTF	National Land Transport Fund
NLTP	National Land Transport Programme
NOR	Notice of requirement
Transport Agency	The New Zealand Transport Agency
ONRC	One Network Road Classification
OPEX	Operating expenditure
PBC	Programme Business Case
PPP	Public Private Partnership
RMA	Resource Management Act
RoNS	Road of National Significance
SAR	Scheme Assessment Report
SE	Scheme estimate
SH(#)	State Highway (number)
WEBs	Wider economic benefits

EXECUTIVE SUMMARY

State Highway 1 (SH1) is the critical transport corridor linking Northland with Auckland and indeed the rest of the country. It plays a vital role in the movement of goods and services and in connecting communities with social services.

Currently, SH1 performs poorly from a safety and resilience perspective. This situation is forecast to worsen with the considerable growth in transport demand forecast in the corridor. This is due to Warkworth being an identified area of substantial growth and the Northland region identified as a Regional Economic Development (RED) area which is experiencing high levels of sustained growth. The Northland Economic Action Plan (NEAP) identified this section of SH1 as critical to enabling the economic opportunities of the Northland area through improved accessibility. The Whangarei to Auckland programme business case (PBC) also confirmed the importance of a safe, resilient and accessible SH1 as a key component of delivering om the growth aspiration of the Northland region.

There have been extensive investigations into the performance and potential long-term solutions to address the challenges facing SH1 between Warkworth and Te Hana.

This detailed business case (DBC) amalgamates the existing work and considers the implications of the Government Policy Statement (GPS) for Land Transport in 2018.

The finding of this DBC is that the long--term solution to best address the safety, resilience and regional accessibility needs for this section of SH1 is a new offline transport corridor. There is however some uncertainty on when the long-term intervention is needed, with current forecasts indicating 2030. In order to secure a corridor for future construction when the intervention is needed, to provide some certainty to the community as well as retain the appropriate level of flexibility for implementation, it is recommended that the long-term option is route protected in the short-term. **This DBC is for the route protection only** of the Indicative Alignment and a further "Implementation Business Case will be required to make the investment case for implementation much closer to the likely time of implementation.

As well as route protection of the long-term option in the short-term, there are a number of short-term options that have been identified to delay the need for the implementation of the long-term option, including

- Travel Demand Management
- Public Transport services
- Speed management
- Increased use of alternative modes
- Localised safety improvements (underway)

This DBC also recommends the further investigation and development of short-term interventions to delay the implementation of the identified long-term solution.

Broad Context

The Warkworth to Wellsford project (the Project) is the second and final stage of the broader Ara Tuhono - Puhoi to Wellsford project. The first stage (being Puhoi to Warkworth) is currently under construction.

The Project has been investigated since 2010. This investigation has predominantly taken the form of a scheme assessment report (SAR), which was completed in November 2016. Since then the most recent investigation included the refinement and consideration of options through to Te Hana (which is 4km north of Wellsford). A proposed "Indicative Alignment" was identified for the Project at the end of 2017.

As well as these detailed investigations, in 2017 the Transport Agency Board approved a programme business case (PBC) for the SH1 corridor from Auckland to Whangarei which defined clear outcomes for the Auckland to Whangarei corridor.

The majority of this Project development (and indeed this DBC) has been completed before the introduction of the 2018 Government Policy Statement on Land Transport (GPS2018). Whilst the travel time benefits component of the project do not appear aligned with the GPS2018, the broader outcomes of the Project, being a safer, more resilient route that provides improved accessibility to Northland (a key Regional Development (RED) area), are consistent with the GPS2018. The optioneering and analysis undertaken to arrive at the Indicative Alignment was reviewed with the GPS 2018 'lens' and considered robust and aligned with the GPS2018.

GPS2018 does however place greater emphasis on mode neutrality. This could result in greater investment in rail or coastal shipping for this corridor. Analysis of these options indicates that potential investment in rail does not fundamentally change the need for this Project and the proposed Indicative Alignment. Rail has the potential to reduce some freight traffic on SH1 but not a substantial amount. This reduction on its own is not sufficient to change the Indicative Alignment, however it could delay the need for implementation by 1-5 years, depending on the growth in the corridor over the next ten years.

The Transport Agency undertook a review of the Whangarei to Warkworth corridor given the revised GPS. The Transport Agency Board (October 2018) subsequently endorsed the re-evaluation approach for the Whanagarei to Warkworth corridor which confirmed between Te Hana and Warkworth route protection of the long term option.

Problems, opportunities, constraints and outcomes

Between Warkworth and Wellsford, SH1 is classified as a High Volume National Route in the One Network Road Classification (ONRC), the highest classification. Between Wellsford and Te Hana the classification is a National Route. This classification is due to the number of heavy vehicles movements and the connection to a Port (and resultant scale of freight moved).

The existing section of SH1 between Warkworth and Te Hana traverses difficult terrain. The existing alignment is defined by a number of geometric constraints, resulting in areas of tight horizontal and steep vertical alignment.

This situation is resulting in a disproportionately high number of deaths and serious injuries along the route. The route is also subject to resilience challenges, with over 30 hours delay

from full closures on this section of SH1 (generally due to motor vehicle accidents and some environmental factors such as flooding and slips) over the period 2013-mid 2018. This is high compared to other High Volume Strategic National Routes.

The Warkworth to Te Hana corridor constraints are also impacting on the level of social and economic accessibility for customers (including freight and tourism customers). The safety, resilience and higher travel cost due to the gradients and travel time delays along the route, reduces the route's accessibility for customers compared to other routes elsewhere in the North Island with the same ONRC classification.

This poor safety and access performance is not commensurate with the road's ONRC classification.

The Project will provide a safer and more resilient transport corridor that will increase accessibility for customers. This will provide customers with a travelling experience consistent with expectations of a High Volume National Route and National Route given the use and demand of this section of the transport system. This in turn will also assist in improving performance of the wider Northland economy.

The outcomes sought by this Project, as defined by investment objectives, are:

- **Investment objective 1**: Improve resilience to key social and economic activities between Auckland and Northland through reduction in unplanned closures by 90% between Warkworth and Te Hana
- **Investment objective 2**: Improve safety for road users by reducing the number of DSI's by 100% between Warkworth and Te Hana
- **Investment objective 3**: Facilitate increase in Northland's regional GDP due to improved accessibility for freight for key markets between Warkworth and Te Hana by 30%
- **Investment objective 4**: Contribute to an increase of Northland's tourism market through improved accessibility for tourism trips between Warkworth and Te Hana by 30%

These investment objectives align with the Project objectives used in the SAR development.

Stakeholders

Stakeholders have been involved throughout the Project development. This has included Auckland Council, Northland local and regional councils, iwi, interest groups, potentially affected property owners, communities of interest and regional road users. The Project team have built upon the partnership arrangement with Hōkai Nuku representing mana whenua with known interests along the Puhoi to Wellsford route. Other iwi with interests in the Project have also been involved as the Project developed. This involvement of stakeholders and mana whenua to date has helped shape the Project and the proposed Indicative Alignment .

Stakeholder involvement will continue to be a key part of the Project moving forward with public engagement potentially refining the Indicative Alignment. There has been some delay since the last public engagement with the Project team awaiting approval to re-engage with the public once approval of this DBC is achieved and the approach to route protect the Indicative Alignment is confirmed.

Property owners have been consulted and engagement with landowners (directly affected and neighbours) will continue as the Project progresses through the statutory approvals phase.

Based on public consultation on the Indicative Route as presented in early 2017 there is strong support for the Project from stakeholders and agreement with the Project objectives. A common theme from stakeholders is to understand the timeline for construction. There are localised areas of concern for property owners, particularly at the Warkworth interchange end of the Project. There are also general concerns regarding impacts on the farming areas north of Wayby Valley Road and a general sense in some locations that environmental impacts may have been given more priority than impacts on property owners.

Alternatives and options investigated

Identification and assessment of transport interventions to connect Auckland and Northland has occurred over a long period of time and has involved numerous studies including the 2017 Auckland to Whangarei PBC.

Early strategic studies identified the SH1 corridor as the preferred route to accommodate the forecast increased demand on the Auckland to Whangarei corridor. Non road based modes such as rail or coastal shipping networks play an important role in freight transport. However due to cost and operational limitations, non-road based modes are unlikely to significantly reduce the growing demand for road based transport demand.

A long list of road based options was developed and subsequently assessed and a short list of options for the route identified between Warkworth and Wellsford. This included online and offline options.

The online options were considered in detail. However, these options were not preferred due to considerable impact on the environment and on customers during construction as well as not delivering well against the investment objectives. The costs were also similar to the offline options considered and therefore the perceived benefits of a potentially less costly online solution did not eventuate.

The off-line optioneering included a wide range of options of varying standards and alignments. Due to the topography of the area the scale of earthworks was substantial and the consideration of tunnels and viaducts was undertaken to reduce the potential environmental impact.

In 2016, a number of additional short-list options for the northern section of the route (from Wellsford to north of Te Hana) were considered. Additional options were developed to provide for a tie-in north of Te Hana, and connections to Mangawhai and Wellsford. These options were derived from the long list options developed during the scoping phase and were assessed in a manner consistent with the options development process thus far.

The extension to Te Hana is an important aspect of the Project's development. The Auckland to Whangarei PBC had identified the importance of the entire SH1 corridor from Auckland to Whangarei for the wider Northland economy and at the same time the potential cultural, environmental and social implications of connecting south of Te Hana were better understood, this included:

- Cultural constraints mapping identified a number of sites of cultural significance in and around the current SH1 alignment through Te Hana
- Large structures would be required to cross the river in this location on the existing alignment, and these structures, including retaining structures, would impact on environmentally and culturally important areas
- The Te Hana section of SH1 is identified as having resilience challenges associated with the bridge at the northern end of Te Hana
- Terminating a new offline option just south of Te Hana provides a lesser value for money outcome as a result of congestion and safety implications
- The very poor ground conditions immediately to the east of Wellsford

Therefore, extending the Project termination point to north of Te Hana provided the opportunity to better respond to the Investment Objectives.

GPS Review – Implications of Increased Investment in Rail

The potential implications on the corridor of the renewed focus from the GPS 2018 on mode neutral transport planning, and current Ministry of Transport (MoT) investigation into the capability of the North Auckland Line have been considered.

Technical work undertaken for the Transport Agency[1] investigated the potential industries that could use an enhanced rail line. The results of this study have been considered in this DBC to understand the implications of the proposed rail investment on this Project. In this section of the corridor rail is forecast to remove approximately 100 heavy vehicles a day from the State Highway. The impact of removing this traffic from the road network on a range of potential demand scenarios was assessed.

Depending on the road traffic growth assumptions the implications of increased investment in rail is to delay the likely need for the Project by between 1 and (more likely) five years from 2030 to 2035.

The Indicative Route

From the short-list options considered in 2016, an Indicative Route from Warkworth to Te Hana was identified, and public engagement on the Indicative Route occurred in early 2017. The Indicative Route provides an offline route between the northern extent of the Pūhoi to Warkworth section to a connection back to SH1 north of Te Hana near Vipond Road. The Indicative Route provides a 4 lane offline transport corridor, including an 850m long tunnel just north of Warkworth.

The inclusion of a tunnel has been carefully considered as part of the Project development. Two levels of assessment have been undertaken. A high level assessment on whether a tunnel could be completely avoided, and then a later more detailed assessment in 2017 on the tunnel alignment itself.

Overall it was considered that relocating the Indicative Route in order to try to avoid the need for a tunnel would result in less desirable outcomes and a route with substantially reduced performance against the Investment Objectives. In practical terms, based on

[1] North Auckland Line Freight Demand Review, Beca, March 2018 - draft

currently available information, the inclusion of a tunnel is an appropriate solution to the challenges presented by the topography and delivers the best overall outcome. The cost differential was included in this assessment and whilst tunnels are expensive, the alternative (without a tunnel) resulted in considerably more earthworks and associated costs and environmental impacts.

The Indicative Route was selected through a multi criteria assessment with regard to the feasibility, engineering constraints and potential environmental, property, economic, cultural and social impact which the various options may have. Significant environmental effects have been avoided wherever possible through route choice and wherever possible, the remaining unavoidable impacts have been mitigated through design, or can be mitigated through the later detailed design and implementation phases. Implementability and operability were included as assessment criteria in the evaluation of potential options, and the Indicative Route has since undergone further assessment against the implementability and operability of the option, as well as other assessment as set out in the AEE.

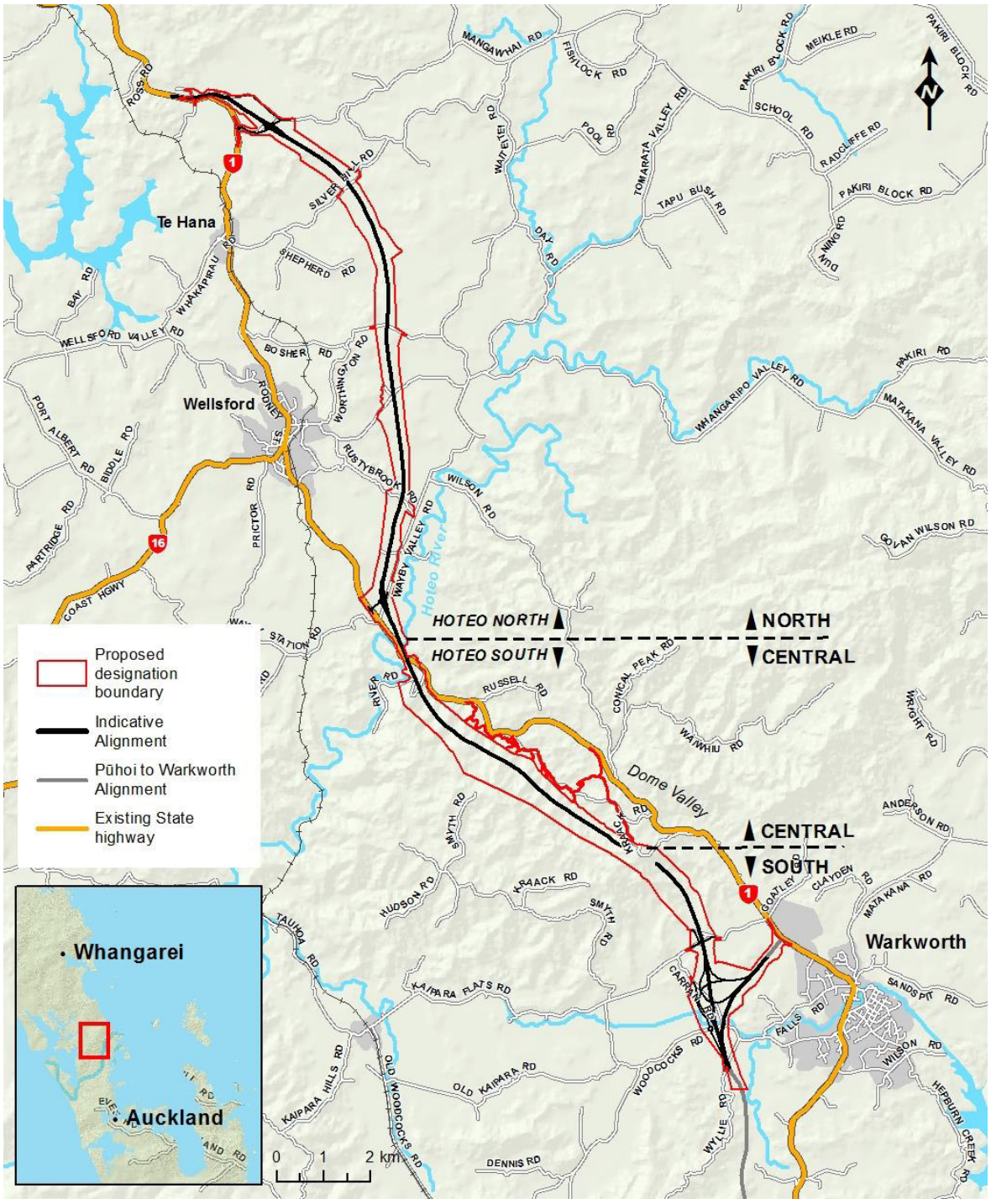
The Indicative Route was subsequently refined in the following locations, based on further design and technical assessment, and public engagement feedback:

- Northern tie into the existing SH1
- Form of Warkworth interchange
- Minor alignment refinements
- Tunnel alignment

This design refinement resulted in the confirmation of an “Indicative Alignment” being recommended for route protection. The Indicative Alignment selected is shown in Figure 1. The Indicative Alignment is the proposed long-term solution and this has been the focus of this DBC.

The Indicative Alignment has been through a comprehensive assessment process and as part of this assessment process the potential environmental, social, cultural and economic effects and potential mitigation of effects have been identified.

Figure 1 : Warkworth to Wellsford Indicative Alignment



Indicative Alignment Outcomes

The Indicative Alignment performs well against the Investment objectives and provides safety, resilience and economic accessibility for Transport Agency customers and in particular the freight customers.

The Indicative Alignment delivers strongly against the identified investment objectives, providing a more resilient and safer piece of infrastructure compared to the existing SH1,

and that will increase the accessibility for customers. All of these factors also contribute to the objective of increasing the economic performance of the Northland region.

In the long-term, the specific performance of the Indicative Alignment against the investment objectives are as follows:

- **Investment Objective 1**
  Improve resilience to key social and economic activities between Auckland and Northland through reduction in unplanned closures by 90% between Warkworth and Te Hana:
  The Project provides an alternative route to the existing state highway route.. If current trends continue, resilience is forecast to worsen. The Project is forecast to result in no closures in the long term. The improved corridor availability will also contribute towards attracting investment to the Northland region and delivering the economic growth sought through reliable and resilient accessibility..
- **Investment Objective 2**
  Improve safety for road users by reducing the number of DSI's by 100% between Warkworth and Te Hana:
  The Project will deliver a high standard route with improved safety performance over the existing SH1 route. The whole of the Puhoi to Wellsford route is forecast to operate with a similar safety performance to that of the Northern Gateway SH1 section (Orewa to Puhoi) (low personal and collective risk rating). In addition to this, traffic volumes on the existing State Highway will be reduced dramatically (90% of traffic is expected to use the Project) thereby reducing the exposure on the existing State Highway. Overall the Project is forecast to lead to a reduction of 174 deaths and serious injuries over a 30 year period in addition to the Dome Valley safety improvements already planned for SH1.
- **Investment Objective 3**
  Facilitate increase in Northlands regional GDP due to improved accessibility for freight for key markets between Warkworth and Te Hana by 30%
  The Project will improve accessibility to Northland and for critical freight and tourism movements. Travel times for light vehicles using the corridor are forecast to reduce by an average of 7 minutes (as forecast in 2026). The travel time savings are primarily as a result of easing of horizontal and vertical alignment through the Dome Valley and provision of a bypass around the centres of Wellsford and Te Hana. Heavy vehicles will experience greater travel time savings due to a reduction in grade on the existing SH1 in the Dome Valley. In addition to travel time savings, the Project will improve journey time reliability. The provision of a dual carriageway means delay caused by slower vehicles will dramatically decrease on the corridor allowing more reliable travel time for all users on the route. This is forecast to enhance the economic performance of the wider Northland region given the heavy reliance on this critical strategic corridor for accessing the rest of New Zealand and the world through the Auckland gateway.
- **Investment Objective 4**
  Contribute to an increase of Northlands tourism market through improved accessibility for tourism trips between Warkworth and Te Hana by 30%:
  Improving the reliability and safety of the journey between Auckland and Northland as outlined in the objectives above will also provide improved accessibility for the important tourism market. As outlined in the Twin Coast Discovery PBC for Northland there is the potential for a 30% increase in visitor spend in the Northland

region through targeted local investment. This investment will be strengthened through improved accessibility between Auckland and Northland on the strategic road connection, being SH1. This Project contributes to this increase in accessibility and resilience for tourist trips.

These outcomes will also add to the outcomes of the wider Auckland to Whangarei PBC and the overall aspirations of the Northland Economic Action Plan (NEAP) which are to increase the economic performance and prosperity of Northland.

Providing certainty through route protection of the long-term option will assist in this regard.

Economics

The Project is a significant piece of transport infrastructure and has an expected estimated cost of $1.7Bn to $2.1Bn.

The Project has been assessed against the 2018-21 Investment Assessment Framework (IAF) and identified as having a Priority 5/6 investment profile. .

The Project creates a present value of $696 million in conventional benefits over the typical 40 year evaluation period. Wider economic benefits (WEBs) have been assessed for Warkworth to Wellsford and are expected to contribute $154 million in benefits over the evaluation period.

The BCR of the Project is 0.7 when considering only conventional benefits. The BCR remains at 0.7 with the inclusion of WEBs. This Project is part of the wider Puhoi to Wellsford corridor Project which with WEBs has a BCR of 1.1.

The Project is through difficult terrain and typography and therefore has a significant construction cost. Importantly the full Puhoi to Wellsford corridor has a BCR above 1.0 (with WEBs) including the Project and will deliver the outcomes sought in an economically efficient manner.

Project Triggers

An important question for this Project is when is the infrastructure needed? This is a significant Project that will take time to get ready for implementation and then ultimately deliver. In the order of a seven year construction period is envisaged as well as the completion of required statutory approvals processes (in the order of a further year). Clarity on when the Project is needed is therefore important to ensure the Project is in place and delivering the outcomes required when needed given these significant long lead times of implementation.

The need for the Project relates directly to the poor level of safety and resilience in the corridor. The current level of service is not commensurate with the ONRC for this area of the state highway network and will worsen as growth in transport demand in the corridor further reduces the safety and resilience performance of the corridor.

A mix of criteria is proposed to the trigger the implementation for the Project, being at least two of the following criteria:

- DSI savings forecast from Dome Valley safety improvements not achieved within 3 years
- A 30% increase in total number of closure hours per annum from 2018 levels
- Forecast traffic volumes are predicted to exceed 25,000 AADT

With the forecast increases in development at either end of the Project (Warkworth and Whangarei) growth in movement through the corridor is forecast to increase substantially over the next ten years and beyond. This could result in increased safety and resilience pressure in the corridor. Given the scale of the proposed growth in Warkworth in particular, there is considerable uncertainty in forecasting the exact pace of this growth. There is therefore considerable uncertainty on the timing for the long-term solution for the corridor, being the Indicative Alignment.

Given this uncertainty the trigger based approach is proposed to ensure this significant investment is delivered when needed.

Route protection

As identified through the development of the DBC, whilst there is certainty that the Indicative Alignment is the right long-term solution, there is considerable uncertainty on the exact time when the Indicative Alignment is required. It is therefore recommended that the Indicative Alignment is only funded for Route Protection at this time until there is greater certainty on the implementation timeframe.

Route protection of the Indicative Alignment is important to provide certainty for implementation (when required), stakeholders and property owners. Given the scale and length of construction of a Project of this scale, the earlier that route protection is completed the better as this also provides the investor greater flexibility to deliver the outcomes once the implementation phase is approved. Waiting to route protect once there is greater certainty of the actual implementation date could unnecessarily delay implementation by many years and could result in a more challenging approvals process as land is developed and areas become more sensitive to new infrastructure. Whilst not all areas along the route are subject to development pressure, the southern end of the Project in Warkworth is an identified area of significant growth.

Obtaining route protection is forecast to take in the order of 12-24 months.

During development of the Project to date, the lessons learnt from Puhoi to Warkworth and other Transport Agency Projects have been considered. A coordinated approach between design, planning, property and operational considerations has been undertaken to provide flexibility for future implementation, whilst also ensuring potential adverse effects are identified and understood by stakeholders and potentially affected property owners.

It is therefore recommended that the Indicative Alignment is route protected as soon as practical to secure a corridor for future construction when the Project is needed, to provide much needed certainty for Project stakeholders and land owners along the route, and to provide the Transport Agency with maximum flexibility of implementation into the future.

The implications of this proposed route protection would include approximately $4M of costs associated with obtaining the route protection. There would also be the potential property liability of upto $89M once the designation was approved. It is estimated that the

actual cost of property (prior to the immediate 2-3 years prior to implementation when property acquisition typically increases) would be in the order of $15-$25M.

It is acknowledged that this this property cost would not result in transport benefits for a number of years into the future (once implementation complete). However, this investment delivers certainty for stakeholders and provides the opportunity to ensure the long term safety, resilience and access benefits of the Project are protected. Without this route protection in place there is a risk that the delivery of the substantial future outcomes are delayed or compromised. For a project of this scale this level of future proofing is considered appropriate.

There is funding available in the RLTP for route protection, but no implementation at this time.

Future Step

This DBC identifies that there is uncertainty associated with the exact timing of the recommended long-term solution for this corridor due to the scale and pace of change currently and forecast to occur over the next thirty years. This uncertainty is not unusual for a project of this scale. A suite of project triggers for final implementation have therefore been identified as part of this DBC.

It is also recommended that once these triggers are met given the scale of the investment and potential gap in time from this DBC, further analysis is undertaken to assess the confirm the investment case for implementation funding. This should take the form of an "Implementation Business Case" including consideration of (but not limited to):

- Most recent growth in population and land use in the corridor
- Role of North Port and impact on freight patterns (mode etc)
- Role of Northland Rail Line
- Technology changes
- Any updates to EEM (currently under review)
- Affordability

This additional (to current business case practice) business case is considered necessary and appropriate due to the scale of the investment required for implementation and the likely length of time between this DBC being completed and the implementation date, where many things can change.

DBC Recommendation

It is the recommendation of this DBC that:

- **The Indicative Alignment is confirmed as the preferred long-term solution for the corridor**
- **The Indicative Alignment is funded for route protection, being $4-5M in costs associated with securing the designation which is provided for in the NLTP**
- **That funding is provided for the likely property costs of this route protection over the next decade of $15-$25M**

- **Due to uncertainty of the likely implementation date, that the following triggers are confirmed for implementation (and further more detailed investigation), being at least two of the following criteria:**
    - **DSI savings forecast from Dome Valley safety improvements not achieved within 3 years**
    - **A 30% increase in total number of closure hours per annum from 2018 levels**
    - **Forecast traffic volumes are predicted to exceed 25,000 AADT**
- **Once these triggers are met given the scale of the investment and potential gap in time from this DBC, further analysis is considered to assess the case investment case for funding implementation. This should take the form of an "Implementation Business Case", including consideration of (but not limited to):**
    - **Most recent growth in population and land use in the corridor**
    - **Role of North Port and impact on freight patterns (mode etc)**
    - **Role of Northland Rail Line**
    - **Technology changes**
    - **Any updates to EEM (currently under review)**
    - **Affordability**

PART A – THE CASE FOR THE PROJECT

BACKGROUND

The Ara Tuhono- Pūhoi to Wellsford Project has been considered for a number of years. Staging was identified as being required due to the scale of the Project. Two stages were identified, Pūhoi to Warkworth (Stage 1) and Warkworth to Wellsford (Stage 2) The Pūhoi to Warkworth section is currently being delivered as a Public Private Partnership (PPP).

More recently the Auckland to Whangarei PBC has been supported by the Transport Agency Board and this defines clear outcomes for the corridor.

In June 2018 a new GPS for Land Transport was confirmed with an investment focussed on:

- Safety
- Access
- Value for Money
- Environment

These new areas of focus in the GPS 2018 are well aligned with the outcomes of this Project and have been considered in the finalisation of this DBC.

The Warkworth to Wellsford project has been investigated since 2010. This investigation has predominantly taken the form of a scheme assessment report (SAR), which was completed in November 2016.

In parallel with this DBC the Indicative Alignment is progressing through the pre-implementation phase.

This DBC brings this previous SAR work together with the most recent analysis (and AEE development) in the form of the Transport Agency's current practise, being the business case approach.

This DBC makes the case for the Indicative Alignment but has also highlighted the need for early protection of the route to give stakeholders, customers and property owners certainty and therefore **this DBC is for route protection only**.

Context

The Northland economy performs poorly when compared to other regions of New Zealand. This is particularly concerning given its proximity to Auckland. One of the key enablers for improving the economic performance of Northland is transport accessibility. This has been confirmed through the 2016 all-of-government Tai Tokerau Northland Economic Action Plan (NEAP).

SH1 plays a critical transport accessibility role, as the main inter-regional route connecting Northland with Auckland and the rest of New Zealand. In addition to SH1, State Highway 16 (SH16) also support transport movements between the regions. For example, during peak travel periods, SH16 between Wellsford and Auckland is used as an additional, alternative route to SH1. This helps to ensure that SH1 operates as efficiently as possible. However this is only in peak holiday periods as SH16 is longer in length and of a lesser alignment standard due to the typography it traverses, making it unsuitable as the main route between Northland and Auckland.

At present SH1 between Warkworth and Wellsford can be closed by incidents (predominantly crashes, but also flooding and slips), its alignment is comparatively unsafe by national standards and the current level of access is an impediment to economic growth in Northland. This is not consistent with the One Network Road Classification (ONRC) aspirations of a national strategic route.

In this corridor there is also a rail line, the North Auckland Line (NAL) and sea based transport from Northport. The current rail line provides very few services a day (and all freight services) and is subject to both size and weight restrictions. The line requires significant investment to upgrade bridges, tunnels and operating systems if the level of service is to be enhanced.

As a result of current constraints to rail freight, usage of the freight rail service is restricted to selected industries. A business case is currently being progressed by the Ministry of Transport to investigate the case for greater use (and investment) of this rail line by industry. Initial analysis indicates some industries currently using SH1 could transfer to rail if there was an enhanced service provided (ability to take larger containers and a greater frequency of service).

Coastal shipping plays an important role in the transport of freight out of Whangarei. Due to the nature of shipping, this is restricted to moving large volumes of low value goods such as aggregate, logs and oil.

Improving the northern state highway network will help Northland contribute to the so-called ‘golden triangle’ of Auckland, Hamilton and Tauranga. Together these three centres generate 36% of New Zealand’s Gross Domestic Product (GDP) with a prediction for this to rise to 47% by 2026. Investment in transport between Auckland and Whangarei is seen as a key enabler of this continued growth.

The NEAP was released in February 2016 to guide a series of Projects and initiatives aimed at stimulating and transforming the Northland economy.

The NEAP collates these Projects into four common work streams, being:

1. **Enablers:** bringing Northland's transport, digital infrastructure, skills and capabilities, and water resources to a standard that creates an enabling environment for economic development in Northland

2. **Land & water:** To identify and develop opportunities for more productive use of land and water resources across a range of primary industry sectors

3. **Visitor industry**: to reduce the impact of seasonality, improve product dispersal across the region and enhance tourism promotion

4. **Specialised manufacturing & services:** to support the development of new innovation and specialised manufacturing and service sectors

The need to improve logistics and transport infrastructure is a key work area within the Enablers stream. Within this work area, the Project is specified as part of the Connecting Northland Project, with the timelines for route protection and completion indicated as 1-3 years and 5+ years, respectively. The Transport Agency is noted as the lead agency for the promotion /development of the Connecting Northland Project, with local government agencies and Treasury aligned as key partners

The GPS 2009 recognised the importance of an efficient and effective land transport network and the economic performance in the long-term. In the 2009 amendment to the GPS, the NZ Government classified SH1 between Pūhoi and Wellsford as a Road of National Significance (RoNS).

A new GPS was released in June 2018, giving greater priority to a mode neutral approach to planning New Zealand's transport system. The GPS 2018 removed the priority previous GPSs had given to the RoNs. There is however, still strong alignment with the new GPS for this Project. The access theme of GPS 2018 focuses on "*assisting regional New Zealand by supporting regional economic development and the Government's goals for tourism. Resilient and safe transport access within and between regions is vital to a region for economic development and tourism. The focus is on transport investment to improve access and safety, and the economic productivity of the regions.*

GPS 2018 supports investment in an increased focus on regional transport including:

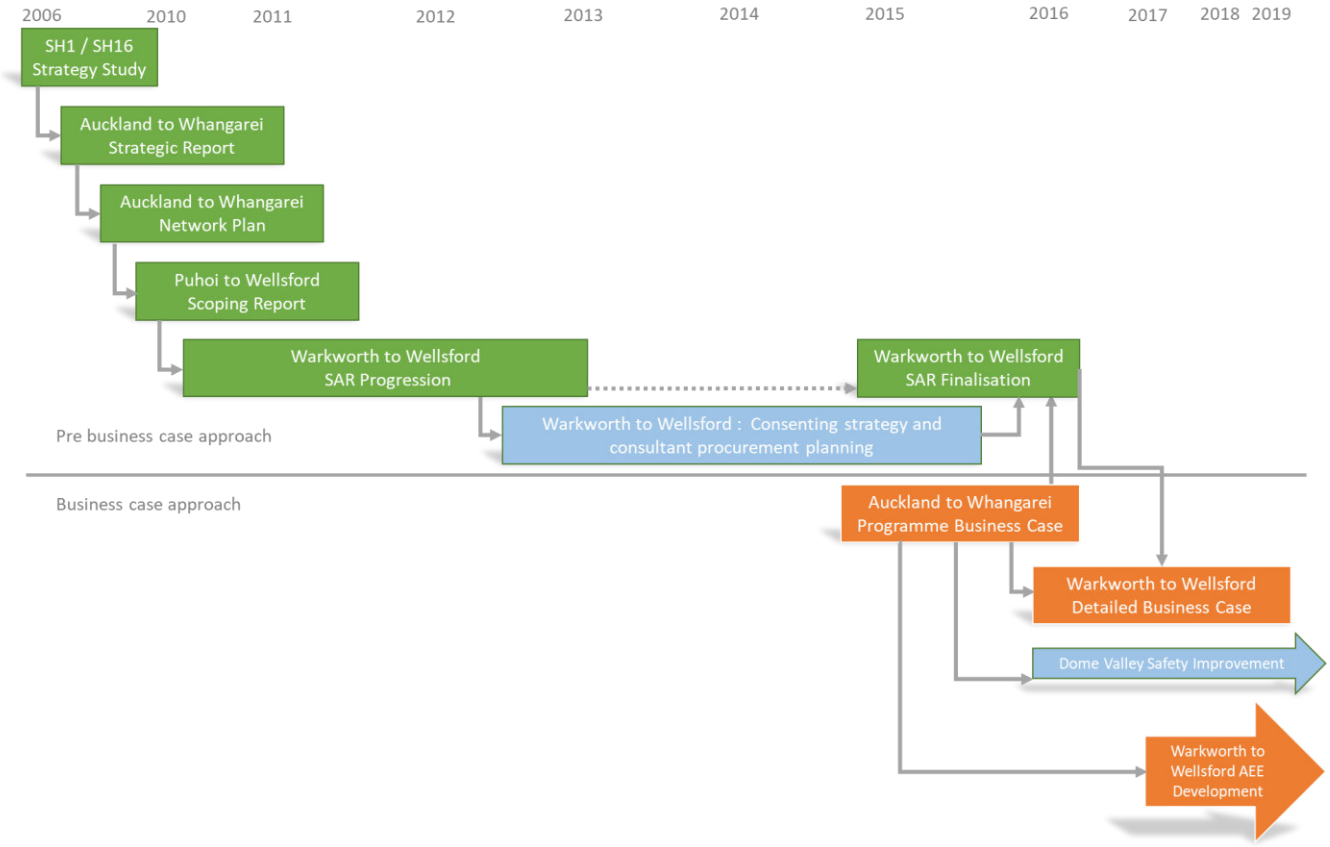
- *developing transport connections that are crucial for linking production points with key distribution points (including routes important for exports, and those intraregional routes critical for getting local goods to market)*
- *making higher risk roads and intersections safer*
- *improving transport connections (including local roads, public transport and active modes) that enable tourists to safely participate in tourism activities*
- *managing and responding to resilience risk on important regional roads (see resilience objective)".*

The Auckland Regional Land Transport Plan 2018-2028 recognises the importance of inter-regional transport links and includes a $5M allocation for the continued investigation of the Puhoi to Wellsford project. Given that the Puhoi to Warkworth section is under construction, this allocation will be entirely used by the Warkworth to Wellsford section for the route protection phase identified from this DBC.

Work completed to date

There have been many investigations and studies since 2006 that have examined this section of the transport network and potential transport solutions. These various studies are outlined in Figure 2.

Figure 2 : Studies timeline



In 2006, the Transport Agency commissioned the SH1 and SH16 Strategy study of the State highway network between Auckland and Wellsford. The purpose of the study was to identify the future function and form for SH1 and SH16, and to provide guidance on what level of investment would be required on each of the State Highway corridors in relation to the function each route fulfils.

The study, completed in 2008, concluded that SH1 was the preferred State Highway for future development to meet the long-term transport needs and that it should be developed to a four-lane highway.

In 2009-2010 the Transport Agency undertook a strategic assessment of the transport requirements between the Auckland and Whangarei regions. These investigations concluded that by 2026, SH1 between Pūhoi and Wellsford would experience considerable congestion during the evening peaks and holiday periods and identified a recommended offline future route.

Following this strategic assessment, a network plan was undertaken that considered the wider transport network implications of the strategic assessment.

In 2010 the NZ Transport Agency commenced a scheme assessment for the proposed highway from Pūhoi to Wellsford. Initial scoping work and short listing of routes was undertaken on the entire route. It was at this time that the Transport Agency determined that the Project should be further considered in two discrete sections given the scale of the works. The two sections were:

- **Stage 1**: Pūhoi to Warkworth, including a Warkworth bypass
- **Stage 2**: Warkworth to Wellsford, including a Wellsford bypass.

During 2010 to 2011 a draft SAR was progressed and prepared for Warkworth to Wellsford. However, in 2012 priority was granted to the progression of the Pūhoi to Warkworth section and the Warkworth to Wellsford SAR remained in draft form pending further work in the future.

From 2013 to 2016 work continued on the consenting strategy for the corridor, the procurement of the Pūhoi to Warkworth section through a PPP, and the procurement of the professional services consultants for the Warkworth to Wellsford section statutory approvals.

In 2016 the Warkworth to Wellsford SAR was updated and completed. It was decided to complete the SAR rather than adopt the Transport Agency's business case approach at that time due to the extent of the existing work and the relatively minor amount of work required to complete the SAR by building on the work largely completed in 2010-11, rather than commence a business case document from scratch.

As part of finalising the SAR the northern termination point for the Project was extended to north of Te Hana.

Te Hana is a small township approximately 4km north of Wellsford. There were a number of reasons for extending the Project to just north of Te Hana, including cultural, social, environmental, geometrics, and to better deliver against the Project objectives identified in the SAR. The details of this decision are discussed in subsequent sections of this report.

In parallel to this Project specific work, planning continued for the wider transport corridor. In 2016, a programme business case (PBC) was developed by the Transport Agency for the Auckland to Whangarei corridor. This PBC confirmed the importance of a safe, more resilient and accessible SH1. SH1 was confirmed as a critical access link between Northland and the rest of New Zealand, and indeed the rest of the world through access to the Ports of Auckland and Auckland Airport.

The problems identified in the PBC for the Auckland to Whangarei corridor are outlined below:

- Poor resilience and costly journeys between Northland and key markets is constraining economic growth and investor confidence
- The corridor is substandard for a national strategic route, resulting in a higher number of crashes involving injury and death
- The lack of a long-term, integrated investment approach creates suboptimal outcomes in transport and reduced economic investment in Northland

The Pūhoi to Wellsford project was assumed in the Do Minimum scenario for the PBC.

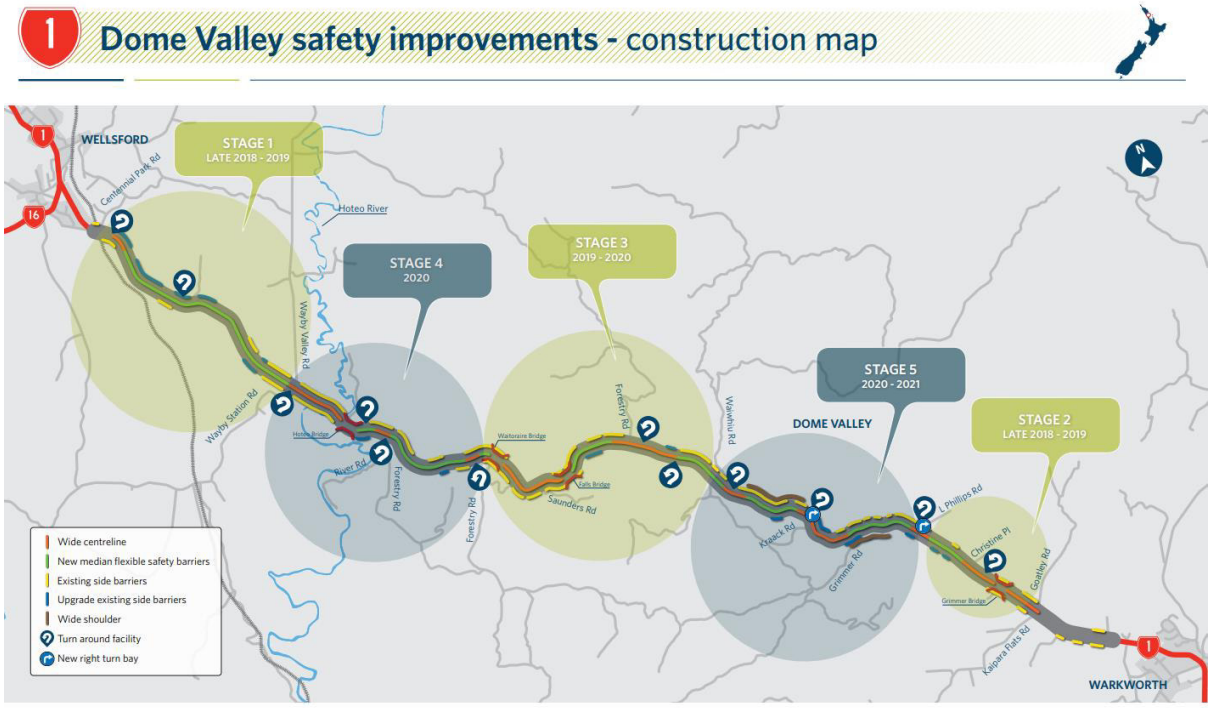
The Twin Coast Discovery PBC was also endorsed by the Transport Agency Board in early 2018 and this focussed investment in the tourism and transport network in Northland with a forecast outcome of a 30% increase in tourism spend in Northland. Transport connectivity between Auckland and Northland was a key dependency of the benefits of the business case.

AEE preparation was commenced in late 2018.

Dome Valley Safety Works

The Safer Roads Alliance (a team investigating and implementing safety works across the Transport Agency network) is also currently delivering short-term focussed safety improvements in the Dome Valley on the existing SH1 alignment with an implementation plan as outlined in Figure 3.

Figure 3 : Dome Valley Safety Improvements



These works will provide a number of improvements to SH1 through the Dome Valley as shown in Figure 3, focusing on reducing traffic accidents. This option does however not address the access and resilience challenges facing the corridor in the future.

Warkworth to Wellsford detailed business case

Scope of document

The Warkworth to Wellsford SAR encompasses the majority of the elements of a DBC as outlined in Table 1. Those elements not covered by the SAR are addressed in this report.

Table 1 : DBC and SAR Comparison

DBC Content	This DBC	SAR
Asset Management		✓
Community and Stakeholder Engagement	✓	
Economics	✓	
Environment and Social Responsibility		✓
Geotechnical		✓
Pavements		✓
Property	✓	
Risk		✓
Road Safety		✓
Statutory Approvals	✓	
Structures		✓
Transport Modelling	✓	

However, the business case approach, whilst similar to the SAR process has some specific differences, including a greater emphasis on the investment story for the Project, rather than a more technical focus. Given how far progressed the Project is and the scale of the work done in completing the SAR it was agreed within the Transport Agency that the point of entry for this Project into the business case process is at the DBC phase.

The DBC has not sought to replicate the work undertaken as part of the SAR process, rather it draws upon it and frames the technical work undertaken in the business case context. This is summarised in the executive summary of this DBC.

In this regard the SAR is an important document to understand this DBC and is referred to extensively in this DBC document. In a typical DBC the option recommended from the process is referred to as the Recommended Option. To align with the AEE being produced this DBC refers to the Indicative Alignment as the option to progress to the next stages of project development.

This DBC has taken some time to finalise as the context for the Project has changed and the recent GPS 2018 required a review of the Indicative Alignment. Given this length of time, the Indicative Alignment has continued to progress through the preparatory phase of pre-implementation and an AEE has been developed for the Indicative Alignment. This work is the most recent and is referred to in this DBC where appropriate.

Terminology used in DBC

For clarity in reading **this report**, given the Project is formally part of the Ara Tuhono- Pūhoi to Wellsford project, whilst the termination point now extends approximately 4km north of Wellsford and to the north of Te Hana, the Project will be referred to as the Warkworth to

Wellsford section of the Ara Tuhono - Pūhoi to Wellsford project. When geographical areas are discussed the term 'Warkworth to Te Hana' will be used in this document.

Another important terminology clarification for this Project is how the option to progress to the next stages of project development is referred to. A number of terms at different stages have been used as summarised below:

- **Indicative Route** – Terminology used for public and stakeholder engagement to describe the Recommended Option (to indicate the indicative nature of the route) at the time of engagement (primarily 2017).
  Indicative Alignment – Proposed terminology for Project in the final consultation phase, indicating greater certainty through the use of the word alignment rather than route and based on further refinement and development of the Indicative Route in late 2017

PROBLEMS, OPPORTUNITIES AND CONSTRAINTS

The existing section of SH1 between Warkworth and Te Hana traverses difficult terrain. The existing alignment is defined by a number of geometric constraints, resulting in areas of tight horizontal and steep vertical alignment. This existing alignment is not commensurate with the road's ONRC classification of a High Volume National Route / National Route for this section of SH1

This situation is resulting in a disproportionately high number of deaths and serious injuries along the route. Short-term safety works in the Dome Valley are currently planned to address the safety challenges through the corridor in the short-term.

The route is also subject to resilience challenges with an average unplanned full closure of the route every 2.5 months (generally due to traffic accidents and some environmental factors such as flooding and slips).

The corridor constraints are also constraining economic growth in Northland through relatively poor inter-regional transport access.

The opportunity is to provide an alignment that is safer, more resilient and results in an enhanced economic outcome for Northland through improved accessibility, all of which is more commensurate with the route's ONRC.

Problems and opportunities

The Auckland to Whangarei PBC identified a number of problems and opportunities on SH1 between Auckland and Whangarei and the relative weighting of these problems. These were:

- **Problem 1**: Poor resilience and costly journeys between Northland and key markets is constraining economic growth and investor confidence (50%)
- **Problem 2**: The corridor is substandard for a national strategic route, resulting in a higher number of crashes involving injury and death (30%)
- **Problem 3**: The lack of a long-term, integrated investment approach creates suboptimal outcomes in transport and reduced economic investment in Northland (20%)

Based on the analysis undertaken as part of the Warkworth to Wellsford SAR and this DBC development Problems 1 and 2 are applicable to the Warkworth to Te Hana section and are equally weighted in terms of relative importance. This equal weighting reflects this section of the corridor's poor safety record, which is one of the worst sections of the entire Auckland to Whangarei corridor. Problem 3 is not considered directly applicable to this section of the corridor as it is not Project specific, however is an important consideration in the implementation plan for this Project, and hence the need for route protection of the

Indicative Alignment to be progressed in the short-term which will assist in the meeting of this third problem statement from the PBC. As noted above, the Pūhoi to Wellsford project was assumed in the Do Minimum scenario for the Auckland to Whangarei PBC.

The identified problems for this Project are therefore summarised as follows:

- **Problem 1**: Poor resilience and costly journeys between Northland and key markets is constraining economic growth and investor confidence (50%)
- **Problem 2**: The corridor is substandard for a national strategic route, resulting in a higher number of crashes involving injury and death (50%)

Problem 1: Resilience and costly journeys

SH1 from Warkworth to Te Hana is part of the main transport connection between Northland and the rest of the country. The evidence shows that the corridor suffers regularly from unplanned incidents, which affect its resilience and availability.

Northland has one of the most deprived populations in the country. While 20% of New Zealand's population is in the lowest quartile of the deprivation index, the equivalent measure for Northland is 35%.

Economically this story has two distinct extremes. Auckland is New Zealand's largest economy, the economic engine room of the country. In contrast, Northland is one of the most economically deprived areas of the country.

Northland is a regional economy that has been underperforming relative to other New Zealand regions and relative to its resource base for too long. The regional economy was impacted by the Global Financial Crisis (e.g. a large reduction in tourists from the UK and the USA) and some significant climatic events, both severe storms and drought conditions. The Far North and Kaipara districts have similar economic structures, with a strong focus on primary production. Whangarei is the region's main urban and servicing centre with a higher concentration of manufacturing and service industries.

Northland's economy accounts for 2.5% of New Zealand's GDP. Nominal GDP in the region increased by 2.6% per annum on average over the past five years, compared to the national average of 4.1%. Northland has an unemployment rate three percentage points above the national rate and nominal GDP per capita is 32% below the national average. Just over 20% of Northland's usually resident population live in areas that have the lowest deprivation score compared to 10% nationally. This data has been taken from Statistics New Zealand website.

Due to its geographic position and isolation from key markets, transport connections for the Northland region are critical for its economic development. Efficient access to the large market and economic opportunities of metropolitan Auckland as well as connectivity to the Auckland airport and seaports at Northport and Auckland will help underpin future growth.

The Ministry Business Innovation and Employment (MBIE) NEAP has identified the importance of the transport network as a key enabler for economic growth in Northland and in particular the role of SH1 in providing access to the rest of the country. The provincial growth fund has supported a number of items identified in the NEAP such as the Hundertwasser museum in Kawakawa, showing the governments ongoing commitment to

the Northland economy.

There were 9 full closures 2013-2018 (to date) on SH1 between Warkworth and Te Hana, equivalent to full closure every 7.3 months. There was a total of 29 hours of closure, giving an average delay of over 3 hours per closure. This data excludes partial closures, which would further compound the issues.

Of these unplanned incidents, 89% resulted from crashes with the remainder being from a fire outbreak. The location of these closures is shown in Figure 4, indicating resilience challenges.

The detour routes for many of these closures are also challenging, as shown in Figure 4. The section between Warkworth and Wayby Valley Road is subject to a large detour with a significant travel time. Many of the detour routes are not able to carry full High Productivity Motor Vehicle (HPMV)s. The length of the detour routes and their inability to carry HPMVs significantly restrict the ability to divert freight traffic away from incidents.

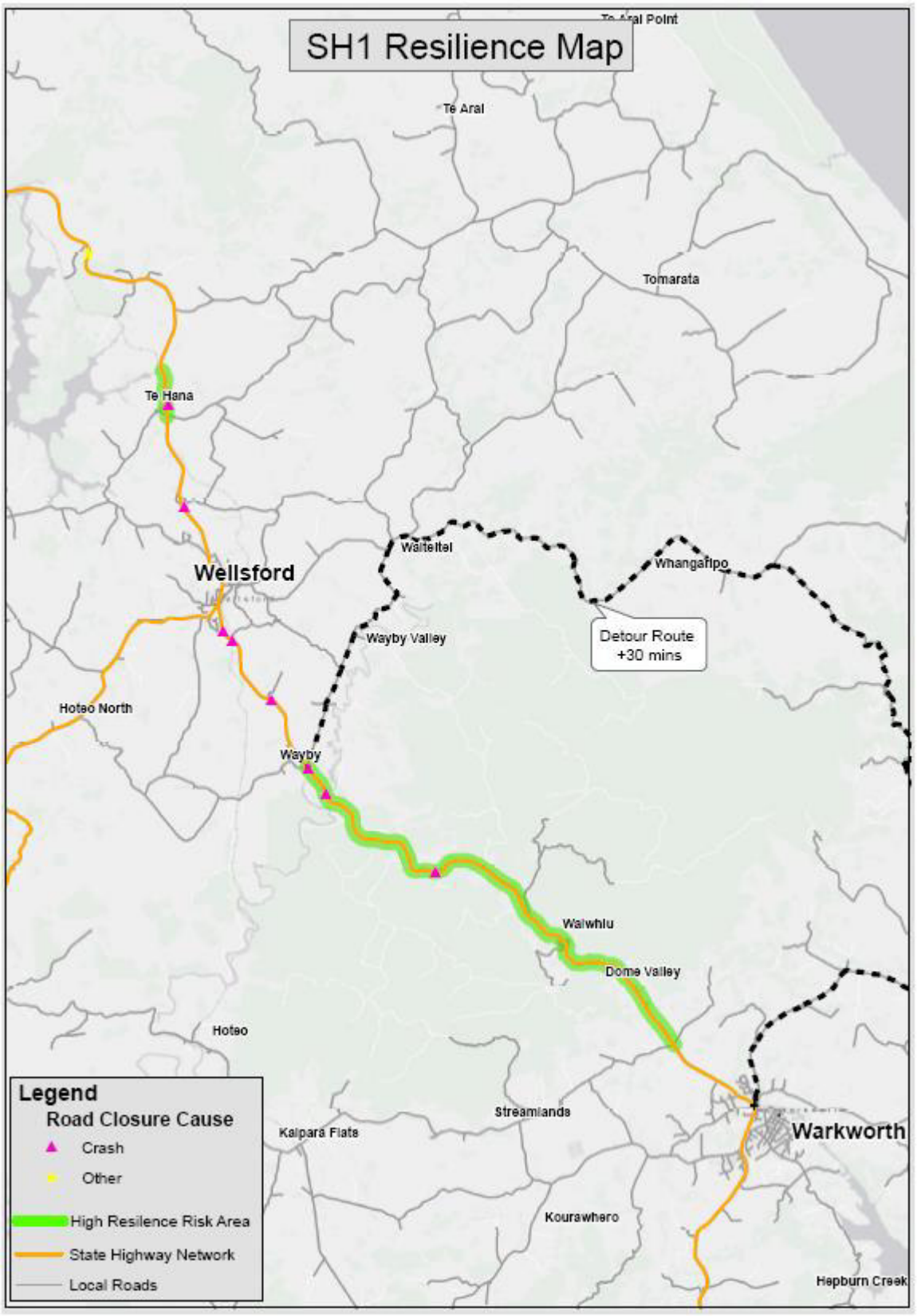
Significant delay (and cost of travel) can occur once a detour route is implemented. Figure 4 shows the additional travel time for traffic once a detour is set up. Accounts from the network operators suggest detour routes themselves are often subject to additional delay as a result of one-lane bridges, priority intersections and crashes on the detour routes themselves.

It is noted the Safe Roads Alliance are providing short-term safety upgrades in the Dome Valley, a 15km project extent between Wellsford and Kaipara Flats Road (the new interface between the Puhoi to Warkworth route and the existing SH1). These upgrades predominantly include the provision of flexible wire rope barriers in the centre of the highway. It is predicted that the death and serious injuries can be reduced by 27 (68%) within 10 years of construction, from the previous 17 deaths and 42 serious injuries between 2006 to 2015. This reduces the severity of the impact of accidents, reducing head on collisions. This intervention does not however necessarily reduce the number of incidents. There is the possibility that this intervention will create additional resilience risk due to the challenging and tight nature of the topography in the area. For instance, when the safety barrier is struck it is highly likely that that the lane will be closed until the vehicle is cleared.

Constraints within the Dome Valley section, such as tight radius curves, bridge structures, areas of environmental significance, property access ways and a narrow designation, also means flexible centre barriers cannot be installed continuously along the corridor. Therefore, whilst the Dome Valley works will improve safety, there may not be a corresponding improvement in resilience of the corridor.

In terms of ‘costly journeys’, access to the gateway of Auckland for the Northland economy is critical. This accessibility provides economic opportunity and access to markets, particularly for freight vehicles. Analysis of travel times derived from the information used to collect Electronic Road User Charges (ERUC) indicates that heavy vehicles are delayed on the hillier sections of SH1, particularly through Dome Valley, and the town centres of Wellsford and Warkworth.

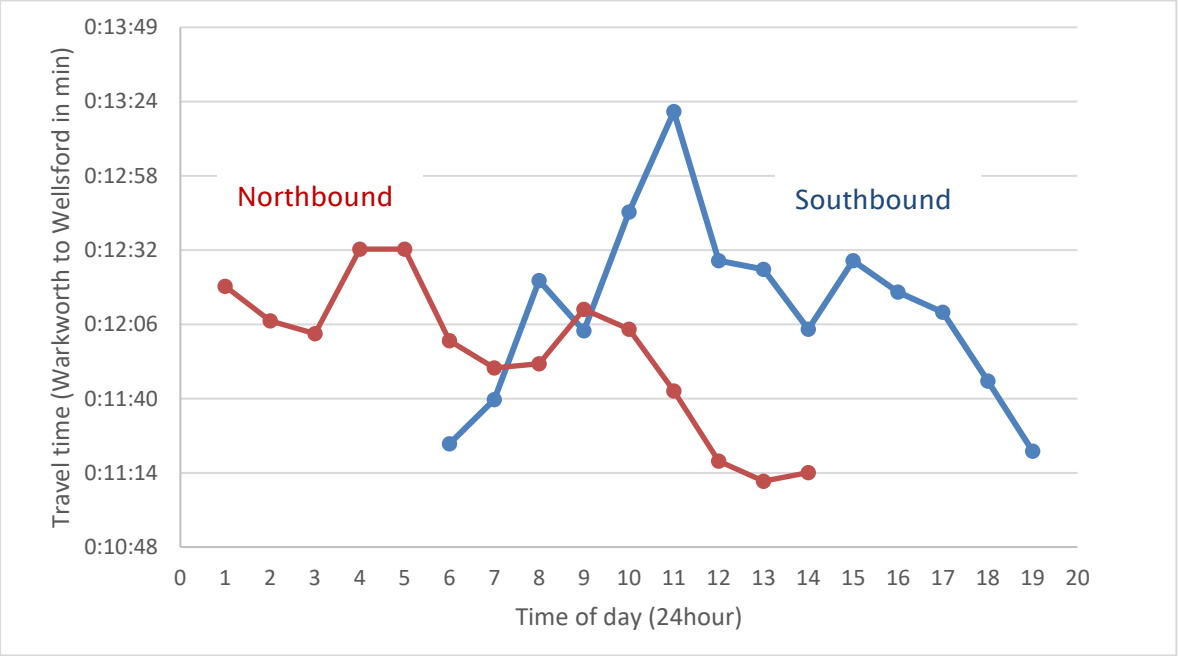
Figure 4: Warkworth to Te Hana unplanned Incidents and detour restrictions (2013-2018)



Speed data for the entire journey between Whangarei and Auckland is shown in Figure 5. Northbound and southbound trips were surveyed across the month of March in 2015 and travel times recorded. These have been plotted against the time of day to indicate variation by time of day and by direction. The analysis shows a range of almost 2 minutes in the southbound direction equating to around 18% of overall travel time. In the northbound direction, travel time varies by around 45 seconds or 7 % of total travel time. The variation is likely a result of congestion in the Warkworth and Wellsford urban areas and the traffic negotiating the steeper gradients in the Dome Valley. During holiday periods this travel time variability is considerably greater with delays of over an hour common through these areas.

While a level of travel time variability is evident on the route, the feedback from members of the public (as part of the PBC consultation) and stakeholders indicates the main issue is one of resilience when SH1 is not available. Freight operators in Northland have repeatedly indicated through this business case process that they have missed a number of just in time delivery deadlines at Auckland Airport or Auckland Port at great cost to them as a result of this section of SH1 being delayed due to an incident.

Figure 5 : Travel time between Warkworth to Wellsford



Travel time data analysed in the Auckland to Whangarei PBC also has shown that the average speed for this section of SH1 is slower than sections of highway with the same ONRC classification. Both northbound and southbound average travel speed is 77km/h over the section (which includes the 80km/h posted speed limit through the Dome Valley). Recent improvements to the Waikato Expressway have targeted 110km/h speed limits and will likely see operating speeds in excess of 90 km/h. The SH29 corridor, a 'High Volume National Route', operates at an average speed of 86km/h[2] and includes the Kaimai Ranges. The

[2] Based on 2014 ERUC light vehicle data between Piarere and Tauriko.
[2] Data to June 2018

evidence supports the perception of costly journeys in this section of the SH1.

Establishing a direct link between economic performance and transport accessibility is difficult as there are many factors that influence economic outcomes, particularly for regions like Northland. However, a strong message from stakeholders and the evidence is that the performance of the transport network, and particularly connectivity to a strong economic centre such as Auckland, has a role to play in the economic performance of a region such as Northland.

Importantly the evidence shows that the level of accessibility between Northland and Auckland is not commensurate with that between Auckland and the Waikato. This poorer level of accessibility is identified in the NEAP as being a significant contributor to the under performance of the Northland economy.

The evidence shows there is a problem with the resilience and performance of SH1 between Warkworth and Te Hana and that the Northland economy is one of the poorer performers in New Zealand.

Problem 2: Safety

The Warkworth to Te Hana SH1 corridor is defined by a number of geometric constraints resulting in areas of tight horizontal and steep vertical alignment. The crash history reflects this with high proportions of head on, cornering and loss of control crashes of high severity. Cornering crashes are particularly prevalent in minor and non-injury crashes, and are the highest proportion of crash incidents overall. The lack of central median barriers on the route is considered to contribute to the high number of head-on crashes, many of which result in serious injuries or fatalities. This results in a disproportionately high level of death and serious injuries.

An assessment of the crash data has been carried out using the NZTA's CAS database over the period 2013-2017 including all available data for 2018. The severity and year between Warkworth and Te Hana is outlined in Table 2.

Table 2: Crashes by year and severity

	FATAL	SEVERE CRASH	MINOR CRASHES
2013	0	5	36
2014	1	11	38
2015	2	15	25
2016	3	17	37
2017	4	23	44
2018[2]	3	9	39
Total	**13**	**80**	**219**

The safety history of the Warkworth to Te Hana corridor indicates an improving safety record following reduction of the posted speed limit in 2010 and investing in safety

measures in 2012. However, the addition of the 2016 - 2018 data indicates an increase over the past 2013-2015 level. Alarmingly, 10 fatal crashes occurred in 2016-2018, four of which were as a result of head on crashes in the Dome Valley.

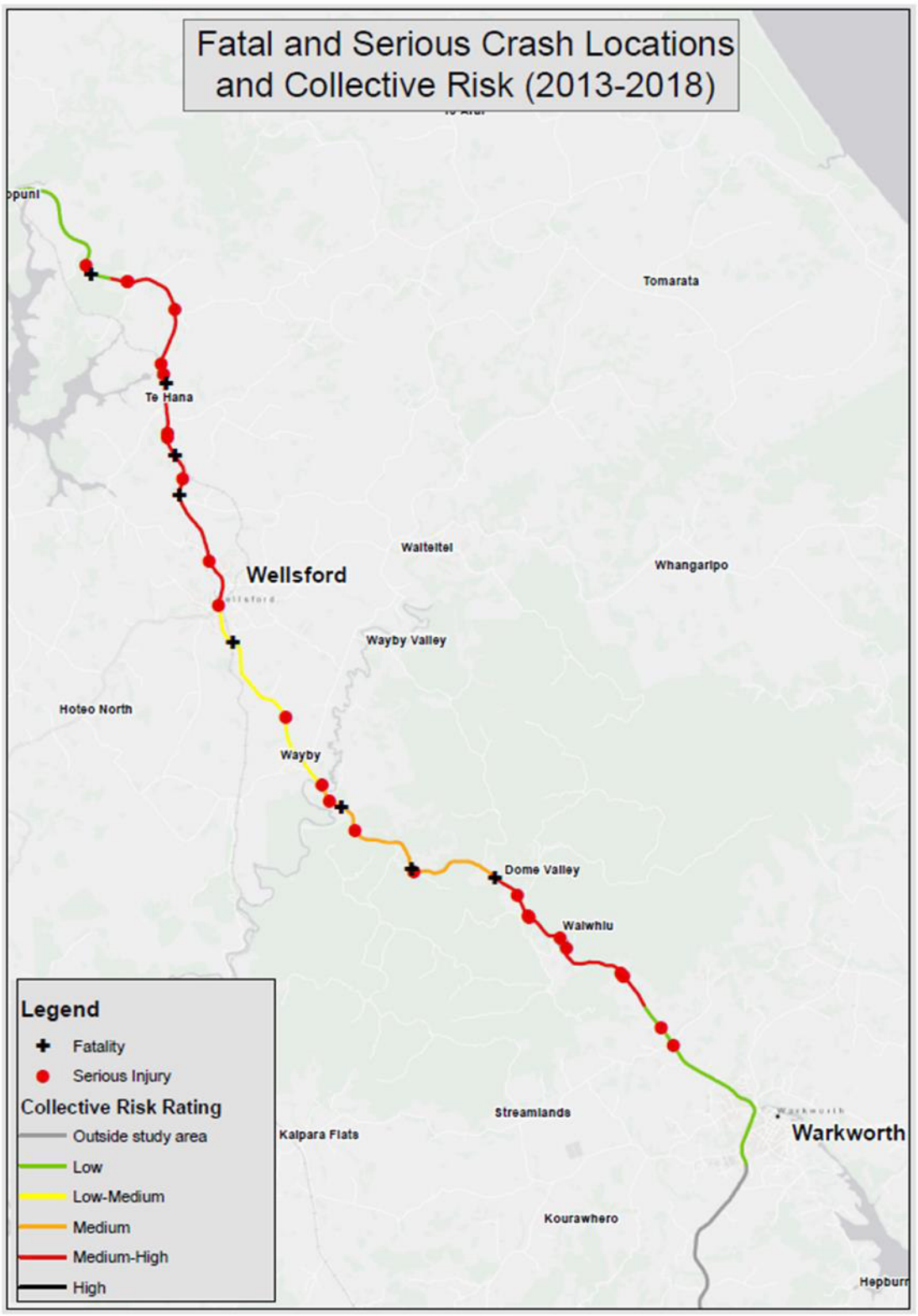
The crash history has been analysed by movement type and severity to identify trends and deficiencies on the corridor and summarised Table 3. A total of 13 fatalities have occurred on the corridor in the period between 2013 and 2018. Of these, seven fatalities have been as a result of a head on collision; five were as a result of cornering, one involving overtaking. Cornering and head on type crashes feature strongly in serious and minor injury accidents as well as cornering type movements.

Table 3: Crashes by severity and movement type

	FATALITIES	SEVERE INJURY	MINOR INJURY
Overtaking and lane changing	1	3	12
Head on	7	31	40
Loss of control	0	8	27
Cornering	5	26	72
Obstruction	0	2	8
Rear end	0	0	17
Turning vs same direction	0	5	9
Crossing	0	0	0
Crossing turning	0	1	4
Merging	0	0	10
Right turn against	0	0	2
Manoeuvring	0	1	3
Pedestrian	0	1	8
Misc.	0	2	7

Figure 6 plots the deaths and serious injuries on the corridor and includes a KiwiRAP collective risk rating for each section of the corridor. This figure shows the extent of the safety problem through the Dome Valley section with two fatalities as a result of head on crashes, indicating a medium-high collective risk rating.

Figure 6: Fatal and serious crashes 2013-2018



Seriousness of crash problem

The corridor crash record has also been compared with other areas of the national transport network using the KiwiRAP Collective and Personal Risk methodologies, as shown in Figure

6. This shows that the section of SH1 varies in Collective risk rating from a Medium-high rating in the Dome Valley section to a low rating in the southern-most section north of Warkworth.

The section of SH1 from Warkworth to Wellsford carries the highest classification in the ONRC system as a "High Volume National" road. The section from Wellsford to Te Hana has a "National Road" classification. From a safety perspective this requires the following standard:

- **High Volume National:** Mostly forgiving roads and roadsides, equivalent to KiwiRAP 4-Star standard. User hazards absent or mitigated, including head on risk. Active road users generally do not have access - if present, they are provided with separate space or are physically separated. The road form provides road user guidance

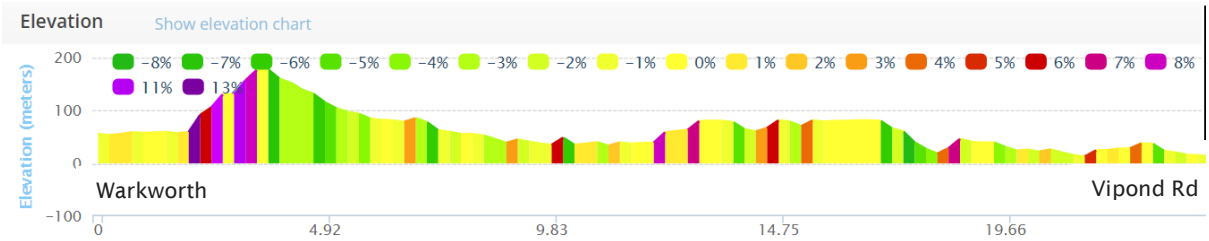
The current route is predominantly a 2 star standard. This does not meet the standard sought for a High Volume National route.

Safety also has a significant impact on the resilience of the route (due to closures because of incidents) and it is noted that the ONRC also seeks the following resilience standard for a National route:

- **Resilience Level of Service** - Route is always available during major weather or emergency events and viable alternatives exist. Rapid clearance of incidents affecting road users. Road users are generally advised in advance of issues and incidents

The evidence assessed to date confirms the problem identified.

Figure 7: Vertical profile of the existing SH1 Warkworth to Vipond Road corridor



Further analysis suggests the corridor is also over represented in crashes with driver fatigue listed as a contributing factor. Crashes involving heavy vehicles are also over represented compared with national levels and are especially high when considering crashes involving serious and fatal injuries.

The Dome Valley Safety Improvements are being implemented as outlined in Figure 3. This is forecast to address a substantial portion of the accidents in this area (being 68% of DSIs) in the short-term. This result in a forecast of approximately 29 DSIs remaining every five years. It is important to note that the Dome Valley Safety Improvements are only a short-term solution as the forecast increase in traffic demands through this section of the corridor in the near future will mean that this section of road will have insufficient capacity to meet the demands, further increasing the risk of a safety problem in the long-term. The benefits of the Dome Valley works will therefore be eroded over time. The Dome Valley safety works are not able to be installed along the entire area of risk due to the topography and physical constraints.

Existing strategies / organisational goals

This section describes for this DBC the relevant national, regional, sector and organisational strategies. The PBC provides a detailed assessment of the applicable strategies. The strategies with the most direct impact on this DBC are outlined below.

One Network Road Classification (ONRC)

The ONRC has been developed by the Road Efficiency Group (which is a collaboration between Road Controlling Authorities across New Zealand) as a classification system that identifies the level of service, function and use of road networks and state highways. The SH1 road corridor is identified as a High Volume National High Volume Route between Pūhoi and Wellsford (the highest classification) and a National route from Wellsford to Whangarei, due to its role providing access between Whangarei and Auckland (including international airport and port facilities).

Upper north island freight story

The Upper North Island Strategic Alliance (group of industry, local authority and government organisations) undertook work in 2013 to support informed decision making on key land use, infrastructure and investment, to improve the economic performance of the Upper North Island and New Zealand. The Freight Story sought to understand the supply and demand of industrial land, promote a strategic and integrated approach towards land use and transport planning and identify constraints on the Upper North Island's strategic rail and road networks.

The problems and potential outcomes for the SH1 corridor are consistent with a number of the critical freight issues that the Upper North Island Freight Story seeks to address. The Freight Story confirmed strategic road and rail network constraints as their top critical issue and in particular, ranks highly the inter-regional road corridor (Auckland/ Waikato/ Bay of Plenty) in terms of 'scale of benefit of collective partner focus' in reducing the cost to do business.

The Government Policy Statement on Land Transport (GPS 2018)

In June 2018 the GPS for Land Transport was finalised by the Government. . Whereas the previous GPS documents had identified the RoNs for significant investment, the latest GPS focusses on the four strategic focus areas of Safety, Access, Value for Money and the Environment as shown in Figure 8.

The Access focus area includes consideration of resilience, choice and access to employment and social opportunities. Included within the Access focus area is also a focus on inter regional access and a particular need to ensure that the regions have appropriate transport access to ensure economic opportunity and growth. This includes the following from section 2.3 of the GPS 2018:

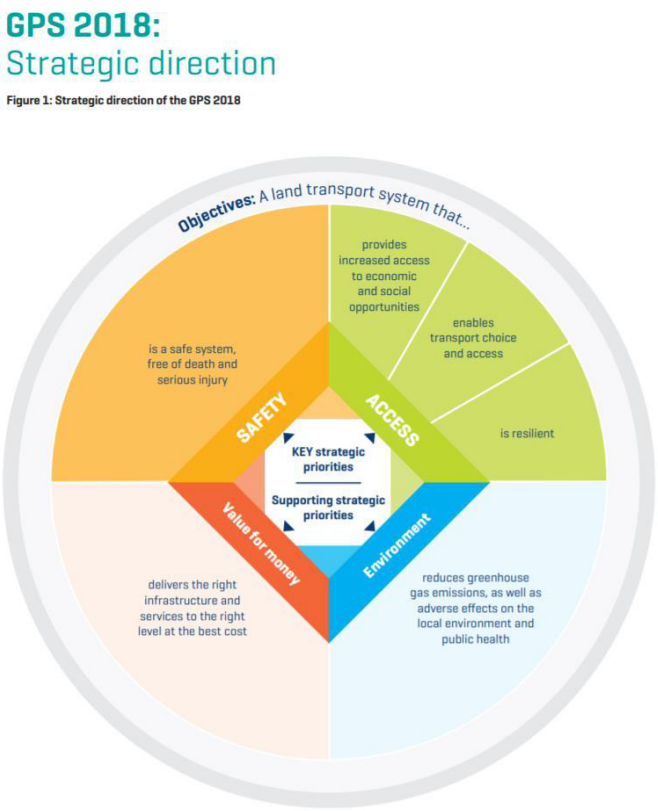
"For New Zealand to thrive we need our regions to thrive. Regional New Zealand is a key driver of the New Zealand economy, for example the majority of exports are generated in regional New Zealand and tourists spend most of their time in the regions.

The GPS supports investments that are supportive of regional priorities such as the movement of freight, enhancing visitor journeys and increasing the resilience of the transport network. This investment will be complementary to the Provincial Growth Fund and to the Government's goals for tourism. The Government's goals for tourism include attracting the right visitor mix, responding to visitor demand and ensuring all regions benefit from tourism. Transport's contribution to the tourism strategy includes providing robust, safe transport infrastructure.

GPS 2018 focuses on assisting regional New Zealand by supporting regional economic development and the Government's goals for tourism. Resilient and safe transport access within and between regions is vital to a region for economic development and tourism. The focus is on transport investment to improve access and safety, and the economic productivity of the regions."

Northland is an identified RED area and therefore ensuring appropriate transport access to this region and providing safe and resilience transport access (of which state highway is the predominant transport corridor) is very much consistent with GPS 2018.

Figure 8 : 2018 GPS Strategic Direction



The Northland Economic Action Plan (NEAP)

The NEAP brings into focus a group of Projects that together will contribute to transforming Northland's economy. This is an all of government action plan to improve the economic performance of Northland.

The NEAP has a short to medium term focus, covering 10 years. A broad range of

organisations will contribute to the success of the Action Plan, from business and Iwi/Maori through to not-for-profit organisations and local and central government, including the Transport Agency.

As outlined in the context section of this DBC, the NEAP has identified that the lack of robust transport accessibility between Northland and the rest of the country is a contributing factor to the area's poor economic situation and has identified four 'game changers' to underpin business growth. The first of these game changers[3] is:

Transport: – *better connectivity with Auckland, within the region and with export markets. Northland is a place-based economy. Roading in particular, is critical for Northland to develop and affects virtually every part of the economy*.

Specifically, the NEAP identifies the Project as needing to be route protected within 3 years (February 2019) and implemented sometime after year 5 (2021).

A number of sectors, identified in the NEAP as potential growth areas, require good links to markets and suppliers in Auckland and beyond. These activities include:

- Improving dairy and related production and processing
- Forestry and related wood processing, and especially growing wood processing including a new saw and pulp mill at Ngawha.
- Aquaculture (although the scale of this is probably more limited)
- Horticulture

Other opportunities identified in the NEAP that may depend on good links to Auckland would include:

- Marine manufacturing (links to suppliers and markets)
- International education
- Tourism

The governments PGF has supported initiatives identified in the NEAP and is considering further investment.

Issues and constraints

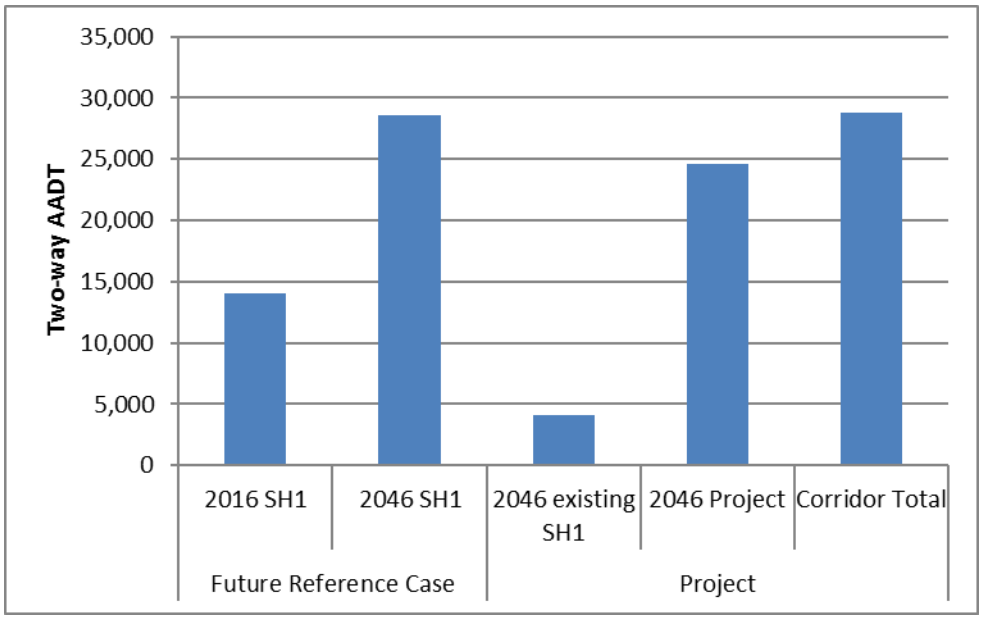
Transport demands

Transport modelling of the corridor has been undertaken to understand the forecast demand in the corridor. The Transport report that details these findings and forecasts is outlined in the supporting AEE documentation.

Figure 9 summarises the forecast transport demand in the corridor, showing a corridor demand in 2046 of nearly 30,000 vehicles per day.

[3] The other three are Digital Infrastructure, Water and Skills and Infrastructure.

Figure 9 : Forecast Traffic Demand



Transport constraints

The major constraints on solving these problems identified above include the limited alternative transport modes, the challenging terrain and ground conditions and the potential environmental effects of construction in the area. Table 4 summarises some of the challenges with alternative transport modes in this corridor that were considered in more detail in the Auckland to Whangarei PBC.

Table 4 : Alternative mode considerations

ALTERNATE	DISCUSSION
Passenger Rail	No plans to upgrade line for passenger services
Rail Freight	Significant upgrades to the current rail line are required to make it viable for more industries. Even with these upgrades there is little scope to transfer significant volumes of additional freight from road to rail. Main commodities using rail (dairy, forestry and cement products) are already at capacity. The demand for passenger rail in Auckland also limits the line's capacity to accommodate freight. Limited potential for increased capacity with resources currently available.
Coastal Shipping	Remote location means that double handling costs are high. Road based transport is still required to transport goods to the main markets in Auckland and south. Significant road demand is still required to access Northport.
Pipeline	Plans to increase refining production at Marsden Point may put pressure on pipeline capacity. There are plans to increase capacity but no timeframe for this has been given. This could increase the need for more fuel tankers on the route.

Walking and Cycling	Improvements in walking and cycling infrastructure can reduce demand for short town centre car-based trips. There is limited potential for mode shift to reduce SH1 demand due to highly dispersed rural nature of population base.
Public Transport	Limited inter-urban provision. Current and likely future levels of demand do not give value-for-money investment. Shuttle services cater for tourist trips. There may demand for services between Wellsford and Warkworth as the latter grows.

Rail is often outlined as an alternative opportunity for transporting freight. However, rail carries around 3.5% of freight by volume between Auckland and Northland. There are typically two return freight trains per weekday on the North Auckland Line between Whangarei and Auckland, one for logs and one for general freight (containers). The potential for a significant shift of freight to rail is limited for the following reasons:

- Existing track capacity is very limited, including tunnels undersized for modern container heights.
- Commodity movement origins and destinations do not fit with the existing rail network and require significant inter-modal transfer, which severely impacts the viability of rail from a cost perspective.

The physical constraints on the North Auckland Line have been recognised by KiwiRail. Investment in the rail line is currently being undertaken. Previous investigations have identified upgrading this rail line is costly and will take a number of years to implement given the works required to the existing bridges and tunnels along the line.

Coastal shipping contributes to 30% of freight movement by volume between Northland and Auckland. This is mainly confined to cement and petroleum products from Northport. Almost all cement products from Northland are moved by ship and nearly all petroleum products not moved by the Wiri pipeline are also transported by ship.

Northport suffers from its remoteness from New Zealand's main markets and producing areas and has had limited success in attracting container services. The future role of Northport is currently being reviewed, however in all scenarios being considered the role of SH1 is important to providing accessibility to the Auckland market.

These constraints were assessed in the Auckland to Whangarei PBC. This 'Alternative Modes' programme of interventions from this PBC was estimated to cost nearly five times the cost of the preferred Programme and performed sub-optimally against the PBC objectives.

However, with the renewed focus from GPS 2018 on mode neutrality and interest in enhancing the capability of the rail line in this area (and in particular to improving rail access to North Port) the potential implications of this on the corridor have been considered.

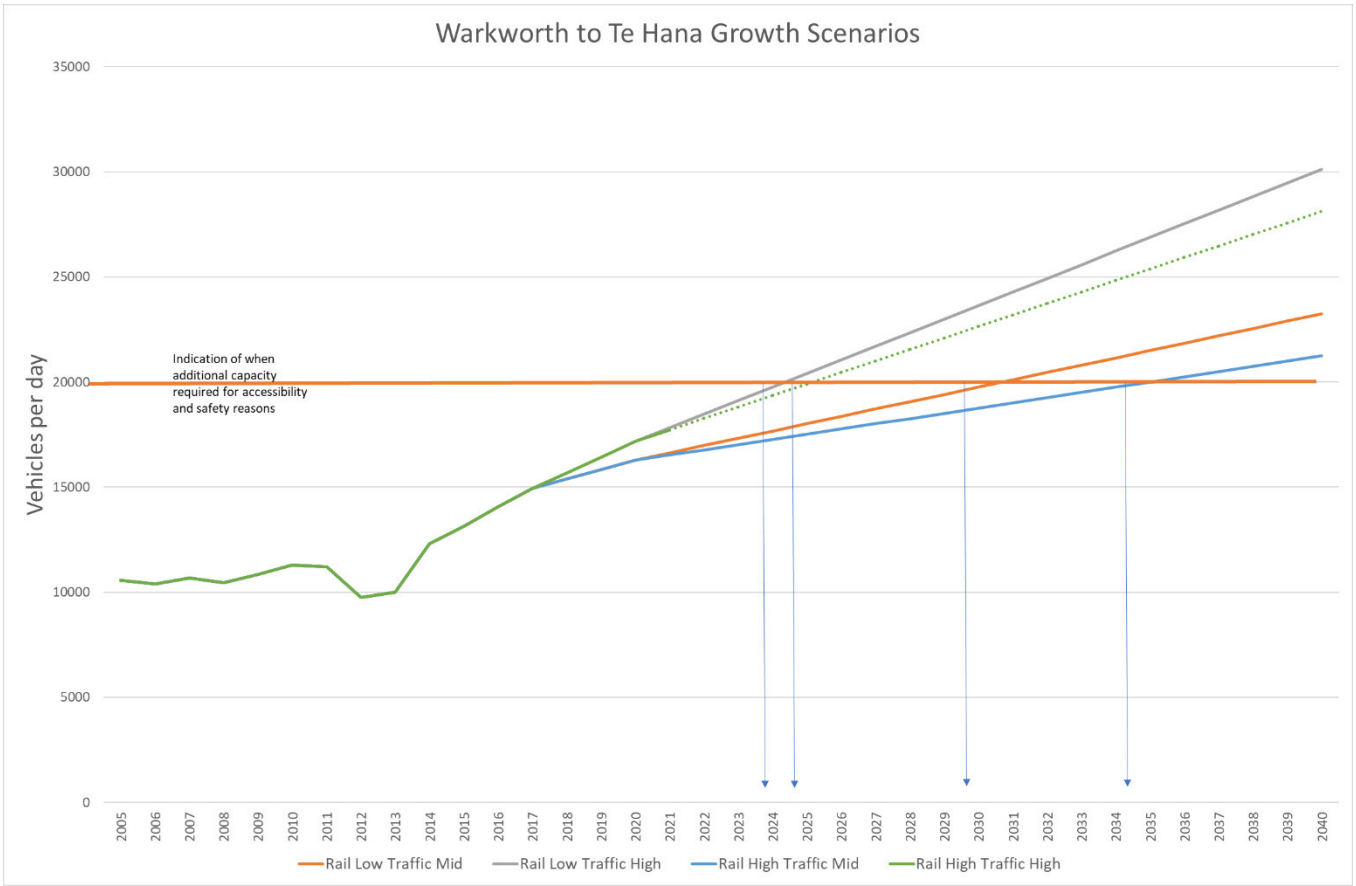
A review of the potential industries that could use an enhanced rail line has been considered to show the implications of the proposed rail investment. On this section of the corridor it is forecast to remove approximately 100 heavy vehicles from the state highway a day.

The impact of removing this traffic from the road network on a high and a medium traffic forecast as well as considering if the impact of rail was doubled (i.e. 200 vehicles a day

removed) was considered. The implications of this are shown in Figure 10 (assuming an indicative capacity of 20,000 vpd) . Note that 'Traffic Mid' assumes 3% growth (the long-term average), and 'Traffic High' assumes 5% growth (the current five year average is 10%).

This shows, dependent on road traffic growth assumptions, the implications of increased investment in rail is to delay the likely need for the Project by between 1 and (more likely) five years.

Figure 10 : Potential implications of increased rail investment in the corridor



Environmental considerations

Between Warkworth and Te Hana there are areas with significant natural resources, including three drainage catchments, being the Mahurangi River, the Hoteo River and the Oruwharo River. The Project also passes through four catchments, being the Mahurangi Harbour and the upper Kaipara Harbour inlets at Whakapirau, Te Hana and Maeneene Creeks. The Mahurangi Harbour CMA and is identified by the Department of Conservation (DoC) as an Area of Significant Conservation Value (ASCV).

The study corridor also contains areas of Outstanding Natural Landscape and Significant Ecological Areas as identified in the Auckland Unitary Plan.

Constructing a new transport link in the area is likely to have a number of potential social, cultural and environmental effects common to large infrastructure projects such as: noise,

visual, landscape and amenity effects, ecological effects, effects on the coastal and estuarine environment, freshwater effects, and heritage and social effects generated during both the construction and operational phases.

These constraints are similar in general nature to those encountered on the Pūhoi to Warkworth project, which were managed through design and route selection as well as through the designation and resource consent conditions imposed by the Board of Inquiry.

Social constraints

The Project area consists largely of farms, forestry and lifestyle blocks. While the land is sparsely populated, impacts on individuals and communities within the study area represent a key consideration for the development of options within the study area.

A social impact scoping exercise has been undertaken. Further assessment of impacts on individuals and communities will be undertaken in the pre-implementation phase.

The identified areas of focus from this scoping include:

- Property impacts
- Community severance
- Amenity during construction
- Economic performance of Wellsford and Te Hana

Physical constraints

The study area contains many areas of steep terrain, some of which are experiencing or have experienced significant mass movement due to the poor nature of the ground conditions in the area. In addition, there are some low-lying soft soil environments which would require specialised ground improvement works.

Construction in such an environment is difficult and design would need to account for the risk associated with the conditions experienced, often leading to increased levels of cost and complexity.

There are also a number of streams and waterways that need to be crossed. There are also waterways prone to flooding, including the Mahurangi and Hoteo Rivers and in particular Wayby Valley Road.

Land use

The land use in the study area is predominantly rural that is used as productive farming or horticulture. There are also areas of residential and commercial land in and around the town centres. Wellsford has zoning to allow for future increases in this residential, commercial and industrial activity around the existing town centre development.

The Warkworth area is an identified for significant growth with an increase in population from the current 5,000 to over 25,000. Structure planning for this growth is currently being progressed by the Council.

Refining New Zealand's liquid fuel pipeline also traverses the area and there is a waste water treatment plant to the south of Wellsford. There are also Transpower lines through the corridor and an extensive network of local roads.

Cultural constraints

As part of the SAR development (Appendix E of the SAR) Hōkai Nuku has undertaken a preliminary cultural constraints mapping exercise. This identified a number of areas of interest and potential sensitivity along the study area.

As part of the assessment undertaken by Hōkai Nuku it was noted that most of the cultural footprint features are not recorded heritage sites. Hōkai Nuku recommended further research and field work be undertaken to confirm the location and extent of all of these features before the potential effects of the Project can be fully identified.

Funding

$6M of funding is identified in the Regional Land Transport Strategy (RLTP) 2018-2028 for pre-implementation in the next three years.

There is no detailed design or construction funding identified in the current RLTP. This creates potential funding uncertainty for the implementation of the Project and will necessitate a relatively long lapse date for the Resource Management Act 1991 approvals.

Uncertainty

Given all of this context, there is uncertainty of the exact scale of challenges the corridor could face in the future. This uncertainty is driven by:

- The pace and scale at which growth in Warkworth is realised
- The pace and scale of the growth in the Northland economy
- The level of investment in the North Auckland Line
- The future role of Northport (and Auckland and Tauranga ports)

This uncertainty needs to be factored into the proposed implementation plan for the Indicative Alignment. There is the potential to identify triggers for implementation of the recommend option as a result of this uncertainty, to link implementation of the long-term option to certain outcomes occurring (such as the level of growth in Warkworth) which reduces the impact of this uncertainty.

OUTCOMES

Between Warkworth and Wellsford SH1 is classified as a High Volume National route in the ONRC, the highest classification. Between Wellsford and Te Hana the classification is a National Route.

The current state highway alignment falls considerably short of the ONRC classifications. This Project will provide a safer and more resilient transport corridor that will reduce the cost of travel for freight and tourism traffic in particular. This will provide a route commensurate with the ONRC classification and will also assist in improving performance of the wider Northland economy.

The approved Auckland to Whangarei PBC identified a number of outcomes and investment objectives for the corridor. The outcomes sought in the Warkworth to Te Hana section of the corridor are consistent with delivering on these wider corridor outcomes.

The outcomes sought by this Project as defined by investment objectives include:

- **Investment objective 1**: Improve resilience to key social and economic activities between Auckland and Northland through reduction in unplanned closures by 90% between Warkworth and Te Hana
- **Investment objective 2:** Improve safety for road users by reducing the number of DSI's by 100% between Warkworth and Te Hana
- **Investment objective 3:** Facilitate increase in Northlands regional GDP due to improved accessibility for freight for key markets between Warkworth and Te Hana by 30%
- **Investment objective 4:** Contribute to an increase in Northlands tourism market through improved accessibility for tourism trips between Warkworth and Te Hana by 30%.

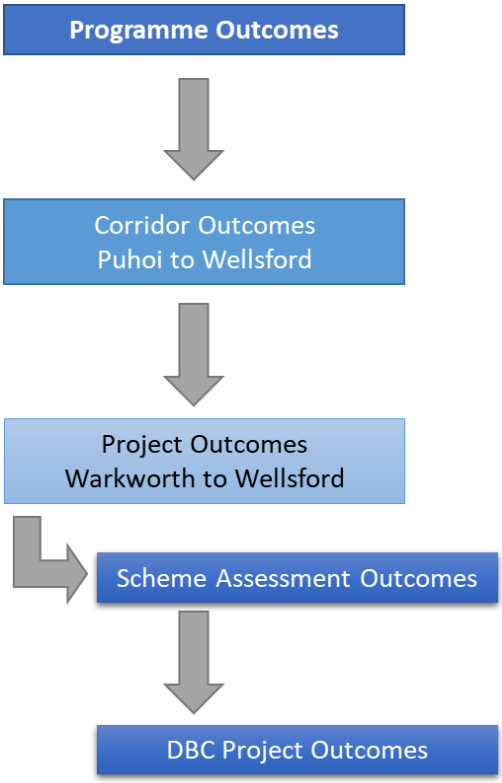
Strategic outcomes

As identified in the Auckland to Whangarei PBC[4], the strategic vision for the Auckland to Whangarei State highway corridor is a safe corridor which provides reliable journey times to support the economic growth of the region and access to key markets. The long-term goal is a divided carriageway on a good alignment between Auckland and Whangarei.

This DBC outlines the outcomes sought from investment in this Project. This section outlines how the DBC outcomes have cascaded from the PBC, through the DBC and ultimately into Project specific outcomes. This approach is summarised in Figure 11.

[4] Page 41 of PBC

Figure 11 : Outcomes Mapping



Programme outcomes

The Auckland to Whangarei PBC identified four programme benefits and three investment objectives (and their relative weightings) as follows:

- **Benefit 1**: Improved safety (25%)
- **Benefit 2:** Improved corridor reliability (30%)
- **Benefit 3**: Stronger regional growth and national GDP (30%)
- **Benefit 4:** Better return on transport investment (15%)

The following corridor investment objectives were also identified in the Auckland to Whangarei PBC.

- **Corridor Investment Objective 1:** We will steadily reduce the number of unplanned incidents so that SH1 between Pūhoi and Whangarei has no full closures without viable alternatives for all vehicles of less than 2 hours by 2030
- **Corridor Investment Objective 2:** We will improve safety along the corridor between Pūhoi and Whangarei by steadily reducing the number of deaths and serious injuries to at least a medium personal and collective risk (as defined by KiwiRAP) by 2030
- **Corridor Investment Objective 3:** We will facilitate regional growth and access to key markets through decreasing the cost of travel for freight and tourism between Pūhoi and Whangarei by 15% by 2030.

Measurement

It is important that the potential benefits of successfully investing can be assessed and measured in order to demonstrate ongoing delivery against investment criteria.

The Auckland to Whangarei PBC identified the key performance measures set out in Table 5 to measure the success of the proposed investment in the corridor.

Table 5: PBC Key performance measures

Investment objective	Investment KPI	Measure	Baseline	Target
Investment objective 1: Resilience	Reduction in incidents	Number of full closures per year	27 per year	0 by 2030
	Reduction in incidents without viable alternative	Closure of more than 2 hours with no viable alternative	18 per year	0 by 2030
Investment objective 2: Safety	Reduction in deaths and serious injuries	No. of deaths and serious injuries	144 DSI in 5 year period	58 DSI in 5 year period
	KiwiRAP risk rating on each section	Medium personal and collective risk rating	66% personal 11% collective achieve target	All sections achieve by 2025
Investment objective 3: Cost of travel	Reduced cost of travel	Average travel speed on corridor	76km/h	90km/h by 2030
	Northland regional GDP	GDP per capita	$35k in 2015 (74% of national average)	National average by 2030

The investment objectives identified for the Auckland to Whangarei PBC are consistent with the strategic outcomes for this section of the corridor (Warkworth to Te Hana).

Project outcomes

The first three corridor benefits identified in the Auckland to Whangarei PBC are considered applicable for this Project within that corridor. The fourth benefit related specifically to corridor wide investment, not specific Projects within the corridor. The fourth Auckland to Whangarei PBC benefit has therefore been removed. The 15% weighting of this benefit has been reallocated to Benefits 1 and 2 on the basis that delivering Benefits 1 and 2 will assist in realising Benefit 3, being stronger economic performance. The applicable Project Benefits are therefore summarised below:

- **Benefit 1:** Improved safety (35%)
- **Benefit 2:** Improved corridor reliability (35%)
- **Benefit 3:** Stronger regional growth and national GDP (30%)

These benefits confirm that the predominant benefits sought relate to safety and reliability/resilience.

During the Project development and in particular during the early stages of the SAR phase, Transport Agency objectives were developed. The SAR has been developed on the basis of these objectives for the Project. There were two levels of SAR Objectives, firstly objectives for the entire Ara Tūhono Pūhoi to Wellsford project and also specifically for the Warkworth to Wellsford section.

The Transport Agency's general Objectives for the Pūhoi to Wellsford project are:

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

The Transport Agency's SAR Objectives for the Warkworth to Wellsford section were to:

- Increase corridor capacity, improve route quality and safety (e.g. gradient, alignment, overtaking), improve freight movement and provide resilience in the wider State highway network.
- Improve travel time reliability and decrease travel times between Warkworth to Wellsford and Northland
- Alleviate congestion at Warkworth and Wellsford by providing for through traffic.

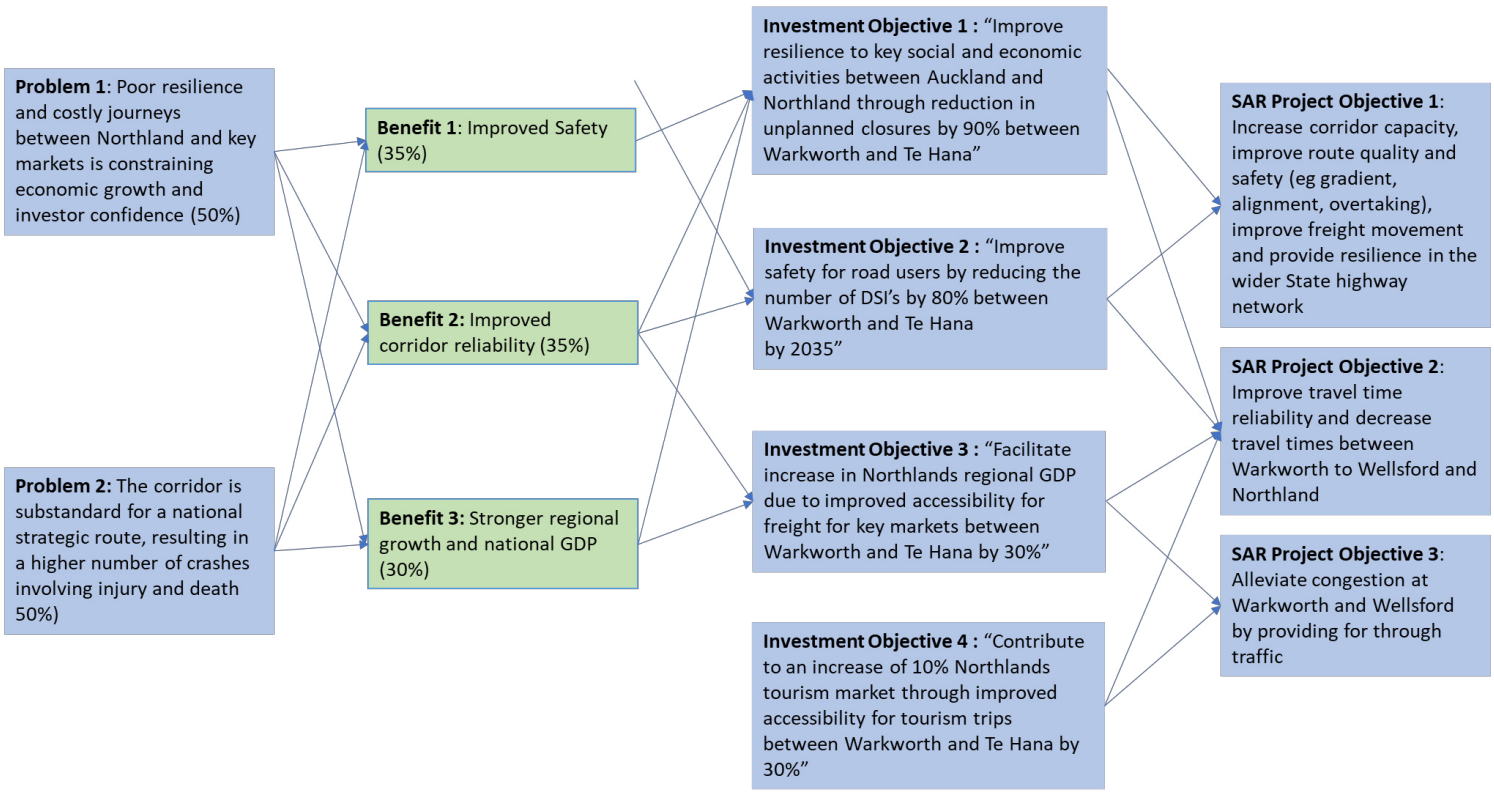
These Project objectives are in the language of the time (2010 – 11) and not consistent with the language used in the business case process. The following Project investment objectives (and therefore outcomes) were therefore developed for the Project. This included taking the previous Project objectives and the PBC objectives and creating Project-specific investment objectives. The outcome of this is shown below:

- **Investment objective 1:** "Improve resilience to key social and economic activities between Auckland and Northland through reduction in unplanned closures by 90% between Warkworth and Te Hana"
- **Investment objective 2:** "Improve safety for road users by reducing the number of DSI's by 100% between Warkworth and Te Hana"
- **Investment objective 3:** "Facilitate increase in Northlands regional GDP due to improved accessibility for freight for key markets between Warkworth and Te Hana by 30%"

- **Investment objective 4:** "Contribute to an increase of Northlands tourism market through improved accessibility for tourism trips between Warkworth and Te Hana by 30%

Figure 12 maps the relationship between the Project problems, benefits and investment objectives.

Figure 12 : Problem, benefit and investment objective mapping



These Investment Objectives are consistent with the Auckland to Whangarei PBC investment objectives with more focus on the Warkworth to Te Hana area of influence rather than the wider corridor. The changes made from the PBC Corridor Objectives include:

- The resilience objective (Investment Objective 1) has focussed on ensuring no full closures in the area. The PBC inclusion of a time limit (2 hours) is more applicable to the overall corridor rather than specific Projects.
- The safety objective (Investment Objective 2) is consistent with the PBC Corridor Objective. The target reduction of DSIs of 100% is due to the fact that the Dome Valley Safety improvements is in the Do Minimum and that this Project should therefore be seeking to address the remaining accidents.
- The regional growth objective (Investment Objective 3 and 4) is about increasing the accessibility to key markets for freight and tourism customers that travel along the route. A 25% target has been identified for the Project, whereas the PBC target was only 15% (for cost of travel reduction). This change is due to the fact that the PBC included a number of sections where no changes in travel are proposed (given the

flat terrain between north of the Brynderwyn Hills and Ruakaka as an example) and those areas with higher costs of travel (such as the Dome Valley) need to reduce the cost by more than 15% for a corridor wide outcome of 15%.

- Investment objective 4 is focussed on the tourism industry. The Twin Coast discovery PBC identified a 40% increase in tourist spend as a result of that programme. The 10% target has been identified for this Project as the increase in accessibility is considered to offer considerable benefits to this sector, but not of the same order of that of the more targeted Twin Coast Discovery PBC.

The PBC investment objective related to providing a clear strategy and certainty to deliver confidence in infrastructure and therefore economic growth is corridor related and therefore not applicable for an individual Project. However, this certainty can be provided this Project and also a clear implementation plan, including route protection in the short-term to give confidence of the location in the short-term.

Figure 12 also maps the investment objectives to the SAR Project objectives. This shows that there is a relationship between a number of the different objectives. Delivering against investment objective 1 will also deliver against the first two Project objectives identified in the SAR and investment objective 2 will also deliver against these first two SAR Project objectives. The third and fourth investment objective will also deliver against the SAR Project objectives 2 and 3.

Whilst the Project objectives used in the SAR are worded differently to the proposed investment objectives in this DBC, their intent is the same and therefore SAR work remains a valid and essential part of this route protection DBC.

No specific weighting was given to the investment objectives, however the oder in which they appear reflects the priority of outcome, being a safe and resilient connection that provides enhanced economic performance for the greater Northland region.

A review of these investment objectives against the 2018 GPS has also been undertaken and they are considered consistent with the outcomes of the 2018 GPS.

KPIs

Ensuring the outcomes of the investment objectives are achieved requires the development of appropriate measures. Table 6 sets out the indicative KPIs. These have been developed to best measure the success of the investment objectives proposed. It is important to note that whilst dates have been identified, this is based on the current forecast need for the long-term option. More detailed benefits realisation work will need to be undertaken during the proposed ”Implementation Business Case” and take account of the outcomes of any short-term measures.

Table 6 : Business Case KPIs

INVESTMENT OBJECTIVE	INVESTMENT KPI	MEASURE	BASELINE	TARGET
Investment objective 1: Resilience	Reduction in incidents	Number of full closures per year	9 full closures in 5 years. Average of 1.8 closures per year	0 by 2030
	Reduction in incidents without viable alternative	Closure of more than 2 hours with no viable alternative	Average of 1.8 closures per year	0 by 2030
Investment objective 2: Safety	Reduction in deaths and serious injuries	No. of deaths and serious injuries	88 DSI in 5 year period	0 DSI in 5 year period
	KiwiRAP risk rating on each section	Medium personal and collective risk rating	58% of corridor above medium risk	All section achieve by 2025
Investment objective 3: Economic Growth	Northland regional GDP	GDP per capita	$35k in 2015 (74% of national average)	National average by 2030
	Increased Accessibility	Average travel speed on corridor	77km/h	90km/h by 2030
	Certainty of Access	Route Protection in place	n/a	By 2020
Investment objective 4: Tourism Growth	Northland regional Tourism Spend	Total annual tourism spend	$1Bn in 2006	$1.1Bn by 2030

STAKEHOLDERS

Stakeholders have been involved throughout the Project development. This has included local and regional councils, iwi, interest groups, affected property owners, affected communities and the general public. This involvement has helped shape the Project and the Indicative Alignment.

Stakeholder involvement will continue to be a key part of the Project moving forward with public consultation on the Indicative Route having been undertaken in early-2017 and this feedback captured. This feedback and further technical work has helped develop the current Indicative Alignment..

Property owners have been consulted with and will continue to be as the Project progresses through the next statutory approvals phase.

Overall there is strong support for the Project and agreement with the Project objectives from stakeholders based on public consultation on the Indicative Route. A common theme from stakeholders was to understand the timeline for construction. There are localised areas of concern for property owners, particularly at the Warkworth interchange end of the Project. These issues have been a focus of the Indicative Alignment development.

Consultation and communication approach

The communications and engagement approach has been built upon the targeted consultation undertaken in early 2010.

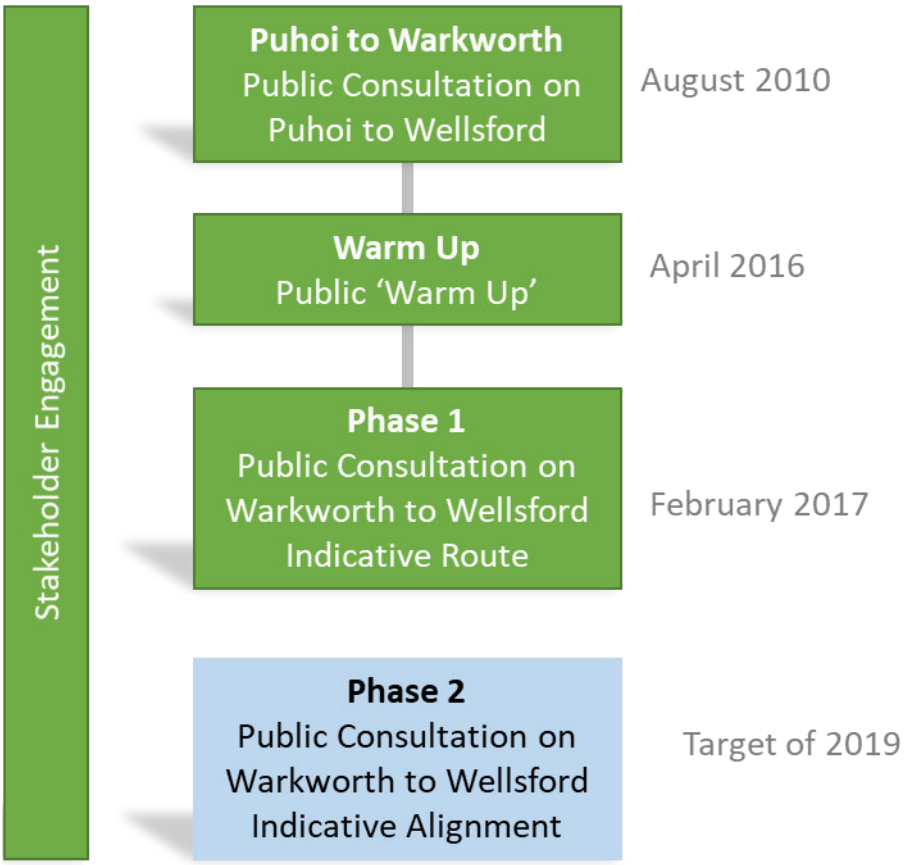
The engagement plan will be updated to guide the communications and engagement through to lodgement of a Notice of Requirement (NoR) and resource consents in 2019.

The purpose of the engagement for the Project has been and continues to be to:

- Inform affected parties and communities
- Achieve understanding of the proposed works and their effects
- Gather knowledge from the community
- Understand others' viewpoints
- Enable others' views to be taken into account and respond to concerns where appropriate
- Minimise misinformation/misunderstanding
- Fulfil the requirements of the Land Transport Management Act 2003

Figure 13 illustrates the engagement undertaken as part of the Project development.

Figure 13 : Project engagement timeline



As outlined in Figure 13 formal public engagement has been undertaken in four phases, being:

- **Puhoi to Wellsford:** This covered the entire Ara Tūhono Pūhoi to Wellsford project and was Project principles focussed. During this phase, the Transport Agency sought feedback from potentially affected parties on the then proposed key design principles, discussed potential connection/access points for the highway, and gathered local knowledge of potential constraints in the local area.
- **Warm Up:** This phase informed the public through open days of the upcoming consultation on an Indicative Route, given that until this point there had been a hiatus regarding communication on the Warkworth to Wellsford section since 2010.
- **Phase 1:** This presented the Indicative Route to affected properties and the wider public.
- **Phase 2:** This presented the Indicative Alignment for which designation and consents will be sought

All communications and engagement processes have adopted the principles of the International Association of Public Participation (IAP2). This engagement has included:

- Newsletters

- Interactive website
- Individual meetings
- Social media
- Open days
- Workshops
- Formal letters (property owners)

The use of the interactive website to engage with the public on this Project has proven to be a very effective means of gathering feedback and public perspectives on the Project.

Parties engaged with

As well as these four distinct phases of public consultation there has also been extensive engagement with a number of stakeholders that have been identified in the following groups:

- Directly affected – properties directly impacted by the proposed route.
- Immediately adjoining neighbours – properties adjoining those that are directly affected.
- Balance of potentially affected properties – other properties within proximity to the alignment that could potentially be affected by the Project (by visual, noise or other temporary effects).
- Area wide organisations – includes government agencies (national, regional and local including emergency services), non-government organisations (NGOs) and advocacy groups (including road user groups and business groups) with wider interest interests (that is, beyond individual properties).
- Mana whenua.
- Wider community of interest – any other person expressing an interest in the Project, irrespective of location.

This has occurred over a long period, from the initial Auckland to Wellsford Strategy Study, through to the present day. Specific parties included the following:

- Directly affected property owners
- Project neighbours
- General public
- Local communities
- Auckland Transport
- Auckland Council
- Northland Inc
- Northland Regional Council
- Kaipara District Council
- Local business and community groups
- Central Government agencies, including DOC
- Heritage NZ
- Hōkai Nuku and other iwi

Since 2010, the Transport Agency has had an established relationship with a number of iwi on the Pūhoi to Wellsford project. A partnership was formed in 2010 by mana whenua within the Project area, namely Ngāti Manuhiri (Ngāti Wai), Ngāti Mauku/Ngāti Kauwae (Te Uri o

Hau), Ngāti Rango (Ngāti Whātua o Kaipara) and Ngāti Whātua iwi. This collective is called Hōkai Nuku.

Hōkai Nuku is mandated by their members to ensure that the enhancement of cultural footprint and values associated with collective mana whenua interests is an integral component of the Ara Tūhono Pūhoi to Wellsford project.

Acknowledging other iwi or hapū with declared interests in the Warkworth – Wellsford area, the Transport Agency has also engaged with Ngati Maru and Te Kawerau a Maki.

Stakeholder views

Puhoi to Wellsford Phase

The feedback gained from this initial consultation was an important input into Project development, with issues raised and opinions expressed carefully considered in the development of the Indicative Route. The publication of the key design principles in June 2010 provided opportunities for the community to assess the potential effects of both the underlying strategy and a specific Indicative Route on themselves, their family, their property and their community as well as to address what they might perceive as matters of public interest (such as the viability and desirability of the Project).

The feedback that has been received can be grouped into the following three levels:

- **Strategic:** focussed on the overall desirability of the Puhoi to Wellsford project, both endorsing and opposing the proposal
- **Design related:** focussed on the key design features of the route including the offline route, the position of the Warkworth bypass, the number and location of access points, and staging
- **Local effects related:** focussed on the impacts of the proposal in specific locations and potential remedies.

These three levels are reflected in the main themes in the feedback. These themes are listed below together with their feedback level:

- Endorsement of the Project as presented both in terms of the overall strategy, accompanied in some cases by urging to get on with construction (strategic)
- Challenges to the viability and desirability of the Puhoi to Wellsford project, mainly in terms of Project economics and potential environmental impact (strategic)
- Advocacy of the allocation of the funding proposed for the Puhoi to Wellsford project to other transport infrastructure in the Region (strategic)
- Advocacy of an upgrade through The Dome to reduce the number of accidents in that area (strategic)
- Advocacy of upgrading the existing SH1, with or without bypasses for Warkworth and Wellsford rather than an offline route (design).

Warm Up Phase

During the general Warkworth to Wellsford 'Warm Up' to advise the public of formal public consultation nearer the end of 2016, feedback was also sought for the Auckland to Whangarei PBC. Over 980 submissions were received and as part of this PBC consultation

they were asked to rank their priority for investment in the corridor. 860 of the submissions prioritised Dome Valley as the area needing transport investment due to safety risks, speed restrictions and resilience (significant detours during unplanned events).

There was also commentary on the need to bypass Wellsford due to the current levels of congestion as a priority from this engagement.

Phase 1

Based on the public consultation held in February 2017 (over 650 people in attendance) the overall themes from stakeholders were:

- Very positive response to the need for the Project and agreement with its objectives (rare to have near universal agreement with a Project in principal)
- The most recurring comment has been when will it be built / get on and build it (including from directly affected land owners)
- Start building it before Puhoi to Warkworth opens – people will come off a motorway into the difficult Dome valley road – safety concern
- A lot of change and development occurring in the area with people building new homes, additional dwellings and spending on improvements

Specific issues by area along the route are summarised below:

Warkworth area:

The main focus in this area was the form, function and location of the Warkworth interchange. There were a number of concerns raised in relation to the size, scale and resultant implication on the environment and in particular the social impacts of residents along Kaipara Flats Road. Specific concerns were also raised in relation to specific features (heritage and vegetation) that were of significance to local residents.

How the interchange would interface with the wider operation of the transport system in Warkworth was also raised given the proposed growth and improvements proposed in the area.

Flooding in the area was also a topic raised consistently, to ensure the Project team understood the issues and also the implications of the Project on these flood areas.

Forrest/Dome area:

The safety of the existing state highway was the main topic in this section, as well as ensuring that the tunnel was appropriately sized given the permanence of the infrastructure when it is a tunnel. Localised impacts during construction were also discussed and raised.

Wellsford area:

This area of the Project provided the strongest support for the Project, largely driven by the impact of traffic through the town centre at present. There was also discussion around the rate of growth at Mangawhai and ensuring this is adequately catered for.

Whilst there was strong support for the new alignment, ensuring Wellsford remained a viable stop for traffic was also raised.

Like Warkworth, the issue of flooding around Wayby Valley Road was also raised by a number of attendees.

Te Hana area:

Localised access issues were the main focus in this area for affected land owners. There was also discussion around the rate of growth at Mangawhai and ensuring this is adequately catered for.

The tie in location worried residents due to safety risks of private access, local road, narrow bridge (Maeneene) and current alignment up to Ross Road. Indications were a preference for the new alignment to tie in further north (ideally continue through to Kaiwaka).**Environmental/cultural/historical interest:**

There were also a number of alignment wide issues raised, including:

- There are lots of pockets of vegetation valued by the community – how/are these being avoided Some have historical value.
- Concern how/if noise and visual effects to/from neighbouring properties can be mitigated
- Flooding is widespread in the area
- Flora and fauna in and around streams and in pockets is known and valued in both Warkworth and Wellsford area

Land owners (both neighbours and directly affected):

There were also a number of specific property and land use issues identified. The process for future neighbours to the alignment was a particular issue raised. There was also concern over the uncertainty this the Project process was going to have on property owners and the wider community.

There was also feedback provided that the proposed alignment was going through some of the more productive pastoral land in the area and the impact on farming viability that could result.

Targeted discussion with local authorities

The Transport Agency sought feedback on the Project from Auckland Council, Auckland Transport, and Kaipara District Council in 2016 to help guide the development of the PBC and SAR and to inform the route selection process. Initial comments were made at a staff level only and are based on a high level presentation on early potential alignments and principles rather than a specific alignment.

This engagement highlighted the impact that infrastructure of this scale could have on the local land use and infrastructure and that these impacts should be considered in the development of the Project as it moved forward and an Indicative Alignment was selected.

ALTERNATIVE AND OPTIONS ASSESSMENT

Identification of the preferred transport solution to connect Auckland and Northland has occurred over a long period of time and has involved numerous studies including the most recent Auckland to Whangarei PBC.

The SH1/16 Auckland to Wellsford Strategic Study in 2008 looked at the roles of SH1 and SH16 in providing strategic transport links to the north. The study developed corridor options to accommodate future demand between Auckland and Wellsford. The study recommended that SH1 corridor provides a nationally strategic role, with SH16 serving a regional function.

Subsequently the Auckland to Whangarei Strategic Study (2010) looked at the SH1 road corridor in terms of its role within the multimodal transport network between Auckland and Whangarei. The road corridor was identified as the preferred option to accommodate the forecast increased demand on the Auckland to Whangarei corridor. The study found that alternative modes such as rail or coastal shipping networks were unlikely to be economically viable to significantly reduce demand for road based freight transport.

A long list of options was then considered for the upgrading of transport connections in the wider SH1 corridor. This included the consideration of alternative modes, online upgrades, new offline routes with many different sub-options within each of these options. This was undertaken for the full route from Pūhoi to Wellsford.

At that point the consideration of options was split into two sections, being Pūhoi to Warkworth and Warkworth to Wellsford. A long list of options, including online and offline solutions were then developed for the Warkworth to Wellsford section. The split point was Perry Road in the south of Warkworth to ensure sufficient overlap of the two sections.

The off-line optioneering included a wide range of options of varying standards and alignments. Due to the topography of the area the scale of earthworks was substantial and the consideration of tunnels and viaducts was undertaken to reduce the potential environmental impact.

At that time (2016) the Pūhoi to Warkworth Project details were better known and the Auckland to Whangarei PBC was being completed. This resulted in a more detailed consideration of the Warkworth interchange interface with the Pūhoi to Warkworth Project. Options for extending the northern tie in point of the Project to north of Te Hana were also investigated.

An MCA analysis was undertaken for the short listed Sector 4 and Sector 5 options and an indicative route from Warkworth to Te Hana was identified. The Indicative Route was then made public and affected property owners, stakeholders and the general public were consulted on this indicative route.

The Indicative Route was then refined to address feedback and further technical analysis, including specific refinement of the Warkworth Interchange, the Northern connection point and general alignment enhancements to arrive at an Indicative Alignment.

Option Development

Identification of the preferred transport solution to connect Auckland and Northland has involved numerous studies since 2006. Alternatives were assessed at all stages of Project development, commencing at a broad scale and systematically narrowing the geographic area from potential corridors down to the Indicative Alignment.

Early strategic studies identified the SH1 corridor, rather than the SH16 corridor, as the preferred route to accommodate the forecast increased demand on the Auckland to Whangarei corridor. In 2010, a long list of corridor options was developed and subsequently assessed and following the results of the assessment a short list of options for the Project alignment was identified.

The long list of corridor options included online and offline options with the online options not favoured throughout the Project development process.

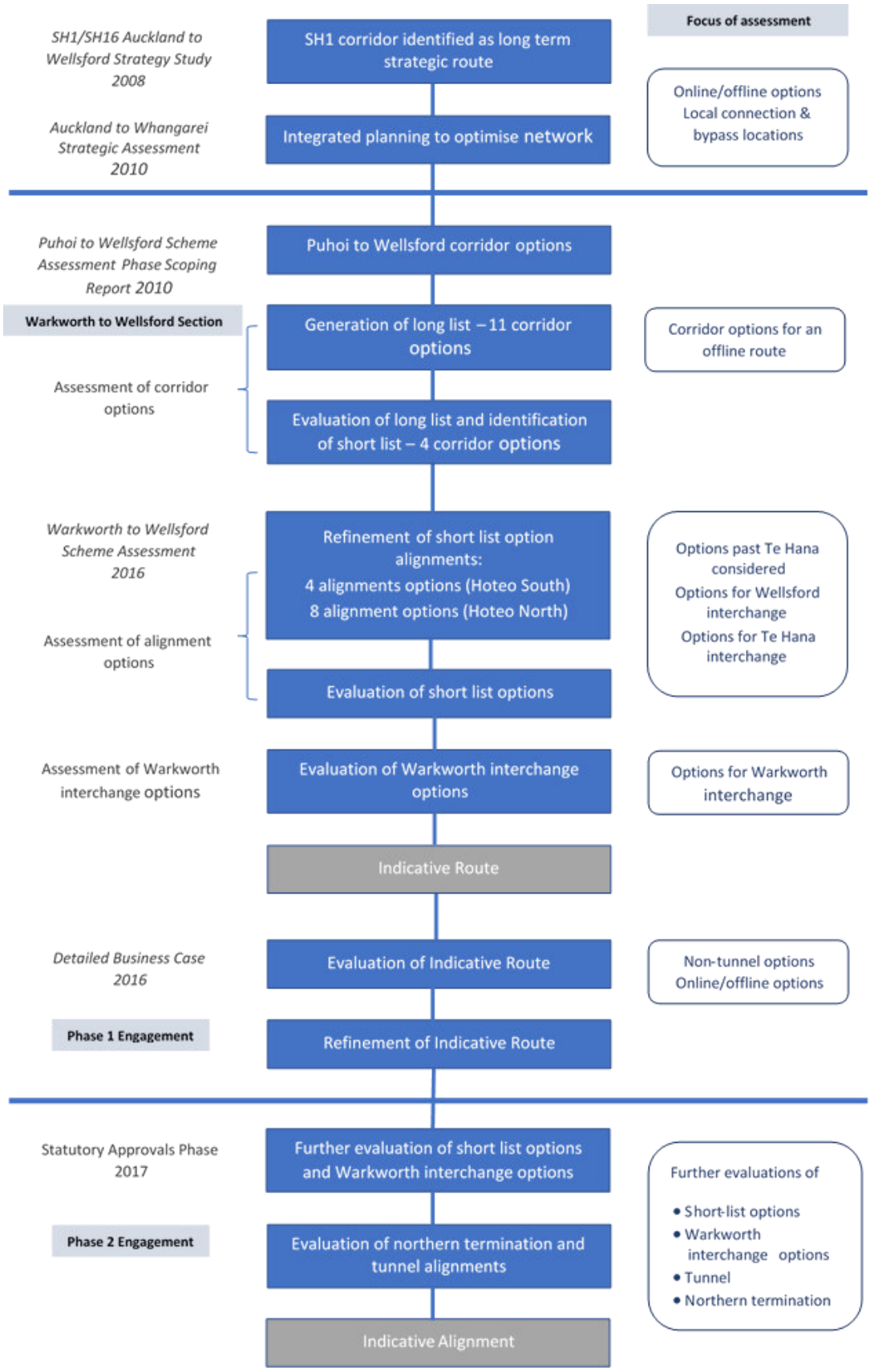
In 2016, a number of refined short-list offline options were considered which provided for a tie-in north of Te Hana, and connections to Mangawhai and Wellsford. From these short-list options, an Indicative Route from Warkworth to Te Hana was identified. In 2017, the Indicative Route was refined based on environmental and other constraints as well as inputs from the community engagement on the Project undertaken in February 2017. An Indicative Alignment for the Project was subsequently confirmed by the Transport Agency in 2017.

The process to confirm the Project and to define a corridor, Indicative Alignment and proposed designation boundary has been highly iterative. It has involved on-going refinement on the basis of information progressively derived from desk top studies, field work and detailed environmental investigations, geotechnical investigation, design development, operational and cost considerations, and engagement with key stakeholders and the community.

The key reports and broad methodology used for the development and options evaluation is shown in Figure 14.

An AEE for the Indicative Alignment is being completed in parallel to this DBC being finalised. The AEE includes a detailed report summarising of the assessment of alternatives undertaken for this Project.

Figure 14 : Option development approach



Indicative Route to Indicative Alignment

An Indicative Route was selected through a multi criteria assessment with regard to the feasibility, engineering constraints and potential environmental, property and social impacts which the option may have. Significant environmental effects have been avoided wherever possible through route choice and the remaining unavoidable impacts are considered to be able to be mitigated through further design development. Implementability and operability were included as assessment criteria in the evaluation of potential options, and the Indicative Route has since undergone further assessment against the implementability and operability of the option.

Subsequent to stakeholder consultation the Indicative Route was refined based on further technical and environmental assessment and feedback received, and an Indicative Alignment confirmed. This refinement was focused on:

- Northern tie in and Te Hana interchange
- Warkworth interchange
- General alignment

The Indicative Alignment is the option that this DBC is based upon.

Key elements of the option development to highlight in the DBC context are:

- Alternative modes
- Online vs offline
- Interchange form and location
- Need for tunnel

Alternatives analysed

One of the key objectives identified in the 2009 GPS was the need to make better use of existing transport capacity. To ensure that existing capacity is maximised before investment in new infrastructure is undertaken, a key component of the 2010 Auckland to Whangarei Strategic Study was the assessment of the existing and potential future capacity of transport modes.

The Auckland to Whangarei Strategic Study investigated existing and potential future transport modes between Auckland and Whangarei. The study indicated that it was not economically viable for either the rail or coastal shipping networks to significantly reduce demand for road based freight transport. The key recommendation of the Auckland to Whangarei Strategic Study was that road based transport was the only mode where a significant increase in capacity was possible to accommodate increased demand along the transport corridor between Auckland and Whangarei.

The report indicated that the section of SH1 between Pūhoi and Whangarei is under pressure with high HCV and general traffic demand, particularly during peak periods. It was recommended that this section of route be improved as a priority to accommodate this demand.

These alternative modes were also considered early in the option selection process (2010) as part of the Puhoi to Wellsford Scoping Report and again by the Auckland to Whangarei PBC and included:

- Passenger rail
- Rail freight
- Coastal shipping
- Walking and cycling
- Public transport
- Road upgrades (online and offline)

The Auckland to Whangarei PBC subsequently looked at the alternatives and concluded that other than road based transport these alternatives did not meet the objectives of the corridor and have confirmed the findings of the earlier studies and reports.

Rail is often outlined as an alternative opportunity. However, rail carries around 3.5% of freight by volume between Auckland and Northland. There are typically two return freight trains per weekday on the North Auckland Line between Whangarei and Auckland, one for logs and one for general freight (containers). The potential for a significant shift of freight to rail is limited for the following reasons:

- Existing track capacity is very limited, including tunnels undersized for modern container heights.
- Commodity movement origins and destinations do not fit with the existing rail network and require significant inter-modal transfer, which severely impacts the viability of rail from a cost perspective.

Depending on the growth rates that occur for both rail and road traffic, the forecast impact of increased rail investment on road based freight could result in a potential delay to the need for this Project by between one and five years. This is not considered to be a material impact on the Project.

Offline vs Offline Alignments

In October 2010, the Transport Agency Board resolved that further consideration should be given to lower cost options for the Project, given the magnitude of the capital cost estimates for the offline alignment. Moreover, the October 2010 board resolution sought to achieve a greater percentage reduction of the construction capital cost (than the 15-20% predicted). Based on this outcome, the decision was made to investigate further online options as an interim measure with the aim of achieving some of the Project objectives at a substantially reduced cost.

A number of additional online options were considered for the Project and assessed to allow comparison with offline options. The online options were developed to provide an initial indication of the level of upgrade achievable for a certain level of cost and did not attempt to optimise their scope. These additional options were principally intended to address the safety issues through the Dome Valley and the traffic issues in Wellsford.

The work undertaken to develop and assess the online options is fully reported separately in the *"Warkworth to Wellsford Online Options: Initial Assessment Report 2010 (Rev 2 Draft,*

August 2011)" which is included in Appendix K of the SAR. The following sections give an overview of this work and the report findings.

There are a broad range of alternatives that could be developed for an online upgrade of SH1. The potential upgrade options included the provision of median barriers, sight distance and curve improvements, super elevation corrections, shoulder widening, passing lanes and intersection upgrades.

A range of scenarios were developed in 2010 for the online options based on establishing a broad understanding of what level of upgrade may be available for a particular level of cost.

For the purposes of the development of these online options, the route between Warkworth and Wellsford was split into two sections:

- Warkworth to the Hoteo River (Dome Valley)
- The Hoteo River to Wellsford (Wellsford Bypass).

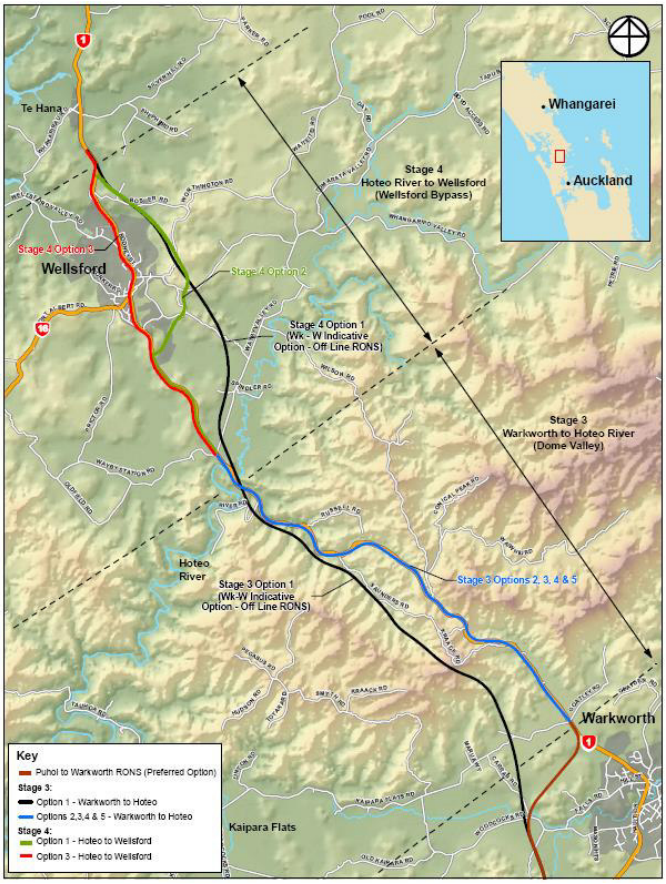
Figure 15 shows these options with the following sections describing the options in further detail.

Sector 4 Warkworth to Hoteo River (Dome Valley) online options description

The following online options were developed and assessed (noting that in the descriptions below, option 1 was the offline option):

- Option 1 was the offline option selected as being the best performing offline option
- Option 2 (Online): Online Expressway – four lane, 80 km/h expressway
- Option 3 (Online): Significant Upgrade of SH1 – upgrade to a 2+1 configuration (alternate direction passing lanes each approximately 1.5 km long provided through the length of the upgrade)
- Option 4 (Online): Moderate Upgrade of SH1 – safety focussed upgrades based on the inclusion of a median barrier over the full length plus localised improvements including some curve improvements and additional passing lanes
- Option 5 (Online): Minor Upgrade of SH1 – safety focussed upgrade based on the inclusion of a median barrier over the full length. Since this analysis was undertaken the Safer Roads Alliance have commenced delivery of a scheme similar to this option..

Figure 15: Online options considered



Hoteo River to Wellsford online options

The following two options were developed and assessed in 2011:

- Option 2 (Online): Two lane Wellsford bypass – an online upgrade of the existing SH1 alignment from north of Wayby Valley Road to a point just north of the Wellsford Golf Club and then a two lane bypass of Wellsford to the east.
- Option 3 (Online): Four lanes through Wellsford – management of SH1 through Wellsford township to provide four lanes including removal of on street parking and provision of an off street parking facility in Wellsford and pedestrian signals or a pedestrian bridge on SH1.

Do-minimum option

The do-minimum option is the baseline against which the options were assessed.

With the appraisal area extending between Warkworth in the south and Vipond Road north of Te Hana, the only infrastructure improvement assumed to be in place over and above the existing situation is the Pūhoi to Warkworth section of the project. This ties in to the existing SH1 at a two-lane roundabout between Hudson Road and Kaipara Flats Road to the north of Warkworth. All other infrastructure improvements in the Auckland Region are consistent with Auckland Transport Alignment Project (ATAP) and the Auckland Regional Transport (ART) model from which the regional transport demands have been developed.

Online options assessment in SAR

After an analysis of the performance of these online options relative to other offline options it was concluded that whilst these options provided an opportunity to reduce the cost of an upgrade between Warkworth and Wellsford, they did not deliver on the SAR project Objectives to the same degree as the ultimately selected option (Sector 4 Option 1 and Sector 5 Option 7). The online options also have the following disadvantages compared to the offline:

- Constructability challenges whilst maintaining access given the terrain and geotechnical environment results in additional cost and duration of construction given the constraints of working within the existing environment
- Duration of construction is longer by a number of years due the need to keep the existing road operational and during construction within the same corridor
- Long-term access to existing SH1 limits performance and options in the future as existing access points along SH1 will need to be maintained

The relative cost compared to offline solutions was also similar. So whilst there were some areas where online options provided the benefits and outcomes sought, online options have a number of key disadvantages over offline options as outlined above, including lower standard options.

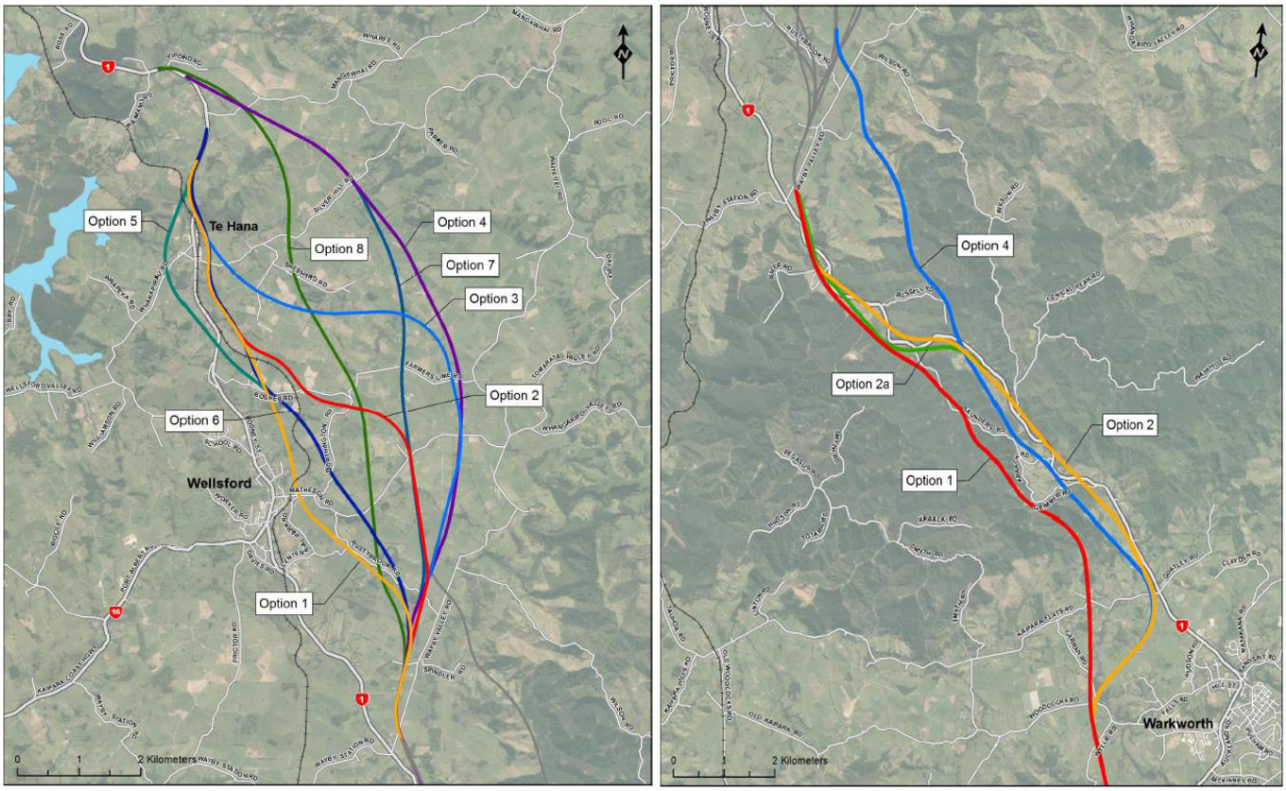
Online and offline assessment in this DBC

Through this DBC phase the online options were assessed using the same MCA criteria adopted for the short listed offline option assessment in order to test and to confirm this initial assessment from the SAR.

The SAR includes a detailed assessment of a wide range of long list options such as different alignments and design standards. This concluded that options to lesser design standards provided less benefits but due to the terrain in the area resulted in a similar level of environmental impact and cost. This DBC has focussed on the short list options from this process.

In undertaking this assessment these offline options were compared against each other and the Do Minimum. The short listed SAR offline options for Sector 4 and 5 are shown in Figure 16..

Figure 16 : Short list offline options



Evaluation of alignment options

Only the offline options were assessed through the MCA process in the SAR. This DBC then took the online options through this same MCA process. During the SAR MCA of offline options, a number of the assessment criteria that provided differentiation between the long list options in the scoping phase became non-differentiators when evaluating the short-list options. For example, given there was little difference in the length of the short-list offline options within each sector, the overall network travel times were similar for all options and so the extent to which the options will enhance inter-regional and national economic growth and productivity became a non-differentiator.

During the evaluation of the short-list options, the non-differentiators were not scored and not used as part of the evaluation, in order that they did not diminish the differentiation between options resulting from other criteria which were differentiators. These non-differentiators, however, have been included in the evaluation framework for completeness and to record their consideration as part of fulfilling the LTMA objectives, corridor objectives, and Project objectives.

In determining which criteria would be considered as non-differentiators, only the comparison between short-list options was considered. Almost all criteria would differentiate between the short-list options and the do-minimum option, however, the purpose of the evaluation was to identify an Indicative Route and, through the evaluation of options, all the options being considered performed better than the do-minimum option, in an overall sense.

As part of this DBC the online options were put through the MCA process. At this point many of the criteria identified as 'non differentiators' for the offline assessment did indeed provide differentiation when compared to an online option. The assessment of the online options in the MCA also made an assessment of the offline options for these newly identified 'differentiating' assessment criteria. All offline options were given the same score as it had previously been determined that there was no differentiation between these options for these criteria.

Option evaluation - Sector 4

The evaluation results for the Sector 4 options between Perry Road and the Hoteo River are included in Table 7. Appendix A provides the more detailed evaluation by sub criteria for this sector.

Table 7 : Sector 4 option assessment

	Sector 4								
	DoMin	Option 1 : All West of existing SH1	Option 2 : Similalr Alignment to existing SH1	Option 2 Alternative	Option 4 : Crossing SH1 prior to Hoteo River	Online Option 2: 80km Expressway 2+2	Online Option 3 : Significant 2+1	Online Option 4: Moderate upgrade, safety focused	Online Option 5: Safety focus
	1	2	3	4	5	6	7	8	9
Assessment of Effects									
Assisting Economic Devlopment									
The extent to which the option will enhance inter regional and national economic growth and productivity (RoNS #1).		+++	+++	+++	+++	++	+	0	0
The extent to which the option will improve movement of freight and people between Auckland and Northland (RoNS #2).	0	+++	++	++	+	0	0	0	0
The extent to which the option will improve connectivity between the medium to long term growth areas in the northern Rodney area (Orewa, Warkworth and Wellsford) (RoNS #3).		+	+	+	+	0	0	0	0
The extent to which the option will support local economic development.	0	–	––	––	–	–	–	–	–
Safety and Personal Security									
The extent to which the option is expected to improve road safety in the area and reduce all road crashes.		+++	+++	+++	+++	++	++	+	+
Improving Access and Mobility									
The extent to which the option achieves the strategic (through traffic) function of SH1 as a national significant route linking the Auckland to Northland regions.		+++	+++	+++	+++	++	+	0	0
The extent to which the option provides a strategic alternative to address route security, resilience and flexibility.	0	+++	+	+	++	0	0	–	–
The extent to which the option provides a strategic alternative to address a point incident.		++	++	++	++	0	0	–	–
Proximity of the option's interchange location to activity nodes.	0	––	–	–	–	0	0	0	0
The extent to which the option will improve the reliability of the transport network through providing a more robust and safer route between Auckland and Northland (RoNS #4).		+++	+++	+++	+++	+	+	0	0
The extent to which the option maintains convenient local access and connectivity.		++	++	++	++	–	–	–	–
Impacts in realignment of SH1 during construction.	0	–	–––	––	–	–––	–––	–––	–––
Protecting and Promoting Public Health									
The extent to which the optin can provide for walking and cycling to contribute to positive health outcomes and provide more transport choices, both through and between towns.		+	+	+	+	0	––	––	––
Environmental Sustainability									
The extent to which the option will minimise the physical extent and significance of the project.	0	––	––	–––	–––	––	––	–	0
The extent to which the option will avoid potential environmental impacts on areas of high ecological value or high landscape value.	0	–	–––	––	–––	–––	––	–	0
The extent to which the option will impact on coastal areas or water courses.	0	–––	––	––	––	––	––	–	0
The extent to which the option will impact on sensitive receptors with regards to air quality and noise during both construction and operation.	0	–	––	––	––	–	–	–	–
The extent to which the option will reduce overall energy use and greenhouse gas emissions (NEECS).		++	++	++	++	+	0	0	0
The extent to which the option will avoid impacts on places of archaeological or heritage significance (eg Protects Items – RDC).	0	0	–	–	0	–	–	–	0
The extent to which the option will avoid impacts on places of cultural significance.	0	–	0	0	0	–	–	0	0
The extent to which the option will impact on communities during both construction and operation.	0	–	––	––	–	––	––	–	–
The extent to which the option will minimise social effects on community facilities (eg schools, hospitals, sports fields).									
The extent to which the option will minimise local economic effect including community attractions (eg Ransom Wines, Honey Centre) and businesses (eg Genesis Aquaculture, Southern Paprika Ltd).		––	––	––	––	–	–	–	–
The extent to which the option will support regional and lcoal land use planning intentions.	0	–	–	–	–	0	0	0	0
Value for Money									
The overall cost of the option.	0	–	–	–––	––	–	–	0	0
Geotechnical cost risk (construction and operation).	0	––	–––	–––	–––	–––	–––	––	–
Constructability cost risk.		–	–	–	–	–––	–––	––	–
The ability of the option to be tolled.		+++	+++	+++	+++	0	0	0	0
The ability of the option to be staged.	0	+	++	++	+	+	+	+	+
The extent to which difficulties through the consenting process may delay the date for opening RoNS.		––	––	––	––	–––	––	––	–
The extent to which the difficulty of construction may need the construction period to be extended – delaying the date for		––	––	––	––	–––	–––	––	––
Summary									
Assisting Economic Devlopment	0	+	+	+	+	0	0	0	0
Safety and Personal Security	0	+++	+++	+++	+++	++	++	+	+
Improving Access and Mobility	0	+	+	+	+	0	0	–	–
Protecting and Promoting Public Health	0	+	+	+	+	0	––	––	––
Environmental Sustainability	0	–	–	–	–	–	–	–	0
Value for Money	0	–	–	–	–	––	––	–	–
Ranking	5	1	3	4	2	6	8	9	7

Option 1 was ranked the highest in the MCA for the following reasons:

- Ranked best (or equal best) against assisting economic development criteria
- Ranked equal best against safety criteria

- Ranked second best against improving access and mobility criteria
- Ranked equal best in protecting and promoting public health
- Ranked third for environmental sustainability
- Ranked equal best for value

The other options did not perform as well against all criteria in comparison. This was due to:

- Option 2 performs comparatively poorly in all categories with lowest scores in Assisting Economic Development, Improving Access and Mobility and Environmental Sustainability and Urban Form.
- Option 2A also performs comparatively poorly in all categories with lowest scores in Assisting Economic Development, Environmental Sustainability and Urban Form and second lowest in Value for Money and the Improving Access and Mobility.
- Option 4 scored equal best in Improving Access and Mobility and lowest in Value for Money but the scoring in the other categories was similar to Options 2A.
- Overall Option 1 is the highest ranking option and performs best in Assisting Economic Development, Environmental Sustainability and Urban Form and equal first in Improving Access and Mobility and Value for Money.
- Sensitivity testing ranked Option 1 highest on all occasions.
- All of the online options perform worse than the Do minimum as a result of little benefit with increased effects.
- All online options had considerable impacts during construction
- All online options did not fundamentally deliver against the objectives of the Project.

Option 1 was therefore been adopted as the selected option in Sector 4. The selection of Option 1 provided the following benefits compared to other short-list options:

- It is shorter than the other options which would result in improved movement of freight and people between Auckland and Northland
- Its separation from SH1 provides greater route resilience than other options
- It better avoids impact on areas of high ecological value and landscape value than other options
- It is expected to have lower air and noise impacts on sensitive receivers due to its separation from the Dome Valley
- It has lower geotechnical risks than the other options and lower constructability risks than most of the other options.
- It was the best performing option in the MCA assessment.

Option Evaluation - Sector 5

The evaluation results for the Sector 5 options between the Hoteo River and Te Hana are included in Table 8.

Option 7 was ranked the highest in the MCA for the following reasons:

- Ranked equal best against assisting economic development criteria

- Ranked equal best against safety criteria
- Ranked equal best against improving access and mobility criteria
- Ranked equal best in protecting and promoting public health
- Ranked equal best for environmental sustainability
- Ranked equal best for value

Table 8 : Sector 5 option assessment

	Sector 5										
	Do Min	Option 1 : Closest to Wellsford (through Te Hana)	Option 2 : East of Wellsford (through Te Hana)	Option 3 : Wide of Wellsford (through Te Hana)	Option 4 : Most eastern option (bypass Te Hana)	Option 5 : Close to Wellsford west of Te Hana	Option 6 : Close to Wellsford (through of Te Hana)	Option 7 : Option 2 but bypass Te Hana	Option 8 : Through the middle	Online Option 2 : 2 lane Wellsford Bypass	Online Option 3: 2+2
	11	12	13	14	15	16	17	18	19	20	21
Assessment of Effects											
Assisting Economic Devlopment											
The extent to which the option will enhance inter regional and national economic growth and productivity (RoNS #1).		+++	+++	+++	+++	+++	+++	+++	+++	++	+
The extent to which the option will improve movement of freight and people between Auckland and Northland (RoNS #2).	0	+++	+++	+++	+++	+++	+++	+++	+++	++	+
The extent to which the option will improve connectivity between the medium to long term growth areas in the northern Rodney area (Orewa, Warkworth and Wellsford) (RoNS #3).		++	++	++	++	++	++	++	++	++	++
The extent to which the option will support local economic development.	0	0	0	0	0	0	0	0	0	0	–
Safety and Personal Security											
The extent to which the option is expected to improve road safety in the area and reduce all road crashes.		+++	+++	+++	+++	+++	+++	+++	+++	+	0
Improving Access and Mobility											
The extent to which the option achieves the strategic (through traffic) function of SH1 as a national significant route linking the Auckland to Northland regions.		+++	+++	+++	+++	+++	+++	+++	+++	++	+
The extent to which the option provides a strategic alternative to address route security, resilience and flexibility.	0	++	++	++	+++	++	++	+++	+++	+	0
The extent to which the option provides a strategic alternative to address a point incident.		+++	+++	+++	+++	+++	+++	+++	+++	++	+
Proximity of the option's interchange location to activity nodes.	0	–	––	–––	–––	––	––	––	––	–	0
The extent to which the option will improve the reliability of the transport network through providing a more robust and safer route between Auckland and Northland (RoNS #4).		+++	+++	+++	+++	+++	+++	+++	+++	+	0
The extent to which the option maintains convenient local access and connectivity.		++	++	++	++	++	++	++	++	+	–
Impacts in realignment of SH1 during construction.	0	–	–	–	0	––	–	0	0	––	–––
Protecting and Promoting Public Health											
The extent to which the optin can provide for walking and cycling to contribute to positive health outcomes and provide more transport choices, both through and between towns.		++	++	++	++	++	++	++	++	+	–
Environmental Sustainability											
The extent to which the option will minimise the physical extent and significance of the project.	0	–	–	––	–––	––	––	–––	–––	–	–
The extent to which the option will avoid potential environmental impacts on areas of high ecological value or high landscape value.	0	–––	–––	–––	–	––	–––	–	–	–	––
The extent to which the option will impact on coastal areas or water courses.	0	–	–	––	––	––	––	––	––	–	–
The extent to which the option will impact on sensitive receptors with regards to air quality and noise during both construction and operation.	0	+	++	++	++	++	++	++	++	–	–
The extent to which the option will reduce overall energy use and greenhouse gas emissions (NEECS).		++	++	++	++	++	++	++	++	+	0
The extent to which the option will avoid impacts on places of archaeological or heritage significance (eg Protects Items – RDC).	0	––	–	–	–	–	––	–	––	–	–
The extent to which the option will avoid impacts on places of cultural significance.	0	–––	–––	–––	–	––	–––	–	––	–	––
The extent to which the option will impact on communities during both construction and operation.	0	–––	––	––	–	––	––	–	–	––	–––
The extent to which the option will minimise social effects on community facilities (eg schools, hospitals, sports fields).		++	++	++	++	++	++	++	++	0	–
The extent to which the option will minimise local economic effect including community attractions (eg Ransom Wines, Honey Centre) and businesses (eg Genesis Aquaculture, Southern Paprika Ltd).		––	––	––	––	––	––	––	––	0	0
The extent to which the option will support regional and lcoal land use planning intentions.	0	––	0	0	0	–	–	0	0	0	0
Value for Money											
The overall cost of the option.	0	––	–––	––	–	–––	–––	–	––	–	–
Geotechnical cost risk (construction and operation).	0	––	––	–	–	–––	–––	–	––	–––	–
Constructability cost risk.		–	–	–	–	–	–	–	–	––	–––
The ability of the option to be tolled.		+++	+++	+++	+++	+++	+++	+++	+++	0	0
The ability of the option to be staged.	0	+	+	0	0	++	++	0	0	+	+
The extent to which difficulties through the consenting process may delay the date for opening RoNS.		––	––	––	––	––	––	––	––	––	––
The extent to which the difficulty of construction may need the construction period to be extended – delaying the date for		–	–	–	–	–	–	–	–	––	–––
Summary											
Assisting Economic Devlopment	0	++	++	++	++	++	++	++	++	+	+
Safety and Personal Security	0	+++	+++	+++	+++	+++	+++	+++	+++	+	0
Improving Access and Mobility	0	++	+	+	++	+	+	++	++	+	0
Protecting and Promoting Public Health	0	++	++	++	++	++	++	++	++	+	–
Environmental Sustainability	0	–	–	–	–	–	–	–	–	–	–
Value for Money	0	–	–	–	0	–	–	0	–	–	–
Ranking	10	6	4	5	2	7	8	1	3	9	11

The other options did not perform as well against all criteria in comparison. This was due to:

- Options 1, 2, 3, 5 and 6 score poorly in terms of impacts on places of cultural significance. Option 4 and 7 score best for impacts on places of cultural significance.
- Options 1, 2, 3, 5 and 6 that run through Te Hana scored lower because of significant cultural impact, poor environmental outcomes, community impact, major structures required, cost, poor ground east of Wellsford, slip zone through hill east of Te Hana, more structures and poorer earthworks balance
- Overall Option 1 is the lowest ranking option in Environmental Sustainability and Urban Form due to its proximity to Wellsford, with all others scoring the same but better than Option 1.

- Option 1 scores lowest on the impact on community during construction and operation due to proximity to Wellsford and likely disruption as a result
- Overall Option 3 performance is in between that of Options 1 and 2.
- Options 5 and 6 score worst primarily due to passing through very poor ground east of Wellsford, high cost and general impacts on community during construction.
- Options 1, 4 and 7 score best against value for money. Option 1 is the least expensive with Option 4 and 7 close second.
- Options 4, 7 and 8 score best with regard to avoiding areas of high ecological value
- Overall Options 4 and 7 Score highest or equal highest for all summary categories and were sensitivity checked.
- Option 8 has a major earth cut required through the eastern end of the hill east of Te Hana and consequentially has higher costs
- The differences between Option 4 and 7 are the distance from Wellsford, and that Option 7 runs through the existing infrastructure corridor. Option 7 is slightly higher cost than Option 4.
- Sensitivity testing showed that Options 4 and 7 scored highest in all categories.
- Option 7 has been adopted as the selected option
- All of the online options perform worse than the do minimum as a result of little benefit with increased effects
- All online options had considerable impacts during construction
- All online options did not fundamentally deliver against the objectives of the Project.

The selection of Option 7 provides the following benefits compared to other short-list options:

- It better avoids impact on areas of high ecological value or landscape value and on coastal areas and water courses
- It avoids areas of cultural significance
- It avoids poor geological ground
- It reduces community impacts
- It avoids slip zones
- It has a good earthworks balance
- It runs within an existing infrastructure corridor (oil and gas pipeline)
- It provides better value for money
- It is the best ranked option in the MCA

Following the evaluation of the short-list options, the selected Indicative Route comprised Option 1 for the Perry Road to the Hoteo River sector (Sector 4), Option 7 for the Hoteo River to Te Hana sector (Sector 5)..

This analysis confirmed the assessment undertaken in the SAR phase that the online options were not preferred as the long-term solution for this corridor.

The Indicative Route is expected to deliver the following against the Project investment objectives:

- **Safety:** reduction of 174 deaths and serious injuries (over 30 year period)
- **Resilience:** 175 fewer hours of full closures (over 30 year period)

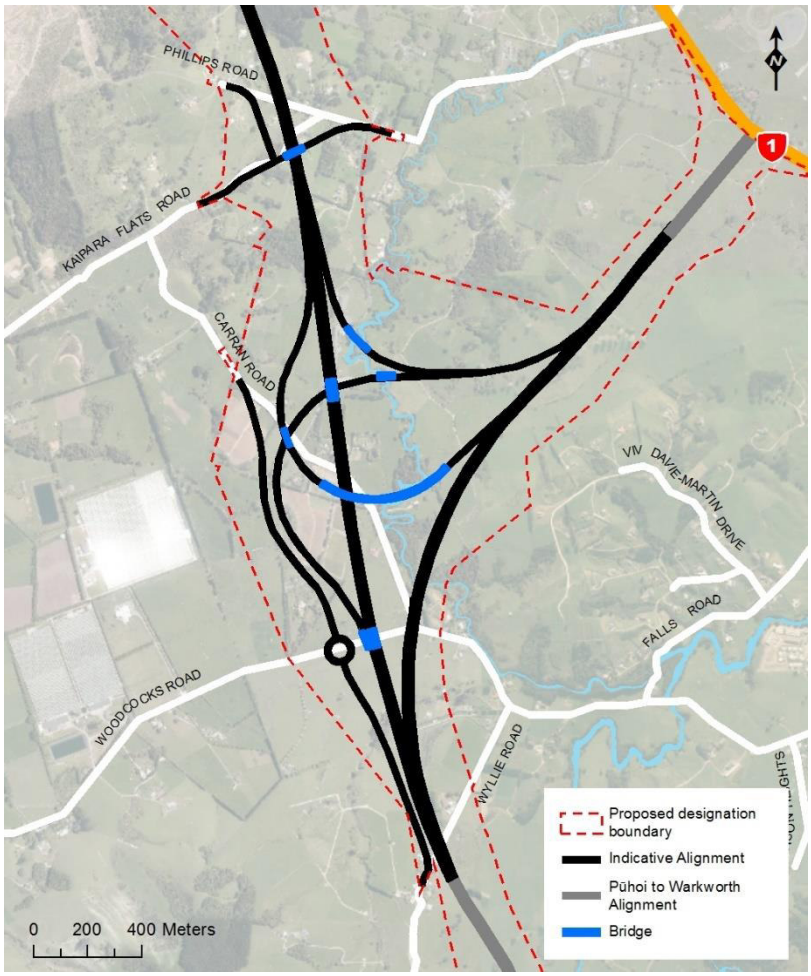
- **Improved Accessibility**: average seven minute travel time saving, reducing the cost of travel by 30%

Interchange Form

Warkworth Interchange

The form and location of the Warkworth interchange was not confirmed as part of the SAR due to the timing of the procurement process for the PPP contract for the Pūhoi to Warkworth project, prior to contract award. Subsequent to the SAR being finalised an analysis and assessment of interchange options at Warkworth was undertaken in November 2016 and presented in the Phase 1 engagement. Based on subsequent design work and feedback through Phase 1 engagement the interchange was refined and the form shown in Figure 17 confirmed.

Figure 17 : Final Warkworth interchange option



Wellsford interchange

A number of interchange options and locations were considered at Wellsford in 2016. This included:

- The interchange form
- A single interchange at Whangaripo Valley Road
- Split interchange south and north of Wellsford
- Full interchanges south and north of Wellsford
- Different layout options for each of the above options

An assessment of these options concluded that two full interchange options north and south of Wellsford was preferred to a single central interchange. This was due to:

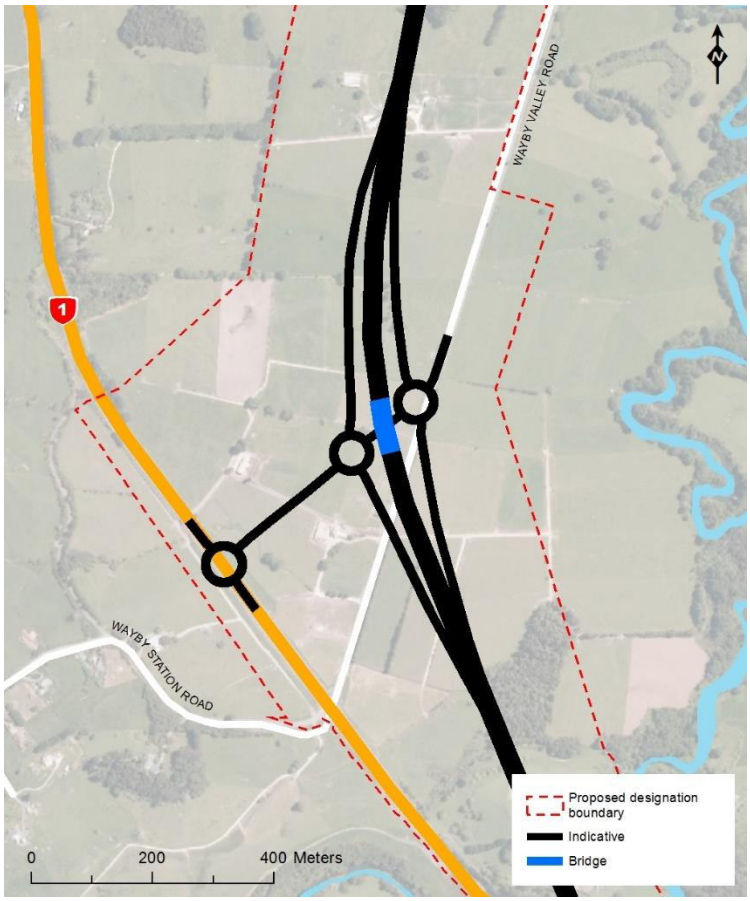
- Making better use of existing infrastructure
- A central Wellsford interchange would require extensive upgrades to Whangaripo Valley Road
- Difficulty in terrain and cost of a central interchange
- No transport advantage of a central interchange (travel times were not quicker)

The preferred Wellsford Interchange (south) location was identified at Wayby Valley Road. This was due to:

- Urban design and landscape framework guidance
- Extension of the Project to the north of Te Hana, which connects to the Twin Coast Discovery Highway and proximity to this new interchange location in the north
- Use of existing transport infrastructure
- Potential connectivity to Mangawhai for resilience
- Operational flexibility with the proposed tunnels through the Dome Valley (by providing an interchange between Wellsford and the proposed tunnels)

This interchange is proposed to be a full diamond service interchange connecting to Wayby Valley Road. The ramp terminal intersections are controlled with single lane roundabouts as this provides both continuity with the adjacent interchanges on the route and best prevents the likelihood of wrong way movements onto the ramps. The interchange is shown in Figure 18.

Figure 18 : Wellsford interchange



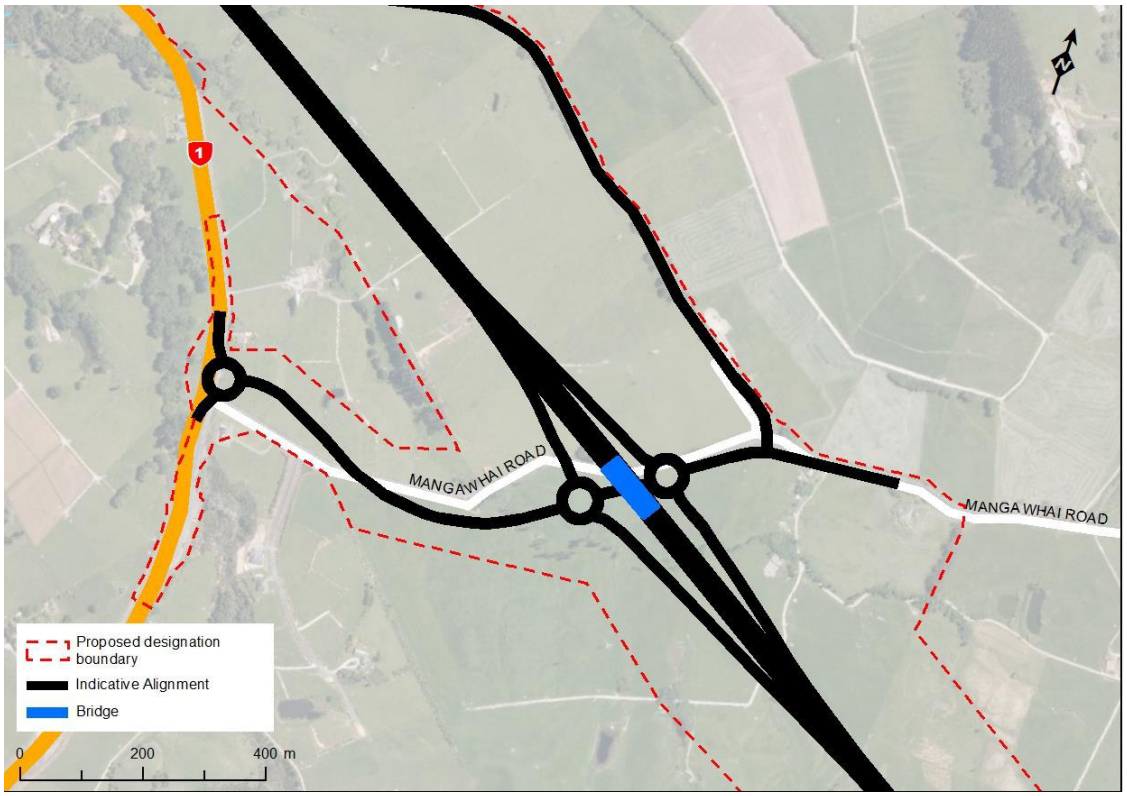
The Indicative Alignment crosses Wayby Valley Road on a skew and the existing intersection of Wayby Valley Road with SH1 will require relocation north, to prevent drivers becoming disorientated and to provide a clear view of the way ahead from the interchange.

The Wellsford Interchange will be the primary exit to Wellsford from the south and serve a vital role managing access to and from the new state highway with approximately 12 km between adjacent interchanges. To retain state highway access between SH1 and SH16, SH16 will be extended through Wellsford along the current SH1 to connect to the Wellsford interchange. The remainder of SH1 will be revoked to local road status.

Te Hana Interchange

The Te Hana Interchange (or northern Wellsford interchange) will connect to the Twin Coast Discovery Highway, of which Mangawhai Road is a part, and also provide access to Wellsford when travelling from the north. The interchange is shown in Figure 19.

Figure 19 : Te Hana interchange



To construct this interchange, approximately 2.9 km of Mangawhai Road will be realigned to provide a safe connection to the new interchange and a direct connection to the current SH1. This will require modification of the existing southbound passing lane on SH1.

The ramp terminal intersections are controlled with single lane roundabouts as this provides both continuity with the adjacent interchanges on the route and best prevents the likelihood of wrong way movements onto the ramps.

Need for a tunnel

The inclusion of a tunnel of approximately 850m has been carefully considered as part of the Indicative Alignment. Further to the selection of the Indicative Route further analysis was done to ensure a tunnel was the most appropriate solution for the Project. There have also been minor refinements made to the tunnel location as greater understanding of the ground conditions is developed. Appendix B provides a summary of that analysis and provides an assessment of the tunnel and other options.

In summary, one of the main objectives of the corridor is to provide a high standard route that is safe which also assists freight movement. Vertical gradients are an important factor for heavy vehicles. In addition, the relevant Austroads design standards limit the acceptable gradients and their length in order to ensure that speed differentials between vehicles are

not excessive and that an appropriate level of service is provided overall. As a consequence, the maximum gradient of the route needs to be limited to around 6%.

This means that the route can only achieve a certain elevation after leaving the lower lying land north of Warkworth, before encountering the east-west hill terrain and ridge referenced above.

Adopting these standards results in the vertical alignment intersecting with the ground surface on the slopes of the hilly terrain some 170m below the ridge line. Thus, a cutting would need to be excavated through the hill to accommodate the road, and this would be of huge proportions. Alternatively, a tunnel is needed to be constructed to carry the road through the hill beneath the ridge. The engineering and environmental challenges associated with a cutting of the required depth through the ridge would be immense. With cut slopes, up to 150m high and a huge volume of material (in the order of $10M^3$ of earthworks) requiring excavation, there would be attendant environmental impacts of major significance. **As a consequence of the above factors, a tunnel carrying the road through the ridge is proposed as offering the most practical engineering solution which also minimises the environmental effects at this location.**

Lesser geometric standards were also examined to reduce the need and scale of a potential tunnel. This including consideration of gradients up to 12% and speeds of 80km/hr. This still resulted in substantial cuts of over 100m in hieght. The tunnel is anticipated to save in the order of $10M^3$ of earthworks and 3-4 years of construction time.

Given this initial analysis, when considering a tunnel a number of alternative alignments were considered to understand if other non-tunnel options were more appropriate and the impacts outlined above could be avoided.

The east-west ridge line just north of Warkworth is extensive and effectively runs from the existing SH1 westwards for several kilometres. Consequently, if the route were to be realigned in order to try to avoid the need for construction of a tunnel, the route would have to be relocated significantly in order to avoid the east-west ridge.

A relocation eastward would put the alignment either;

- in, or very close to, the SH1 corridor where significant geological instability exists with numerous existing landslides and steep side slopes, or,
- relocated even further east of SH1 where attendant sub optimal outcomes in respect of environmental issues and further land instability. Routes in these locations were considered as part of the long list and short listing process described earlier and were found not to offer the best outcomes.

Moving the route westwards to avoid the ridge would likely require a shift of several kilometres, would still require significant earthworks, and result in a significantly longer route. This would hence be less attractive to traffic as compared to the SH1 route and would also prevent the route from achieving the advantages offered by aligning it in the NW-SE valley which lies to the north of the east-west ridge line, as discussed above. Overall an alignment to the west would thus offer sub-optimal outcomes in terms of cost and environmental outcomes.

Overall therefore, it was considered that relocating the Indicative Route in order to try to avoid the need for a tunnel would result in less desirable outcomes and a route with

substantially reduced performance against the Project objectives. In practical terms, based on currently available information, the inclusion of a tunnel is an appropriate solution to the challenges presented by the topography and delivers the best overall outcome.

Further geotechnical testing of the Indicative Route indicated different ground conditions than previously assumed. The tunnel was reviewed again as outlined in the AEE alternatives assessment which identified an optimised route for the tunnel, rather than a substantive issue.

In summary the conclusions of this analysis have indicated that:

1. alternative alignments were assessed to see if a tunnel could be avoided
2. This indicated that if a tunnel was not selected, alternative alignments would be much longer and result in significant cuts into ridgeline, resulting in a larger environmental impact
3. Having determined a tunnel as the best option, more specific assessments of the alignment were undertaken to optimise the location.

THE INDICATIVE ALIGNMENT

The Project provides an offline route between the northern extent of the Puhoi to Warkworth section of the Puhoi to Wellsford project to a connection back to SH1 north of Te Hana at Vipond Road. The option provides a 4 lane alignment and includes a tunnel just north of Warkworth.

The Indicative Alignment has been confirmed based on Phase 1 consultation feedback and further technical analysis. An AEE is currently being prepared for this alignment.

The Indicative Alignment

An overview of the Indicative Alignment and some of the key constraints that were considered are shown in Figure 20.

For description and assessment purposes, the Project has been divided into the following areas:

- Hoteo South: From the southern extent of the Project at Warkworth to the Hoteo River.
- Hoteo North: Hoteo River to the northern tie in with existing SH1 near Maeneene Road.

Hoteo South

The Indicative Alignment connects to the alignment of the new motorway currently being built between Pūhoi and Warkworth, and continues in a northerly direction. The Indicative Alignment passes over Woodcocks Road and requires a diversion of Carran Road west of the alignment at the proposed Warkworth Interchange.

Continuing north, the Indicative Alignment crosses the flat valley of the Mahurangi River and passes below Kaipara Flats Road near Phillips Road. Both Kaipara Flats Road and Phillips Road require realignments. Heading north, the Indicative Alignment begins to climb as it runs along a short valley towards the southern extent of the forestry, to the west of SH1. Due to the steepness of the terrain through this area, the Indicative Alignment will pass through 850 m long tunnels below Kraack Road. Two separate tunnels will carry north and south bound traffic.

The Indicative Alignment continues from the northern portals of the tunnels through the commercial forestry plantation to the west of the existing SH1, running parallel to and below the main ridge and across a series of steep valleys as it passes through the Dome Valley. The Indicative Alignment in this location requires substantial cut slopes and fill embankments. The Indicative Alignment passes under and over private forestry roads to maintain forestry access.

The Indicative Alignment crosses the New Zealand Refining Company Ltd (Refining NZ) and First Gas pipelines (fuels and gas pipelines) just south of the Hoteo River, which will necessitate works to these pipelines prior to construction of the Project in this location.

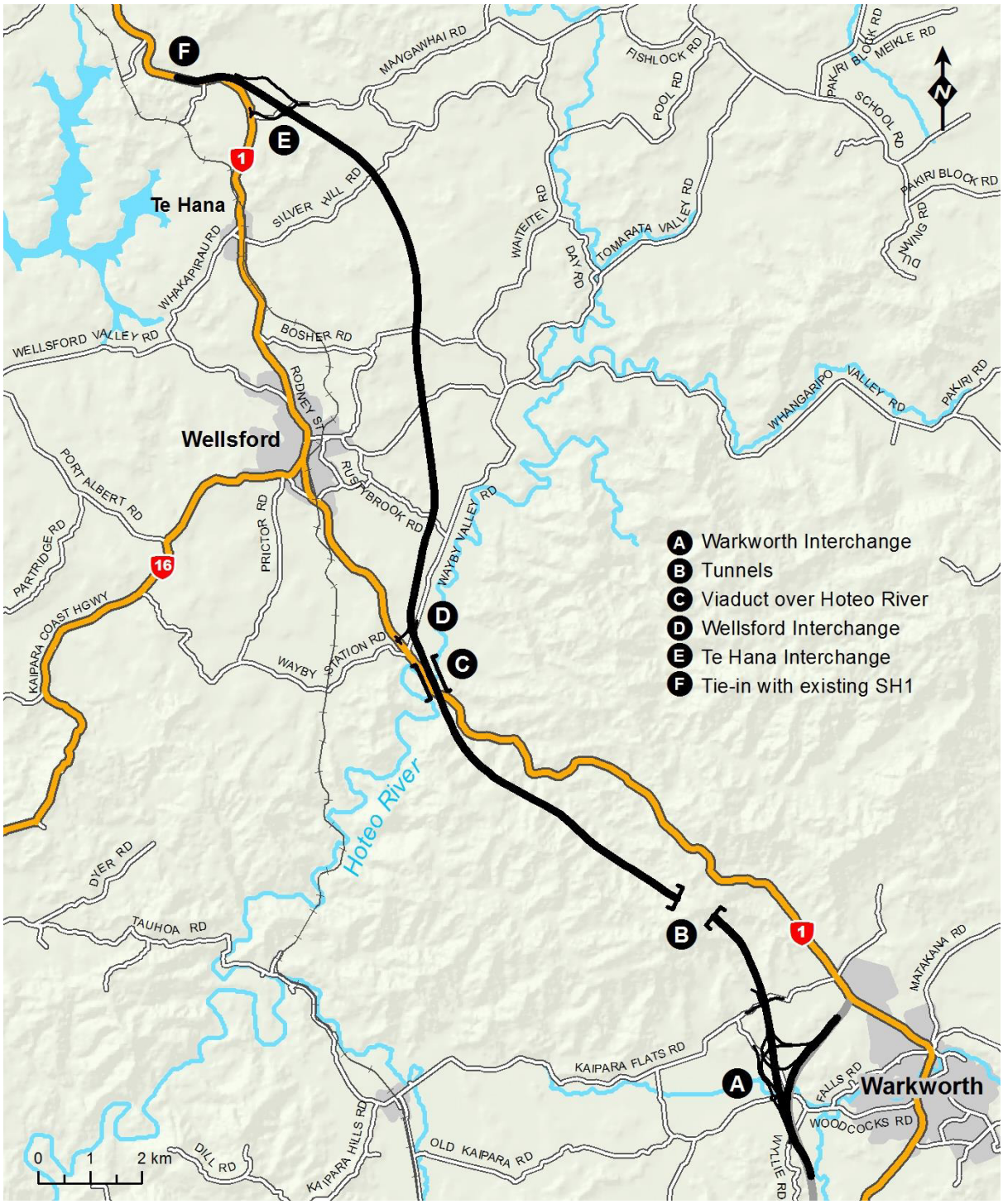
Hoteo North

At the north end of the Dome Valley the Indicative Alignment crosses SH1, the Hoteo River, and the Waitaraire Stream (which runs through the Dome Valley and discharges into the Hoteo River) on a viaduct. The proposed Wellsford Interchange is located north of Hoteo River, centred on Wayby Valley Road. The mainline carriageway of the proposed interchange spans over Wayby Valley Road, with Wayby Valley Road itself requiring a realignment to accommodate the interchange. The proposed interchange provides access to Wellsford and includes a new (roundabout) intersection with the existing SH1. The position of the interchange has been set to minimise intrusion into the floodplain of the Hoteo River.

The Indicative Alignment continues northward, parallel to Wayby Valley Road, crossing Roberston Road (which in that location would be closed by the Indicative Alignment), crossing beneath Rustybrook Road, before turning north and crossing over Whangaripo Valley Road (east of its intersection with Borrows Road). Continuing north, the Indicative Alignment passes beneath Farmers Lime Road, before crossing over the fuels and gas pipelines. The Indicative Alignment descends from Farmers Lime Road along the valley and crosses under Silver Hill Road at the site of a disused quarry. It then rises, turning northwest as it crosses the eastern extent of the ridgeline of the hills that extend westwards to Te Hana. The Indicative Alignment continues northwest and crosses over the fuels and gas pipelines again, and also a realigned Mangawhai Road with which the alignment connects at the proposed Te Hana Interchange. The Indicative Alignment passes under a Transpower high voltage electricity transmission line in the vicinity of this interchange and to the west of the existing Vipond Road reserve. An additional transmission line support structure is required to ensure the necessary vertical clearances are achieved between the carriageway and the lines. Vipond Road will be formed from Mangawhai Road, and its existing intersection with SH1 will be closed.

The Indicative Alignment continues northwest to bridge over the Maeneene Stream and a realigned Maeneene Road/Waimanu Road intersection before tying into the existing alignment of SH1 north of Waimanu Road.

Figure 20 : Warkworth to Wellsford Indicative Alignment



Warkworth interchange

The proposed Warkworth interchange on the Indicative Alignment is a system interchange, where free-flow ramps connect the new state highway to the Puhoi to Warkworth motorway.

The southbound on-ramp uses the Pūhoi to Warkworth alignment, resulting in a design speed of 100kph. All other ramps have a design speed in the order of 80kph. All of the free-flow ramps connect with the Puhoi to Warkworth alignment to the south-west of the Puhoi to Warkworth roundabout. Carran Road is diverted around the interchange to maintain local road connectivity but has no connection to the interchange.

This alignment makes good use of the existing transport infrastructure in the area, including the new Puhoi to Warkworth section of Ara Tuhono.

Wellsford interchange

The proposed Wellsford interchange on the Indicative Alignment has been located at Wayby Valley Road due to the following considerations:

- Future urban growth areas for Wellsford
- Urban design and landscape framework guidance
- Extension of the Project to Te Hana, which connects to the Twin Coast Discovery Highway
- PBC recommendations
- Connectivity to Mangawhai

The Wellsford interchange is a full diamond service interchange connecting to Wayby Valley Road. The ramp terminal intersections are controlled with single lane roundabouts as this provides both continuity with the adjacent interchanges on the route and best prevents the likelihood of wrong way movements onto the ramps. The Indicative Alignment crosses Wayby Valley Road on a skew and the existing intersection with SH1 will require relocation north to prevent drivers becoming disorientated and to provide a clear view of the way ahead from the interchange.

The Wellsford interchange will be the primary exit to Wellsford from the south and serve a vital role managing access to and from the new state highway with approximately 12 km between adjacent interchanges. The tunnels located between the Warkworth and Wayby interchanges place additional operational constraints on the new state highway and the Wayby interchange will likely be the entry and exit point for dangerous goods and over dimensional vehicles. The interchange will also be a staging point for incident management.

Te Hana interchange

The proposed northern interchange on the Indicative Alignment will connect directly into to SH1 at Maeneene Stream Bridge north of the existing Vipond Road intersection. Maeneene Road will be aligned to the east with a new at grade intersection with Waimanu Road.

The interchange will connect to the Twin Coast Discovery Highway, of which Mangawhai Road is a part, and also provide access to Wellsford when travelling from the north. It is a full diamond interchange servicing the settlements of Te Hana to the southwest and Mangawhai to the east. To construct this interchange, 2.9 km of Mangawhai Road will be realigned to the south and the existing intersection of Mangawhai Road with SH1 will be replaced with a direct connection to the old carriageway. This will require modification of the existing southbound passing lane.

The full state highway cross section is maintained throughout the interchange and to within 800m of the Project extent. The wire rope median barrier will continue in a reducing median width around the curve aligning with the Maeneene Stream bridge. Terminating the full cross section on the straight as described allows flexibility for the alignment of any subsequent extension of an upgrade to SH1 further to the north in the future.

Local roads

The Warkworth to Wellsford Project would require work on a number of local roads along its length in order to maintain local access. Access along all the local roads traversed by the new state highway would be maintained (with the exception of Robertson Road which is not required to be maintained for land access) and would be grade-separated, crossing either over or under the state highway as follows:

- Kraack Road – is an important reference point identifying the location of indicative crossing of the Dome ridgeline and the separation of the Mahurangi and Hoteo River catchments. However, Kraack Road is not impacted by the Indicative Alignment as the route is located west of Kraack Road and is underground.
- Saunders Road – crosses over alignment on a bridge
- River Road – crosses over alignment on a bridge
- SH1 (Hoteo) – alignment crosses over existing SH1 on a bridge
- Wayby Valley Road – alignment crosses over Wayby Valley Road on a bridge
- Rustybrook Road – crosses over alignment on a bridge
- Whangaripo Valley Road – alignment crosses over Whangaripo Valley Road on a bridge
- Worthington Road / Farmers Lime Road – crosses over alignment on a bridge
- Silver Hill Road – alignment crosses over Silver Hill Road on a bridge
- Mangawhai Road – alignment crosses over a realigned Mangawhai Road on a bridge
- Vipond Road – at grade intersection with SH1 closed and alternative access provided along Vipond Road from an intersection on Mangawhai Road
- Maeneene Road will be realigned and a new at grade intersection formed

The realignment of some local roads has been adopted rather than providing connections across the Indicative Alignment, including:

- Carran Road – realigned to connect to Woodcocks Road west of the Indicative Alignment and clear of the Warkworth Interchange
- Phillips Road – realigned to connect to Kaipara Flats Road west of the Indicative Alignment

Further option development

The next phase of the Project is the pre-implementation phase.

This has already been commenced for the Indicative Alignment for which a Notice of Requirement to designate land, resource consent applications and (at a later date) other statutory approvals will be sought.

As part of seeking the planning approvals an Assessment of Effects on the Environment (AEE) has been prepared, along with numerous supporting technical assessments.

Completion of this work is currently underway and this DBC has incorporated this work in its development where appropriate.

Depending on the outcome of further design and technical assessment, the Indicative Alignment may need to be further refined in response to Phase 2 engagement or matters raised during the statutory approvals phase.

INDICATIVE ALIGNMENT – ASSESSMENT

A comprehensive identification and assessment of options has been undertaken to identify the Indicative Route. This has then been further refined to take into account the outcomes of consultation and further design work and technical assessments to determine the Indicative Alignment. As part of this assessment process the impacts and likely mitigation of the Indicative Alignment have been identified.

The Indicative Alignment performs well against the DBC investment objectives and provides safety, resilience and cost of travel benefits for customers and in particular the freight customers who use the corridor.

The Indicative Alignment has been designed to avoid the majority of the known sensitive social and environmental areas along the corridor, however the Project is significant and will require mitigation to ensure that the effects of the Project on these sensitive environments are appropriately managed.

The Project impacts are considered generally similar in scale and type to the Pūhoi to Warkworth project

The outcomes of the planned Phase 2 engagement could result in refinement of the Indicative Alignment, however given the process adopted to date, any changes would be anticipated to be relatively minor.

Outcomes

The Project investment objectives are set out below.

- **Investment objective 1:** Improve resilience to key social and economic activities between Auckland and Northland through reduction in unplanned closures by 90% between Warkworth and Te Hana
- **Investment objective 2:** Improve safety for road users by reducing the number of DSI's by 100% between Warkworth and Te Hana
- **Investment objective 3:** Facilitate increase in Northland's regional GDP due to improved accessibility for freight for key markets between Warkworth and Te Hana by 30%
- **Investment objective 4:** Contribute to an increase of Northland's tourism market through improved accessibility for tourism trips between Warkworth and Te Hana by 30%

The Indicative Alignment delivers strongly against these objectives, providing more resilient and safer infrastructure that will reduce the cost of customers' trips. All of these factors contribute to the goal of increasing the economic performance of the Northland region.

Specific performance measures against the investment objectives are as follows:

- **Investment Objective 1**: The Warkworth to Wellsford Project provides an alternative route to the existing state highway route. The existing SH1 will be available as an

alternative route. If current trends continue, the Warkworth to Wellsford Project will provide a reduction of 175 hours of full closures over a 30 year period. The Warkworth to Wellsford Project will not only provide network resilience through provision of an alternative to the existing SH1, but the improved corridor availability will contribute towards attracting investment to the Northland region.

- **Investment Objective 2**: The Project will deliver a high standard route with improved safety performance over the existing SH1 route. The Pūhoi to Wellsford route is forecast to operate with a similar safety performance to that of the Northern Gateway SH1 section (low personal and collective risk rating). In addition to this, traffic volumes on the existing state highway will be reduced dramatically (90% of traffic assumed to use the new route) thereby reducing the exposure on the existing State Highway. Overall the Warkworth to Wellsford Project is forecast to lead to a reduction of 174 deaths and serious injuries over a 30 year period.
- **Investment Objective 3 (and 4)**: The Warkworth to Wellsford Project will improve accessibility to Northland and for critical freight (and tourism) movements. Travel times for light vehicles using the corridor are forecast to reduce by an average of 7 minutes (as forecast in 2026). The travel time savings are primarily as a result of easing of horizontal and vertical alignment through the Dome Valley and provision of a bypass around the centres of Wellsford and Te Hana. Heavy vehicles will experience greater travel time savings due to a reduction in grade over the Dome. In addition to travel time savings, the Project will improve journey time reliability. The provision of a dual carriageway means delay caused by slower vehicles will dramatically decrease on the corridor allowing more reliable travel time for all users on the route. This is forecast to enhance the economic performance of the wider Northland region given the heavy reliance on this critical strategic corridor for accessing the rest of New Zealand through the Auckland gateway.
- **Investment Objective 4**: Improving the reliability and safety of the journey between Auckland and Northland as outlined in the objectives above will also provide improved accessibility for the important tourism market. As outlined in the Twin Coast Discovery PBC for Northland there is the potential for a 30% increase in visitor spend in the Northland region through targeted local investment. This investment will be strengthened through improved accessibility between Auckland and Northland on the strategic road connection, being SH1. This Project provides this increase in accessibility and resilience for tourist trips.

These outcomes will also add to the wider Auckland to Whangarei PBC outcomes and the overall aspirations of the NEAP to increase the economic performance and prosperity of Northland.

Implementation

Constructability

This is a large scale project with a construction timeframe of approximately 6-7 years. There will be significant structures and earthworks. The construction industry in New Zealand has the proven track record to deliver a Project of this scale and type.

A PPP consortia has been procured to implement the Pūhoi to Warkworth section which is similar in general form to the Indicative Alignment, giving confidence that there is the capability to construct this Project.

The Indicative Alignment proposes a tunnel which is not typical in New Zealand roading Projects. However, there is experience of tunnel construction throughout New Zealand, including the Johnstone Hill tunnel just south of Pūhoi and the new Waterview tunnel. If required there is international capability to deliver this type of construction and the New Zealand construction market has the experience of sourcing and working with this international capability.

In summary, whilst a large Project that carries construction risks, this risk is not considered significant and can be mitigated and managed through the Transport Agency's typical processes and procedures.

Operability

A detailed operational review has not been undertaken in the Project development to date. However, the Project is a relatively standard form of road and the Transport Agency has a strong track record at maintaining and operating this type of transport infrastructure.

The proposed tunnel will have particular operational requirements. These operational requirements have been and will continue to be factored into the design, including the form of the Wellsford interchange at Wayby Valley Road that provides operational flexibility for the maintenance and operation of the tunnel. The costs of this maintenance and operations have been factored into the cost estimates for the economic analysis for the Project.

The proposed tunnel would require an increased maintenance capability above that required for a typical state highway. However, the Transport Agency have the capability and expertise to undertake this maintenance and operations.

Statutory requirements

Numerous statutory approvals will be required for the Project. The approvals required under the Resource Management Act 1991 (RMA) are a designation of land and a suite of resource consents. Approvals will also be required under other legislation including the Heritage New Zealand Pouhere Taonga Act (HNZPT) 2014 and the Wildlife Act 1953.

An initial consenting strategy for the Project was prepared in July 2016. A decision on the proposed consenting pathway was made in early 2017, being to lodge the RMA application package with the Environmental Protection Authority for referral to a Board of Inquiry for determination. There have been a number of contextual changes since that time, and consequently, the consenting strategy has now been revised.

The proposed consenting strategy is now to lodge a Notice of Requirement for a designation land, and the main package of resource consents (i.e. earthworks, streamworks, vegetation removal, construction and operational discharges to water) with Auckland Council. The Notice of Requirement and consents would be publicly notified, and then considered at a hearing by a panel of independent commissioners appointed by the Council. This would be followed by an appeal process and a potential Environment Court hearing (if appeals are lodged). The primary objective of this consenting phase is to secure a designation of land and the main resource consents to enable future construction.

Nearer to the time of construction, additional consents may be needed for specific construction activities (e.g. water takes and disturbance of contaminated soils), and applications will also need to be made under the HNZPTA and Wildlife Act.

Property impacts

There are approximately 91 directly affected properties associated with the Indicative Alignment. These parties have been engaged with and will continue to be as the Project progresses through the design development and statutory approvals process. To date, 15 properties have been purchased under Transport Agency Advance Purchase criteria.

Property impacts have been minimised to a practicable extent through the selection of the Indicative Alignment.

Asset management

The Project proposes the construction of a new four lane offline state highway. There will therefore be an additional operational cost associated with new infrastructure as well as the existing state highway. Revocation of the existing SH1 route to Auckland Transport will be considered closer to implementation dates. Revocation will impact on potential asset management responsibilities in the future.

The Indicative Alignment includes an 850m tunnel which carries greater maintenance and operational costs.

A detailed maintenance review will be undertaken at the detailed design phase of the Project.

Wider Project impacts

Environmental impact

There are a number of areas of high environmental value in the corridor between Warkworth and Te Hana (as outlined in the Project AEE). The route selection and design process for the Warkworth to Wellsford Project, informed by preliminary technical assessments and targeted consultation, has avoided most of the known sensitive land uses and environmental areas and values within the Project area.

Particular consideration has been given to the potential effects of the Indicative Alignment on areas with established permanent residential populations and sensitive environmental attributes.

Impacts on these areas and the environment in general has been a key part of the selection process for the Indicative Alignment. The Indicative Alignment was one of the better performing options against the environmental impacts criteria, as it avoided many areas of ecological significance. The potential environmental, social, cultural and economic effects of the Project have been assessed, and potential mitigation measures identified. Reducing and mitigating the impacts on the CMA and waterways in this area in particular has been a focus in the ongoing design development.

Whilst the Indicative Alignment largely avoids areas of high value habitat and natural value and significant sites, there is potential for adverse effects to occur in sensitive areas such as around Kaipara Flats Road, the Hoteo River margins, and in proximity to the northern tie-in point near Vipond Road. These areas would be key risk areas with respect to the extent of potential effects and the ability to appropriately avoid, remedy or mitigate the adverse effects of the Project.

The design and assessment undertaken during the pre-implementation phase has identified potential effects on these areas proposed mitigation is being developed.

Social impact

The construction of the Warkworth to Wellsford Project and the operation of the road are expected to give rise to both positive and adverse social effects for people and communities along the Indicative Alignment.

A preliminary social impact scoping exercise was completed in January 2017, which identified the following potential social impacts and also the recommended areas of focus for the further assessment of social impacts during the next phase of the Project.

Based on the data collected as part of the scoping, the following positive impacts could occur and require further investigation in the Social Impact Assessment (SIA):

- Property Impacts
- Community Severance
- Amenity during construction
- Economic performance of Wellsford and Te Hana

There are a number of properties along the route that will be directly affected as a result of the Project through potential full or partial purchase if the Project proceeds. The social implications of this for the individuals and the wider community as a result of the property and population loss need to be considered.

The new alignment is offline of the existing state highway and therefore will sever the land that it passes through. The new alignment is predominantly through forestry and agricultural land which limits the potential community severance.

Construction of large transport Projects generates temporary adverse effects during construction. This includes potential increases in construction traffic and the associated amenity consideration such as noise, dust and other similar effects.

Construction has potential social impacts on individuals and the communities along the route as a result of this increased traffic and amenity impacts. Management of these effects will be a key part of the consenting of the Project.

The bypass of the above towns will remove up to 90% of regional through traffic from the main streets of these two communities (this is 90% of through traffic, not 90% of all traffic). This will impact on the 'passing trade' element for these businesses. Depending on the business, this portion of the business can be significant (i.e. a service station).

The scoping exercise has collected relevant data to inform the SIA.

A SIA for the Indicative Alignment will be completed following Phase 2 engagement and form part of the AEE development.

INDICATIVE ALIGNMENT - ECONOMIC ANALYSIS

This section outlines the economic analysis for Warkworth to Wellsford. The assessment profile for the Project is described as a **Priority 5/6**.

The Project creates a present value of $696 million in conventional benefits over the typical 40 year evaluation period. WEBs have been assessed for Warkworth to Wellsford and are expected to contribute $154 million in benefits over the evaluation period.

The BCR of the Warkworth to Wellsford project is 0.7 when considering only conventional benefits. The BCR remains at 0.7 with the inclusion of WEBs. This Project is part of the wider Puhoi to Wellsford corridor which with WEBs has a BCR of 1.1.

Background

As the Project has developed over time so too has the economic case for the Project. As part of the earlier SAR development, an economic assessment was undertaken for the Pūhoi to Wellsford corridor. The outcome of this analysis is summarised in Table 9. This shows a BCR of 1.1.

Table 9 : Original Puhoi to Wellsford Economic Summary

ECONOMIC EFFICIENCY	
Time zero	1 July 2015
Base date for costs and benefits	1 July 2015
Present value net total Project cost of Pūhoi to Wellsford	$1,174m
Present value net benefit of Pūhoi to Wellsford (exc. WEBs)	$1,253m
Present value net benefit of WEBs of Pūhoi to Wellsford	$1,346m
BCR (exc. WEBs)	1.1
BCR (inc. WEBs)	1.1

Since this economic analysis there have been a number of changes in the Project development. This has included beginning the implementation of the first stage of the corridor Project, being the Pūhoi to Warkworth section. Other key changes include:

- Pūhoi ramps included in the Pūhoi to Warkworth section
- Scope of the Warkworth to Wellsford Project extended to north of Te Hana
- Costs of the Warkworth to Wellsford section have been updated to 2017 dollars
- Significant growth has been forecast and been allowed for around Warkworth through the Auckland Plan 2050 and Supporting Growth (formerly Transport for Future Urban Growth)
- Additional growth allowed for around Wellsford
- Update to EEM factors

Due to these changes the economics for the Project has been updated. This has included the development of a new transport model to take account of the significant changes in growth forecast in the area and interaction with future transport networks proposed by Supporting Growth Alliance in the Warkworth area.

Confirmation of the Pūhoi to Warkworth section of the corridor Project was a key influence on the provision of additional development in the Warkworth area through the Unitary Plan and TFUG processes. The level of growth now allowed for in the area is greater than considered as part of the Pūhoi to Warkworth Business Case and previous corridor economic assessment. The Supporting Growth[5] confirms that *"Warkworth's current population is currently around 5,000 residents. It is Projected to grow to a substantial satellite town (more than five times its current size). Around 1,000 hectares of future urban land has been identified for this growth, mainly in the north, northwest and south of the existing Warkworth town centre".*

In order to recalculate the corridor wide economic performance, the benefits from the Pūhoi to Warkworth section must be considered. It is highly conservative to assume these as per the original assessment, as additional growth and traffic is now forecast as a result of land use changes. It is however difficult to recalculate the benefits of the Project with the new land use assumptions, as the Project has enabled the land use change which (arguably) could not have occurred without the Project confirmation in the first place. The updated analysis adopts. However, to update the corridor BCR we have added the Pūhoi to Warkworth DBC benefits and costs to the updated Warkworth to Wellsford Project benefits (based on updated transport modelling and land uses changes) and costs together to give an indicative overall Pūhoi to Wellsford BCR.

This has resulted in an updated Pūhoi to Wellsford BCR as outlined in Table 10.

[5] Alliance of Auckland Transport, New Zealand Transport Agency and consultant and legal partners to identified and protect for future transport network for Auckland planned growth in Warkworth, North West, South and North of Auckland

Table 10 : Updated Pūhoi to Wellsford Economic Summary

ECONOMIC EFFICIENCY	
Time zero	1 July 2018
Base date for costs and benefits	1 July 2018
Present value net total Project cost of Pūhoi to Wellsford	$1,787m
Present value net benefit of Pūhoi to Wellsford (exc. WEBs and WEIs)	$1,455m
Present value net benefit of EEM WEBs of Pūhoi to Wellsford	$269m
Present value net benefit of WEBs and WEIs of Pūhoi to Wellsford	$525m
BCR (exc. WEBs)	0.8
BCR (inc. EEM WEBs)	1.0
BCR (inc. WEBs and WEIs)	1.1

Importantly this analysis indicates that the Pūhoi to Wellsford corridor BCR has dropped without WEBS to 0.8 due to cost increases, however the BCR with WEBS has remained steady at 1.1 due to an increase in the value of the WEBS.

The above update includes the original cost from the Pūhoi to Warkworth DBC. There has been no further consideration of the subsequent implications of the PPP contract as awarded (which was to reduce the cost of the Puhoi to Warkworth Project as assumed in the Pūhoi to Warkworth DBC BCR by approximately 25%). The costs above are therefore considered conservative.

Wider economic benefits

In addition to the traditional EEM transport benefits it is acknowledged that large infrastructure Projects such as this Project can create wider economic benefits (than just the direct benefits to the user). An analysis of these benefits has been undertaken considering the potential economic benefits of:

- Tourism
- Forestry
- Increase in general productivity
- Increase in labour
- Resilience

The increase in accessibility for the Northland economy and in particular the improvement between the Northland and Auckland economies is the driver for these benefits. A whole of corridor approach has been used in determining these potential benefits. Appendix C documents the approach taken to calculate these potential WEBs

The analysis has estimated these potential WEBs at between $700m and $1,050m as outlined in Table 11.

Table 11 : Potential corridor WEBs

POTENTIAL WEBS		
WEB	Low Range ($M)	High Range ($M)
Tourism	183	274
Forestry	119	179
General productivity	40	60
Increase in Labour	270	406
Resilience	88	131
TOTAL	**700**	**1050**

Through discussion with the Policy and Investment team at the Transport Agency, it was agreed that not all of these WEBs fit within the current EEM approach and therefore should be presented in two parts, as WEBs and Wider Economic Impacts (WEIs). The definition if each is as follows:

- **WEBs** : Increase in Labour and Resilience,
- **WEIs** : Tourism, Forestry and General Productivity

These potential WEBs and WEIs are for the entire corridor from Pūhoi to Whangarei. To apportion these to the Projects within the corridor the forecast travel time savings per vehicle by section has been used. This results in the Project specific WEBs as outlined in Table 12.

Table 12 : Potential WEBs by corridor section

	POTENTIAL WEBS AND WEIS			
Route Section	Low Range WEBs ($M)	Low Range WEBs and WEIs ($M)	High Range WEBs ($M)	High Range WEBs and WEIs ($M)
Puhoi to Warkworth	190	371	285	557
Warkworth to Te Hana	79	154	118	231
Puhoi to Te Hana	269	525	403	788
Te Hana to Whangarei	90	175	135	263
TOTAL		**700**		**1050**

Economic summary of Indicative Alignment

The above tables refer to the Pūhoi to Wellsford corridor economic case. Table 13 outlines the economic case for the Project, being the Warkworth to Wellsford section and includes the most upto date cost information.

Table 13 : Project economic summary table

ECONOMIC EFFICIENCY	
Time zero	1 July 2017
Base date for costs and benefits	1 July 2017
Present value net total Project cost of Project	$1043m
Present value net benefit of Project (exc. WEBs)	$696m
Present value net benefit of EEM WEBs of Project	$79m
Present value net benefit of WEBs and WEIs of Project	$154m
BCR (exc. WEBs and WEIs)	0.7
BCR (inc. EEM WEBs)	0.7
BCR (inc. WEBs and WEIs)	0.8

Benefits	
Travel time benefits	$563.5m
Vehicle operating cost benefits	$16.9m
Accident cost savings	$55.9m
Vehicle emissions	$0.8m
Travel time reliability	$28.2m
Resilience	$31.2m
Total	**$696.5m**
Costs (NPV)	
Capital cost	$1007m
Operations and maintenance	$36m
Total	**$1043m**

Travel time benefits make up the majority of benefits for the scheme, approximately two thirds of the total conventional benefits with crash benefits making up the remainder. This is consistent with assessments for other inter-regional rural highway Projects where, typically, travel time savings dominate.

This cost benefit analysis is based on the following assumptions:

- Costs are split across a 6 year construction period spread evenly over the 6 years.
- Benefits accrue from year 7 to year 40 with a discount rate of 6%
- "Urban other" values of time have been used from the NZ Transport Agency EEM
- Peak hour model outputs have been factored to daily levels and then annualised, multiplying by 350 to reflect weekends.
- With 90% of traffic on the corridor routing onto the new option, crashes on the existing state highway would be expected to reduce by approximately 100%, assuming that the Dome Valley safety improvements have already resulted in a reduction of 65%. This high level analysis has been undertaken rather than assessing individual accident types and causes.

This latest economic analysis has seen an increase in the Project BCR (without WEBs) from the 0.25 in the SAR to 0.6 as outlined above. The costs have remained similar, the change has therefore been to the benefits. This driven by the following changes:

- "Urban other" values of time have been changed to "Rural strategic" given the strategic nature of the route
- Updated EEM factors

- Updated transport modelling which has seen increases in land use in the area consistent with the recent Unitary Plan decisions version

Traffic forecasts have been updated to reflect the increased land use in the area as a result of the Unitary Plan. This has resulted in increased demand (as predicted in the SAR economic assessment).

The BCR for the Warkworth to Wellsford Project has been assessed to be 0.7 without WEBs, with WEBs and WEIs the Project BCR increases to 0.8.

This Project is part of the broader approach of improving the accessibility between Northland and the rest of the country as outlined in the NEAP which seeks to increase the economic performance of the Northland economy. Whilst the Project BCR is less than 1, it is important to recognise the nature of the Warkworth to Wellsford Project is a section of the wider Pūhoi to Wellsford corridor Project, which has a BCR of 1.1 (with WEBs and WEIs).

At the time of the DBC development, the EEM was being reviewed. The outcomes of this review are unknown, however could impact on the transport benefits associated with this project. This is an uncertainty until the new EEM is released and the resultant changes (If any) are known.

Sensitivity analysis

A number of sensitivity scenarios have been analysed. The following scenarios have been considered:

1. A 25% reduction in cost (given Pūhoi to Warkworth experience)
2. A 10% increase in cost
3. Excluding safety benefits

Table 14 summarises the results of these sensitivity testing.

Table 14 : Economic sensitivity analysis

SENSITIVITY TESTING	
Scenarios	**BCR (ex WEBs)**
25% reduction in cost	0.9
10% increase in cost	0.6
No safety benefits	0.7

Assessment Profile

The Warkworth to Wellsford Project was assessed using the latest Transport Agency "Investment Assessment Framework for the 2018-21 National Land Transport Programme", April 2018. This outlines a two-stage assessment process that includes and assessment of Results Alignment and Cost Benefit Appraisal and Revenue Strategy (IRS)31 guidelines. An assessment profile of the Warkworth to Wellsford Project is a **Priority 5/6** (depending on

how the Access criteria is treated) having been determined using the Transport Agency's funding allocation process as detailed below:

Results Alignment

The criteria for results alignment is outlined in Table 15. This shows the criteria for either a low, medium, high or very high rating.

Table 15 : IAF Results Alignment Guidance

GPS PRIORITIES	LOW	MEDIUM	HIGH	VERY HIGH
	A low results alignment may be given if the activity addresses one or more of the following criteria:	A medium results alignment may be given if the activity addresses one or more of the following criteria:	A high results alignment may be given if the activity addresses one or more of the following criteria:	A very high results alignment must only be given if the activity addresses one or more of the following criteria:
Safety - a safe transport system free of death and serious injury	• address safety gaps with reference to the ONRC	• addresses safety issues presenting a medium crash risk[8], affecting communities subject to medium safety risk, and/or in Safer Journeys area of medium concern	• addresses safety issues presenting a high crash risk, affecting communities subject to high safety risk, and/or in Safer Journeys area of high concern • addresses safety issues presenting a high societal consequence risk	• implements a speed management approach focusing on treating the top 10 percent of the network that will result in the greatest reduction in deaths and serious injuries • targeting areas of high collective risk with high DSI reduction measures that achieve a DSI reduction of at least 40%
Access to opportunities, enables transport choice and access, and is resilient - Thriving regions	• address identified resilience gap or impediments to accessing social and economic opportunities	• addresses an identified gap in an approved RED programme • addresses significant resilience gap or impediment to access on regionally important social and economic connections • supports priority elements in agreed integrated land use and multi-modal plans in regions • makes best use of key corridors that prioritise regional freight and tourism • provides operational efficiencies to reduce the costs of meeting appropriate levels of service without impacting benefits adversely	• enables a significant regional economic development opportunity in an approved RED programme • addresses significant resilience gap or impediment to access on nationally important social and economic connections • addresses a gap in an approved RED programme in high priority RED regions • makes best use of key corridors that prioritise national freight and tourism • provides significant operational efficiencies to reduce the costs of meeting appropriate levels of service without impacting benefits adversely	
Access to opportunities, enables transport choice and access, and is resilient - Liveable cities	• address identified resilience gap or impediments to accessing social and economic opportunities	• addresses significant gap in access to social or economic opportunities • address identified gap in access to new housing in medium growth urban areas • addresses identified resilience risk to continued operation of the network • addresses significant gap in integrated intermodal and user information, and significant deficiencies in network operation • provides operational efficiencies to reduce the costs of meeting appropriate levels of service without impacting benefits adversely	• supports high priority elements in agreed integrated land use and multi-modal plans • address significant gap in access to new housing in high growth urban areas • addresses a significant resilience risk to continued operation of key corridors • makes best use of key corridors that prioritise multi-modal use and freight • provides significant operational efficiencies to reduce the costs of meeting appropriate levels of service without impacting benefits adversely	
Environment - Reduce adverse effects on the climate, local environment and public health		• enables reductions in harm to the environment and people, particularly arising from land transport-related air pollution, noise, and impact of construction and ongoing use of transport infrastructure on water quality and biodiversity • addresses long term reductions in greenhouse gas emissions from land transport	• addresses significant reductions in harm to the environment and people, particularly arising from land transport-related air pollution, noise, and impact of construction and ongoing use of transport infrastructure on water quality and biodiversity • addresses long term significant reductions in greenhouse gas emissions from land transport	

There are two key components of the investment outcomes that relate to the results alignment criteria:

- Safety
- Access – Thriving Regions

Safety is the first priority, with access a second order criteria.

It is also important to acknowledge that this project is predominantly about route protection and this is a long-term project and therefore this timeframe has been considered in this assessment against the results alignment criteria.

Assessment- Safety

It is considered that the project meets the MEDIUM criteria for safety for the following reasons:

- The Warkworth to Wellsford section of SH1 has a high crash risk (due to the number of DSIs ad Collective risk rating of medium-high) and this option addresses the long-term safety concern of the corridor.
- It is acknowledged that the Dome Valley Safety works will improve safety in the corridor. However, it is important to acknowledge that:
  - Dome Valley works are short term only

    - These works will still result in a forecast number of DSIs of 30 every five years in this section of the corridor (67% reduction in this part of the corridor)
    - There are a number of fatalities in the corridor outside of the Dome Valley works section
    - Traffic volumes are increasing a high rate in this corridor
- There have been recent increased in DSIs (including fatal) in this corridor recently that are not included in the DBC figures, further emphasising the safety risk in this corridor.
- The stated ONRC outcome for this section of state highway is a 4 Star Kiwirap rating, the long term recommended option will achieve this safety outcome

It is considered that the results alignment is a **MEDIUM** for safety.

Assessment - Access

It is considered that the project meets the **MEDIUM/HIGH** criteria for access for the following reasons:

- Northland is a RED and this project is identified as an important element of the transport component of the RED programme and importantly states that this section of State Highway 1 should be route protected prior to 2022. This project is therefore a stated enabler of the RED programme
- The route provides access to the major tourism area of Northland (eg Bay of Islands) which had over 1M visitor nights in 2015 and exceeded a $1Bn industry for the Northland region.
- From a resilience perspective, it is considered there is a gap (with the state highway closed for over 30 hours) effecting access

It is considered that from an access perspective, the assessment could be either medium or high, the assessment.

Cost Benefit Appraisal

The BCR for Warkworth to Wellsford as outlined above is less than one, with the broader Pūhoi to Wellsford corridor Project BCR being just above 1, of LOW.

Prioritisation

Based on the two criteria, an investment priority weighting is identified as defined in Table 16. Based on a **MEDIUM/HIGH** Results Alignment and a Low Cost Benefit Appraisal, an investment **Priority of 5/6** is identified. It is important to note that this investment priority relates to the implementation of the project, which is some years away and further investment analysis is proposed prior to the commitment of any implementation funding, when results alignment would also be updated.

Table 16 : IAF Prioritisation criteria

RESULTS ALIGNMENT	COST- BENEFIT APPRAISAL	PRIORITY ORDER
Very high	L/M/H/VH	1
L/M/H	Very high (BCR 10+)	2
High	High (BCR 5-9.9)	3
High	Medium (BCR 3-4.9)	4
Medium	High (BCR 5-9.9)	4
High	Low (BCR 1-2.9)	5
Medium	Medium (BCR 3-4.9)	5
Medium	Low (BCR 1-2.9)	6
Low	High (BCR 5-9.9)	7
Low	Medium (BCR 3-4.9)	8
Low	Low (BCR 1-2.9)	Exclude

FINANCIAL CASE

The cost of implementation of the Project is forecast to be between $1.7Bn and $2.1Bn (in 2017 dollars). This cost includes the necessary construction, property and implementation costs as well as maintenance and operational costs (including the proposed tunnel).

Implementation funding is not yet allocated in the RLTP, with funding in the current 2018-2028 RLTP ($5M in total) committed to investigations (securing the necessary statutory approvals as outlined in this DBC) for this Project.

More work is required on the exact form of implementation and potential additional funding sources (through other sources such as tolling) before the financial case can be finalised.

Project delivery costs

The costs of the Indicative Alignment are summarised in Table 17 below.

Table 17 : Indicative Alignment cost

PROJECT COSTS	
Item	**Costs ($M)**
Base Estimate	1,486
P50 Contingency	245
Expected (P50) Estimate	1,731
P95 Contingency	342
Expected (P95) Estimate	2,073

This shows an estimate of between $1,731M and $2,073M. These P50 and P95 figures represent an increase of 16-40% to the base estimate. These costs have been peer reviewed and are within 8% of this review.

A detailed outline of assumptions included in this pricing can be found in section 12 of the SAR. Since the SAR the estimate has been updated as the scheme as evolved. Some of the key assumptions include:

- Pricing and rates are current as at 2nd quarter 2017 and have been derived from the Pūhoi to Warkworth Project estimate where appropriate
- Rates and prices exclude GST
- No escalation has been allowed for beyond June 2017
- Transport Agency managed costs for all phases – 2.5% of physical works cost for all phases
- Design & documentation – 10% of physical works cost

- MSQA – 4% of physical works costs
- Allowances for required environmental compliance.
- Different ground treatments were assumed for embankments along the length of the alignments, based on the geotechnical terrain systems being traversed. The treatments included provisions for items such as wick drains, piles, excavate and replace and geotextiles, to a total provision of $120M
- OGPA pavement has been assumed
- Viaducts were generally provided where fill depth exceeds 25 m for a longitudinal length of 50 m or more.
- Incorporates allowances for barriers, signage, road marking, lighting and ITS.
- A nominal allowance was made for general service relations. Works in the vicinity of the Transpower pylons and oil / gas pipelines have also been included.
- 3% of physical works cost, excluding P&G, for landscaping.
- The costs of the tunnel option were based on the Johnstone's Hill Tunnels costs with up lift for escalation and increased cost of the mechanical/electrical systems to cater for the deeper and longer tunnel length.
- Preliminary and general (P&G) is assumed at approx. 50% of physical works costs
- Risk and contingency
- Property costs have been excluded

Ongoing maintenance and operations costs

Operations and maintenance costs for the Indicative Alignment were prepared in the initial scheme assessment work in 2011. A significant proportion of these costs are the annual costs of operating and maintaining the proposed tunnel. These costs have been calculated at $330K per year for tunnel maintenance and $1M per year on tunnel operating costs (assuming lighting running for 16 hours per day and fans running for 2 hours per day).

Within these costs is a small allowance for contingency.

These operations and maintenance costs once discounted (over 40 years at 6% as per EEM) account for around 1% of the overall discounted capex costs for the Project. This means that while the operating and maintenance costs are important from a financial and funding perspective, they do not have a significant impact from an economic analysis / economic performance perspective.

There is opportunity to refine operating and maintenance costs in the next phase of work on the Project. For example, by critically examining both vertical geometry and tunnel cross section and other factors such as the use of LED lighting brings power consumption down with longer life thus reducing maintenance costs.

Project revenues

No detailed analysis of potential Project revenues has been considered. Potential Project revenues could include tolling revenue. As no decision has been made on whether the Project will be tolled, no analysis has been undertaken of the potential revenues, or impacts on traffic movements that tolling would have.

An indicative tolling analysis has been completed assuming the current level of toll as on the Northern Gateway and 90% of traffic use the new route. This is an ambitious usage assumption but provides an understanding of the potential upper bound of potential income from tolling. This analysis indicates an annual income of approximately $20M, giving and NPV value over 40 years of approximately $150M. This shows tolling will assist in funding the Project but does not pay for the cost of the Project.

If tolling was to be considered, this detailed analysis would need to be undertaken.

Implementation Funding options

The mechanism for the implementation of the Project is not yet confirmed and therefore it is difficult to consider in detail the funding options at this time.

Implementation funding is not yet allocated in the RLTP, with funding in the current 2018-2028 RLTP ($5M in total) committed to investigations (securing the necessary statutory approvals as outlined in this DBC) for this Project.

There is also $43M of property purchase funding available (from 2016 to 2021) in the current RLTP which is considered sufficient for the potential property purchases over that time period. Additional funding will be required if the route protection is secured.

Funding through the National Land Transport Programme (NLTP) is the most likely source of funding in full or part for the Project. Other funding options could include a Crown grant and the potential for private funding through a PPP procurement model.

Given the Project BCR is less than 1.0 with traditional EEM benefits, there is a possibility that the Project would not be fully funded by the NLTP, although we note the Ara Tūhono Pūhoi to Wellsford project has a BCR greater than 1.0. Any shortfall in funding would be required to be closed to allow the Project to be implemented. This shortfall could include options such as a Crown grant.

The Pūhoi to Warkworth section is being implemented through a PPP model. This has the impact from a funding perspective of spreading the funding burden over 30 years rather than funding the cost over the five year construction period.

Route Protection Funding

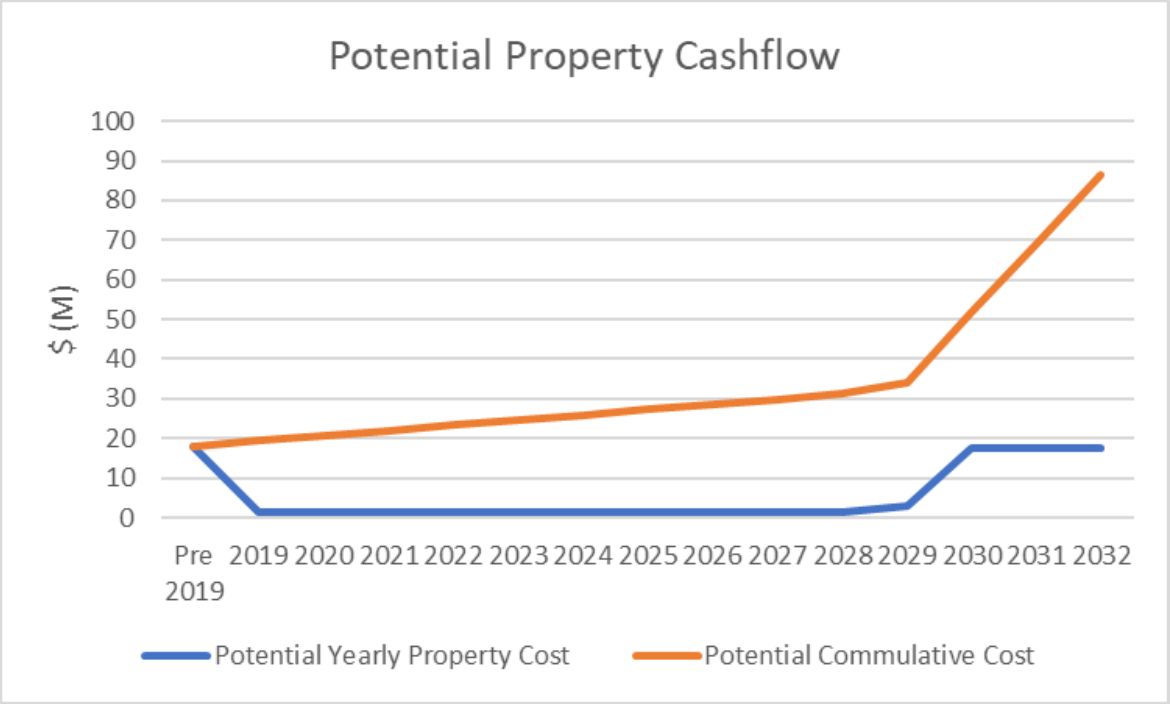
If the Project is route protected there is a cost associated with this route protection. This includes:

- Approximately $4M of cost in obtaining the designation associated with protecting the route
- A theoretical property liability of $87M, being the full cost of acquiring the properties within the proposed designation.

It is estimated that the actual cost of property would be substantially less in the years preceding implementation. Typical projects undertaken in the transport industry with longer periods of time between route protection and implementation have found that in the order of 75-80% of property purchases occur in the 2-3 years prior to implementation when

certainty of funding and physical works starting is known. This historical pattern indicates a 'likely' property funding need of in the order of $15-$25M in the period prior to immediate implementation.

An indicative property forecast as a result of the route protection approach is shown below:



There is the risk that this cost could increase if there was a need to purchase a greater number of properties. This could occur in this corridor due to the relatively low intensification likely (therefore incentive to hold onto properties for as long as possible due to increasing value). Given the predominantly rural nature of the properties and the productive nature of many of the properties this is likely to temper this risk (as the land will likely be attractive to potential purchases for the existing use).

This risk could be minimised through a more rigid application of the hardship approach to property purchases which is appropriate for a designation with a potentially longer timeframe to implementation. Clarity of this hardship approach for property owners will be important so all parties understand the likely implications for them.

PART B – READINESS AND ASSURANCE

COMMERCIAL ANALYSIS

Introduction

This is a significant Project from a scale and complexity perspective. Implementation of the Project will require careful planning and execution to ensure the commercial success of the Project, as a 10% change in the financial performance of the Project is over $100M.

As demonstrated on the successful Waterview Project in Auckland, the Transport Agency have the required capability, processes and experience to manage this implementation.

Route Protection

As identified through the development of the DBC, whilst there is certainty that the Indicative Alignment is the right long-term solution, there is considerable uncertainty on the exact time when the Indicative Alignment is required. It is therefore recommended that the Indicative Alignment is only funded for Route Protection at this time until there is greater certainty on the implementation timeframe.

Route protection of the Indicative Alignment is important to provide certainty for implementation (when required), stakeholders and property owners. This certainty is important for stakeholders as the Indicative Alignment has been provided to the communities and is therefore known and is providing considerable uncertainty for property owners (as there is a route known, but not protected officially). The provision of a designation also signals the long term intention for the corridor, allowing other projects to proceed with greater clarity of what could happen in the future. The NEAP clearly outlines the importance of this certainty for long term investment in Northland as well.

Given the scale and length of construction of a Project of this scale, the earlier that route protection is completed the better as this also provides the investor greater flexibility to deliver the outcomes once the implementation phase is approved. Waiting to route protect once there is greater certainty of the actual implementation date could unnecessarily delay implementation by many years and could result in a more challenging approvals process as land is developed and areas become more sensitive to new infrastructure. Whilst not all areas along the route are subject to development pressure, the southern end of the Project in Warkworth is an identified area of significant growth.

Obtaining route protection if forecast to take in the order of 12-24 months. The initial investigations (AEE) as part of this process are currently being progressed.

During development of the Project to date, the lessons learnt from Puhoi to Warkworth and other Transport Agency Projects have been considered. A coordinated approach between design, planning, property and operational considerations has been undertaken to provide flexibility for future implementation, whilst also ensuring potential adverse effects are identified and understood by stakeholders and potentially affected property owners.

It is therefore recommended that the Indicative Alignment is route protected as soon as practical to secure a corridor for future construction when the Project is needed, to provide much needed certainty for Project stakeholders and land owners along the route, and to provide the Transport Agency with maximum flexibility of implementation into the future.

The implications of this proposed route protection would include approximately $4M of costs associated with obtaining the route protection. There would also be the potential property liability of upto $89M once the designation was approved. It is estimated that the actual cost of property (prior to the immediate 2-3 years prior to implementation when property acquisition typically increases) would be in the order of $15-$25M.

Implementation strategy

The timing for implementation is not yet known. However, the route protection process is intended to be progressed during 2019/20. The current programme is to submit a Notice of Requirement to designate land in 2019 and related resource consents to ensure the land required for the Project is protected and ready for future construction and is known publicly so appropriate planning and preparation can be made for the Project.

This is considered a prudent approach as there is a clear need for the Project to be completed in the future. Whilst there is some uncertainty over exactly when the Project is needed, given it depends on transport demand growth through the corridor, the Indicative Alignment is the right solution when the need arises. Projects of this scale are expensive to implement and therefore funding will play an important role in the ultimate implementation of the Project. However, there is a timing issue and current analysis indicates a need for the Project in around 2030.. It is therefore prudent to protect the route now as this process takes time and provides certainty for landowners, stakeholders and customers as to where the route will go.

Whilst there is no funding commitment for construction, there is some funding available for property purchase. The 2018-2028 RLTP has $5M of funding available for investigation (route protection of this Project).

There are a number of options for implementation. Based on the procurement strategy development for the Pūhoi to Warkworth project, a Project of this scale and complexity the favoured implementation approach is either:

- Competitive alliance
- Design and construction
- PPP

Whilst no detailed analysis of the possible procurement options has been progressed at this time a collaborative contract is preferred over a design and construction style contract. Similar to the Pūhoi to Warkworth section, this is considered to provide a better commercial

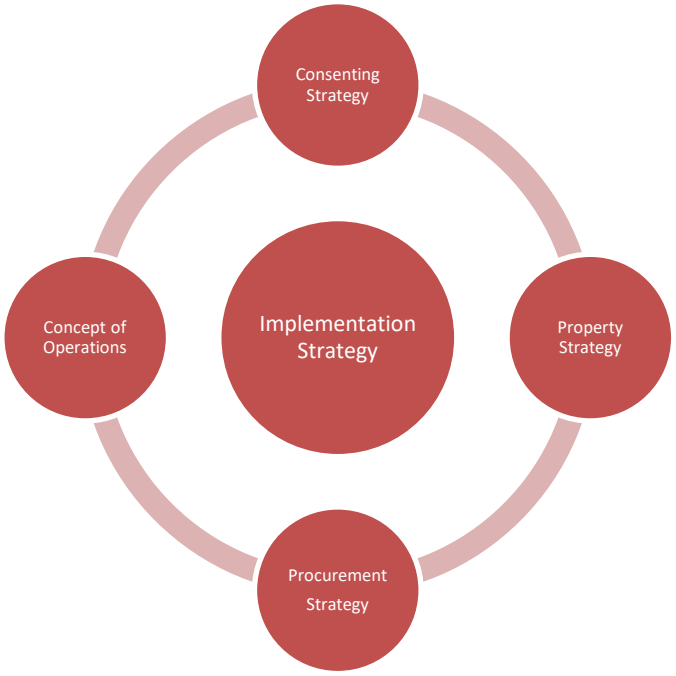
outcome and risk management approach due to the unknown construction timeframe and likely risk profile (including geotechnical).

No decision on the funding approach has been determined as yet, but a PPP is a potential funding model which would dictate the form of the implementation contract. The Transport Agency have used this model with success for two other large Projects, being the Pūhoi to Warkworth section of this Project and Transmission Gully in Wellington.

Implementation of the Project has been considered throughout the Project's development to ensure its successful implementation. An example of this is the current consenting strategy which seeks to build on the success of the Pūhoi to Warkworth section and seek outcome based consent conditions that provide increased flexibility for the constructor to implement the Project as efficiently as possible. The design is also being developed to support this approach.

This holistic approach is summarised in Figure 21.

Figure 21 : Aspects of Implementation Strategy



Consenting strategy: Will seek outcomes based conditions with flexibility for implementation and also an appropriately sized designation to allow for this flexibility.

Property strategy: The property strategy identified early purchase provisions and a proven process of early engagement with property owners to ensure property is not an impediment to the Project implementation. The property strategy is currently being updated to reflect updated costs and funding availability for purchases. The property strategy update will ensure consistency with the Transport Agency's Advance Purchase Policy for Property Acquisitions. An important component of this strategy will be the focus of property acquisition in the years (typically three) immediately prior to implementation.

Procurement strategy: A procurement strategy is yet to be prepared, however building upon the Pūhoi to Warkworth section procurement strategy we know that there are a number

of robust procurement options that the Transport Agency has the capability and process to appropriately manage. This procurement strategy will be an important component of the proposed "Implementation Business Case"

Concept of operations: A concept of operations has been prepared for the Project and has identified operation and maintenance requirements of the Project, including specifically the proposed tunnel and also considers different implementation methods depending on the overall Project implementation approach.

Risk allocation and transfer

A risk management process is undertaken regularly by the Project team. This includes a risk workshop where the risks and opportunities facing the Project are identified. Management controls are identified to reduce or avoid these risks.

The current top risks for the Warkworth to Wellsford Project identified by the Transport Agency at this time are as follows:

- **Funding risk:** There is a risk that the Project does not obtain funding for future stages. This risk creating increased uncertainty for stakeholders and particularly property owners. Without this funding commitment, implementation timing is not able to be confirmed. This risk is being mitigated by being clear with stakeholders that implementation funding at this time is not yet confirmed.
- **Interface with stakeholders**: Interfacing with the Project's stakeholders is a risk and important to ensure successful outcomes for the Project and its stakeholders. Ensuring stakeholders understand the Project will assist in understanding any stakeholder concerns. The mitigation strategy is to engage early and often with stakeholders on issues as they arise.
- **Project Technical challenges** – There is a risk that ground conditions and terrain result in a more costly scheme and additional substantial mitigation requirements. This is mitigated by undertaking further investigations and appropriate contingency in the cost estimates. Given the terrain and geology of the route, this technical risk will remain till implementation.

These risks are focussed on the pre-implementation phase, and the risk register will be updated with a greater focus on implementation once more detailed analysis being undertaken in the pre-implementation phase is completed.

Implementation sourcing options

Similar to the Pūhoi to Warkworth section, this Project is of such a scale that it is anticipated there would be international interest. There is also the capability locally to deliver a Project of this scale and complexity in New Zealand and this experience sits with a number of suppliers, giving confidence of strong competition from suppliers to undertake this Project. This experience extends across all of the implementation options being considered.

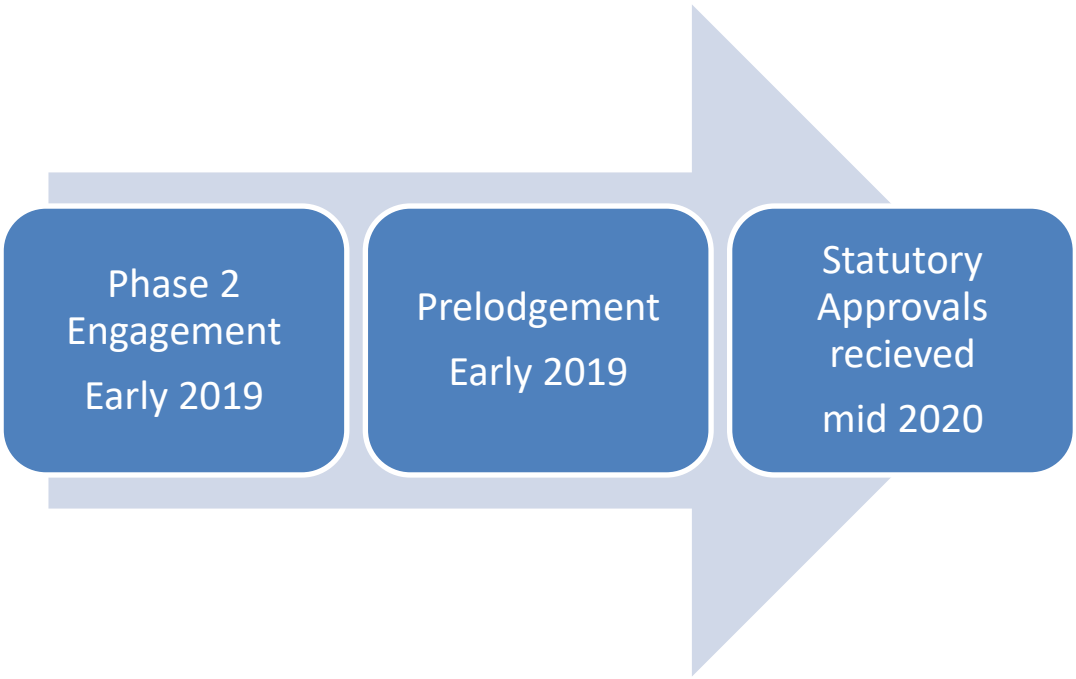
Contract length

If the Project was completed in a single stage, it is anticipated that the construction duration would be between 6 and 7 years. Depending on the type of contract for implementation, the ongoing maintenance and operational requirements would determine the final contract length (i.e. if a PPP was adopted the contract length could be 30 years).

Schedule

The pre-implementation phase of the Project has unknown timeframes given the two-step consenting approach. Timeframes are subject to change given the uncertainty of the two-step process (i.e. if there are appeals to the first step decision). Figure 22 outlines **indicative** milestone dates that the Project is currently working to based on the experience of the Transport Agency and its advisors on Projects of this scale. This would see statutory approvals obtained in early 2020.

Figure 22 : Indicative Pre-implementation milestones



The timing of implementation of the Project will depend on a number of different factors, including the significant issue of funding. Once the pre-implementation phase is complete there will a focus on establishing the implementation pathway.

MANAGEMENT CASE

When is the project needed

A key task for the management case will be determining when to implement the Project. This is particularly important for this Project given the level of uncertainty of the pace and scale of growth in the area and the performance of the short-term safety measures.

This is a significant Project that will take time to get ready for implementation and then ultimately deliver. An indicative construction period of seven years is envisaged . Clarity on when the Project is needed is therefore important to ensure the Project is in place and delivering the outcomes required when needed. If we wait for the project to be needed before planning implementation, we will be seven years too late.

The need for the Project relates directly to the poor level of safety and poor resilience in the corridor. The current level of service is not commensurate with the ONRC for this area of the state highway network.

Projected pace of growth will impact on the need for this Project, as will other factors such as traffic demand management (TDM) and peak hour demands. With the forecast increases in development at either end of the Project (Warkworth and Whangarei) growth in movement through the corridor is forecast to increase substantially over the next ten years and beyond. This could result in increased safety and resilience pressure in the corridor. Given the scale of the proposed growth in Warkworth in particular, there is considerable uncertainty in forecasting the exact pace of this growth. There is therefore considerable uncertainty on the timing for the long-term solution for the corridor, being the Indicative Alignment.

A mix of criteria is proposed to trigger the consideration of implementation for the Project, being at least two of the following criteria:

- DSI savings forecast from Dome Valley safety improvements not achieved within 3 years
- A 30% increase in total number of closure hours per annum from 2018 levels
- Forecast traffic volumes are predicted to exceed 25,000 AADT

Monitoring these triggers would also allow the opportunity for investment in the corridor before the triggers are met, such as corridor TDM initiatives and potential investment in the rail corridor as examples. This could further impact on the timing of the triggers being met.

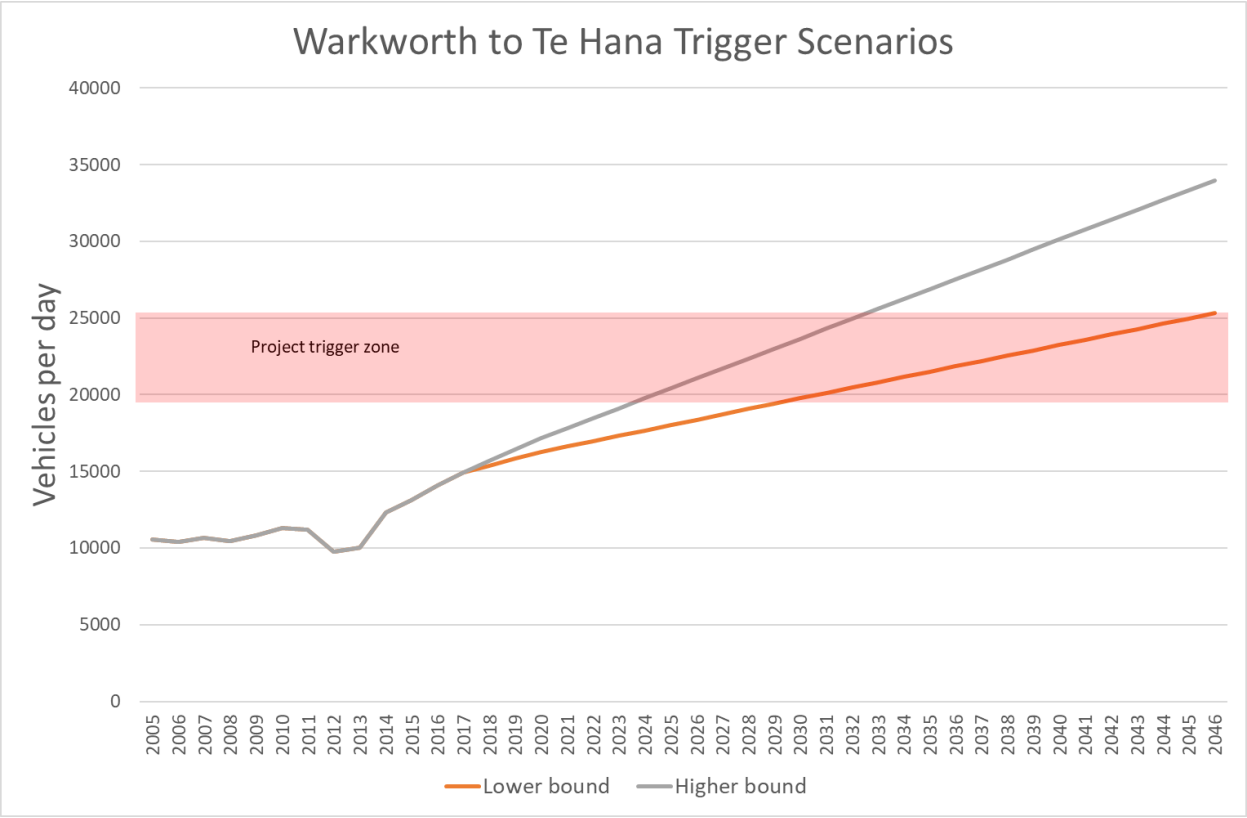
This combination of triggers has been selected for the following reasons:

- **Safety:** This is a significant driver for the Project and if the short-term safety solutions are working as effectively as forecast, the long-term (step change) safety solution should be progressed.
- **Resilience:** The availability of access to the Northland economy is critical. If this deteriorates the long-term solution needs to be implemented.
- **Growth:** As outlined in Figure 23 a trigger ‘window’ of a daily volume of between 20-25,000 AADT was originally considered the appropriate zone for the Project. A

relative wide range of trigger is forecast as the rate of growth in the peak periods, number of heavy vehicles and potential impacts of resilience challenges in the corridor will all have an impact on the urgency for the Project. This range allowed a level of flexibility in the decision to implement the scheme. The higher value of this range is proposed as the other two criteria, being safety and resilience are the more important drivers for the project.

This indicates a relatively wide range of timing for the Project, depending on growth rates.

Figure 23 : Implementation Triggers



Initial analysis indicates that the above trigger criteria could be triggered as soon as 2032 or after 2040.

Given there is uncertainty over the pace of growth in the corridor, it is considered prudent to route protect immediately for the Project to ensure that there is the ability to implement the Project when needed at some stage in the future . This will also provide certainty to property owners throughout the corridor.

Future Investigations

This DBC identifies that there is uncertainty associated with the exact timing of the recommended long-term solution for this corridor due to the scale and pace of change currently and forecast to occur over the next thirty years. This uncertainty is not unusual for a project of this scale. Project triggers for implementation have therefore been identified as part of this DBC.

It is also recommended that once these triggers are met given the scale of the investment and potential gap in time from this DBC, further analysis is undertaken to assess the funding for implementation. This should take the form of an additional business case step, being an "Implementation Business Case" that focusses on the case for implementation of the Indicative Alignment, including consideration of (but not limited to):

- Most recent growth in population and land use in the corridor
- Role of North Port and impact on freight patterns (mode etc)
- Role of Northland Rail Line
- Technology changes
- Any updates to EEM (currently under review)
- Affordability

It is recommended that this "Implementation Business Case" is undertaken when the triggers outlined previously are met.

Project Monitoring (benefits realisation)

The short-term options identified for the corridor should be investigated and implemented as soon as practical. The effectiveness of the Safer Roads Alliance improvements in the Dome Valley should be monitored yearly to understand what actual impact they are having and what this might mean for likely triggers being met, or the adequacy of the proposed triggers.

This monitoring should be reported yearly to the Project Sponsor.

Project Management Board

The Project Management Board is a leadership team providing governance to the project team delivering the main components of the statutory approvals work.

During the implementation phase this governance structure will need to be updated to reflect the changing nature of the Project and the expert governance experience the implementation phase will require.

NZ Transport Agency Board

The NZ Transport Agency Board has overall responsibility for Transport Agency Projects. The Board reports directly to the Minister of Transport and is responsible for:

- land transport planning
- managing the state highway network
- regulating access to, and participation in, the land transport network
- promoting land transport safety and sustainability.

Agency Decisions Committee

The Decisions Committee is the most senior Project decision making team within the SD&D group, which comprises the National Manager Professional Services and various other senior managers and technical specialists.

Project Sponsor

The Project Sponsor is Paul Glucina, System Design Portfolio Manager. The Project Sponsor is responsible for:

- Ultimate authority and responsibility for the Project
- Endorsing changes to scope, schedule, budget and quality
- Endorsing escalation and championing recommendations to the Agency Decisions Committee
- Providing policy guidance to the Team Leader
- Endorsing the Project Management Plan to confirm that Project scope and deliverables are correct
- Reviewing progress and providing advice on resolution of issues
- Supporting the Project Leader
- Resolving issues beyond the Project Leader's authority.

Team Leader

The Project Leader is John Robson, Senior Project Manager (Complex Projects). The Team Leader is responsible for:

- Delivering the Project
- Managing any changes to consultants' scope, schedule, budget and quality
- Endorsing escalation and championing recommendations to the Agency Decisions Committee
- Providing leadership to the Project team
- Delivering the Project Management Plan to confirm that Project scope and deliverables are correct
- Supporting the Project team

Project roles

The Project team comprises of:

ROLE	NAME
Project Sponsor (SD&D)	Paul Glucina
Team Lead/ Project Manager	John Robson
Principal Planner – Consents	Belinda Petersen
Stakeholder Manager	Kelli Sullivan
AEE Professional services supplier	Jacobs/GHD JV
Legal services supplier	Chapman Tripp

Assurance and acceptance

Formal construction funding acceptance (sign-off) of a Project of this size will require approval of the Transport Agency Board. As for a traditional procurement model (e.g., Competitive Alliance), all standard value gate processes would apply, including risk and assurance committee, and the Decisions Committee, prior to going to the Board.

The Transport Agency has documented processes and policies for independent road safety audits, structures design reviews and internal and external roading, environmental including urban and landscape design reviews under a traditional procurement approach. These will be used, where appropriate, subject to the overriding objective of ensuring the consenting approach facilitates innovation, is outcomes-focussed, while also maintaining assurance for the Transport Agency around the asset quality.

Key dates as currently envisaged for this assurance are outlined in Table 15.

Table 18 : Key Assurance milestones

ITEM	BY WHOM	TIMING
DBC Approval	Decisions Committee then Board	Second half 2019
Approval to lodge NOR application	Decisions Committee then Board	Early 2020
Implementation Procurement	Decisions Committee then Board	TBC

Change control

The SD&D group of the Transport Agency has documented policies and procedures on scope change with financial delegations set out in the Transport Agency Instruments of Delegation. These change controls will be adhered to during the delivery of the Project with escalation to the appropriate scope committees as required to ensure that any initiated scope change is given full value-for-money considerations, as any significant change in scope post-financial close is likely to have considerable and long-term portfolio implications.

Cost management

The SD&D group of the Transport Agency has documented policies and procedures on cost management. Given the current stage of the Project (pre-implementation) this is largely managing professional service costs and other miscellaneous supplier costs associated with the Project.

The Project team includes a dedicated Project Manager (John Robson) to support the team leader in this function as well as two other Project management resources.

Monthly cost reporting is required of all consultants and these costs are tracked and monitored in the Transport Agency internal systems in a no surprises environment.

The property budget is the most significant area of the current Project budget and this is also managed by the Project Manager.

LESSONS LEARNED AND POST IMPLEMENTATION MONITORING

Lessons learned

Lessons learnt from this Project will be fed back into the Transport Agency's Project development and delivery lifecycle through a number of different mechanisms and levels of Project and Transport Agency management. These include a Lessons Learned Review (LLR) and Contract Management Review processes.

A lessons learnt process is being implemented for the consenting process. The Project team is also actively engaging with Project teams on other similar Projects to gather and learn from their experiences, including the Pūhoi to Warkworth Project as an example.

Post implementation monitoring

The Warkworth to Wellsford Project objectives are presented in Section 4. Monitoring the achievement of these objectives will be a continuous process as the Project progresses through detailed design, construction and operation.

A detailed post construction monitoring regime will be developed for the Project at the appropriate time to assess whether the outcomes envisaged have been delivered. This benefits realisation assessment will then allow lessons learnt and mitigation plans to be developed and fed back into the Transport Agency.

Benefits Realisation

The Project has been developed to provide the benefits outlined in this DBC. It is critical that these benefits are tracked to ensure they are realised, or if not there is data available to assist in understanding why. This allows this investment to me maximised as well as providing the opportunity for future investment decisions to be enhanced through real data rather than forecasts (which are by their nature less certain).

Given the uncertainty around the implementation timing of this project and then future investigation step proposed closer to implementation it is recommended that a benefits realisation plan is developed at that time to be consistent with the latest thinking and the most recent outcomes sought.

APPENDIX A – ONLINE AND OFFLINE OPTION ASSESSMENT

Assessment and evaluation methodology

For the evaluation of the short-list options and to enable the identification of the Selected Option, an MCA process was developed during the SAR phase with reference to the Project objectives for the Ara Tūhono Pūhoi to Wellsford project.

The six evaluation framework categories were as follows:

- **Assisting economic development** – through improved strategic connections for freight and tourism between the Auckland and Northland regions
- **Safety and personal security** – through improved road safety and reduced road crashes
- **Improving access and mobility** – through improved route security, resilience, reliability and connectivity
- **Protecting and promoting public health** – through improved community connectivity and reduced severance
- **Environmental sustainability** – assessment of the key effects on natural and built environments and best use of existing networks and infrastructure
- **Value for money** – relating to cost and ability to be tolled.

Criteria were developed within each of these key categories to reflect the Project issues. These criteria were specifically formed with consideration of the selection of alignment options.

The assessment of options was undertaken following a process of refinement and value engineering of the short-list options.

MCA evaluation scoring

Once the evaluation framework was agreed, the options were assessed against each of the specific criteria set out above. An equal weighting of these criteria was used. The data associated with each of the measures were used to inform the evaluation process, rather than quantify it precisely. The assessments were based on the information collated during both the scoping phase and the subsequent assessments of the short list options and undertaken using expanded criteria and measures as discussed above. Where specific, measurable data was not available, qualitative assessments were undertaken based on professional judgement and experience of the professional design team.

Following the assessment process during the SAR development, workshops were held in April 2016 and June 2016 to evaluate the offline options against each of the criteria from the assessment framework on the following basis:

- + + + Triple positive - very strong positive effects

- ++ Double positive - strong positive effects
- + Positive - small / moderate positive effects
- 0 Zero - neutral with regard to the base option
- - Negative - small / moderate negative effects
- -- Double negative - strong negative effects
- --- Triple negative - very strong negative effects

Then in a December 2016 workshop the same criteria and approach was used to assess the online options. Within each category, the results of the evaluation against criteria were averaged and then these average scores were summed to give the overall rankings. In addition, sensitivity testing was undertaken to test the ranking of options under a series of scenarios that saw the weighting for each of the categories doubled in turn to confirm the robustness of the outcomes of the evaluation (e.g. doubling the weighting of the environmental criteria).

The workshops were attended by a range of specialists from the Project team and the Transport Agency (including road design, geometrics, transport planning, ecology, landscape, cultural, general environmental, Resource Management Act (RMA) planning, legal). The process included a briefing on each of the alignment options and a discussion on the agreed criteria. Specialists provided information on the assessment that they had undertaken for each option and any differences between each alignment option.

The MCA discussion was conducted for each of sectors 4 and 5, with group discussion and agreement on the score for each alignment option for each criterion. Sensitivity testing was run to test whether there were any dominant criteria that were influencing the ranking. The scoring for each option and criteria is presented in the following sections, with the data that supported the discussion and scoring process.

		Sector 4								
	Do Min	DoMin	Option 1	Option 2	Option 2 Alternative	Option 4	Online Option 2: 80km Expressway 2+2	Online Option 3 : Significant 2+1	Online Option 4: Modest upgrade, safety focused	Online Option 5: Safety focus
	0	1	2	3	4	5	6	7	8	9
Assessment of Effects	0									
Assisting Economic Devlopment										
The extent to which the option will enhance inter regional and national economic growth and productivity (RoNS #1).	0		+++	+++	+++	+++	++	+	0	0
The extent to which the option will improve movement of freight and people between Auckland and Northland (RoNS #2).	0	0	+++	++	++	+	0	0	0	0
The extent to which the option will improve connectivity between the medium to long term growth areas in the northern Rodney area (Orewa, Warkworth and Wellsford) (RoNS #3).	0		+	+	+	+	0	0	0	0
The extent to which the option will support local economic development.	0	0	–	– –	– –	–	–	–	–	–
Safety and Personal Security										
The extent to which the option is expected to improve road safety in the area and reduce all road crashes.	0		+++	+++	+++	+++	++	++	+	+
Improving Access and Mobility										
The extent to which the option achieves the strategic (through traffic) function of SH1 as a national significant route linking the Auckland to Northland regions.	0		+++	+++	+++	+++	++	+	0	0
The extent to which the option provides a strategic alternative to address route security, resilience and flexibility.	0	0	+++	+	+	++	0	0	–	–
The extent to which the option provides a strategic alternative to address a point incident.	0		++	++	++	++	0	0	–	–
Proximity of the option's interchange location to activity nodes.	0	0	– –	–	–	–	0	0	0	0
The extent to which the option will improve the reliability of the transport network through providing a more robust and safer route between Auckland and Northland (RoNS #4).	0		+++	+++	+++	+++	+	+	0	0
The extent to which the option maintains convenient local access and connectivity.	0		++	++	++	++	–	–	–	–
Impacts in realignment of SH1 during construction.	0	0	–	– – –	– –	–	– – –	– – –	– – –	– – –
Protecting and Promoting Public Health										
The extent to which the optin can provide for walking and cycling to contribute to positive health outcomes and provide more transport choices, both through and between towns.	0		+	+	+	+	0	– –	– –	– –
Environmental Sustainability										
The extent to which the option will minimise the physical extent and significance of the project.	0	0	– –	– –	– – –	– – –	– –	– –	–	0
The extent to which the option will avoid potential environmental impacts on areas of high ecological value or high landscape value.	0	0	–	– – –	– –	– – –	– – –	– –	–	0
The extent to which the option will impact on coastal areas or water courses.	0	0	– – –	– –	– –	– –	– –	– –	–	0
The extent to which the option will impact on sensitive receptors with regards to air quality and noise during both construction and operation.	0	0	–	– –	– –	– –	–	–	–	–
The extent to which the option will reduce overall energy use and greenhouse gas emissions (NEECS).	0		++	++	++	++	+	0	0	0
The extent to which the option will avoid impacts on places of archaeological or heritage significance (eg Protects Items – RDC).	0	0	0	–	–	0	–	–	–	0
The extent to which the option will avoid impacts on places of cultural significance.	0	0	–	0	0	0	–	–	0	0
The extent to which the option will impact on communities during both construction and operation.	0	0	–	– –	– –	–	– –	– –	–	–
The extent to which the option will minimise social effects on community facilities (eg schools, hospitals, sports fields).	0									
The extent to which the option will minimise local economic effect including community attractions (eg Ransom Wines, Honey Centre) and businesses (eg Genesis Aquaculture, Southern Paprika Ltd).	0		– –	– –	– –	– –	–	–	–	–
The extent to which the option will support regional and lcoal land use planning intentions.	0	0	–	–	–	–	0	0	0	0
Value for Money										
The overall cost of the option.	0	0	–	–	– – –	– –	–	–	0	0
Geotechnical cost risk (construction and operation).	0	0	– –	– – –	– – –	– – –	– – –	– – –	– –	–
Constructability cost risk.	0		–	–	–	–	– – –	– – –	– –	–
The ability of the option to be tolled.	0		+++	+++	+++	+++	0	0	0	0
The ability of the option to be staged.	0	0	+	++	++	+	+	+	+	+
The extent to which difficulties through the consenting process may delay the date for opening RoNS.	0		– –	– –	– –	– –	– – –	– –	– –	–
The extent to which the difficulty of construction may need the construction period to be extended – delaying the date for opening RoNS.	0		– –	– –	– –	– –	– – –	– – –	– –	– –
Summary										
Assisting Economic Devlopment	0	0	+	+	+	+	0	0	0	0
Safety and Personal Security	0	0	+++	+++	+++	+++	++	++	+	+
Improving Access and Mobility	0	0	+	+	+	+	0	0	–	–
Protecting and Promoting Public Health	0	0	+	+	+	+	0	– –	– –	– –
Environmental Sustainability	0	0	–	–	–	–	–	–	–	0
Value for Money	0	0	–	–	–	–	– –	– –	–	–
Ranking	0	5	1	3	4	2	6	8	9	7

	Do Min	Do Min	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Online Option 2 : 2 lane Wellsford Bypass	Online Option 3: 2+2
	0	11	12	13	14	15	16	17	18	19	20	21
Assessment of Effects	0											
Assisting Economic Devlopment												
The extent to which the option will enhance inter regional and national economic growth and productivity (RoNS #1).	0		+++	+++	+++	+++	+++	+++	+++	+++	++	+
The extent to which the option will improve movement of freight and people between Auckland and Northland (RoNS #2).	0	0	+++	+++	+++	+++	+++	+++	+++	+++	++	+
The extent to which the option will improve connectivity between the medium to long term growth areas in the northern Rodney area (Orewa, Warkworth and Wellsford) (RoNS #3).	0		++	++	++	++	++	++	++	++	++	++
The extent to which the option will support local economic development.	0	0	0	0	0	0	0	0	0	0	0	-
Safety and Personal Security												
The extent to which the option is expected to improve road safety in the area and reduce all road crashes.	0		+++	+++	+++	+++	+++	+++	+++	+++	+	0
Improving Access and Mobility												
The extent to which the option achieves the strategic (through traffic) function of SH1 as a national significant route linking the Auckland to Northland regions.	0		+++	+++	+++	+++	+++	+++	+++	+++	++	+
The extent to which the option provides a strategic alternative to address route security, resilience and flexibility.	0	0	++	++	++	+++	++	++	+++	+++	+	0
The extent to which the option provides a strategic alternative to address a point incident.	0		+++	+++	+++	+++	+++	+++	+++	+++	++	+
Proximity of the option's interchange location to activity nodes.	0	0	-	--	---	---	--	--	--	--	-	0
The extent to which the option will improve the reliability of the transport network through providing a more robust and safer route between Auckland and Northland (RoNS #4).	0		+++	+++	+++	+++	+++	+++	+++	+++	+	0
The extent to which the option maintains convenient local access and connectivity.	0		++	++	++	++	++	++	++	++	+	-
Impacts in realignment of SH1 during construction.	0	0	-	-	-	0	--	-	0	0	--	---
Protecting and Promoting Public Health												
The extent to which the optin can provide for walking and cycling to contribute to positive health outcomes and provide more transport choices, both through and between towns.	0		++	++	++	++	++	++	++	++	+	-
Environmental Sustainability												
The extent to which the option will minimise the physical extent and significance of the project.	0	0	-	-	--	---	--	--	---	---	-	-
The extent to which the option will avoid potential environmental impacts on areas of high ecological value or high landscape value.	0	0	---	---	---	-	--	---	-	-	-	--
The extent to which the option will impact on coastal areas or water courses.	0	0	-	-	--	--	--	--	--	--	-	-
The extent to which the option will impact on sensitive receptors with regards to air quality and noise during both construction and operation.	0	0	+	++	++	++	++	++	++	++	-	-
The extent to which the option will reduce overall energy use and greenhouse gas emissions (NEECS).	0		++	++	++	++	++	++	++	++	+	0
The extent to which the option will avoid impacts on places of archaeological or heritage significance (eg Protects Items – RDC).	0	0	--	-	-	-	-	--	-	--	-	-
The extent to which the option will avoid impacts on places of cultural significance.	0	0	---	---	---	-	--	---	-	--	-	--
The extent to which the option will impact on communities during both construction and operation.	0	0	---	--	--	-	--	--	-	-	--	---
The extent to which the option will minimise social effects on community facilities (eg schools, hospitals, sports fields).	0		++	++	++	++	++	++	++	++	0	-
The extent to which the option will minimise local economic effect including community attractions (eg Ransom Wines, Honey Centre) and businesses (eg Genesis Aquaculture, Southern Paprika Ltd).	0		--	--	--	--	--	--	--	--	0	0
The extent to which the option will support regional and lcoal land use planning intentions.	0	0	--	0	0	0	-	-	0	0	0	0
Value for Money												
The overall cost of the option.	0	0	--	---	--	-	---	---	-	--	-	-
Geotechnical cost risk (construction and operation).	0	0	--	--	-	-	---	---	-	--	---	-
Constructability cost risk.	0		-	-	-	-	-	-	-	-	--	---
The ability of the option to be tolled.	0		+++	+++	+++	+++	+++	+++	+++	+++	0	0
The ability of the option to be staged.	0	0	+	+	0	0	++	++	0	0	+	+
The extent to which difficulties through the consenting process may delay the date for opening RoNS.	0		--	--	--	--	--	--	--	--	--	--
The extent to which the difficulty of construction may need the construction period to be extended – delaying the date for opening RoNS.	0		-	-	-	-	-	-	-	-	--	---
Summary												
Assisting Economic Devlopment	0	0	++	++	++	++	++	++	++	++	+	+
Safety and Personal Security	0	0	+++	+++	+++	+++	+++	+++	+++	+++	+	0
Improving Access and Mobility	0	0	++	+	+	++	+	+	++	++	+	0
Protecting and Promoting Public Health	0	0	++	++	++	++	++	++	++	++	+	-
Environmental Sustainability	0	0	-	-	-	-	-	-	-	-	-	-
Value for Money	0	0	-	-	-	0	-	-	0	-	-	-
Ranking	0	10	6	4	5	2	7	8	1	3	9	11

APPENDIX B – TUNNEL ASSESSMENT

Puhoi to Wellsford RoNS: Warkworth – Wellsford Indicative Route.

Kraack Road Tunnel

Draft Rev 2 – 16/12/16

Purpose

The purpose of this memo is to consider the rationale for the inclusion of a tunnel of circa 1.1 km length as part of the proposed Indicative Route (IR) for the Warkworth to Wellsford (WW2W) stage of the Puhoi to Wellsford (P-W) RoNS.

1. Introduction

The SAR for WW2W has recently been updated and is in the process of being finalised. This document is the culmination of work which started in 2010 when the Puhoi – Wellsford RoNs was announced and the Transport Agency awarded a scheme assessment commission to SKM (now Jacobs).

The original 2010 work examined a wide range of options for the Warkworth to Wellsford stage of the RoNS. These options included a long list of some 13-14 options which routed both east and west of the existing SH1 and included a westernmost option which followed the line of the NAL railway. The assessment of these options through a multi-criteria analysis (MCA) was reported in the scheme Scoping Report and resulted in a short list of 3 main options and 1 sub option in 'Sector 4'. (Sector 4 is the section of the P-W project between Warkworth and the Hoteo River to the north of Dome Valley).

The shortlisted options were subsequently assessed through an extensive and more detailed MCA , the outcomes of which are set out in the Wk-W SAR

The short list option selected as being preferred as a result of these assessments (the Indicative Route) – is proposed to be put forward to the public for consultation in February 2017. This route includes a twin bore tunnel of approx. 1.1 km in length.

The purpose of this note is to examine the rationale behind the inclusion of a tunnel as part of the IR and give an overview of the factors surrounding its inclusion from an engineering, environmental and operational perspective.

2. Route options & preferred option (Indicative Route)

The scheme assessment sets out the various criteria used in the MCA and the performance of the shortlisted options against those criteria. Option 1 was assessed as the best performing option of the short list (which were themselves the best performing options from an original long list of some 14 options). Option 1 has therefore been adopted as the IR within Sector 4.

The primary factors associated with route's MCA performance relate to the following key facts: (Refer to the SAR for a more detailed description of the assessment process).

- The route is separate from the existing SH1 corridor – providing greater network resilience
- The route is west of the existing SH1 and traverses land which is primarily in pine forest plantation rather than native vegetation and largely in a single ownership.
- The route is located away from dwellings and businesses scattered through the Dome Valley reducing the impact of the route from a social and economic perspective.

- Being west of SH1, the route avoids a significant number of environmentally and ecologically sensitive areas (including a DoC reserve).
- Through the challenging topography of the Dome, the route is able to follow the side of a valley which broadly aligned northwest – southeast and is parallel to and to the west of the existing SH corridor. This means that the route does not 'cross-cut' perpendicularly through a series of major valleys and ridges with associated engineering and earthworks challenges.

3. Gradients & performance against objectives.

Whilst the selected route has the above attributes, the topography of the area is such that the route is required to climb substantially from the low lying land immediately to the north of Warkworth up into the area of the Dome, where the terrain is challenging and the ground surface is at significant elevation. Additionally, before reaching the NW-SE orientated valley referenced in the last bullet point of Secton 2 above, the route must cross a significant hill ridge line. This ridge is broadly oriented northeast-southwest (i.e. at 90 degrees to the road alignment) and hence directly blocks the path of the Indicative Route. The route must therefore traverse this ridge before it can enter and run along the side of the NW-SE valley discussed above (refer to Appendix 1 which shows the IR).

One of the main objectives of the RoNS is to provide a high standard route which assists freight movement, and have vertical gradients are an important factor. In addition, the relevant Austroads design standards limit the acceptable gradients and their length in order to ensure that speed differentials between vehicles are not excessive and that an appropriate level of service is provided overall. As a consequence, the maximum gradient of the route needs to be limited to around 6%. This means that the route can only achieve a certain elevation after leaving the lower lying land north of Warkworth, before encountering the east-west hill terrain and ridge referenced above. Adopting these standards results in the vertical alignment intersecting with the ground surface on the slopes of the hilly terrain some 170m below the ridge line (Refer Appendix 2). Thus a cutting would need to be excavated through the hill to accommodate the road, and this would be of huge proportions. Alternatively a tunnel is needed to be constructed to carry the road through the hill beneath the ridge. The engineering and environmental challenges associated with a cutting of the required depth through the ridge would be immense. With cut slopes, up to 150m high and a huge volume of material (potentially millions of cubic metres) requiring excavation, there would be attendant environmental impacts of major significance. As a consequence of the above factors, a tunnel carrying the road through the ridge is proposed as offering the most practical engineering solution which also minimises the environmental effects at this location.

4. Alternative alignments

The east-west ridge line is extensive and effectively runs from the existing SH1 westwards for several kilometres. Consequently, if the route were to be realigned in order to try to avoid the need for construction of a tunnel, the IR would have to be relocated significantly in order to avoid the east-west ridge.

A relocation eastwards would put the alignment either;

i) in, or very close to, the SH1 corridor where significant geological instability exists with numerous existing landslides and steep side slopes, or,

ii) relocated even further east of SH1 where attendant sub optimal outcomes in respect of environmental issues and further land instability. Routes in these locations were considered as part of the long list and short listing process described earlier in this note and were found not to offer the best outcomes.

Moving the route westwards to avoid the ridge would require a shift of several kilometres, would still require significant earthworks, and result in a significantly longer route. This would hence be less attractive to traffic as compared to the SH1 route, and would also prevent the route from achieving the advantages offered by aligning it in the NW-SE valley which lies to the north of the east-west ridge line, as discussed above. Overall an alignment to the west would thus offer sub-optimal outcomes in terms of cost, environmental outcomes.

Overall therefore, it is considered that relocating the Indicative Route in order to try to avoid the need for a tunnel would result in less desirable outcomes and a route with substantially reduced performance against the project objectives. In practical terms, based on currently available information, the inclusion of a tunnel is an appropriate solution to the challenges presented by the topography and delivers the best overall outcome.

5. Cost assessments & Whole of Life Costs

The MCA process used to select the Indicative Route included a 'value for money' criteria. The measures used as part of the assessment of performance against this criterion included capital cost of the options. These costs estimates capture the capital cost of construction of the options, including the cost of the tunnel for the IR. However, the measures did not include a specific item for operation and maintenance (O&M) costs as part of the MCA.

It is noted that none of the other options in the short list assessment (other than Option 1 - the IR) did not include a requirement for a tunnel and hence would have lower 'whole of life' (WoL) O&M costs. Whilst the overall performance of these other options in the MCA was inferior to that of the IR, the differential between the options in respect of WoL costs was not tested as aprt of that assessment. Consideration of the significance of WoL costs is therefore outlined below.

Whilst O&M costs could be expected to be broadly similar across any route option built to a particular geometric standard and cross-section, there are particular WoL operational and maintenance costs associated with tunnels. Therefore the relevance of these needs consideration in the context of the IR. A significant portion of such costs, especially for longer tunnels, is associated with power consumption for ventilation and fire, life & safety (FLS) systems. This power consumption and cost is heavily influenced by the extent to which forced tunnel ventilation is required (via jet fans) and the frequency and duration of the need for such ventilation to maintain air quality in the tunnel within a prescribed range. Hence close consideration of tunnel design aspects which assist natural ventilation will reduce this frequency and or duration of jet fan operation.

An assessment of the O&M costs associated with the tunnel has been undertaken and is outlined in the paper attached as Appendix 3. The key findings of the paper are:

- O&M costs for the tunnel represent approximately one third of the overall WoL O&M costs for the entire route, and the 'present value' of such costs comprise less than 1% of the present value of the capital cost of construction.
- O&M costs for the tunnel do not have a significant impact on the economic performance of the project
- Given the level of detail and geotechnical information presently available the construction cost estimate does not have an accuracy to within 1% and hence tunnel O&M costs are not significant in terms of the MCA assessment process and therefore do not influence the preferred option selection.

- Careful design and detailing of the tunnel, its alignment, gradient and cross-section, together with selection of appropriate equipment and lining materials have the potential to substantially reduce the ongoing maintenance regime and operational costs for the tunnel.

In light of the above, the detailing surrounding these aspects of the tunnel needs further consideration and this will need to be undertaken by appropriate experts during the next phase of the project in preparing for the designation and consenting phase. However, in advance of this work, the following sections of this note examine various aspects of the proposed IR alignment and tunnel configuration, and discusses specific factors that may mitigate to some degree the WOL costs associated with it.

6. Alignment Geometrics and tunnel configuration.

The gradient of the carriageway approaching the tunnels is most onerous in the northbound direction. This is due to the relatively limited length available in which to achieve significant elevation gain heading northwards from the relatively low lying land to the north of Warkworth. The northbound carriageway uphill gradient prior to the tunnel portal is currently on a straight 5% grade for a distance of approximately 1.5km and the alignment includes a crest curve within the length of the tunnel. Additionally, the current vertical alignment of the IR provides for split level northbound and southbound carriageways at the tunnel portals (refer Appendix 2). Currently the northbound carriageway is higher than the southbound. This arrangement is intended to improve the earthworks required as the alignment daylights the northern portal and then runs along the side of a valley to the north.

However, here is an opportunity to revise these arrangements to provide twin bores for the tunnel that are at the same level. This would provide fire, life and safety (FLS) advantages, and at the same time improve the vertical gradient of the climb northwards from Warkworth towards the tunnel. There is potential to improve the current 5-6% gradient to less than 3% over a 2.5km length, including within the tunnel itself. This will significantly improve the performance of all northbound vehicles, but particularly HCVs on the northbound incline, with reduced speed differentials between vehicle types. These factors will bring safety benefits and will also reduce the vehicle emissions. This in turn will assist with the need for and frequency of use of tunnel forced ventilation (jet fans). Moreover, changing the vertical geometry within the tunnel to remove the crest curve and provide a straight grade along the length of the tunnels will aid natural ventilation and assist air movement longitudinally in addition to the normal 'piston effect' associated with vehicle flow.

For the southbound approach to the tunnel portal the gradients are less challenging as a consequence of greater length available for the climb and the fact that the alignment runs up the side of the northwest -southeast oriented valley discussed above. Hence these gradients are less of an issue. Additionally, after entering the tunnel southbound traffic will be on a downhill grade and hence emissions will also be lesser than for a climbing vehicle.

It is considered that the above amendments could be achieved without extending to any great extent the currently proposed length of the tunnel (approx. 1.1km).

If the vertical geometry of the road were to be amended so as to reduce the length of the tunnels, i.e. by locating the tunnel higher up the hillside, this will have detrimental effect on gradients. It is likely that this increase in gradient would require the introduction of additional climbing lane(s) for slower moving heavy vehicles, particularly in the northbound direction. The Road Safety Audit (RSA) undertaken on the IR has already made comment on the use of climbing lanes – indicating that if they were to be introduced they should not be terminated immediately prior to the tunnel entrance

portal. Thus – if gradients were increased, not only would a 3-lane northbound carriageway be required over considerable length, the tunnel itself would need to be widened to accommodate 3 lanes with resultant significant increased construction costs.

7. Other considerations

Since the capital cost of constructing and mechanical and electrical (M&E) fit out of the tunnel has been assessed and included as part of the estimated costs through the MCA, it is primarily the tunnel ongoing operation and maintenance costs that are 'extraordinary' in respect of this route option. These costs are not insubstantial, but direct comparisons with the anticipated O&M costs of, say, the Waterview tunnel are not directly comparable for a number of reasons:

Long term, tunnel operational costs are often dominated by the cost of electricity consumption associated with the FLS and ventilation systems. Whilst a thorough assessment of these will be needed as part of the development of the project in the next stage, it is considered that these costs for the Kraack Road tunnel are likely to me mitigated by the following aspects:

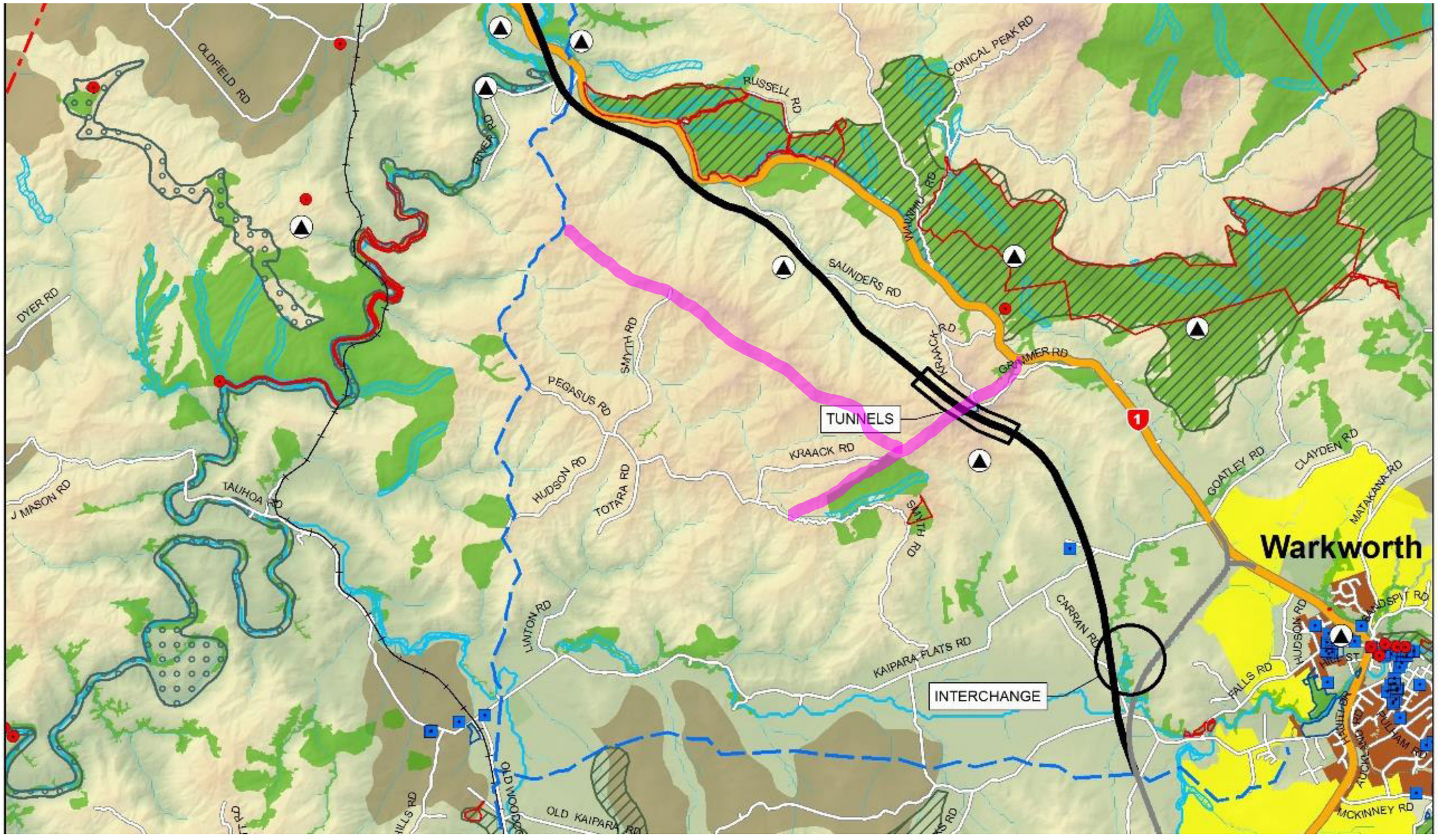
- The geometry of the road through the tunnels will aid natural ventilation to some degree – this has already been discussed above.
- The level of traffic predicted to use the tunnels is much lower than anticipated in the design of the Waterview tunnels being built as part of the Western Ring Route. Therefore, the vehicle emissions should be lower and the frequency/duration of the need for forced ventilation less.
- As the likelihood of forced ventilation is reduced, alternative power suppliers could be considered such as wind or solar energy storage, or standby diesel generators.
- Technologies in respect of tunnel systems, power sources and ventilation techniques are advancing constantly. As the route is unlikely to be built in the near future (potentially 10 years away +), alternative technologies that are more energy and cost efficient than those in use today, may be available at the time of construction.

8. Conclusion

The necessity for a tunnel of 1km +length to be included in the IR is not seen as a fatal flaw and there are a number of design actions and technologies that can be implemented to reduce the ongoing O&M commitment of the tunnel. These need to be assessed more fully in the next stage of the project as part of the preparation of documentation for statutory approvals, and in order to confirm that the tunnel WOL O&M costs can be managed to acceptable levels.

This aspect should be a focus of the next phase of the project's development.

Appendix 1 – Warkworth Wellsford Indicative route (Sector 4 – The Dome)



Significant ridge lines

APPENDIX C – WIDER ECONOMIC BENEFITS

Warkworth-Wellsford

Review of Wider Economic Impacts

Revised 12 February 2017

1 Introduction

1.1 Scope of the appraisal

There is a desire to improve SH1 to provide a high quality link connecting Auckland and Whangarei and construction work has already commenced on the section between Puhoi and Warkworth. The purpose of this report is to consider the wider economic benefits and impacts associated with upgrading SH1 between Warkworth and Whangarei either in its entirety or in particular sections that are over and above those captured in a conventional economic appraisal based on the detailed approaches set out in the EEM.

The analysis concentrates on the improvements for the corridor as whole looking at a number of specific elements where it is possible to make an estimate of the quantified economic benefits. This is intended to provide a basis for the subsequent allocation of these to form part of the assessment of particular sections.

To supplement the items where it is possible to make an estimate of the monetarised economic benefits, an assessment has been made of the other effects of the upgrading of the route on the population and development impacts in the areas affected. While this does not provide monetary estimates of the impacts of the road it does provide indications of the extent to which the upgrading of the corridor between Warkworth and Whangarei will support increases in economic activity and the planned land-use development aspirations within the corridor.

It should be emphasised that to a large extent the elements identified in this analysis reflect opportunities for increases in economic activity. The realisation of these opportunities and the associated benefits may depend on the actions of what may be a small number of players whose responses may not always be easy to predict. There is therefore a degree of uncertainty attached to the results of the analysis set out in this report which should therefore be regarded as indicative of the orders of magnitude of the benefits rather than as precise estimates.

1.2 Structure of the report

The report starts in Section 2 by giving a brief overview of the Northland economy highlighting its relatively disadvantaged position compared to much of the rest of New Zealand and particularly to the immediately adjacent Auckland region. This sets the background to the potential impacts that might arise with the improvement of the connection to the areas further south. Section 3 looks at the level of service currently offered to light vehicles by the existing road connection between Warkworth and Whangarei and Section 4 discusses how improvements to this could stimulate the growth of tourism, a major component of economic activity in many parts of the Northland region.

Freight transport issues along the corridor are considered in Section 5, and Section 6 and 7 then consider the impacts of improvements in the conditions faced by heavy vehicles on the timber industry (Section 6) and other key industries (Section 7). The extent to which the upgrading of the route might improve resilience is set out in Section 8. Sections 9 and 10 consider the evidence from observed changes in employment and population. Section 11 then considers the proposals for land-use development in the corridor and the way in which these are likely to be supported by the upgrading of the corridor, to some extent reflecting the more general assessments of population and employment increases discussed in the previous two sections.

Section 12 describes the development and application of a simple connectivity model to assess the benefits from the closer interaction of the Northland areas with Auckland and Section 13 briefly introduces the imperfect competition WEB. Section 14 brings together the quantified elements of the appraisal to produce an estimate of the total wider benefits from the upgrading of the corridor as a whole and discusses the way in which these might be allocated to particular sections. Section 15 compares the estimates of the wider benefits for the route built up in Section 14 with results derived from experience overseas.

2 General Assessment of the Northland Economy

A driver for the improvement of the connection between Auckland and Northland is the relative under- performance of the Northland economy as a whole and the importance of the links to Auckland and other areas to the south to stimulate and support economic activity in the area.

The current position of the Northland economy has been reviewed in detail as part of the Tai Tokerau Northland Growth Study. The key findings from this (which in some instances have been updated into current prices) are:-

- Northland has a relatively low GDP per capita when compared with all other regions in New Zealand. The position for 2015 is set out in Figure 2.1

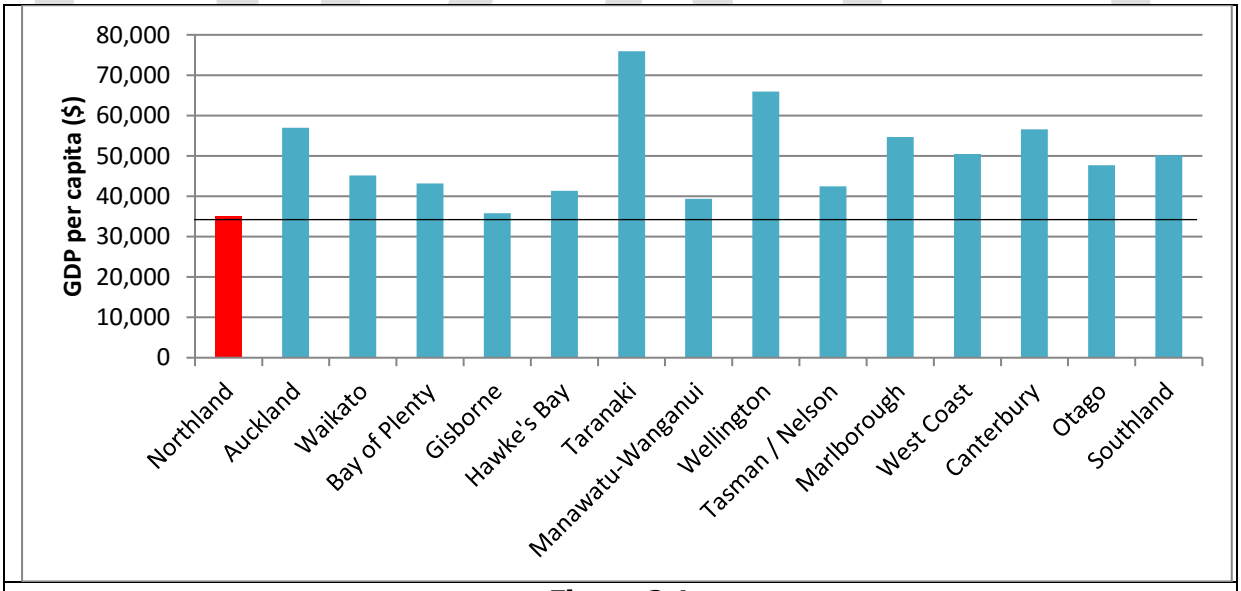


Figure 2.1
GDP per capita by region 2015 (current prices)

- GDP growth over recent years has been below the national average but above that experienced by some other regions. This is set out in Figure 2.2

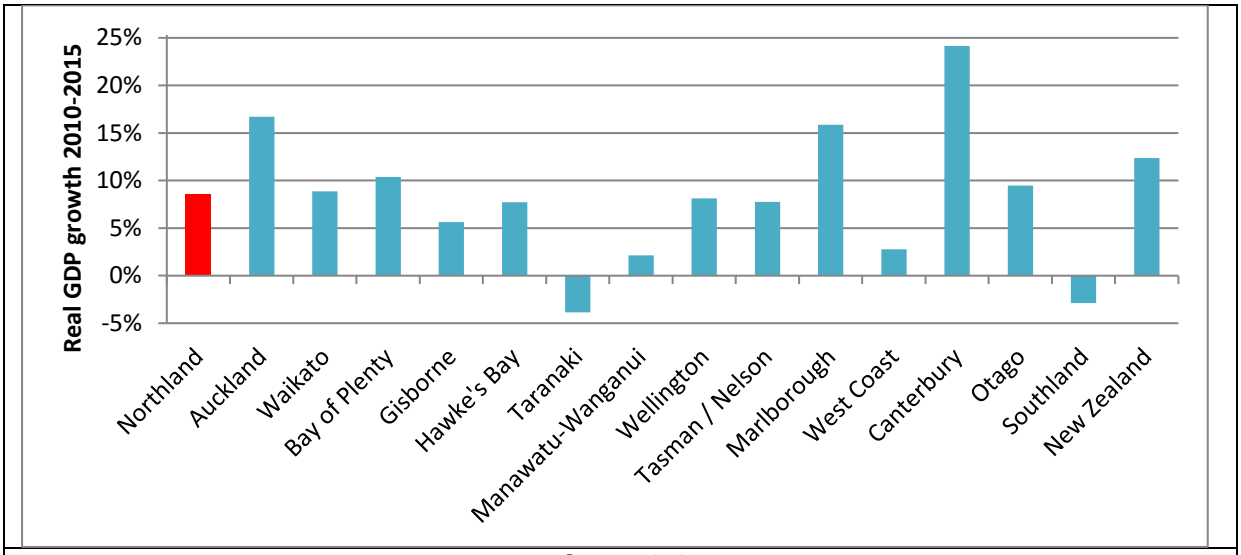


Figure 2.2
Growth in Real GDP 2010-2015

- Growth in employment has also been below the national average as can be seen in Figure 2.3. This particularly reflects the low growth in the Far North District which was less than half that experienced by the other two districts.

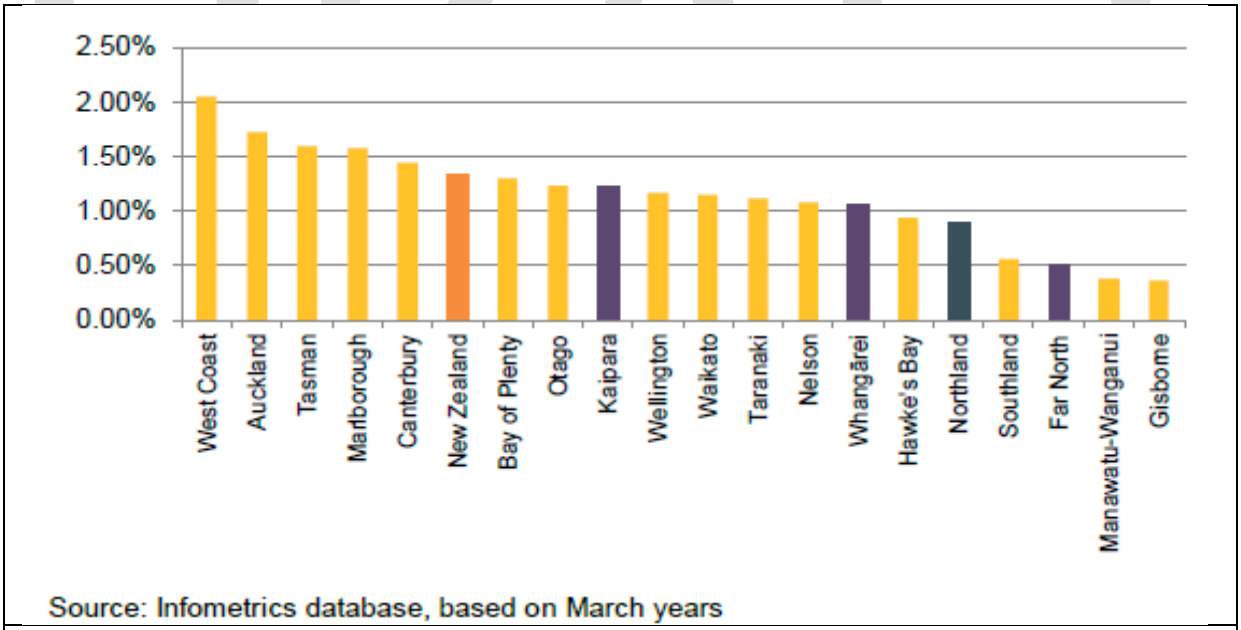


Figure 2.3
Estimated growth in employment across regions, 2003-2013 (per cent pa)

Finally median household income is low compared to New Zealand as a whole and to almost all other regions. This is set out in Figure 2.4

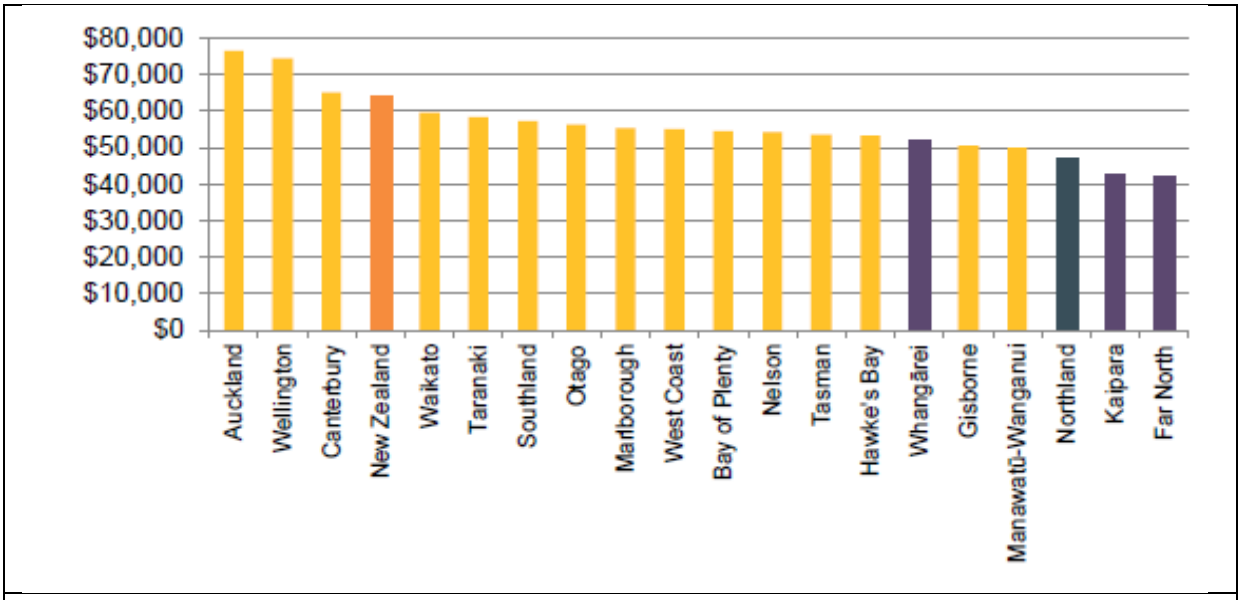


Figure 2.4
Annual median household income 2013

In 2013 the median household income for the region was $46,900, the lowest for any region in the country and only about 75 per cent of the national average of $63,800. However within the regional average, there are substantial disparities, with the average income for Whangarei of about $52000 contrasting with the lower median household incomes of about $42,000 for Kaipara and Far North.

The overall position that emerges is therefore of a region with relatively low incomes and low growth compared to much of the rest of the country. In particular the economic performance of the region is in contrast to the higher growth and incomes of the neighbouring Auckland region. Measures to improve the connectivity between the two may therefore help to spread growth from Auckland into the areas further north and may also provide opportunities for Northland workers and businesses to participate in the more dynamic markets to the south.

3 Current Road Conditions

3.1 Introduction

A characteristic of Northland is its remoteness from the major centres in New Zealand. Currently Whangarei is about 160 kms and over 2 hours travel time from the centre of Auckland and Kaitaia, the main centre of the Far North District is 314kms or over 4 hours from Auckland.

SH1 provides the main road connection between Northland and areas further south, and given the dominance of the road network in the movement of both passengers and freight, the level of service offered by this is therefore key to supporting economic activity in the region.

3.2 Travel Speeds

Information is available from commercial GPS data on the travel times and speeds for light and heavy vehicles by route section for the section between Puhoi and Whangarei and the information for light vehicles is summarised in Figure 3.1. It should be noted that this data is for March 2015 and so does not take into account the higher flows and delays experienced in the holiday periods earlier in the year.

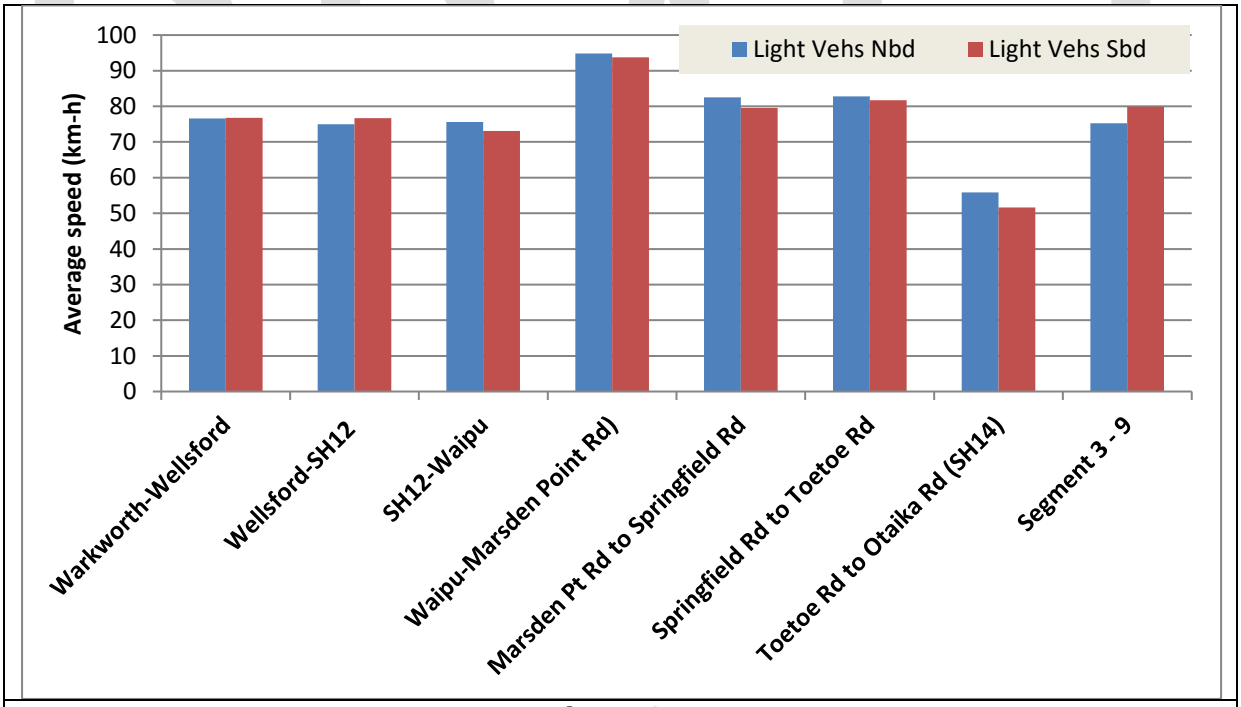


Figure 3.1
Average Travel Speeds by Road Section ; Light Vehicles

Although some parts of the route have median high speeds of 90 km-h or more, for much of the rest the speeds are fairly low and the route as a whole only achieves an average speed of about 75 km-h northbound and 80 km-h southbound.

3.3 Travel Time Variability

Travel times are often not only relatively slow but can also be variable. In addition to median travel speeds, information is also available on the variability of travel times for light vehicles and this is set out in Figure 3.2 and Figure 3.3.

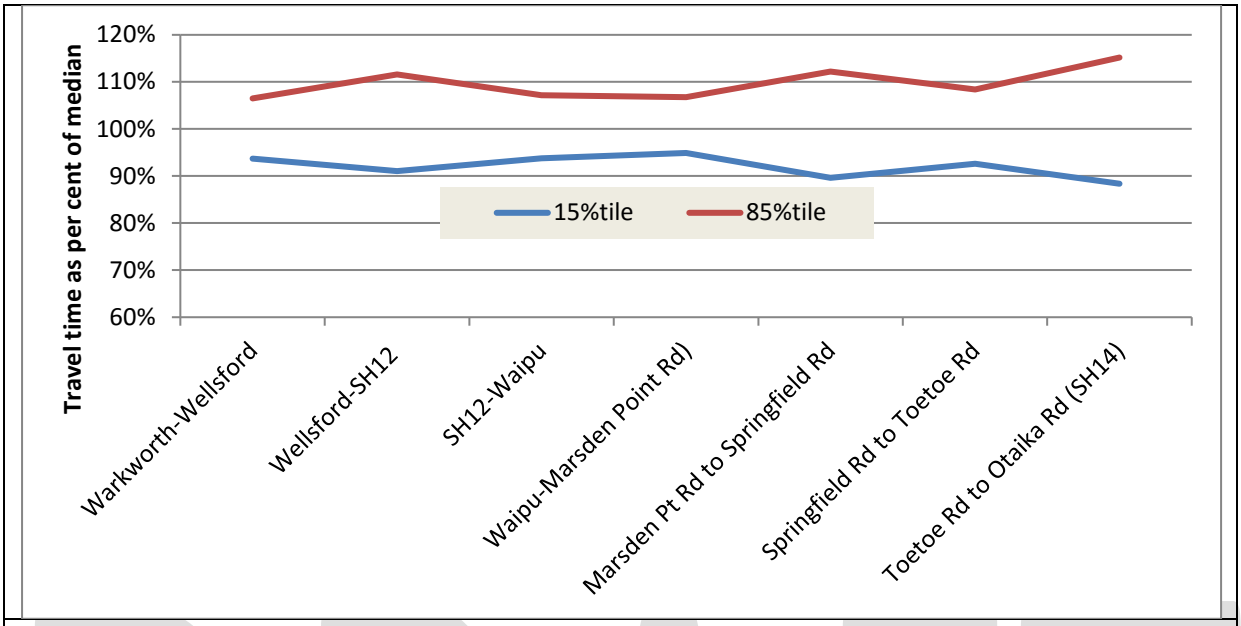


Figure 3.2
SH1 Auckland-Whangarei Northbound
Variations in travel times for light vehicles

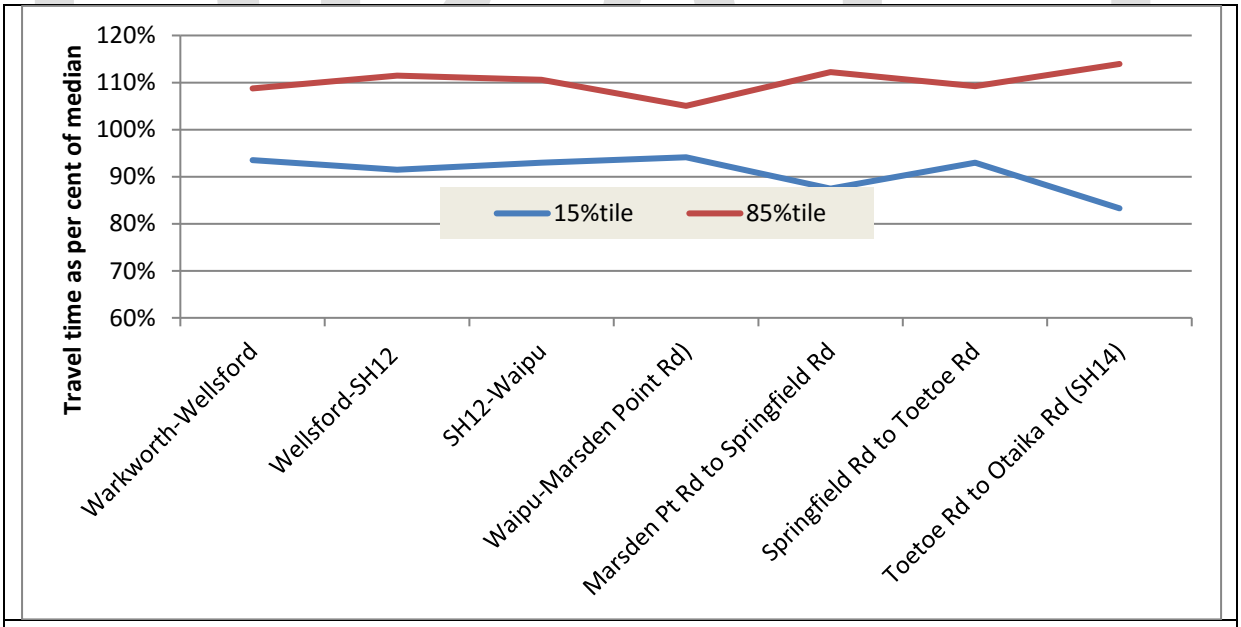


Figure 3.3
SH1 Auckland-Whangarei Northbound
Variations in travel times for light vehicles

The results set out in the two figures above highlight the different levels of variability for the different route sections, particularly between Wellsford and SH12 and the section north of Marsden Point Road.

Improvements to the route including bypassing Wellsford, the remaining urban settlement on the route south of Whangarei and easing the more difficult terrain would reduce overall travel times and the travel time variability and would thus improve the connectivity between Northland and Auckland area areas to the south. The effects that this might have on the key sector of tourism are considered below.

4 Tourism

4.1 Background to tourism

Tourism is a major activity in Northland in and 2015 it was estimated to account for about 3.7 per cent of current Northland GDP with a total value of about $217m per year (2010 prices). The share of tourism in regional GDP is broadly in line with that for New Zealand as a whole. Employment in tourism is estimated at about 2,900 (2013) representing about 4.1 per cent of the total workforce.

Within the region the importance of tourism varies significantly with a particular focus in the relatively economically deprived and remote Far North District. This is set out in Table 4.1.

Table 4.1
The contribution from tourism and its share of GDP 2015

	GDP from tourism ($m)	Share of total GDP
Far North	120	6.8%
Whangarei	82	2.4%
Kaipara	16	2.2%
Northland Region	217	3.7%
Total New Zealand	8,229	3.9%

In the Far North, tourism contributes almost 7 per cent of District GDP, a level twice that of the Region (and of the country) as a whole and underscores its importance in the local economy. Reflecting this high share, tourism in the Far North provides about half of total tourist contribution for the region as a whole.

The breakdown of expenditure by origin of the visitor in year ending March 2016 is set out in Table 4.2Table 4.2

Table 4.2
Tourist expenditure in Northland by origin of visitor

Source of visitors	Far North District	Kaipara District	Whangarei District	Northland Region
Total Overseas	159.0	14.0	82.0	255.0
Total NZ	309.4	91.9	362.2	763.5
Northland	117.8	41.9	139.8	299.5
Auckland	111.8	38.2	116.9	266.9
Overseas proportion	33.9%	13.2%	18.5%	25.0%
Northland proportion	25.2%	39.6%	31.5%	29.4%
Auckland proportion	23.9%	36.1%	26.3%	26.2%
Grand Total	**468.4**	**105.9**	**444.2**	**1018.5**

A high share of tourist expenditure is from outside Northland. This includes both tourists from the rest of New Zealand, primarily Auckland and those from the rest of the world who to a large extent would enter the region via Auckland and so would be largely dependent on SH1 especially north of Wellsford. The level of service on this route would therefore potentially have an impact on the extent of tourism activity and contribution to GDP in Northland. Its upgrading could provide a boost to the tourism sector.

Parts of the route between Auckland and Northland have been upgraded in the past. The sections below in the report examine the impacts on the tourism industry of these improvements.

4.2 Potential impact with improved connections

4.2.1 Introduction

The scale of the tourist market is very dependent on the links with Auckland both for domestic and international visitors and improvements to these could be expected to increase the level of tourist activity in Northland. To investigate this, the effects of the construction of the Northern Motorway firstly to Silverdale and secondly from Silverdale to Puhoi have been examined. In addition the position following the opening of the Kopu Bridge improving access to the Thames-Coromandel area has also been considered.

4.2.2 Completion of the Northern Motorway to Silverdale

The completion of the Northern Motorway between Greville Road and Silverdale in December 1999 reduced the delays through the North Shore for travellers from Auckland and points further south and so increased the accessibility to Northland. The position which resulted in terms of tourist nights in Northland is set out in Figure 4.1.

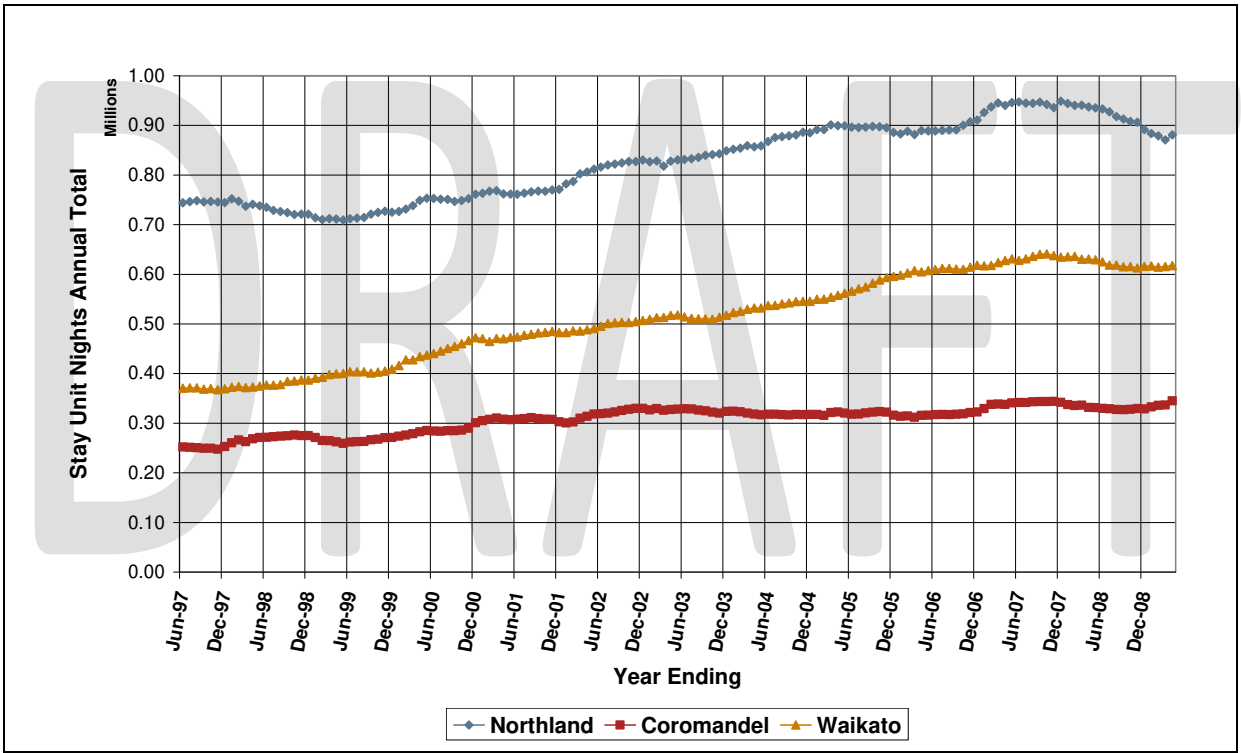


Figure 4.1
Changes in Tourist Nights in Northland, Coromandel and Waikato 1997 – 2009

The figure indicates that the opening of the new section of motorway at the end of 1999 coincided with a shift from a falling level of tourist activity in Northland, to one that was growing. This contrasts with the position for the Coromandel and Waikato where growth occurred more or less continuously over this period and suggests that the difficulty of reaching Northland before the improvement of the route was suppressing growth. With the extension of the motorway and the improvement of journey conditions growth in tourism in Northland was able to resume. The boost to tourism in Northland following the construction of the Northern Motorway to Silverdale therefore appeared to be of the order of about 10 per cent.

4.2.3 Completion of the Northern Gateway Toll Road

Subsequent to the opening of the Northern Motorway to Silverdale, the motorway was further extended to Puhoi bypassing Orewa, with the construction of the Northern Gateway Toll Road opened in January 2009. The effects of this on tourist activity however are less obvious as can be seen in Figure 4.2

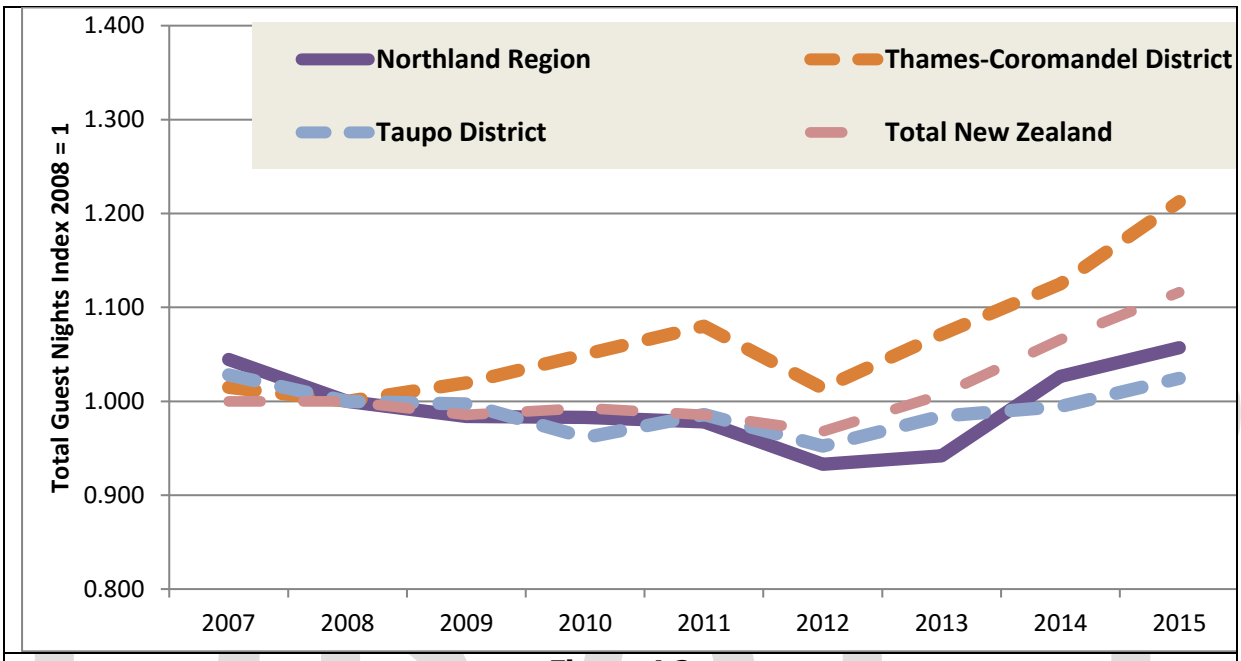


Figure 4.2
Total Tourist Nights by Area
Index 2008 = 1

The changes in the numbers of guest-nights in the Northland region very much mirror those experienced for the country as a whole or for Taupo, another major tourist destination. The growth is less than experienced for the Thames Coromandel area. In this instance therefore unlike the position in 2000, the improvements to the road connections to Northland do not appear to have had much impact in the level of tourism in the area.

4.2.4 Evidence from Kopu Bridge

As a final test the position has been examined following the opening of the new Kopu Bridge which replaced a long one-way bridge which was a major bottleneck on travel on SH25 between Auckland and the Coromandel peninsula. The bridge was opened at the end of 2011 and the position around the opening year is set out in Figure 4.3. This is in terms of estimated contribution of tourism to local GDP. The figure also includes the position for New Zealand as a whole and for Far North and Ruapehu Districts, to some extent providing evidence of general changes in tourism away from the route being improved.

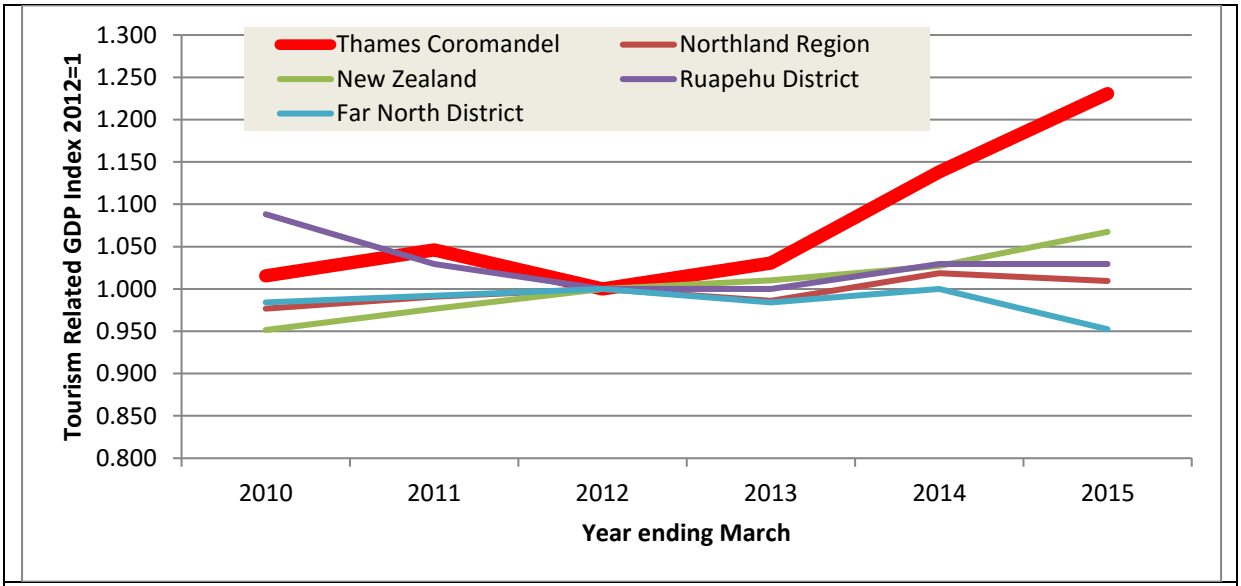


Figure 4.3
Contribution of Tourism to Local GDP Index 2012 = 1.00

The position set out in Figure 4.3 suggests that the improvement of the Kopu Bridge has had a significant impact on the level of tourist activity in the Coromandel area. Comparing the growth in Coromandel with the other areas identified suggests that the improved access could have increased the GDP contributed from tourism by up to 20 per cent. This is probably an extreme example, reflecting the extent of the very substantial delays caused by the old bridge which were reported as long as 90 minutes at peak times[1].

Because of the particular circumstances of the Kopu Bridge caution is required in applying the changes in tourist activity observed here directly to other areas. The relationship observed would need to be tempered for use for routes where the existing problems were not so severe and the benefits of upgrading therefore less dramatic.

4.3 Evidence from elsewhere

There is relatively little other evidence on the quantified impact of road improvements on tourist activity. Some work has however been undertaken in relation to the Scenic Byways programme in the US, which although it has a different focus provides some insights into the response to the road improvements forming a major part of the programme. While much of the work has concentrated on the effects of construction activity on the local economies there have been some estimates of increases in visitors and visitor expenditure. From a review of "Scenic Byway 12 Economic Impacts"[2] the Scenic Byway programme was estimated typically to increase traffic flows by 3.4 -20 per cent, and visitor expenditure in areas directly affected by 5-10 per cent. While the Programme has a somewhat different focus to the work proposed for the Auckland-Whangarei route, the information does provide some background to the opportunities which might arise with the road upgrading, especially if this is supported by increased efforts to market the Northland connection and attractions as a whole.

[1] http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=3542362 accessed 30/11/16
[2] Scenic Byway 12 Economic Impacts Scenic Byway 12 Committee Zions Bank Public Finance July 2014

4.4 Overall assessment

The examination of the evidence connecting road improvements to changes in tourism activity indicates there appears to be a range of responses. In New Zealand, these vary from relatively little impact as appeared to be observed for the Northern Gateway Toll Road to a moderate impact from the earlier opening of the Northern Motorway to Silverdale and a larger impact from the opening of the new Kopu Bridge, giving a range of a 0-20 per cent increase in tourist activity for a particular improvement. The evidence from the US would suggest an increase in visitor expenditure of 5-10 per cent from upgrading the profile of the route associated with limited on-line improvements.

Tourism is currently estimated to contribute about $220m to regional GDP and is forecast to increase substantially with a growth of 65 per cent targeted for the period from 2016-2025[3], equivalent to about 4.7 per cent per year. While the observed data on the response of the sector to transport improvements spans a fairly wide range, an increase of 7.5 per cent in response to the improvement of the corridor as a whole does not seem unreasonable given the evidence. For this increase we have conservatively assumed a growth rate of 2.3 per cent, about half of the target growth rate for the period up to 2025. The benefits to tourism would therefore be equivalent to about $16m per year at current levels or a discounted value over 40 years of about $230m. This probably represents a central case and a range based on an increase in tourism of 5 or 10 per cent in response to the new road would give total discounted benefits between $150m and $300m.

[3] Tai Tokerau Northland Growth Study

5 Freight Transport Issues

5.1 Introduction

For a range of other economic activities freight connections play an important part and for other than petroleum and cement movements between Northland and the rest of New Zealand are mainly provided by SH1 for road transport and the by North Auckland Line for rail

Information on the estimated volumes of freight flows to and from Northland in 2012 is available in the 2012 NFDS. The key highlights are summarised in Table 5.1.

Table 5.1
Estimated freight flows to and from Northland in 2012 (m tonnes pa)

Mode	To Northland	From Northland	Total
Road	1.31	1.61	2.92
Rail	0.02	0.11	0.13
Coastal shipping	0.00	3.16	3.16
Total	1.33	4.88	6.21

Source : National Freight Demand Study 2012

Although the flows carried by coastal shipping are high, these represent the movements of bulk commodities only petroleum products from the refinery at Marsden Point and cement from the Golden Bay plant at Portland. All other freight travels by road mainly using SH1 or by rail, with the majority travelling by road.

Rail is used primarily for the movement of logs to the Bay of Plenty or dairy products to Auckland with other general freight in small quantities to and from a wide range of destinations. The total volumes into and out of the region have been declining with flows in 2015 about 15 per cent lower than those in 2012.

The general patterns of freight movement set out in Figure 5.1 highlight the imbalance of flows with movements by both road and rail out of Northland being larger than movements in the reverse direction, reflecting the nature of Northland as a major bulk producing area (timber, dairy etc). Because of this predominance of movements from Northland, the potential for back loading is limited and for many journeys the full costs of the return trip have to be borne by the southbound movement. This would include a high share of low value products for which the transport costs would form a relatively large proportion of the delivered price. Improvements to the costs for these movements by improving the road corridor could therefore have particular benefits especially for lower value products competing with other sources of supply in the Auckland or overseas markets.

5.2 Travel times and travel time reliability

Data from Google maps suggests a typical travel time for cars of about 2hrs 5 mins for travel from Whangarei to Ports of Auckland on the Waitemata Harbour and about 2 hrs 10 mins to Neilson Street (Sat 9 am). Allowing for the slower speeds of heavy vehicles (typically in the range of 85-95 per cent of light vehicle speeds as derived from GPS data this would give a typical travel time of about 2 hr 20mins to 2 hrs 30 mins for a heavy vehicle. Even if the vehicle returns empty avoiding any time spent loading or unloading for the journey back to Northland, this is reported as making achieving two return trips per day difficult and prevents the most efficient use of the asset.

The problem is compounded by variations in travel times especially if these are hard to predict. Some information is available on the delays to heavy vehicle traffic as measured by the percent of time where the average recorded speed was less than 80 per cent of the posted limit are set out in the report Beca Freight Studies 2015 published by the Ministry of Transport in May 2016. An extract from this showing the position for SH1 between Auckland and Whangarei is set out in Figure 5.1.

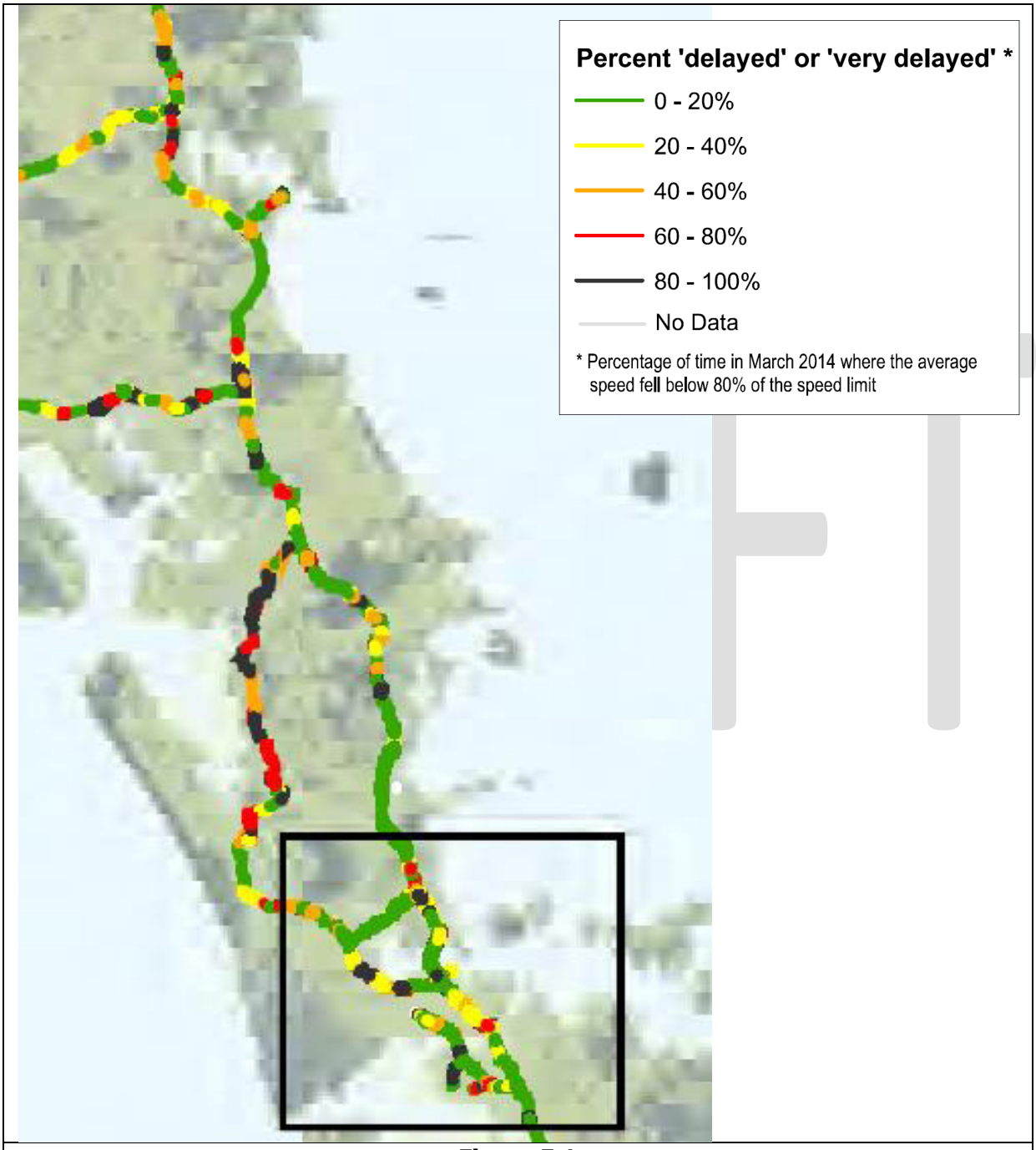


Figure 5.1
Delays to Heavy Vehicle Traffic

This highlights the substantial delays within and to the north of Warkworth and around the Bryderwyns to the north of Wellsford.

Information is also available from the analysis of commercial GPS data for March 2015 for the section of route between Puhoi and Whangarei which confirms the issues highlighted in Figure 5.1. For the route as whole between Puhoi and Whangarei the median travel time for heavy vehicles amounts to about 1 hr 37 mins northbound and 1 hr 42 mins southbound with average speeds of 71km-h and 67 km-h respectively. As indicated above this gives typical travel speeds about 10 per cent below those for light vehicles.

The median speed by route section for heavy vehicles is set out in Figure 5.2

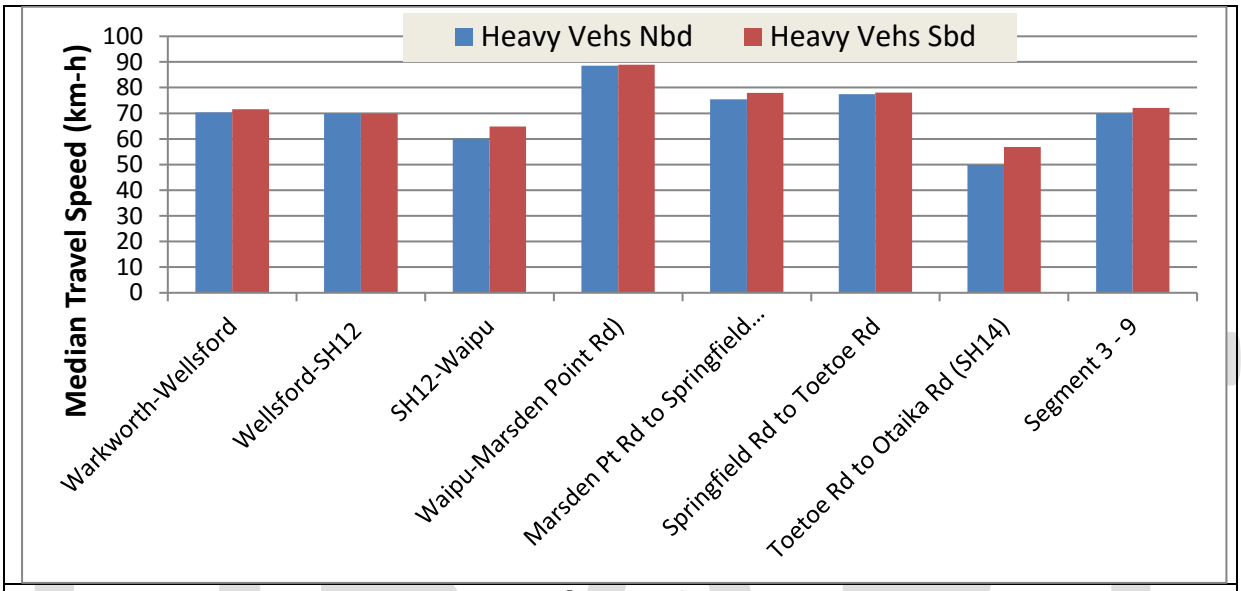


Figure 5.2
Median speeds for heavy vehicles on SH1 between Wellsford and Whangarei

Reflecting the position in Figure 5.1, these show considerable variations of speed along the route, reflecting in part the congestion in the settlements along the way particularly Wellsford. For almost all sections except the flat and straight road between Waipu and Marsden Point Road these give speeds that are substantially lower than might be achieved with a high standard route throughout. Vehicles travelling at an average of 90 km-h would achieve travel time savings of between 16 and 18 minutes respectively reducing the travel time by about 25-28 per cent.

In addition to reducing the travel time the new road would also reduce the travel time variability. An indication of this, based on the 15th and 85th percentile times has been derived from the GPS data and this is illustrated in Figure 4.3 and Figure 5.4.

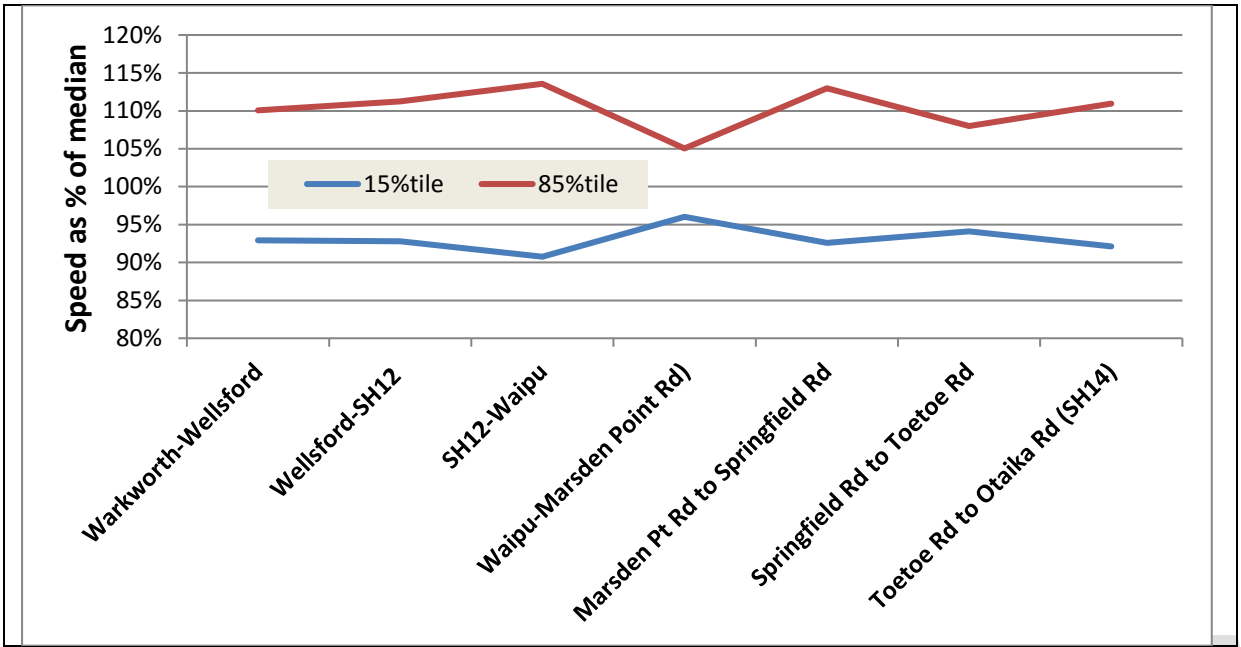


Figure 5.3
SH1 Auckland-Whangarei Northbound
Variations in travel times for heavy vehicles

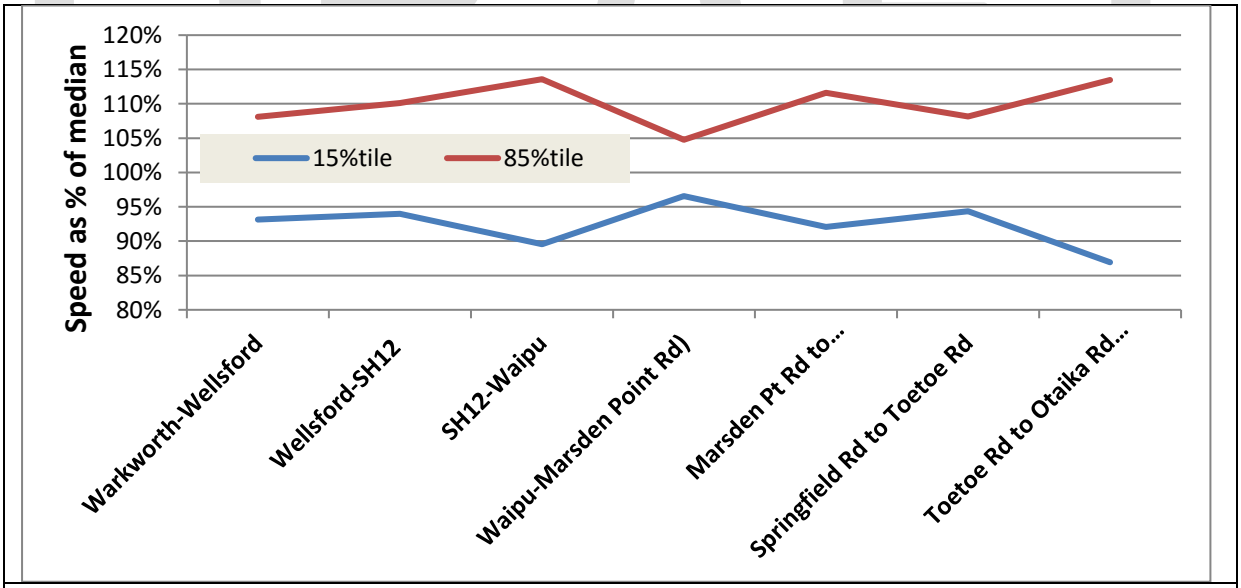


Figure 5.4
SH1 Auckland-Whangarei Southbound
Variations in travel times for heavy vehicles

Overall the route has a variance of about +/-10 per cent spanning the 15th/85th percentile times. For a journey of 2 hours or more Auckland-Whangarei, this would be equivalent to a range of 25 minutes, and would put further pressure on the ability to complete a return trip with the 5.5 hour limit. With a new road the improvement in travel times and travel time variability may be just sufficient to allow a return trip within the stipulated period.

The problem may also be compounded by the requirement of a number of those receiving the goods for these to be delivered within a specified time window. Unreliability in travel times can make achieving delivery in these windows challenging unless an appropriate margin of safety is included in the journey time and in many instances this may involve the driver having to wait before he can make his delivery, reducing the efficiency of the use of both vehicle and driver.

5.3 Resilience

As well as day to day variations caused by fluctuations in traffic conditions and flows there is also perceived to be an issue with the resilience of the route and the impact of unplanned closures. The position for 2014 is set out in Figure 5.5 and Figure 5.6

Figure 5.5
Location of Route Closures in 2014

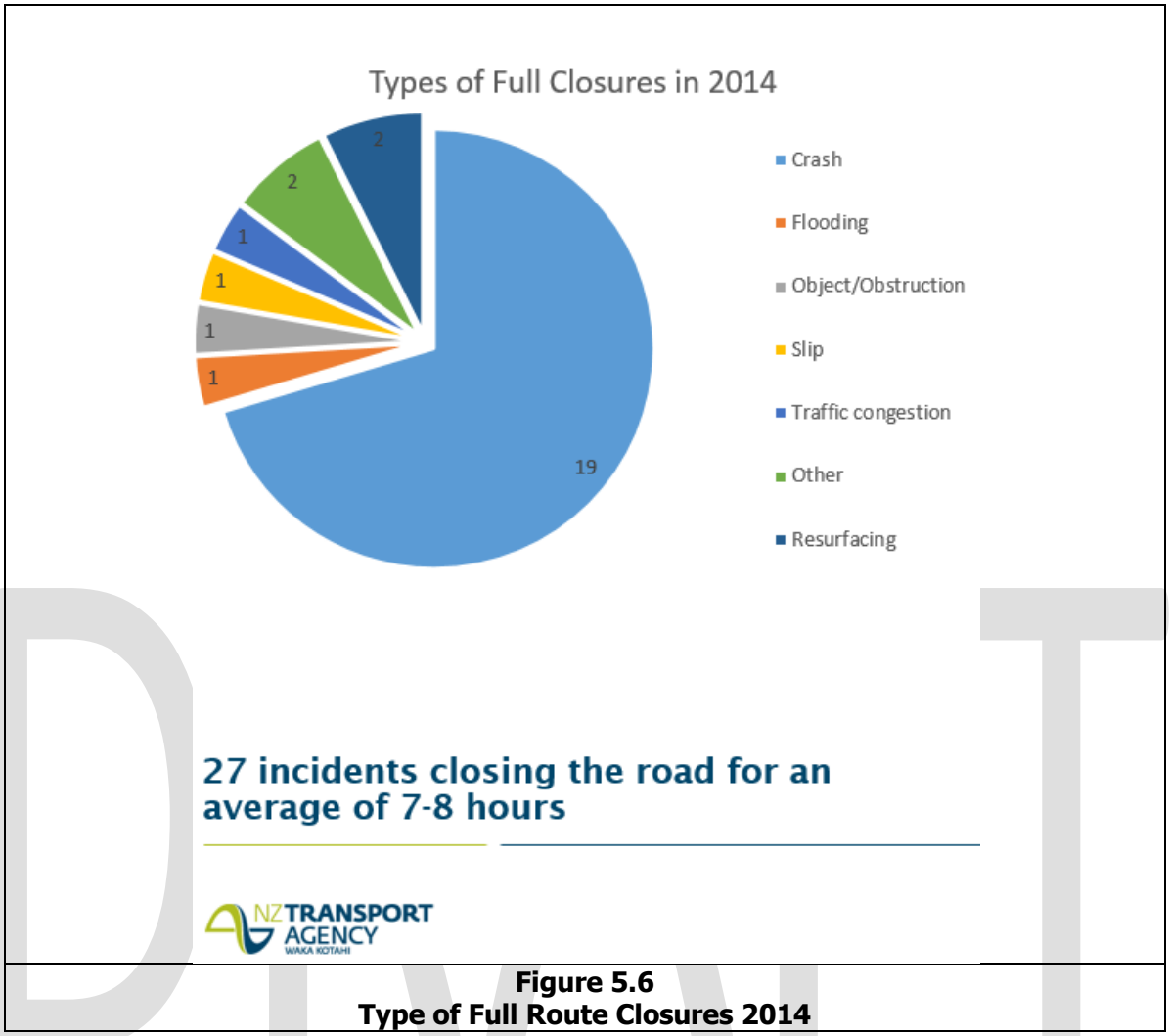


Figure 5.6
Type of Full Route Closures 2014

In 2014 the road was closed on average about once every two weeks with traffic being disrupted for an average of 7-8 hours. On this basis traffic delays from closures could affect up 3-5 per cent of total traffic on the route.

The position is compounded because of the lack of suitable diversion routes for heavy vehicles if the main route is closed. This is illustrated in Figure 5.7.

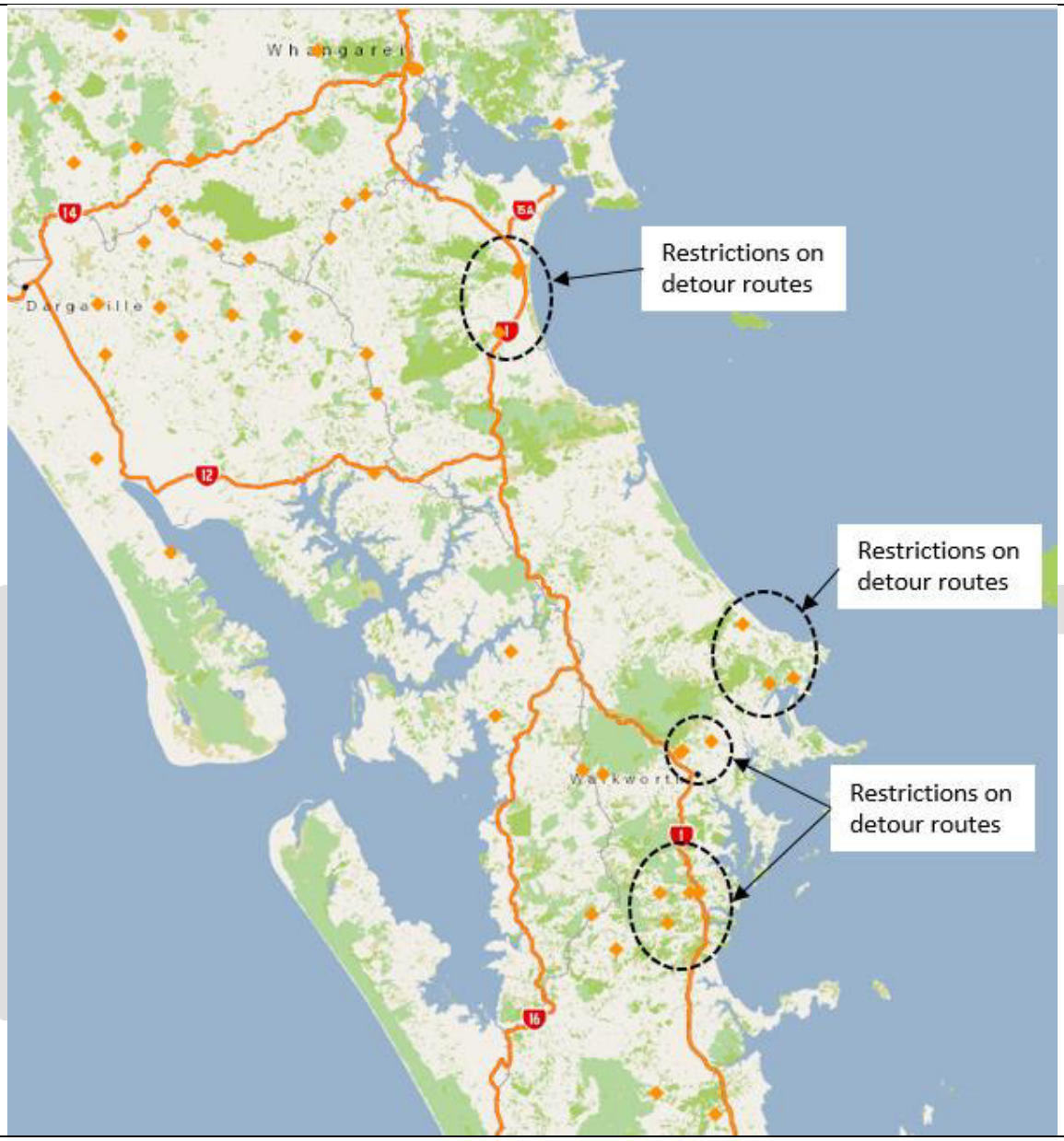


Figure 5.7
Restrictions on Diversion Routes for HPMVs

The problems of route closure compounded by the lack of suitable diversion routes for heavy vehicles have an impact on the linkages between Northland and areas further south. This affects the extent to which firms in Northland can reliably supply markets in these areas. From discussions with firms in the area there is a consensus that improving these linkages for freight vehicles, both in terms of travel times and travel time reliability, would improve the ability of sectors of the Northland economy to compete more effectively bringing benefits to the area as a whole. A particular example of this is the forestry sector and the potential impacts on this industry are discussed in the next section.

6 Impacts on Forestry

6.1 Introduction

Alongside tourism, forestry and wood processing is another major activity in the Northland region employing about 2000 people in 2015[4] and contributing about $255m (2010 prices) to the regional economy in 2013, a share of about 5 per cent. The volumes harvested in the region have been growing sharply as the large areas of forests planted 25-30 years ago have matured coupled with generally increasing prices for the timber especially in terms of the NZ dollar, and low international transport costs.

The volumes harvested in recent years are set out in Figure 6.1.

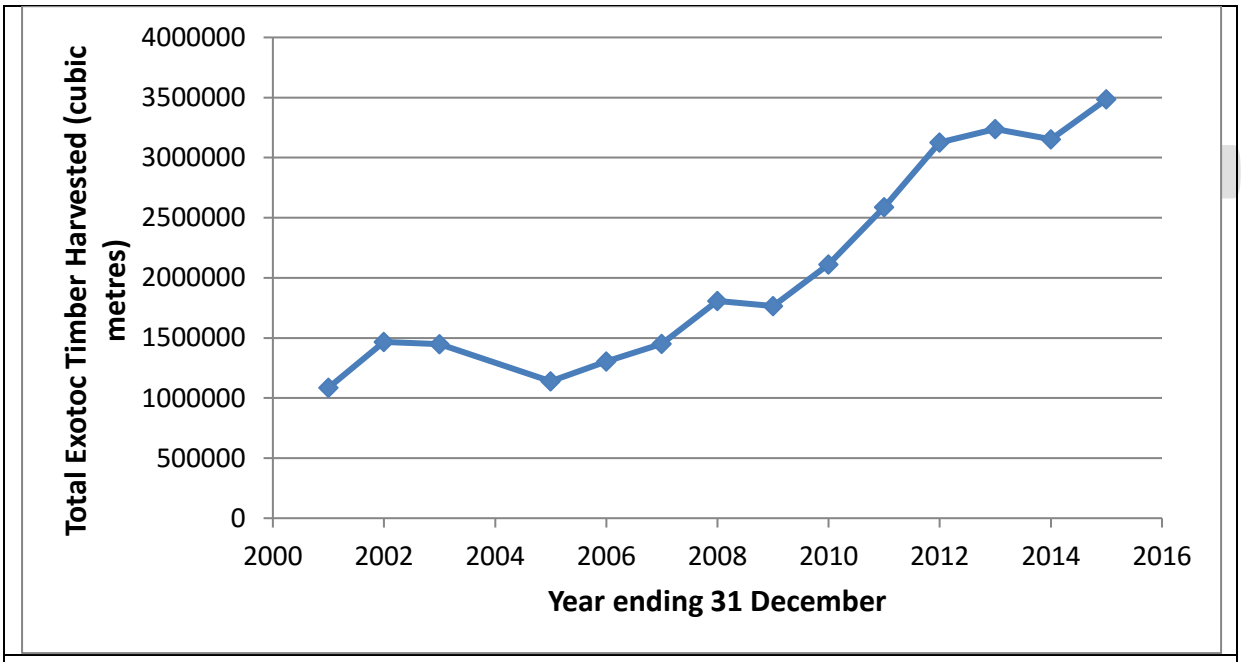


Figure 6.1
Total Log Harvests (cu m) Northland Region
Source Statistics NZ

A characteristic of the output of the Northland forests is the relatively high proportion exported directly as logs and the relatively low share used for processing. This is set out in Figure 6.2. It should be noted that Figure 6.2Figure 6.2 uses data from MPI and is based on Wood Supply Areas rather than regional councils. The Northland Wood Supply Area includes the Auckland region.

[4] Statistics NZ Business Demographics Database

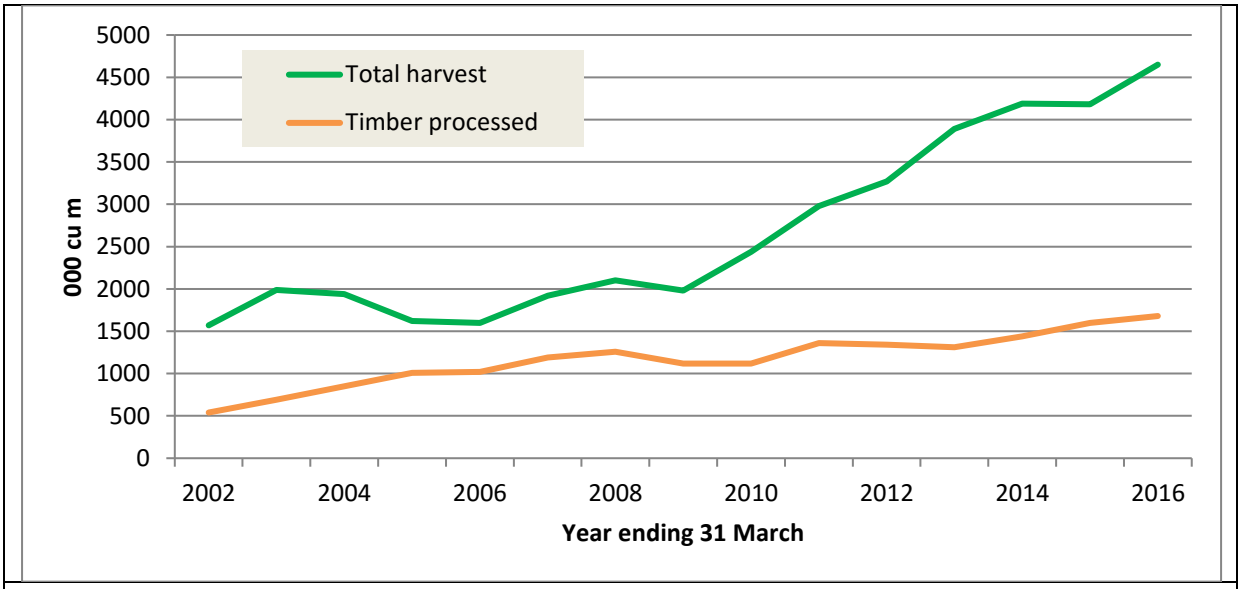


Figure 6.2
Total Logs harvest and Volumes Used for Processing : Northland Wood Supply Area
Source MPI

While the total volumes of logs harvested have increased sharply, the volumes processed have grown only relatively slowly.

The share of logs used for processing can be compared with the national position and this is set out in Figure 6.3

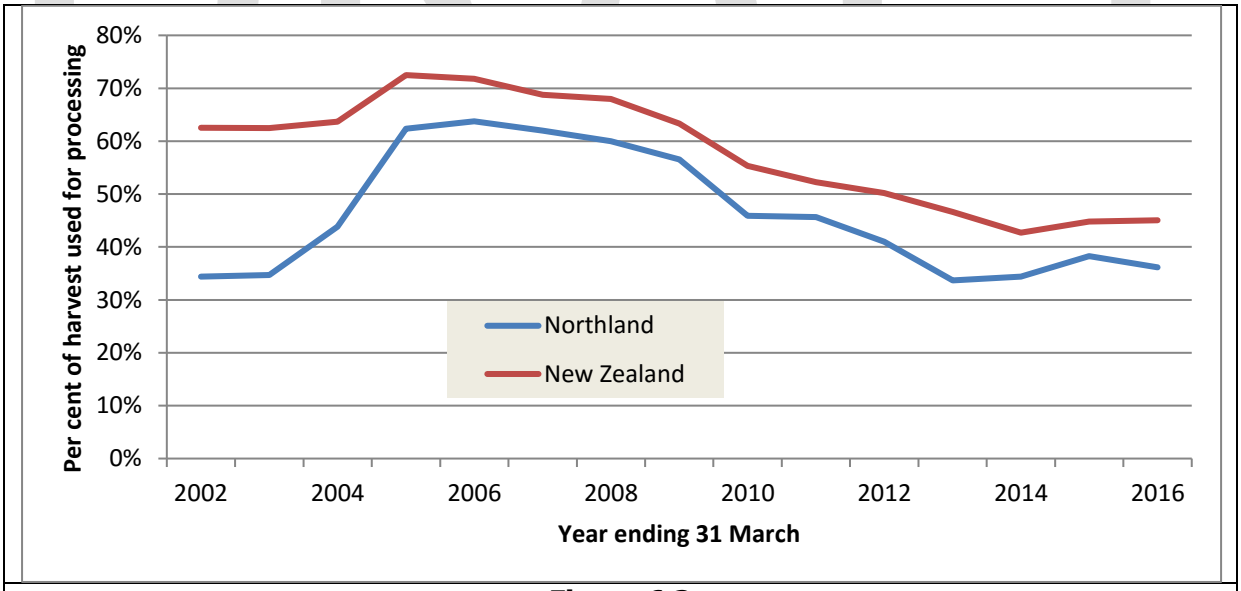


Figure 6.3
Share of logs for processing in total harvest

Source MPI

It can be seen that the share of logs used for processing in Northland has consistently been below the average nationally, although the both have displayed a general downward trend. In part this reflects the changing nature of the market with increasing demands from China with an emphasis on unprocessed material and in part because of the rapid growth of the total volumes harvested and limited ability of processing facilities to match this rapid rate of growth.

The balance between exporting the logs without processing and converting these into some form of processed timber product is important because of the different revenues obtained and the impact on local GDP. Typically the price for export logs is of the order of $NZ120-140 per cubic metre (broadly equivalent to per tonne). Prices for sawn timber are typically of the order of $NZ400-$500 per cubic metre and for manufactured timber, panels etc and for processed timber such as plywood, boards, or engineered timber, the average FOB price is around $1000 per tonne.

The evolution of prices for export logs and for timber exports is set out in Figure 6.4 and Figure 6.5

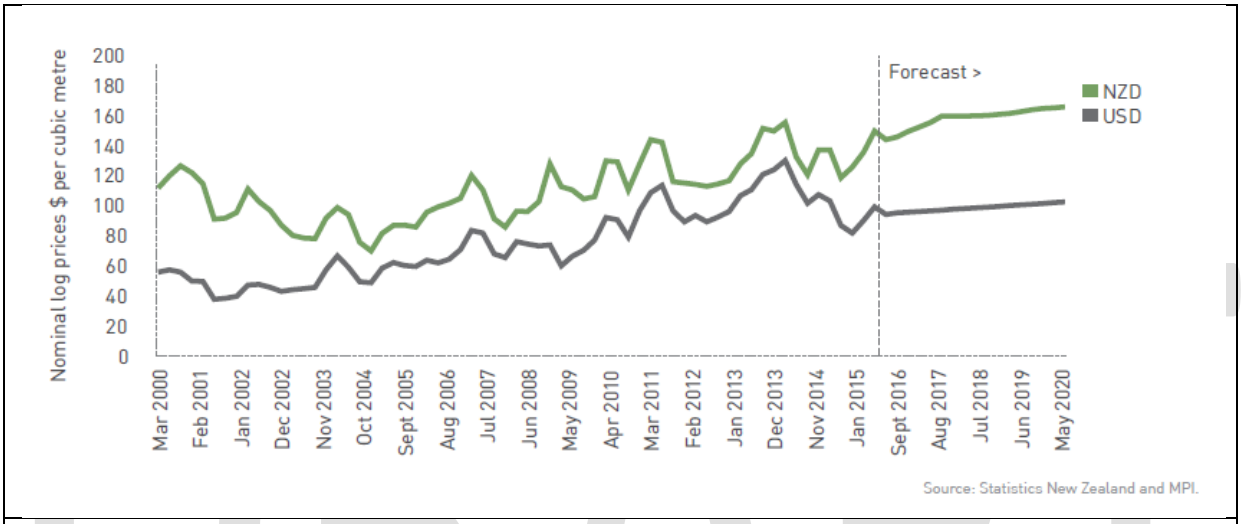


Figure 6.4
Export Log Prices ($ per cubic metre FOB)

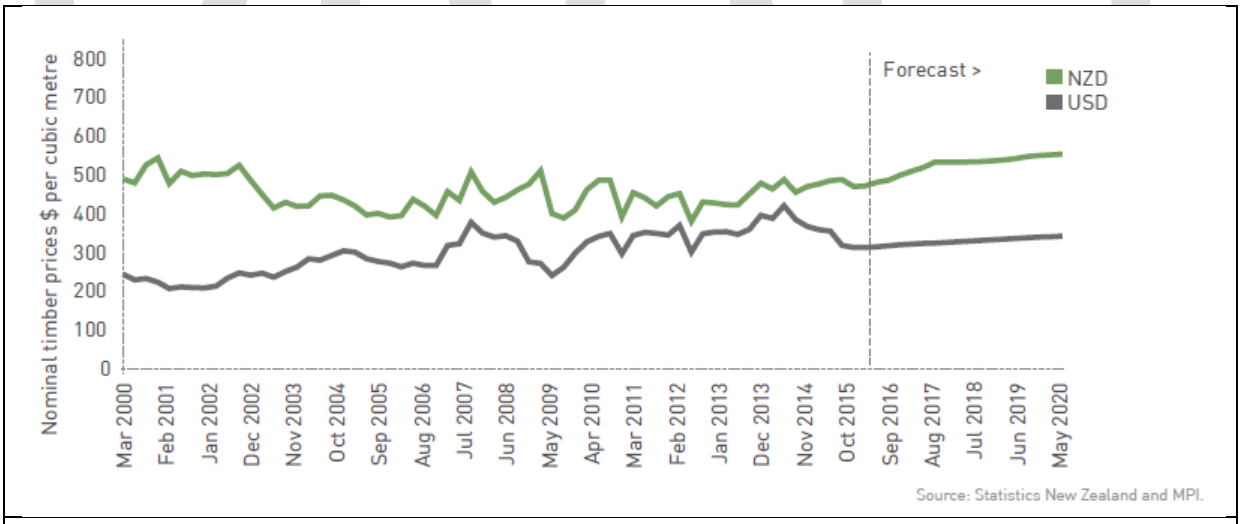


Figure 6.5
Prices for Exported Timber ($ per cubic metre FOB)

Both graphs show clearly the effects of the depreciation of the NZ dollar against the US dollar improving the returns for both export logs and processed timber and highlight the difference in the prices obtained.

The level of processing in Northland compared to other major wood producing areas is set out in Figure 6.6.

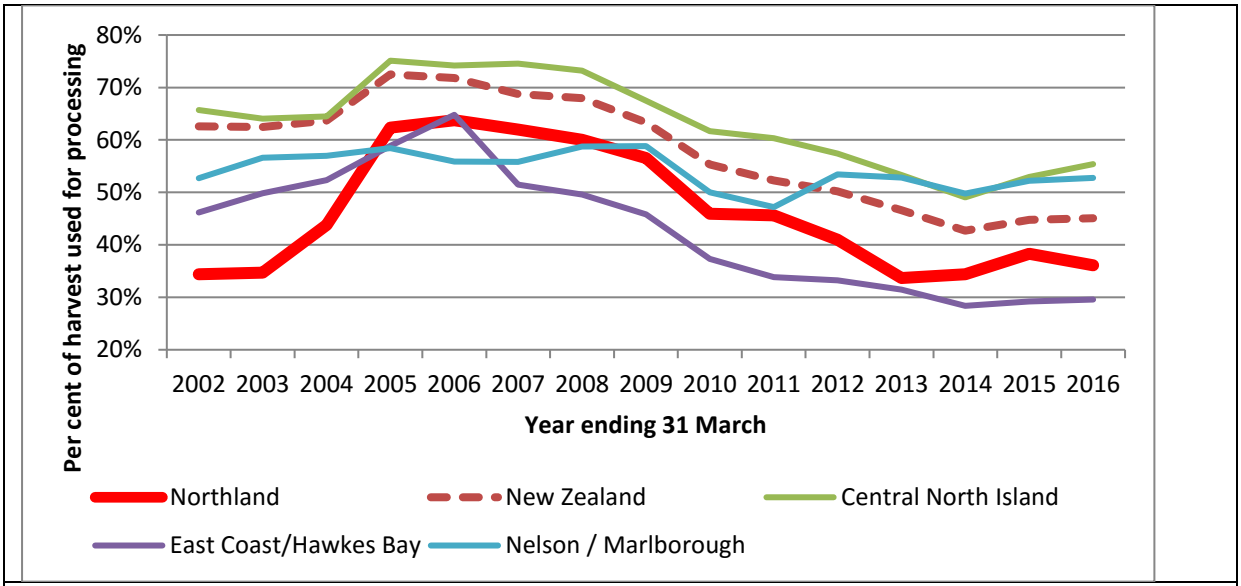


Figure 6.6
Share of logs processed in different Wood Supply Areas

A factor that emerges from this is that the areas more remote from container ports, Northland and East Coast/Hawke's Bay (where output is mainly concentrated in Gisborne) have lower levels of processing than those where access to international container shipping services is available, in these instances via Tauranga and Nelson. This therefore suggests that improving the access to Auckland port could help in increasing the level of processing for wood harvested in Northland and increase the value added generated in the local economy.

6.2 Potential for increases in the share of logs processed

This theme is reiterated in the Tai Tokerau Northland Growth Study which highlights the poor quality of the transport network linking with the main domestic and international markets accessed through Auckland which constraining the potential development of wood processing in Northland. This was also indicated as a factor by representatives of the forestry industry interviewed as part of earlier work on SH1. Subsequent discussions undertaken as part of the current work have highlighted that there is also competition for selling timber products into Auckland itself, the major domestic market in New Zealand. Reducing the costs of transport between Northland and Auckland would therefore give the timber producers in Northland better access to this market and may therefore help to stimulate the development of the wood processing industry in the area with consequent benefits to the local economy.

While determining the extent to which this might occur is challenging, the effects of possible shifts have been examined. If the level the volume of logs processed in 2016 had increased from 39 per cent to 46 per cent, a share in line with the national average, the total value of output would have increased by about $75m with a GDP increase in the order of $$25-30 million. However even in this case, the share of logs to processing while higher than currently achieved would still be below the better connected Wood Supply Areas of Central North Island and Nelson Marlborough.

In looking forward the volumes of logs harvested are forecast to decline to 2020 as the "wall of wood" associated with the substantial planting in the 1990s subsides, as can be seen in Figure 6.7.

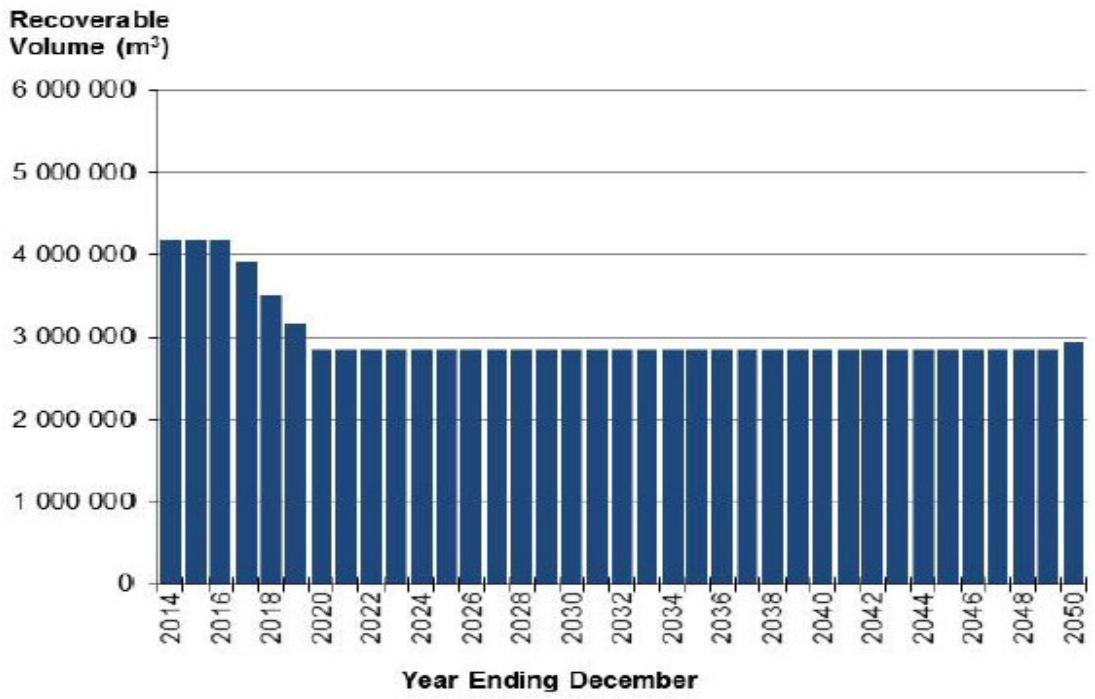


Figure 6.7
Scenario 2: Large-Scale Owners Harvest at Stated Intentions. Overall Non-Declining Yield (from 2020) with a Target Rotation of 28 Years

However even with the lower volumes, the increase in GDP associated the additional level of processing would still be substantial, amounting to about $15m-20m per year over the longer term with a discounted value of about $130-170m. This is possibly conservative since it assumes that there is no value to the residues remaining after the sawn logs have been produced. The use of these residues in pulp and paper and in panel making indicates that these residues do have a value and to that extent the estimates made are conservative.

The practicality of a change of this magnitude has been assessed against the proposals for the development of the wood processing industry set out in the Tai Tokerau Northland Economic Development Study. This identifies the possibility of development of a timber processing plant at Ngawha. As currently proposed this would involve a larger shift to processing logs within the region than assumed above (1 million tonnes per year compared to the figure hypothesised above of 150-200,000 tonnes) and so the potential increase in processing, which could in practice arise from the development of a new plant or more incremental changes by existing producers would not in principle appear unreasonable.

There is the issue as to whether increased production of processed timber would simply shift economic activity to Northland from other parts of New Zealand. While this in itself may be advantageous from a regional development viewpoint, given the relatively backward condition of the Northland economy as outlined in Section 2, material from the most recent report on the "Situation and Outlook for Primary Industries" (MPI 2016) suggests that the ability to export processed timber is limited by domestic demand. Providing an additional source of supply from Northland would therefore allow exports to be increased either directly from Northland producers or from producers from areas further south whose sales into the Auckland area may be reduced with greater Northland output. To that extent the increased output from Northland can be treated as an incremental benefit from the road upgrading.

7 Other Industries

7.1 Introduction

For a range of other industries the road connections with the markets in and accessed through Auckland are important, especially as in the case of forestry where producers in Northland are in competition for the Auckland market . In this case reductions in transport costs could potentially affect their market share, although this would depend on the relationship of transport costs to the value of the delivered product.

A number of the key industries identified in the Tai Tokerau Northland Growth Study have been considering including:-

- Dairy
- Livestock rearing and meat processing
- Horticulture

7.2 Dairy

The dairy sector is important in Northland with milk production and processing contributing $331m representing about 5.9 per cent of regional GDP. The industry is dependent on links to Auckland both for domestic markets and for overseas export markets, with the latter predominating. At present while some travels by rail the majority of the output from the region is transported by road to Auckland and points beyond. In 2012 this accounted for about 70per cent of the total output. The road connection is therefore important, both in its own right and as a potential back-up for the North Auckland Line in the event of any disruption to services along the rail route.

However the output of the dairy industry is typically high value and is often not particularly perishable, especially that produced at the larger plants at Kauri and Maungaturoto. Changes in transport costs would therefore have relatively low impact on the final delivered price of the product, or the volumes produced. However a shortage of transport capacity resulting from disruption on the North Auckland Line could be more significant.

7.3 Livestock rearing and meat processing

Meat is important and again relies on linkages with Auckland to access both domestic and international markets. Total production in the area was estimated at about 30,000 tonnes resulting in exports worth about $230 m in 2013. Virtually all the product moves by road but again this is a high value product for which the transport costs are likely to form a relatively small proportion of the total.

Some of the output particularly chilled meat is however time sensitive and the share of this is growing generally across New Zealand. For this part of the output, the reliability of the transport connections to the exporting ports would be important to ensure that the scheduled sailing are met especially with the advent of slow steaming which has reduced the time available to sell the product, particularly in the more distant European markets.

7.4 Horticulture

The horticulture industry contributes about $147m to Northland regional GDP, representing about 2.6 per cent of the total (2013 – 2010 prices). The main products grown are kumara (98 per cent of national production) avocados (37 per cent), kiwifruit and mandarins. As such these are supplied to a combination of domestic and international markets. The total movement of horticultural products from Northland to other parts of the country was estimated at about 40,000 tonnes in 2012 almost entirely carried by road.

While improvements to the road network would be of some benefit, the main constraints on the size of the industry relate to supply limitations and barriers to access to overseas markets.

7.5 Overall Assessment

While for the key industries of dairying, livestock and meat production and horticulture there would be benefits in improving the road access to Auckland in terms of transport cost and reliability, the current level of service offered by the route is not seen as a major constraint on activity. The upgrading of the route would therefore be unlikely to result in major changes in the patterns of production or the linkages with markets.

8 Potential Resilience Benefits

Given the scale of closures along the route identified in Section 5 an assessment has been made of the direct benefits that might be achieved if these were reduced. In addition to these direct benefits from reduced travel times there would also be indirect benefits resulting from improved journey time reliability. These would include increases in tourism as Northland becomes more reliably accessible to visitors travelling from or through Auckland and the impact on the forestry industry discussed above.

The material in Section 5 indicates that in 2014 the road was closed on 27 occasions with the average duration of closure about 7-8 hours. This was estimated to affect about 110,000 vehicle movements per year, with an average delay of about 3.5-4 hours.

In the event of a closure drivers potentially have two alternatives:-

- They can wait until the road re-opens
- They can divert along a longer route before rejoining the main route later.

On the first assumption drivers would face a delay of about 410,000 hours in total. Valuing these at the values of time in the EEM would give a total cost of about $15m per year. While the position would improve with the new route, this would still be subject to some delays. In this case it has been assumed that these would fall by 85-90 per cent[5] giving a total cost of about $2m per year.

However in practice drivers would tend to take advantage of possible diversion routes, especially if these are well signposted and managed. While the diversion routes differ in length and likely travel time depending on the particular route section, for this analysis a typical diversion is assumed to involve an increase in journey time of an hour (allowing time for the routes to be set up and drivers to be alerted to these) and an increase in distance of 15 kms. However a number of these diversion routes are not available for the heaviest goods vehicles and it has been assumed that these have no option but to wait until the route reopens.

In this scenario on the basis of the current traffic flows , the costs of diversion (assuming that the heaviest goods vehicles wait until the route is reopened) would amount to about $5.5-6m per year but would fall to about $1.5-2.0 m if the road were upgraded, giving a reduction of about $4 m. On the basis of traffic growth of 1.5 per cent per year the total discounted benefits from improving resilience would amount to about $45-50m. At a growth rate of 2.5 per cent this would grow to about $60m.

It should be noted that these figures should not be regarded as precise but are indicative of the broad order of magnitude of the benefits from improved resilience. In particular the development of improved diversion routes for the heaviest goods vehicles and measures to reduce the impacts of any route closures could have a significant impact on the results estimated above, reducing them substantially.

[5] Half the accidents, half the disruption since now two carriageways and half the duration since easier to clear

9 Employment Impacts

9.1 Introduction

By making areas more accessible, the improvement of the route between Auckland and Whangarei may help to make the locations served more attractive for employment growth and thus stimulate economic activity in the corridor. To assess the possible extent of this the position following the extension of the Northern Motorway first to Silverdale at the end of 1999 and subsequently to Puhoi in early 2009 has been reviewed.

9.2 Growth after 1999

For the period after 1999 the growth in employment for the two areas where the new road probably had the greatest impact is set out in Figure 9.1. For comparative purposes this also includes the position for two areas, Browns Bay and Westlake/Takapuna which are away from area served by the motorway extension.

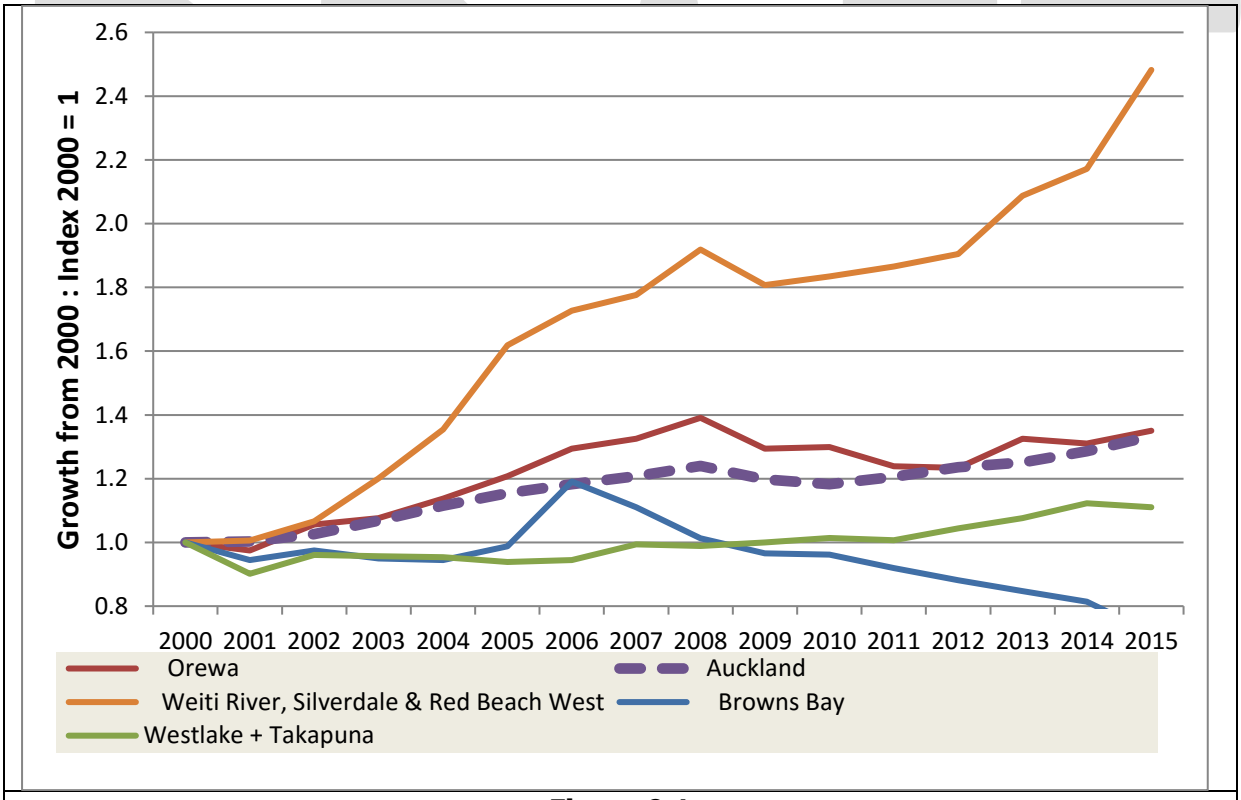


Figure 9.1
Growth in Employment from 2001 : Orewa, Silverdale Browns Bay and Takapuna (Index 2000 = 1)

Source Statistics NZ Business Demographics database

Employment growth in Orewa and the combined areas of Silverdale[6] has generally been above that for Auckland as whole, particularly for Silverdale where employment has grown very substantially potentially reflecting the opportunities provided by the increased accessibility. For Orewa employment growth has also been above that for Auckland as a whole although the difference is not so substantial.

While the growth in employment is dependent on a number of factors, the improved accessibility from the main Auckland area is likely to have been a major catalyst for the Silverdale area making feasible its large scale development largely in greenfield areas. By 2008, just before the declines in employment engendered by the GFC, employment in the Silverdale area had grown by over 90 per cent compared to 2000 compared to a region-wide growth of 24 per cent.

For Orewa which had more existing development, growth in employment to 2008 at 39 per cent was slower than for Silverdale but still well above the regional average of 24 per cent. This growth can be compared to an increase in employment of just 1 per cent for Browns Bay and a small decline in Takapuna.

9.3 Growth after 2008

The position further north has also been considered to reflect changes after the opening of the Northern Gateway Toll Road in early 2009 and this is set out in Figure 9.2.

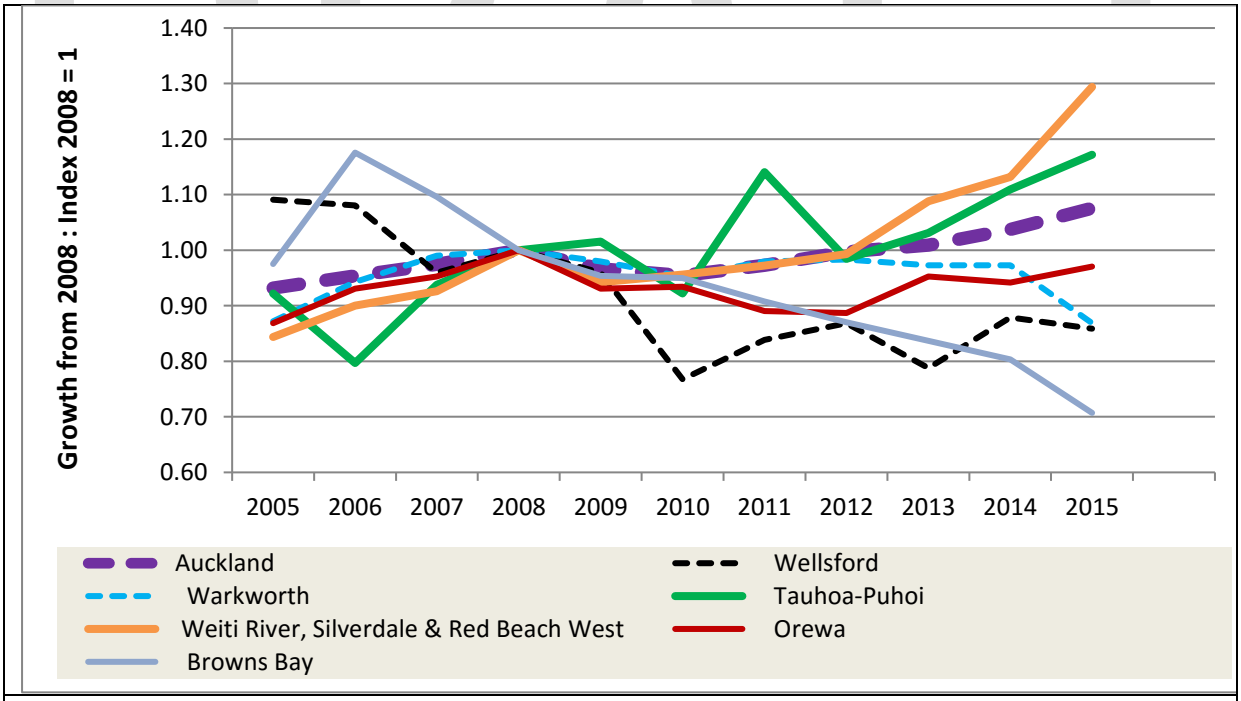


Figure 9.2
Growth in employment from 2008 : Areas potentially impacted by the Northern Gateway Toll Road

[6] Defined as the Census Area Units of Weiti River, Silverdale Central, Silverdale North, Silverdale South and Red Beach West

Here the position is more mixed, possibly reflecting more limited employment opportunities in the area directly served by the motorway extension and the effects of the GFC. For the census area unit of Tauho-Puhoi, the area closest to the end of the extension to Puhoi, employment growth while fluctuating from year to year has typically been above that of the Auckland region as a whole.

By contrast employment growth in Warkworth has been similar to the regional average between 2008 and 2014 and has been above that for Browns Bay. For Wellsford there has been a steady decline in employment over the period from 2005 for which the northern extension of the motorway to Puhoi appears to have had little impact. For both these areas, Warkworth and Wellsford, the end of the motorway may be at too great a distance to have much impact on the areas, especially Wellsford.

Further south growth in Weiti River and Silverdale continued to be substantial although for Orewa the earlier growth spurt seemed to have finished with employment generally declining between 2008 and 2012 before resuming growth broadly in line with that for the region as a whole in 2012.

In general the evidence from the extensions of the Northern Motorway suggests that its extensions have resulted in increases in employment in the areas newly served, although the scale of this depends on their particular characteristics and their ability to accommodate and support the increased activity. Thus the Silverdale area appeared to experience particularly large growth in employment with the extension of the motorway to the area in 2000 with the Orewa area where there was already substantial development also benefitting but not to the same extent. With the extension to Puhoi at the beginning of 2009, the area immediately served in general had employment growth above the regional average and above that for Orewa, but for the Wellsford and Warkworth areas further north the impacts were only very limited.

9.4 An alternative approach to the assessment of employment effects and benefits

While the evidence on the linkage between transport investment and employment impacts is very limited, two studies in the UK suggested that major road schemes could increase employment in the corridors served by between 0.4 and 4 per cent[7] While changes of this magnitude may not be appropriate for the upgrading of the Auckland-Whangarei corridor, the opportunity has been taken to consider the effects of applying the approach developed in this earlier work.

The total employment in the area served by the Auckland-Whangarei link is set out in Table 9.1

Table 9.1
Current Employment in the Auckland-Whangarei Corridor

Area	Total Employment 2015
Far North District	17850
Whangarei District	31690
Kaipara District	5820
Rodney Local Board Area	13840

[7] The M62 Cross Pennine Route and the Second Severn Crossing in the UK. The results of this are discussed in http://www.nzta.govt.nz/assets/resources/rons-economic-assessment-2010-05/docs/full-report.pdf

For this analysis a fairly cautious approach has been taken to reflect the differences between the UK experience and the position in the Auckland-Whangarei road corridor. As a result, it has been assumed that the new employment creation would amount to 0.2 per cent of the current employment in the areas served directly by the upgraded route and 0.1 per cent of the employment in Far North District. Applying these rates to the 2015 flows would give an increase in employment of about 120 over the route as a whole as set out in Table 9.2.

Table 9.2
Increases in Labour Demand with Road Upgrading

Area	Employment in 2015	Additional employment rate	Total New Employment
Far North District	17850	0.1%	20
Whangarei District	31690	0.2%	60
Kaipara District	5820	0.2%	10
Rodney Local Board Area	13840	0.2%	30
Total	**69200**		**120**

This increased employment would give rise to increased GDP. Applying the increases in employment to the GDP per worker for each of the areas would give an increase in GDP within Northland of about $10m based on the 2015 position and about $3-4m for Rodney. On the assumption that this contribution remains constant for the project this would result in a total increase in GDP discounted over the evaluation period of $120m

The growth in new jobs of 200 can be compared with the current employment levels in the corridor of about 40,000 and the growth forecast for the Marsden Point/Ruakaka area alone of about 4000 over the period to 2061. The modest increases can also be compared with the more substantial growth that occurred following the opening of the motorway to Silverdale.

Achieving the predicted growth does not therefore appear unrealistic, although as indicated earlier, while the improved route will provide the opportunity, realising this opportunity will depend on action by other parties and the nature of the outcome is therefore uncertain.

10 Population Impacts

10.1 Introduction

Earlier work looking at the impacts of the development of the Northern Expressway as far as Silverdale[8] suggested that that this had resulted in substantial population growth in the areas served by the new road. Dividing the potential area of influence into several bands and comparing the results for these against areas unaffected by the new road, the analysis reached the conclusion that population had increased substantially faster in the areas near and to the north of the new exits than had occurred across the Auckland region and also in the Waitakere and Manukau City areas used as a control.

This analysis looked at the position up to the mid 2000s using data from the 2006 Census. There is however the opportunity to follow a similar approach to examine the impacts of the extension of the motorway to Puhoi using results from the 2013 Census and this is reported below. The original work was undertaken at a very detailed level using data for meshblocks. However in line with the approach taken for employment, the work has been repeated using data at a CAU level. This substantially simplifies the analysis and a comparison with the results for the period from 2001-2006 using both approaches indicates that the broad story remains unchanged.

10.2 Approach to the Assessment

The assessment has been undertaken using Census population data at a CAU level. Following the work by Grimes and Liang, a number of areas of influence have been defined. The North Shore City area has been divided into three areas:-

- an inner area within 3 kms of a motorway exit,
- an outer area within 3-7 kms of a motorway exit and
- the remaining areas

Further north 5 areas have been defined:-

- Hibiscus Coast and Whangaparaoa within 7 kms of the motorway junction,
- Tauhoa-Puhoi,
- Warkworth,
- Wellsford and
- the remaining parts of Rodney mainly to the west.

10.3 Results of the Assessment

The growth in population for each of the areas identified is set out in Table 10.1 and illustrated in Figure 11.1 showing growth between 2001 and 2006 reflecting the opening of the Northern Motorway to Silverdale and for 2006 – 2013 capturing the effects of its further extension to Puhoi.

[8] Bridge to Somewhere: The Value of Auckland's Northern Motorway Extensions, A Grimes and Y Liang Motu 2008

Table 10.1 Growth in Resident Populations along the Northern Motorway					
	2001	**2006**	**2013**	**2001-2006**	**2006-2013**
Total Auckland	**1,160,271**	**1,304,958**	**1,415,550**	**12.5%**	**8.5%**
Waitakere and Manukau City	463,380	528,723	570,027	14.1%	7.8%
North Shore	177,579	198,024	216,354	11.5%	9.3%
Rodney	75,378	88,716	100,614	17.7%	13.4%
Wellsford	1737	1671	1698	-3.8%	1.6%
Warkworth	2826	3270	3909	15.7%	19.5%
Hibiscus Coast and Whangaparaoa	27855	33147	38529	19.0%	16.2%
NS Inner Area	125211	140565	154692	12.3%	10.1%
NS Outer Area	50925	56127	60480	10.2%	7.8%
Tauhoa-Puhoi	3336	4041	4560	21.1%	12.8%
Other Rodney	39,624	46,587	51,918	17.6%	11.4%

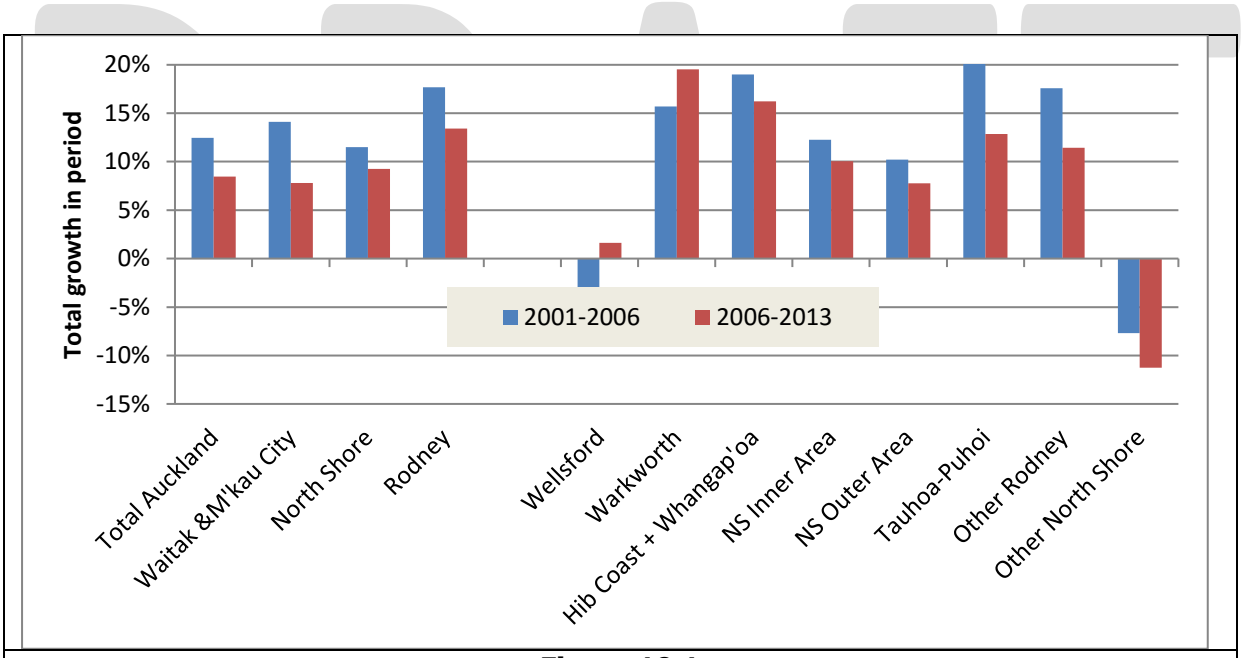


Figure 10.1
Population Growth for Selected Areas 2001-2006 and 2006-2013

The results set out in Table 10.1 and Figure 10.1 indicate that for almost all the areas identified growth in the second period from 2006-2013 has been much slower than that in the earlier period from 2001 to 2006, even though the second period is longer by two years. The examination of the growth identified for particular areas therefore needs to take this into account.

In looking at the impacts in different areas and considering the North Shore area first, population growth in the areas in the North Shore closest to the motorway ramps has been more substantial than those experienced in the outer area and in the other areas of North Shore for both of the time periods considered. For both areas growth over the period to 2006 has been greater than that subsequently

Further north population in the Hibiscus Coast and Whangaparaoa area has grown strongly in both periods, substantially faster than in the region or Rodney as a whole and faster than in the areas further south. Compared to the regional total the gap in growth rates has widened.

Warkworth the next major centre has also experienced a high growth rate, with the acceleration in the second period against the trend possibly reflecting the effects of the extension of the motorway to Puhoi. This effect may also to some extent extend as far as Wellsford where although the population growth rate has been low, there was again some acceleration in the second period. For the more rural Tauhoa-Puhoi CAU while growth was above the regional average, the rate was slower in the period after 2006 than before, suggesting that for this area at least the effects of the extension of the motorway to Puhoi was more limited.

10.4 Overall Assessment

The analysis of the effects of the extension of the motorway network on population levels suggests that the improvements in accessibility do lead to increases in population levels. This seems to be especially the case for areas reasonably close to the motorway network in the North Shore and Hibiscus Coast and Whangaparaoa. Further north the extension of the motorway network to Puhoi seems to have encouraged a higher rate of population increase in Warkworth and Wellsford. Here growth in the period following the opening of the motorway to Puhoi has been higher than in the earlier period in contrast to more general trends. For the more rural area to the north growth has still been substantial but the greater dispersion of the population within this appears to have limited the effects of the Puhoi extension, a finding that is in keeping with that for the North Shore further south.

10.5 Comparison with employment growth

To some extent the results of the analysis of population growth mirrors the results from the growth of employment set out in the previous section, especially for the Hibiscus Coast and Whangaparaoa areas. For the towns further north however it does appear that the increasing accessibility has a rather larger impact on population levels than on employment, and this may in turn give rise to increases in commuting as the residents take advantage of the easier access to the jobs further south. The increases in population along the line of the route would also expand the potential workforces in the communities served. As a result by reducing constraints on the labour supply in these areas this may possibly contribute to the growth of economic activity in the corridor.

11 Supporting Specific Development Aspirations

11.1 Introduction

The analysis of the impacts of extending the Northern Motorway, first to Silverdale and then subsequently to Puhoi has indicated that this has been accompanied by population and employment growth that is typically higher than might be expected without the road upgrading. The upgrading of SH1 would therefore potentially support the specific land use developments proposed within the road corridor. These would provide additional support for the estimated increases in population and employment discussed above.

11.2 Development in Whangarei District

11.2.1 The scale of Development proposed

The proposals for the development of Whangarei District have been set out in the Whangarei District Council District Growth Strategy (DGS) and the key components which include development opportunities at Ruakaka/Marsden Point and at Waipu along or served by the SH1 corridor are highlighted in Figure 11.1.

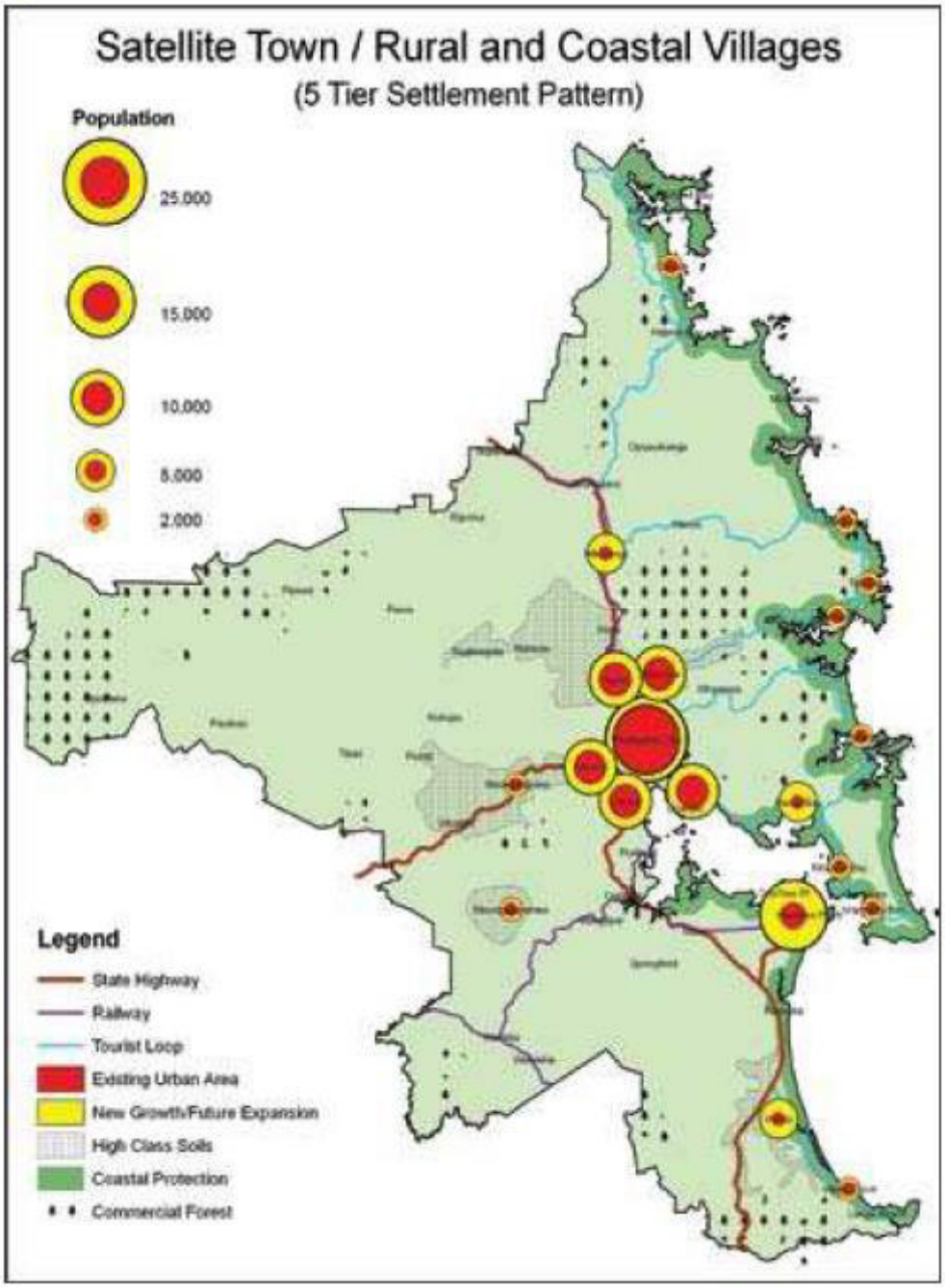


Figure 11.1
Proposed development areas in Whangarei District

As well as being an identified residential growth area, Ruakaka/Marsden Point is also seen as an important employment growth area, building on the advantages of the proximity to the port and the availability of business land. The proposals in the DGS call for an increase in the numbers employed of almost 3,000 or 300 per cent as can be seen in Table 11.1.

Table 11.1
WDC Business Projections Ruakaka/Marsden Point

	2006	2041	2061
Business Floor Area (m²)	326,497	1,088,095	1,529,403
Business Land Area (ha)*	63	165	233
Employees (by Workplace)	1,071	2,813	3,953

* Business area includes land zoned Business 1, 2, 3, 4 and Port Industrial, and does not include the Port or Marsden Point Oil Refinery.

The successful development of the area as an employment centre will depend on the quality of the linkages with other locations, particularly the main urban area in Whangarei City, to provide a wide catchment for employers locating in the area. This will include both access to workers and access to markets, of which that in Auckland is likely to be important for a range of industries. As part of this those travelling between Whangarei and the newly developing areas will have to share the part of the route along SH1 with other longer distance road users and there will therefore be the need to provide sufficient capacity for both groups of travellers.

Development is also proposed at Waipu to the south although this would be of a much smaller scale than in Ruakaka/Marsden Point. Again this would need to be supported by good connections to the urban areas and employment opportunities further north although the increased demands from this would be more modest.

As well as providing access to Auckland for those requiring this on a regular basis, the improvement of the route may also encourage development for industries /people who need periodic access to Auckland but who normally work locally or at home.

12 General Strategic Benefits

12.1 Introduction

An alternative approach to considering the quantified impact of the proposed road upgrading is assessing the general benefits of improved accessibility between firms and agencies in Northland and that further south in Auckland and to some extent would capture the effects of the upgraded route on employment and population discussed in the previous sections.

12.2 Approach

While the nature of the route and the distance between the major urban area probably precludes the development of a formal agglomeration model following the guidelines set out in the EEM, the results of which are allowed to be included in the scheme BCR a simplified approach has been developed using similar parameters to assess in outline the scale of the any benefits from interaction which might be generated. This approach has been used previously in the MED Linkages between New Zealand Cities study and is broadly analogous to that developed as part of the work set out in NZTA research report "The economic impacts of connectivity (forthcoming)

This has been based on the employment in the three TLAs within the Northland region and in the local board areas within Auckland. Typical travel times and distances have been determined for all the movements between these and these were converted into generalised costs of travel in 2015 prices using the parameters in the EEM.

Using this approach allows the effects of reductions in travel times and hence travel costs to be assessed. In the simplified model developed, changes in travel times were only assumed for travel between the three Northland TLAs and the Auckland Local Board areas to the south and no allowance was made for benefits which might accrue for trips between the Rodney Local Board a Area and areas further south and also within the local board area itself and some undercounting of the total impacts may result.

The analysis of current and possible future travel times considered above in Section indicated that an upgrade of the route from Warkworth to Whangarei as a whole which raised average speeds to 90 km-h would achieve a travel time saving of up to13 minutes. The analysis has been based on this figure. It should however be appreciated that with increasing congestion the benefits of the upgraded route will increase over time. The position taken may therefore underestimate the full benefits over time.

12.3 Results of the Connectivity Analysis

The regional connectivity benefits for 2015 assuming the full savings in time of 13 minutes are set out in Table 12.1.

Table 12.1
Base Case Connectivity Benefits by Area

Area	Total Connectivity Benefits in 2015		
	$m	**Share by area**	**Per cent of area GDP**
Far North	4.1	19%	0.2%
Whangarei	11.3	53%	0.3%
Kaipara	2.5	12%	0.3%
Total Northland	**29.2**	**83%**	**0.28%**
Rodney and North Shore	1.3	6%	0.01%
West	0.4	2%	0.01%
Central and South	2.0	9%	0.00%
Total	21.4	100%	0.03%

The results of the connectivity model would suggest that a reduction of 13 minutes in the travel time between Puhoi and Whangarei, equivalent to allowing an average speed of 90 km-h along the route together with some shortening of the route would give rise to connectivity benefits equivalent to about $20-25m on the basis of present day flows and values, mainly reflecting the benefits to Northland activities of improved access to the major markets in Auckland. The benefits largely accrue to the more urban area of Whangarei where the activities located in the town would gain particular benefit from the closer connections with Auckland. The benefits to Auckland industries of accessing the smaller markets in Northland would be much smaller amounting to only about 17 per cent of the total.

As noted above the exclusion of any benefits within the Rodney Local Board area and between it and the other local board areas within New Zealand would suggest that the estimates may be underestimated

To assess the value over time it has been assumed that employment would increase by 2 per cent per year at least as far as 2047, 20 years after the assumed opening date (in line with recent growth trends) and that productivity would increase by 1.5 per cent in line with Treasury forecasts. On this basis the discounted benefits would amount to about (assuming a constant 13 minute saving in travel time) would amount to about $350m of which the benefits just to Whangarei would amount to about $200-250m.

13 Other WEBs

A further WEB not included so far is the effect of imperfect competition on price cost margins. To adjust for this the EEM recommends that business user benefits calculated from the conventional economic assessment should be increased by 10.7 per cent. In practice this is equivalent to increasing the full user benefits by about 5 per cent. This element can be finalised when the conventional economic analysis has been undertaken.

14 Summary of Quantified Economic Impacts

14.1 Introduction

From the analysis described in the earlier sections, three main area have been identified where it is potentially possible to identify impacts of the scheme which are quantified in monetary terms and which are not included in the conventional economic benefits. These are:-

- Tourism benefits
- Benefits to the wood processing industry
- More general accessibility benefits

The possible quantification of these has been described above but is brought together and discussed in this section. For the evaluation it has been assumed that the evaluation period runs from 2027 for 40 years and that the benefits have been discounted at 6 per cent to 2016.

14.2 Tourism benefits

The value of tourism to the regional economy has been estimated at about $212m in 2015 and over recent years this has been growing at about 0.5 per cent per year. The response of the industry to the provision of improved road links is uncertain with evidence from other schemes indicating a range from zero to a 20 per cent increase for improvements to specific road links. Taking a fairly conservative approach it has been assumed that upgrading the full corridor between Warkworth and Whangarei would increase the tourism contribution to GDP by 7.5 per cent, taking into account the growth of 10 per cent following the completion of the section of the Northern Motorway between Greville Road and Silverdale the very small change following the completion of the Northern Gateway Toll Road the higher growth experienced following the opening of the Kopu Bridge and experience from the US Scenic Byways programme .

A growth rate of about 4.7 per cent per year has been targeted for Northland but for the appraisal of the tourism benefits in response to the road upgrading we have conservatively assumed an increase of just half this, reflecting a relatively low rate of growth historically. On this basis the contribution of the upgrading of the corridor as a whole to regional tourism GDP would amount to about $20m per year on the basis of the current 2015 position with a discounted value over 40 years of between $150 and 300m with a central estimate of $230m.

14.3 Wood processing benefits

Discussions with the forestry industry have indicated that there is belief that improved road links to Auckland would support increased production of timber products for sale in the major markets rather than exporting the logs in an unprocessed form. Again the scale of this increase is difficult to determine, but a fairly modest increase in the share processed from the current figure of 39 per cent to the current New Zealand average of 46 per cent would give an increased contribution to GDP estimated at about $150 million with a range of $125-$170 m based on the flows forecast for the period after the current spike in harvesting reflecting planning in the 1990s has subsided.

14.4 Resilience benefits

A major issue highlighted by users of SH1 is the frequency of closure of the route to unplanned events and the disruption that ensues. For much of the route, where they are available possible diversion routes add substantial times and distances to the journey, but for the heaviest vehicles, restrictions on the structures on these off-line routes mean that they have no option but to wait until the main route reopens. The total costs of delay without any improvement are estimated at about $5.5m per year on the basis of current traffic flows. These are estimated to fall by about $4m per year if the route were improved. The total discounted benefits from this taking into account traffic growth over the period would amount to about $50m.

14.5 Connectivity benefits

Connectivity benefits are analogous to the formal agglomeration benefits set out in the EEM but limited to urban areas and reflect the increases in productivity that may be achieved as areas are able to interact more closely with each other. Thus with an improvement in travel times and possibly more particularly travel time reliability, firms in Whangarei would be able to work more closely with suppliers and customers in Auckland providing the potential to take advantage of the economies of scale and range of opportunities that exist in the major urban areas. There would also be impacts in the opposite direction with firms in Auckland being able to access particular specialist suppliers and skills in Northland but this impact is very much smaller.

The analysis has been undertaken on the assumption that the improvement of the route will reduce journey times between Auckland and Whangarei by up to 13 minutes, reflecting the difference in travel times from an increase from the current average speed of 75 km-hr or so to 90 km-h. On the basis of a simple model and assuming that benefits are only generated between the Northland Districts and those in Auckland, the estimated total benefits if the upgrading had been in operation in the current year would have amounted to $20 m. Following the approach in the EEM these increase both in relations to increases in the size of the workforce and productivity increases. In addition the travel time savings on which the analysis is partly based would also increases with growing levels of congestion on the Do Minimum network, but these have not been included in the analysis at this stage

For the evaluation attention has been focussed on the benefits just for Whangarei, a relatively urbanised area where connectivity benefits typically associated with advanced business services are most likely to be generated. This limits the potential for double counting since the nature and location of the benefits identified for tourism and forestry means that the agglomeration type benefits are likely to be more limited and more likely to be located away from Whangarei.

The total discounted benefits estimated for Whangarei District are about $220m with a range of $200-250m.

14.6 New Employment Creation

There is some albeit limited evidence that new road construction can lead to overall increases in employment. On the basis of this it is estimated that the upgrading of the route in the corridor between Auckland and Whangarei could lead to an increase in the demand for labour of about 100-120 resulting in an increase in GDP of about $10-15m pa or a total benefit of about $100-125m

14.7 Overall assessment

The benefits from the different components have been brought together and summarised in Table 14.1.

Table 14.1

Auckland-Whangarei Corridor Upgrading : Summary of Wider Economic Benefits ($m NPV)

Benefit type	Central Estimate	Low Estimate	High Estimate
Tourism benefits	230	150	300
Benefits to the timber industry	150	130	170
Resilience benefits	50	40	60
Connectivity benefits	220	200	250
Benefits from increase in labour demand	110	90	130
Imperfect Competition Effects			
Total	760	610	910

The profile of the benefits for the central case is set out in Table 14.2.

Table 14.2 Estimated Quantified Wider Impacts ($m)						
Year	Connectivity benefits	Other GDP Impacts				Total inc Connectivity Benefits for Whangarei only
	Whangarei only	Timber	Tourism	Resilience	Increase in Labour Demand	
2027	17	18	21	5	13	74
2028	18	18	22	5	13	75
2029	18	18	22	5	13	76
2030	19	18	23	5	13	78
2031	20	18	23	5	13	79
2032	20	18	24	5	13	80
2033	21	18	24	5	13	82
2034	22	18	25	5	13	83
2035	22	18	25	5	13	84
2036	23	18	26	5	13	86
2037	24	18	27	5	13	87
2038	25	18	27	5	13	89
2039	26	18	28	6	13	90
2040	27	18	28	6	13	92
2041	28	18	29	6	13	94
2042	29	18	30	6	13	95
2043	30	18	30	6	13	97
2044	31	18	31	6	13	99
2045	32	18	32	6	13	101
2046	33	18	33	6	13	103
2047	34	18	33	6	13	105
2048	34	18	33	6	13	106
2049	35	18	33	6	13	106
2050	35	18	33	7	13	107
2051	36	18	33	7	13	107
2052	37	18	33	7	13	108
2053	37	18	33	7	13	109
2054	38	18	33	7	13	109
2055	38	18	33	7	13	110
2056	39	18	33	7	13	111
2057	39	18	33	7	13	111
2058	40	18	33	7	13	112
2059	41	18	33	7	13	113
2060	41	18	33	8	13	114
2061	42	18	33	8	13	114
2062	42	18	33	8	13	115
2063	43	18	33	8	13	116
2064	44	18	33	8	13	117
2065	44	18	33	8	13	117
2066	45	18	33	8	13	118
NPV	221	150	229	47	113	760

Overall the net present value of the benefits from the quantified wider impacts is estimated to be of the order of $760m. The breakdown of this is illustrated in Figure 14.1.

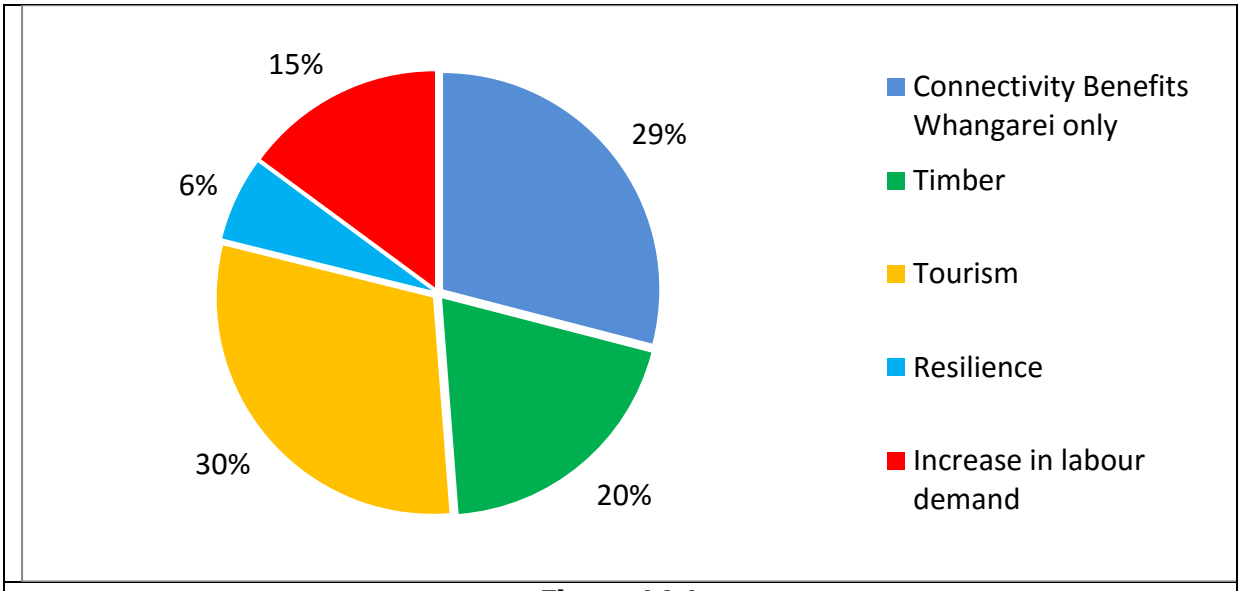


Figure 14.1
Breakdown of estimated quantified wider scheme impacts

Benefits to tourism form the largest part of the benefits, reflecting the importance of improving the links between Northland and the key markets to the south, followed closely by the connectivity benefits, also at just under 30 per cent.

14.8 Distribution of benefits by Route Section

The benefits identified are assumed to apply to the corridor as a whole. For the first three items a possible breakdown by section could be based on the travel time savings forecast for each and for the final item, the breakdown of benefits could be based on the balance of unplanned closures and delays for each section. .

14.9 Double Counting Issues

The benefits identified cover a range of activities and as far as possible it is intended that these should be additive and exclude any double counting. The benefits to specific industries, namely timber and tourism are assumed to arise from a change in the scale of the industry (sometimes called dynamic clustering) and so would in principle be different to the static clustering effects set out as connectivity benefits (primarily agglomeration) arising from a higher level of productivity but using the same inputs.

This in theory should limit any double counting but it is recognised that to some extent this may occur. This would however be difficult to identify. To help balance this, by focussing on the relatively urbanised area of Whangarei District and disregarding the impacts on Far North and Kaipara Districts, the approach taken to the estimation of the connectivity benefits is intentionally constrained and may offset the effects of any double counting.

There may ne some overlap between the estimates for tourism and forestry and for increases in labour demand. However while it is difficult to be certain about the exact nature and location of the increases in labour demand, the approach developed suggests that much of this (75 per cent of the total) may either be in Whangarei District or in Rodney. Other benefits to Rodney have been excluded from the analysis and so would not involve any double counting. For Whangarei District, forestry and wood processing and tourism represent a relatively small part of the local economy and so the potential for double counting between these and the increases in labour demand are more limited.

15 Evidence from Overseas

The Appalachian region covering parts of Alabama, Georgia, Kentucky, Maryland, Mississippi New York North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, and West Virginia is one of the poorest areas in the United States. To help address the problems of the region particularly those caused by its isolation the construction of the Appalachian Development Highway System (ADHS) a network of over 2500 miles (4000 kms) of high grade roads was commenced in 1965. This aimed to provide a higher level of accessibility for the area in an effort to boost economic activity and overcome the disadvantages of its remoteness from the main centres within the United States.

The estimated effects of the road construction have been analysed in some detail and the results are set out in "National Policy for Regional Development: Evidence from Appalachian Highways" (Jaworski 2016). The analysis looked at the improvements in accessibility that had resulted from the upgrading of the highway network giving improved access to markets within and beyond the region and compared these with changes in population, income and employment. The outcome of the analysis was that the development of the road network in the area was estimated to have led to an increase in income of about 1 per cent for the area as a whole or up to about 1.4 per cent per capita in the poorest areas.

While there are obviously issues with translating the findings and ratios for the Appalachian region to Northland, and any results need to be treated with some caution, applying these factors to the GDP for Northland in 2015 of about $5.9bn would give a total annual increase of about $60-80m based on the 2015 position with a total discounted benefit of about $1.1bn. These can be compared with the estimates above of about $0.6 – 0.9bn, suggesting that estimates of the impact of the corridor upgrading between Auckland and Whangarei are of an appropriate order of magnitude.