7. Alternatives

7.1 Statutory requirements to consider alternatives

Section 171(1)(b) of the RMA requires a territorial authority, when considering a NOR, to have particular regard to whether adequate consideration has been given to alternative sites, routes, or methods of undertaking the work.

Section 105 of the RMA requires regard to be had to various matters including “any possible alternative methods of discharge, including discharge into any other receiving environment”. Alternatives assessment required by section 105 is addressed in Section 29.5 below.

7.2 Overview of the option evaluation and design process

Identification of the indicative alignment involved a process of option development, evaluation and refinement. The process involved experienced roading engineers and designers working in conjunction with traffic engineers, planning, environmental and geotechnical specialists to identify options, which were subsequently assessed in workshops attended by experts in those relevant fields. Workable options were then carried forward and developed as the amount and level of information increased.

The options evaluation and design process is outlined in Figure 7-1 below.
Figure 7-1: Options development process
7.3 Scheme assessment phase options development and evaluation

The Scheme Assessment phase options evaluation and design process initially comprised the development of alignment options for the Pūhoi to Wellsford RoNS. This initial work established that an inland corridor following close to the NAL was less favourable than the more direct corridor northwards to Warkworth and then on to Wellsford. Accordingly, the inland option did not progress to the shortlist analysis and the Scheme Assessment for the section of the corridor between Pūhoi and Warkworth was progressed.

The process to develop and evaluate alternatives for the Project during the Scheme Assessment phase included:

- Stage 1: Collection and collation of base data and mapping of physical and social constraints;
- Stage 2: Development of a long-list of options/corridors and assessment of these against an evaluation framework to determine a short-list of route options; and
- Stage 3: development and further assessment of the short-list of route options and selected preferred route.

Feedback received from the first two phases of consultation with the community and stakeholders (refer to Section 8 of this AEE) was considered by the NZTA during the design process and in the evaluation of alternatives. The outcome from some of the feedback was to re-evaluate or modify sections of the route as appropriate.

7.3.1 ‘Do-minimum’ option

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

Section 2.8 of the NZTA EEM specifies the following with respect to the ‘do-minimum’ for transport activities:

"Most forms of activity evaluation involve choices between different options or courses of action. In theory, every option should be compared with the option of doing nothing at all, ie the do-nothing.

For many transport activities, it is often not practical to do nothing. A certain minimum level of expenditure may be required to maintain a minimum level of service. This minimum level of expenditure is known as the do-minimum and shall be used as the basis for evaluation, rather than the do-nothing.

It is important not to overstate the scope of the do-minimum, ie it shall only include that work which is absolutely essential to preserve a minimum level of service.

Particular attention is required if the cost of the do-minimum is comparable to the cost of the options being considered. In such cases, the do-minimum should be re-examined to see if it is being overstated."

The future infrastructure improvements through the study area that are considered by the NZTA to be essential to preserve a minimum level of service include:

- A Memorandum of Understanding (MOU) was agreed between the former Rodney District Council (RDC) and the NZTA (as Transit New Zealand) in October 2006. This MOU sets out agreed intersection improvements required in Warkworth to accommodate planned levels of development in the Warkworth area to 2021, as set out in the Warkworth Structure Plan (refer to Section 29.4.6 of this AEE). The MOU recommended a staging programme for the improvements to ensure these remain consistent with the planned level of development.
- The NLTP provides a list of proposed projects within the study area. These were reviewed to determine those essential to preserve a minimum level of service and those not required if alternatives considered as part of this study were to be implemented.

Both the MOU and NLTP were reviewed by the NZTA to determine which network improvements should be included in the ‘do-minimum’ for the Auckland to Whangarei Strategic Assessment and subsequently for the Project.

The ‘do-minimum’ option assumes that the existing SH1 alignment and configuration remains with the exception of committed intersection improvements at Warkworth in line with the MOU staging recommendations. A Warkworth western collector road, also referenced in the MOU, has also been assumed to form part of the ‘do-minimum’ option refer Figure 7-2 below for the proposed route of the Warkworth Western Collector.
No other improvements recommended in the NLTP were included in the ‘do-minimum’ option.
7.3.2 Long-list corridor options development

Development of the initial route options for the Pūhoi to Warkworth section of the Ara Tūhono P-W RoNS involved physical constraints mapping across the entire study area to enable composite constraint analysis. The study area was analysed in terms of a wide range of bio-physical constraints, including waterbodies, topography, geology, Department of Conservation reserves and Auckland Council regional parks and local reserves, sites of ecological value, the CMA, ONLs, and SNAs.

This analysis enabled the development of a long-list of route options in Phase 2 of the Scheme Assessment that sought to avoid or minimise effects on major constraints while addressing the NZTA’s project objectives cognisant of the influence of social and environmental factors. A ‘line of best fit’ was generated for each route option. The ‘line of best fit’ had the least cumulative impacts over its length, based on the categorisation of the constraints.

The start point for the route options was the northern end of the NGTR and a nominal end point was determined on SH1 in the vicinity of the intersection of SH1 and Kaipara Flats Road, to afford a bypass of Warkworth.

The alignments of ‘best fit’ were then developed into possible routes, in the context of a broader corridor, using 3-dimensional road modelling software.

A preliminary concept design of the routes was undertaken by the NZTA to derive basic information for use in the assessment of the performance of the corridors against the relevant evaluation criteria. The preliminary concept design included identification of horizontal and vertical alignments, cut and fill requirements, waterway crossings and indicative cost estimates. While indicative routes were developed for each of the long list options, it was recognised that there was potential for the alignment of the options to be adjusted as investigations advanced.

Additional inland options were developed to follow the NAL railway in the west.

A long-list of 13 route options was developed between Pūhoi and Warkworth.

(a) Long-list corridor evaluation

The evaluation framework for the long-list to short list corridor assessment was developed from the Auckland to Whangarei Strategic Assessment Context Report and Network Plan and refined to provide a more detailed quantitative and qualitative assessment of the corridors. In addition, the Ara Tūhono P-W RoNS and Project objectives (as outlined in Section 2.4 above) informed the scope of the evaluation criteria. A number of measures for evaluating the criteria were developed that were then used to inform the evaluation of the options.

Following the development of the 13 route options, technical assessments of the options were undertaken. The assessments included:

- An engineering and functional assessment based on geometric parameters, construction requirements, and structural requirements;
- A traffic assessment drawing upon outputs from the 2026 strategic traffic model developed for the Auckland to Whangarei Strategic Assessment;
• An environmental and social assessment undertaken against the objectives of relevant legislation and policy documents, including the NZTS, GPS, LTMA, NZTA Policy and the RMA, the extent of potential environmental, social and cultural effects and the ability to gain approvals for each option; and

• An indicative cost assessment.

Road designers, planners, environmental specialists, geotechnical engineers and traffic engineers attended workshops to review the long-list route options against the Project’s evaluation framework.

Following the long-list workshop, the 13 possible route options were grouped into seven broad corridors (refer to Figure 7-3 for evaluation prior to the identification of a short-list of options.)
Figure 7-3: Long List Options
Each of these corridors included between one and four of the long-list route options, and varied in width between several hundreds of metres and more than one kilometre. While the options generally re-join SH1 north of Warkworth in the vicinity of its intersection with Kaipara Flats Road, the northern end of the corridors was flared to reflect the ability to tie into the existing SH1 further to the north if required.

During the long-list workshop, the conclusions of the Auckland to Whangarei Network Plan and the option of an on-line upgrade to the existing SH1 were considered. The Network Plan conclusions and analysis at the long-list workshop resulted in the discounting of an on-line upgrade as an option for the short-list given that it would not be in line with the Network Plan or the Project objectives. However, following feedback from consultation undertaken on the broad principles of the route selection in June 2010, evaluation of an on-line option was undertaken as described in Section 7.5 of this AEE.

Corridors C, D, E, F and G were not dependent on any particular alignment north of Warkworth and hence do not preclude development of a range of alignment options north of Warkworth for the northern section of the Ara Tūhono P-W RoNS through to Wellsford. Corridors A and B were discounted on this basis and did not go forward for consideration of the short list options.

### 7.3.3 Identification of short-list corridor options

The categories and criteria used to evaluate the long list options are outlined in Table 7-1.

**Table 7-1: Evaluation framework categories and criteria**

<table>
<thead>
<tr>
<th>Category</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assisting Economic Development</strong></td>
<td>The extent to which the option will enhance inter-regional and national economic growth and productivity.</td>
</tr>
<tr>
<td></td>
<td>The extent to which the option will improve movement of freight and people between Auckland and Northland.</td>
</tr>
<tr>
<td></td>
<td>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).</td>
</tr>
<tr>
<td></td>
<td>The extent to which the option will support local economic development.</td>
</tr>
<tr>
<td><strong>Safety and Personal Security</strong></td>
<td>The extent to which the option is expected to improve road safety in the area and reduce all road crashes.</td>
</tr>
<tr>
<td><strong>Improving Access and Mobility</strong></td>
<td>The extent to which the option achieves the strategic (through traffic) function of SH1 as a nationally significant route linking the Auckland and Northland regions.</td>
</tr>
<tr>
<td></td>
<td>The extent to which the option provides a strategic alternative to address route security, resilience and flexibility.</td>
</tr>
<tr>
<td></td>
<td>The extent to which the option provides a strategic alternative to address a point incident.</td>
</tr>
<tr>
<td></td>
<td>Proximity of the option’s interchange locations to activity nodes.</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
</tbody>
</table>
A workshop was held to evaluate the seven broad corridor options (Corridors A – G) and identify the short-list options between Pūhoi and Warkworth. Some of the corridors contained more than one possible alignment developed for assessment purposes.
The assessments were undertaken by reference to each route option within a particular corridor rather than the corridor as a whole. This approach was taken so that the wider corridors, and especially those offering a number of possible routes, were not assessed as having greater effects than the narrow corridors where these would be further refined.

Within each category and criterion, the results of the evaluation against criteria were averaged and then summed to give the overall rankings. In addition, sensitivity testing was undertaken to rank options under a series of scenarios that saw the weighting for each of the objectives doubled in turn.

In undertaking the evaluation of the options, workshop participants agreed that the northern portion of Corridor F was not acceptable due to the large impact from the alignment passing through the Warkworth town boundary and effectively splitting the town in half. Consequently, the evaluation of this corridor was undertaken on the basis that the northern third of this corridor would adopt a similar alignment to Corridor E.

Corridors D, E and F were recommended to be considered further during Stage 3 of the Project’s Scheme Assessment.

### 7.3.4 Short-list corridor options evaluation

The short-list options (refer to Figure 7-4) were split into sectors to enable the different options to be ‘mixed and matched’. The sectors included:

- Pūhoi to south of Schedewys Hill;
- South of Schedewys Hill to Perry Road; and
- Perry Road to Warkworth.

Additional desktop and initial field investigations were undertaken across a range of specialist areas, including ecology, heritage and cultural, geological and geotechnical, acoustic, urban design, landscape, social, air quality and water quality.

A value engineering workshop was also held to minimise impacts on known features. Following this workshop, the options were further refined and developed, and then assessed across a broad range of criteria for the evaluation and selection of the preferred option. The options resulting from the value engineering workshop are discussed below.
Figure 7-4: Short-list options
(a) Pūhoi to south of Schedewys Hill (Sector 1)

This sector included only one short-list option, parallel to SH1. The development of the single short-listed option in this sector was the result of avoiding environmental and social constraints in and around the Pūhoi area and the need to tie into the existing NGTR alignment.

Initially, the alignment of this option headed north from the Johnstone's Hill tunnels and crossed SH1 from east to west, adjacent to Te Pā o Te Hēmara Tauhia. The alignment continued along the western side of SH1 past Pūhoi Road and north towards Schedewys Hill.

Following the initial value engineering workshop, the alignment through this sector was amended in two areas:

- North of Johnstone's Hill tunnels the option was realigned to the west of Te Pā o Te Hēmara Tauhia. This reduced the length of the bridge over the Pūhoi Estuary north of the Pā site and shifted the alignment away from the bulk of the CPA1 along the Pūhoi River; and
- North of Pūhoi Road, the alignment was shifted closer to SH1 to reduce the earthworks volumes and limit the area of land that would be isolated between the motorway and SH1.

(b) South of Schedewys Hill to Perry Road (Sector 2)

This sector initially included three options:

- Option 1 was located west of SH1. This option crossed Moirs Hill Road approximately 800 m west of SH1 and continue north through the western end of the Pohuehue Scenic Reserve. This option crossed Perry Road approximately 800 m west of SH1 and passed to the east of Genesis Aquaculture;
- Option 2 was generally parallel to SH1. The alignment was located to the west of SH1 at Schedewys Hill and then cut across to the eastern side of SH1 half way along Windy Ridge. The alignment then crossed SH1, just south of the Pohuehue Viaduct and continued parallel to SH1 through the eastern end of the Pohuehue Scenic Reserve. The alignment crossed Perry Road approximately 800 m west of SH1 and passed to the east of Genesis Aquaculture; and
- Option 3 was located generally to the east of SH1. Option 3 crossed SH1 approximately 700m south of Mahurangi West Road and passed about 900m east of Schedewys Hill. The alignment crossed SH1 approximately 900m south of Perry Road before crossing Perry Road approximately 800m west of SH1 and passed to the west of Genesis Aquaculture.

Following the value engineering workshop, modifications were undertaken on Options 1 and 2:

- Option 1A extended further west to avoid directly impacting the Pohuehue Scenic Reserve; and

77 The description of Sectors used in the short-list assessment is not to be confused with the indicative Project sectors outlined in Section 5.2.3 of this report used to assist with assessment of the Project for the purposes of this AEE and the assessment reports.
Option 2A remained on the eastern side of SH1 past the Pohuehue Scenic Reserve and crossed SH1 approximately 1,100m south of Perry Road.

These additional options were included in the short-list for evaluation.

(c) Perry Road to Warkworth (Sector 3)

The options for this sector followed the same alignment between Perry Road and Woodcocks Road and then generally followed two corridors between Perry Road and north of Warkworth:

- For one group of options, the alignment skirted Warkworth north of Perry Road, crossed Woodcocks Road to the west of Carran Road and continued north towards Kaipara Flats Road near Phillips Road; and
- For the other group of options, the initial portion of the alignment was the same as the group above between Perry Road and Woodcocks Road. From this point, the alignment turned north east and follow the edge of the Warkworth Structure Plan area towards SH1 before turning north again and crossing Kaipara Flats Road just to the west of SH1.

(d) Short-list Evaluation Workshop: Identification of Indicative Option

In summarising the results from the short-list evaluation workshop, the following points are highlighted:

- The ‘do-minimum’ option did not meet the Project objectives;
- Corridors A and B offered no positive benefits in assisting economic development, assisting safety and personal security or protecting and promoting public health (through proximity to services) due to their distance from Warkworth making them unattractive to traffic. In addition, they have relatively high costs and do not offer staging options. Consequently, these corridors compared poorly with the others;
- Corridor C offered low positive benefits in assisting economic development, assisting safety and personal security or protecting and promoting public health due to the length of the corridor. This alignment also has a high cost and compared poorly with the others;
- Corridor G offered positive benefits for economic development, assisting safety and personal security or protecting and promoting public health compared to the other remaining corridors, it had the highest impact on environmental values; and
- Corridors D, E and F were viewed as the best performing corridor options as they had positive benefits for economic development, assisting safety and personal security or protecting and promoting public health and lower impacts on environmental values.

The sensitivity testing, in which each category of criteria was emphasised, demonstrated that in all cases Corridor D performed better than other corridors. In all but one case, Corridor F was the next best option and where it did not rank second, it ranked third. Corridor E ranked second in one case, fourth in one case and third in the remaining four cases.

Accordingly, Corridor D was adopted as the indicative option for the purposes of Phase 2 of consultation (refer to Section 8 of this AEE).
7.3.5 Corridor refinements during Stage 3

Refinements to Corridor D in Stage 3 of the Scheme Assessment occurred in response to both community inputs (refer to Section 8 of this AEE) and in response to the findings of further, more targeted environmental investigations. The main changes included:

- Options for the connection to SH1 at the Johnstone’s Hill tunnels were considered with reference to potential impacts on Titford Cottage, Titford House and Te Pā o Te Hēmara Tauhia. Detailed information on these features was not available due to the lack of access for site investigations. Hence two options for this connection were developed for further assessment;
- The alignment was shifted west at Moirs Hill Road to reduce the fill heights to the north (west of the Pohuehue Scenic Reserve);
- Batters in some environmentally sensitive areas were steepened reducing the footprint and improving the overall cut/fill balance;
- The alignment between the Warkworth Interchange and SH1 was shifted south at Woodcocks Road to minimise the length of the bridge over the Mahurangi River (Right Branch). An additional benefit of this change was the extension of the bridge over Carran Road, avoiding the need for a substantial realignment of Carran Road;
- The alignment was shifted to the western side of Genesis Aquaculture property to avoid direct impacts on the fish farm; and
- The alignment at Perry Road was shifted west.

As a result of these refinements, a preferred route was determined, which was announced to the public in April 2012 (refer to Section 8 for further detail).

7.3.6 Refinements in the statutory approvals phase

Further refinements of the preferred route have been undertaken during the period leading up to lodgement of NORs and resource consent applications. The refinements relate to localised areas, or the design of specific structures along the indicative alignment. The indicative alignment is the result of this work, as shown in Drawings R-100 – R115 in Volume 4.

The main refinements are as follows:

- The link from the existing SH1 carriageway to Waiwera (Hibiscus Coast Highway) has been modified so that both the northbound and southbound lanes pass to the east of the new motorway mainline as a single two-way carriageway. This change removes the need to provide the Waiwera link overpass structure, thereby reducing the extent of works required in this location. The existing northbound Waiwera link road pavement has been retained to provide an access for emergency vehicles onto the northbound carriageway of the new motorway;
- In consultation with Hōkai Nuku, the indicative alignment has been modified between the Johnstone’s Hill tunnels and the proposed Pūhoi Viaduct to minimise impacts on a previously unrecorded pā site north of Billing Road, identified during site investigations to support the statutory approvals. Specifically, the indicative alignment has shifted to the east by approximately 50m and the vertical level of the road has increased by around 7.5m.
adjacent to the previously unrecorded pā site, mitigating what would have otherwise been a significant impact on the pā site. As a result of this alignment modification, the length of Okahu Viaduct has increased to 520m, requiring an additional set of piers;

- The indicative alignment includes the provision of south-facing ramps at Pūhoi. These ramps consist of a northbound off-ramp and a southbound on-ramp. North-facing ramps are not provided;

- A fill embankment south of Schedewys Viaduct that would have been located on unstable ground has been replaced with a 180m long viaduct (Hikauae Viaduct);

- The section of the indicative alignment between a point south of Perry Road and a point at Wyllie Road has been modified to better optimise earthworks volumes and minimise effects on a stand of Kauri trees identified as being of high ecological value. Other changes in this section include:
  - New Kauri Eco Viaduct proposed to replace a large embankment. The viaduct will cross the Mahurangi River (Right Branch), thereby removing the need to culvert the river at this point and also reducing the length of stream diversion required;
  - The indicative alignment has been shifted both westwards and eastwards by up to 120m laterally along this section;
  - The length of the Perry Road Viaduct has increased in length to 510m;

- The indicative alignment in the vicinity of the northern tie-in (to the north of Viv Davie-Martin Drive) has shifted to the northwest to minimise the footprint of the indicative alignment on an existing floodplain, based on new information from Auckland Council. This movement has included the provision of a new bridge structure (Carran Road flood relief bridge) where the indicative alignment will pass across the floodplain;

- The provision of an underpass structure proposed at Cook Road (unformed legal road) has been removed;

- Minor upgrade works are proposed on Moirs Hill Road to provide for safe operation of the road during the construction phase of the Project; and

- Minor realignment works on Woodcocks Road and Carran Road in the vicinity of Woodcocks Road Viaduct are proposed to improve safety at the Woodcocks Road/Carran Road intersection.

### 7.4 Interchange options

#### 7.4.1 Pūhoi Interchange

Based on the expected land use and growth predictions in the Pūhoi area outlined in relevant strategic documents, including the Auckland Regional Growth Strategy, along with discussions with Auckland Regional Council and Rodney District Council at the time, the Auckland to Whangarei Strategic Assessment and the draft Network Plan for SH1 between Auckland and Whangarei recommended that no interchange be provided at Pūhoi.

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78 NZ Transport Agency 2010a, *Auckland to Whangarei Strategic Assessment*, prepared by Sinclair Knight Mertz
79 NZ Transport Agency 2010b, *Draft Auckland to Whangarei Network Plan*, prepared by Sinclair Knight Mertz
The preferred route announced to the public in April 2012 did not provide for an interchange at Pūhoi.

Feedback from the communities at Pūhoi and Mahurangi West throughout the Scheme Assessment phase indicated a preference for retention of the current level of access for these settlements. In the absence of an interchange at Pūhoi, trips between Pūhoi and Orewa would need to travel via the Hibiscus Coast Highway, which is longer than the NGTR (both in terms of distance and time), with a lower geometric standard and lower level of service.

Further to this feedback, coupled with subsequent discussions with Auckland Transport and Auckland Council, south-facing ramps have been included in the indicative alignment.

7.4.2 Warkworth Interchange

During the Scheme Assessment phase, four interchange locations were investigated for the Warkworth Interchange, including:

- North – a northern interchange, the location of which would be dependent on the ultimate alignment selected for the upgrade of SH1 between Warkworth and Wellsford. Accordingly, two northern interchange options were assessed as follows:
  - North 1 – located 1-2km west of SH1;
  - North 2 – located adjacent SH1;
- Central – an interchange located near, and connecting to, Woodcocks Road; and
- Southern – a southern interchange in the vicinity of Valerie Close.

The interchange options each provided full movement on and off the motorway in both northbound and southbound directions. Some additional works would be required to local roads in order to ensure adequate connection to SH1. In particular, Woodcocks Road west of the potential interchange is restricted by a one-lane bridge. Following the evaluation a northern interchange location was selected as being preferred.

A summary of the results of the evaluation is as follows:

- The northern options scored highest on:
  - safety and personal security due to the lower volumes of traffic that pass the schools (Mahurangi College, Warkworth Primary);
  - improving access and mobility due to their greater ability to provide effectively for peak traffic volumes; and
  - value for money as they do not require as much improvement to the local road network as the other options.
- The central option performed best in assisting economic development of the Warkworth area, due to the improved movement of freight between planned industrial and commercial areas and the P-W RoNS and the improved connectivity between the P-W RoNS and the town centre.
- The central and southern options performed best in protecting and promoting public health due to the greater overall reduction in traffic volumes on local roads.
Overall, the northern options ranked highest. Sensitivity testing showed the northern options performed best when the weighting for each of the objectives was doubled in turn. The advantages of the northern options compared to the other options include:

- reduced traffic past Mahurangi College and Warkworth Primary School;
- connectivity to any future potential link from SH1 to the Matakana and Sandspit areas;
- greater flexibility for construction staging; and
- greater potential to service future population growth and development in Warkworth and the surrounding area.

The North 2 option (located adjacent to SH1) was adopted for the indicative alignment as it provides opportunities for greater connectivity with the Ara Tūhono P-W RoNS and the Eastern Beaches and does not preclude the development of the more northern section of the Ara Tūhono P-W RoNS through to Wellsford.

**7.5 SH1 ‘on-line’ upgrade**

Community feedback received during the Scheme Assessment Phase indicated strong public perception that the upgrade of SH1 would provide better value for money than a new off-line alignment. Accordingly, an ‘in corridor motorway’ alignment, generally following close to SH1, and an ‘on-line expressway’ upgrade of the existing SH1 alignment between Pūhoi and Warkworth were investigated following the short-list options evaluation.

**7.5.1 In-corridor motorway**

A 100km/h ‘in-corridor’ motorway alignment was developed between Pūhoi and Warkworth that closely followed the existing SH1 northwards from the NGTR as far as Perry Road and included a bypass of Warkworth. This alignment followed as much of the existing road corridor and State highway designation as possible. The alignment was based on the design standards for a RoNS configuration, similar to that used for the short-list options. The alignment would allow the existing SH1 to be maintained as a separate road with grade-separated crossings as necessary.

However, due to the difference between the existing SH1 geometry and that required to meet the standards for a 100km/h alignment, there was little commonality between the required motorway alignment and the existing SH1 alignment either vertically or horizontally. The resulting alignment for the ‘in-corridor’ motorway was similar to a combination of Sector 1 Option 1 and Sector 2 Option 2A, which was originally Corridor E in the long-list assessment (refer Section 7.3.2 of this AEE). Further, the ‘in-corridor’ alignment would require a large area of additional land outside the existing State highway designation boundary. In addition, the alignment would need to cross the existing SH1 in two locations, which would create difficulties in relation to construction and ongoing operational requirements.

Overall environmental effects of the ‘in-corridor’ motorway alignment were comparable to that of Corridor E, including:

- Land take and effects on properties and property accesses (especially as a motorway would preclude private access directly to it) along the existing SH1;
Assessment of Environment Effects

- Constructability impacts on the existing SH1 resulting from the crossing of SH1 in two locations and the construction adjacent to SH1 between Pohuehue Scenic Reserve and Perry Road;
- Similar potential adverse effects to known environmental and social features as Corridor E, including:
  - Te Pā o Te Hēmara Tauhia and a midden south of Pūhoi
  - Pohuehue Scenic Reserve
  - Honey Centre and Ransom Wines

In summary, the ‘in-corridor’ motorway alignment did not provide better value for money than the short-listed options, with higher costs than the estimated cost for the short-listed options, and had similar environmental effects.

The in-corridor motorway alignment option was not considered to warrant inclusion as a separate short-list option and it was therefore excluded from further consideration.

7.5.2 On-line expressway (upgrade of SH1)

An on-line expressway upgrade of SH1 was initially considered as part of the Auckland to Whangarei Strategic Assessment\(^\text{80}\). Analysis concluded that the on-line expressway option did not perform as well in comparison to the off-line options and the Auckland to Whangarei Strategic Assessment did not identify an online expressway as the preferred option due to the following reasons:

- The cost estimate to upgrade the existing State highway alignment would be similar to that of a new off-line alignment;
- An on-line expressway upgrade would not provide a secure alternative route to the existing SH1 network; and
- It would not be possible to toll an on-line expressway as there is no free alternative route as required under the legislation.

Subsequent analysis undertaken for the Network Plan confirmed this conclusion.

Following community feedback through the Phase 2 consultation undertaken during the Scheme Assessment phase, further assessment of an on-line upgrade to widen the existing SH1 between Pūhoi and Warkworth to a four–lane expressway was undertaken. A summary of the assessment is provided below.

(a) Functional assessment

The RoNS design standards require a design speed of 100km/h. The existing SH1 alignment does not comply with the 100km/hour design speed required for a RoNS. The geometry of the existing State highway alignment is constrained by the terrain through which the alignment passes. The majority of the alignment is well below the desired design standard. For an on-line expressway alignment to comply with the 100km/h design standard, the upgrade would occur within the

\(^{80}\) NZ Transport Agency 2010, *Auckland to Whangarei Strategic Assessment*, prepared by Sinclair Knight Mertz
existing SH1 alignment in relatively few places. Further, the current State highway design, geometry and associated safety record are key reasons for the upgrade of the existing route as outlined in Section 2 of this report.

Based on the review of the existing road alignment and the standards deemed achievable, a design speed of 80km/h was adopted for the purposes of assessing this on-line expressway option even though this speed limit is below the requirement for a RoNS. Whilst an expressway with 80km/h design speed is able to more broadly follow the existing highway alignment, a bypass of Schedewys Hill/Windy Ridge was included due to the challenges of this existing vertical and horizontal geometry compared with an 80km/h design speed standard. A bypass of Warkworth was also included as it is generally accepted that this is required to alleviate congestion on SH1 through Warkworth.

The key design features of the on-line expressway option were as follows:

- **80km/h horizontal design speed with a 65km/h minimum design speed (20% reduction) when using existing carriageway (by comparison all the short-list options were designed for 100km/h);**
- **80km/h vertical design but retain the existing vertical alignment where the existing highway is used ie below the 80km/h design speed;**
- **100km/h vertical and horizontal design speeds for the Schedewys Hill and Warkworth bypasses;**
- **The bypass of Schedewys Hill extends past Windy Ridge in order to achieve allowable gradients (connecting to the southern end of Windy Ridge would result in grades in excess of 10%);**
- **The bypass of Warkworth starts between Perry Road and Valerie Close and would head north-west to follow an alignment similar to that of the indicative alignment from a point to the south of Woodcocks Road. It would then continue and connect with the SH1 north of Warkworth, south of Kaipara Flats Road;**
- **3.5m traffic lanes;**
- **2.5m outside and 1m inside shoulders;**
- **4m median with a wire rope barrier;**
- **Full movement intersections with local roads (intersection treatment based generally on roundabouts);**
- **Left-in, left-out only access to properties (whilst not ideal, deemed allowable for 80km/h design speed) and unless allowed, considerable additional access road works would be required).**
- **The addition of two lanes to SH1 would require the existing formation to be substantially reconstructed.**

Ancillary items such as utility services, safety barriers and signage would also require significant works as a result of the construction of additional lanes.

Table 7-2 provides a comparison of the on-line expressway to an off-line motorway option for the Project from a functional perspective.
Table 7-2: Functional comparison of on-line expressway and off-line motorway

<table>
<thead>
<tr>
<th>Category</th>
<th>On-line expressway</th>
<th>Off-line motorway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Length (Johnstone’s Hill tunnels to Kaipara Flats Road)</td>
<td>19.2km</td>
<td>18.5km</td>
</tr>
<tr>
<td>Design Speed</td>
<td>80km/h (nominal)</td>
<td>100km/h</td>
</tr>
<tr>
<td>Access</td>
<td>Numerous at grade intersections for local roads and properties.</td>
<td>Access at interchanges only with SH1 maintained as separate facility providing for access.</td>
</tr>
<tr>
<td>Minimum Radii</td>
<td>240m</td>
<td>820m generally with 550m approaching Warkworth roundabout.</td>
</tr>
<tr>
<td>Maximum Grade</td>
<td>8%</td>
<td>5.6% up / 6.5% down</td>
</tr>
<tr>
<td>Length of Grades over 4%</td>
<td>4.1km</td>
<td>3.5km</td>
</tr>
<tr>
<td>Earthworks Volumes</td>
<td>4M m³</td>
<td>8.9M m³</td>
</tr>
<tr>
<td>Overall Bridge Lengths</td>
<td>Approximately 1,000m</td>
<td>Approximately 1,860m</td>
</tr>
<tr>
<td>Number of traffic lanes within Corridor</td>
<td>4</td>
<td>4 ~ 6 on motorway + 2 on existing SH1</td>
</tr>
<tr>
<td>Ability to be staged</td>
<td>Yes</td>
<td>Limited</td>
</tr>
<tr>
<td>Ability to be tolled</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>2026 Level of Service (existing SH1 is LoS ‘E’)</td>
<td>C</td>
<td>A</td>
</tr>
<tr>
<td>2051 Level of Service (existing SH1 is LoS ‘E’)</td>
<td>D</td>
<td>A</td>
</tr>
</tbody>
</table>

(b) Geotechnical constraints

While there are a number of geotechnical constraints to an on-line expressway upgrade along the length of the existing SH1 alignment, the main constraints are as follows:

- Pūhoi River Valley – from the northern portal of the Johnstone’s Hill tunnels, the existing SH1 corridor occupies the west bank of the Pūhoi River estuary. Widening the highway to four lanes over this 2km length would require extensive reclamation of the CMA. In addition, to form a stable, widened highway through this low-lying, soft terrain would require extensive ground improvement and foundation strengthening to prevent on-going stability and settlement problems;
- Schedewys Hill – significant earthworks would be required to re-align the existing SH1 alignment at Schedewys Hill to four lanes with a design speed of 80km/h. Further, the section of SH1 along Windy Ridge is constructed over the unstable Northland Allochthon geological formation, which would require significant ground strengthening and stabilisation to upgrade the existing alignment to four lanes; and
- Pohuehue Reserve – to widen the existing SH1 alignment through Pohuehue Reserve (currently on a viaduct and cut to fill embankment) to accommodate four lanes, an
additional multi-span bridge with piers in the Reserve and river bed would be required. Land take from the reserve would also be required.

(c) Access

Approximately 14 local roads connect to the existing SH1 between the Johnstone’s Hill tunnels and Valerie Close, along with a number of direct property accesses. An upgrade of the existing SH1 would require the current accesses to be maintained.

The inclusion of at-grade intersections along the expressway would, in general, not affect local road travel patterns; however, they would likely slow traffic on SH1 at these locations, increasing travel times. Property access would likely be restricted to left-in, left-out property accesses to eliminate any ‘higher safety risk’ right turns. While this would likely facilitate easier left turn access from private properties onto SH1, it would increase overall travel distances.

(d) Constructability

An on-line expressway upgrade of the existing SH1 would result in a number of complex construction issues including:

- Maintaining traffic flows while providing adequate working widths and safety zones during construction would likely be problematic in a number of places and require speed restrictions for traffic on SH1. The absence of a suitable alternative route would compound traffic disruption during construction;
- Maintaining the operation of the existing SH1 would complicate construction activities, particularly the movement of materials across the highway and the construction and maintenance of structures, including retaining walls and viaducts, culverts and sediment ponds. Working adjacent to the existing SH1 and moving traffic would restrict construction work areas, particularly on narrow and constrained sections, which would result in reduced construction efficiencies, greater construction disruption to road users, programme and cost implications;
- Creating a number of crossings of SH1 along with reconstruction of the existing carriageway resulting in complex construction staging and multiple traffic switches, again impacting on road users;
- Increasing the risk of a landslide event impacting the highway due to major earthworks immediately adjacent to the existing highway and known areas of geotechnical instability; and
- Land use and development on either side of the existing State highway limits the availability of nearby sites for water quality control ponds, spoil sites, storage areas and construction compounds.

(e) Environmental and social assessment

The on-line expressway upgrade would likely have greater social and environmental effects than an off-line option for the following reasons:
- The existing SH1 is adjacent to or passes through, or in close proximity to various sensitive environments, including SNAs, an area of native mistletoe near the SH1/Mahurangi West Road intersection, ONLs, estuarine and wetland habitats, significant waterways and DoC reserves, including the Pohuehue Scenic Reserve. The narrow corridor width would limit options to avoid environmental constraints along the alignment;
- An on-line upgrade would require large areas of land, beyond the current SH1 designation boundary, for construction and operational requirements. A new designation would be required along large lengths of the existing SH1, including at Schedewys Hill and Warkworth in order to provide sufficient width for the widened alignment. A larger footprint would have notable effects on the environment and land use immediately adjacent to the existing SH1 with notable areas of habitat removal and permanent land take from reserves likely; and
- The on-line upgrade would be in close proximity to dwellings and facilities and schools, which are sensitive to air and noise effects during both construction and operation. A greater number of landowners would be affected than an off-line upgrade.

(f) Conclusion – on-line expressway upgrade

The assessment of the on-line expressway upgrade undertaken during the Scheme Assessment phase confirmed the conclusion of the Auckland to Whangarei Strategic Assessment in that this option does not perform as well as an off-line upgrade option. The on-line upgrade option does not provide benefits that are commensurate with those of the off-line option in terms of:

- Improved travel times and travel efficiencies;
- Safety improvements;
- Route security and resilience;
- Journey time reliability; and
- Environmental and social impacts.

Whilst the overall cost of the on-line expressway would likely be less than the off-line RoNS upgrade option, it would still require a significant level of capital expenditure and is considered to provide reduced value for money overall. The on-line expressway upgrade would not meet all of the objectives required for this section of the Ara Tūhono P-W RoNS.

Given the findings of this analysis, the option was not considered further in the Scheme Assessment.
7.6 Conclusion – alternatives

The Project has been selected following a rigorous options development, evaluation and design process undertaken during the Scheme Assessment phase for the Pūhoi to Warkworth section of the Ara Tūhono P-W RoNS and the current statutory approvals phase. This process involved a long-list of potential alignments being reduced to a short-list and refinement through additional investigation and design advancement and two phases of consultation with project stakeholders and the wider community to select the indicative alignment.

The indicative alignment will avoid major environmental, social and cultural constraints within the Project area and provide a large number of benefits.

To summarise, the indicative alignment will provide the following:

- Opportunities for positive economic development for the north Auckland and Northland Regions and wider areas;
- Better value for money (when compared to other options);
- Improved safety and personal security through a better quality road with less travel times and better safety features for road users;
- Protection and promotion of public health, including a reduction of through traffic in Warkworth and in proximity to sensitive receivers, such as Mahurangi College;
- Route security and resilience through the provision of alternative options to SH1; and
- Avoidance of impacts on sensitive environmental areas such as the Pohuehue Scenic Reserve and overall lower impacts on environmental values in comparison to the other options assessed.