APPENDIX 11 – NOTES FROM PRELIMINARY REVIEW OF OPTIONS IN SECOND STAGE

NOTES OF PHONE CONFERENCE – O2L, T20 OPTIONS

Date: 9th July 2015, 1pm – 2pm
Attendees: Greg Lee, Sylvia Allan, Jamie Povall, Marten Oppenhuis
Subject: Preliminary discussion on additional route options for T20

Background

Following a further presentation at Tukorehe Marae, it was considered necessary to develop potential additional route options which would as far as practicable avoid known Māori land[1]. It was agreed with NZTA that this should be done before proceeding with further detailed analysis on the three options which had been identified from the MCA Workshop on 29th April 2015.

An initial sketch of an option which avoids most Te Ture Whenua Maori Act land (excepting two blocks at the extreme south and two narrow blocks at the northern end south of the Ohau River) was made. This was developed up to approximately the same level of detail as was available for Options TO1 and TO5 and their variants and was labeled TO15. At the same time, a variant of TO5 was modified to further avoid Māori land. This was labeled TO16 (see Attachments 1 and 2). While developing TO15, a further option which followed part of this route but which deviated to the east at the southern end so that it lay between Manakau township and the edge of the forest, was identified. This was mapped as a dashed green line on the attached TO15 option map.

In addition, Greg Lee raised a number of questions about the northern end of the route options, and prepared a map for discussion (see Attachment 3).

A phone conference call was held to discuss the options in a preliminary way and to decide on the next steps.

Marten Oppenhuis had prepared some "top of the head" notes while developing options TO15 and TO16 and these formed the basis for the discussions along with Greg Lee's questions and maps (Attachment 4).

The notes below record the main points discussed.

Notes from Conference Call

1. In relation to Greg Lee's questions, Marten and Sylvia advised that option 1a had been rejected early because it would affect a range of property including the Manakau Domain and then involved the same issues which had been identified with the route options being looked

[1] MWH has mapped all land held under the Te Ture Whenua Maori Act that it was able to identify. This does not cover general land owned by Māori, and may not pick up Maori roadways and some other classes of land.

at further north (i.e. TO1, 2 and 4). Option 1b continued the full route through Kuku settlement and also required the replacement of the existing Ohau rail and river bridges/structures (a current blackspot). The latter would be problematic during the construction stages. The options shown as 2 had not specifically been considered (Sylvia advised that the general area they occupy had been excluded during the Corridor assessment) as the emphasis was on keeping SH1 as a priority and connecting to SH57 as part of a "ring road" around Levin. Marten indicated that getting over the railway and existing road and connecting to existing SH1 to the north would be problematic. The area around SH1 and the current Kimberley Road intersection had been looked at extensively as part of other early options, and it was relatively visually sensitive.

2. Sylvia raised a question as to whether the bifurcation south of the Ohau River on options TO15 and TO16 could be pushed further north. Marten advised it was too complex with regard to a Kuku access, and in terms of the river's configuration in the general area, as well as the ability for a new route to rejoin SH1 north of the river.

3. The proximity of the overbridge to Manakau Rail overbridge and Whakaharo Road is a problem with option TO16. TO15 is ok in this respect, but has its own issues with rail being on an embankment at the place where the new alignment crosses. Marten considers Waikawa Beach Road and Mokena Kohere Street would need to be realigned because of proximity to the structure. Others were not so sure. Agreed not an issue for Waikawa Beach Road and would need to look carefully at Mokena Kohere Street (if this had to be closed, that would be an issue).

4. Marten noted that options presented may elongate the length of SH1 as compared with current, but TO16 is clearly worse. Others considered that TO15 is similar in length to the current SH1.

5. There was a discussion about the preferred location for an interchange. Gleeson Road area is likely not to be the preferred option as is close to Otaki and quite a distance from Ohau. This matter has not yet been resolved. Also, an interchange at Gleeson Road area was thought to have problematic geometry, and significant property impact. If the green alignment (east of Manakau route) shown on the original TO15 drawing was an option, then it seems to benefits from having a natural place for an interchange, that would be well-located. [Note: thishas now become TO17].

6. Marten had considered that access to the quarry just south of the river would be a problem. In discussion it was clarified that this is currently not accessed by a public road. It may be possible to provide ongoing access via an informal access near to the new SH57 river bridge below the rising deck (close to the river) with either option.

7. Option TO15 would result in a high flyover near to Manakau township. May cause some severance although this should not be overstated as it is only the Domain that is to the west of the railway – the houses here are mostly part of a new subdivision.

8. The vertical profile is challenging at Manakau North Road in Option TO15.

9. The vertical profile from the railway overbridge on the merge back into SH1 south of Ohau Village has marginal separation for all new options but a solution could be found. It was decided at the conclusion of the call that the green dashed option should be drawn up to the same standard as TO15 and TO16 (as TO17) and all three options should be subject to a MCA. It was decided to use the Delphi technique, to use consistent criteria and scoring systems to the last MCA, and to involve all participants from the previous exercise. Sylvia to organise once plans are available from Marten and Jame.

Additional Notes from Marten

Marten's more detailed comments on Greg's options 1a, 1b and 2 (refer Attachment 3) are dated 16th July 2015, and are copied below. Further comments were also provided on technical matters discussed at the conference call.

> *"**1. Location 1a***
>
> *i. Distance is becoming more extreme from current location for SH57 – not an issue as such, just a fact for NZTA to consider.*
>
> *ii. Unless the very substandard Manakau Rail O/B and Waikawa Stream Br alignment/structures and Ohau Rail O/B alignment/structures are upgraded, a substantial road safety risk remains. Upgrading alignment and structures close to the existing will need careful consideration to establish viability (e.g. route traffic management during construction).*
>
> *iii. Side friction from side roads and property access will remain.*
>
> *iv. The on and off ramps will impact heavily on the Manakau village, with the geometric standard needing to support the traffic volume (i.e. a high standard required).*
>
> *v. SH1 will need to be upgraded to a standard which supports central median and edge safety barrier, hence side road and property treatment is challenging in order to resolve the very significant safety concerns on this section of SH1. The current preferred solution to address those safety concerns would remain as being SH1/57 connection which would negate the need for and be preferred to the alternate offered through this option of a long length of SH57 between Manakau and Muhunoa East Road. Connections to the south would not be necessary, as the service IC centred on Gleeson Rd would provide local connection.*
>
> *vi. Service and System IC's are close together, requiring thought to be given to a further grade separation on SH57 (in time becomes SH1) north or south of Ohau River – on the basis that we need to ensure future-proofing and interchanges should be some 5-8kms apart (Muhunoa East Rd is a possibility if it was upgraded to an interchange).*
>
> ***b. Location 1b***

i. Similar issues/considerations to 1a, but the Manakau Rail O/B and Waikawa Street Br alignment/structures are bypassed.

ii. On and off ramps to the existing section of SH1 will be required sufficiently separated from the SH1/57 interchange, unless only provided at Gleeson Rd interchange.

c. Location 2

i. *Sylvia you have raised previous decisions regarding why this possibility (or similar that we looked at previously) was not pursued.*

ii. *In addition the interchange over the existing SH1 and rail will need to push out to the west by several hundred metres so that the geometric standard can be met. It is always a preference for the highway (expressway) to be at grade with the local road over (to control noise and visual intrusion), but this is not possible with the railway needing to remain at grade.*

iii. *Connections to the existing SH1 to the south would require the "off ramp" to be west of the interchange, to allow a merge to be introduced. The on ramp can be incorporated as part of the structures required over the existing highway and railway.*

2. Comments on Interchange on TO15 between the flyover off the current SH and Rail and Waikawa Stream Bridge *(the length between the flyover of Option 15 over the existing SH and rail and Waikawa Str Bidge would be where an interchange would need to be considered).*

a) *An interchange in this location is not impossible but the ramps would need to start at the south end once the flyover geometry was back down to grade and hence the distance to the Waikawa Str Bridge does not allow an interchange to fit (and have the preferred local road over the expressway). However it would be possible to consider keeping the embankment up at the same level as the flyover and hence start the interchange sooner. It would still be necessary to get down to near grade when crossing the Waikawa Str to avoid higher than required bridge elements (again not impossible, just adds cost). The local road would be under the expressway. Could also consider the north facing ramps for a spread diamond to cross Waikawa Str on separate structures – also just a cost consideration.*

b) *For a spread diamond or compact diamond interchange 1.7kms is required longitudinally and for a DiaClo 1.3kms is required. The flyover surface will be 7m above the existing SH and hence will need approx. 400m to bring down vertically to grade. Before introducing an interchange, a further separation is preferred of say 200m, although this could be compromised. The distance from the midpoint of the flyover to Waikawa Street is approx. 1.5kms, so on that basis this location is ruled out. An extended expressway embankment to accommodate an interchange, whilst not impossible geometrically, would be very intrusive and adds significant*

cost. An interchange is challenging and would require multiple crossings of Waikawa Str Br (expressway and north-facing ramps). Would need careful investigation at the DBC, as do all interchanges for all options.

3. North facing ramps at the flyover just south of Ohau Village

From the midpoint (top) of the flyover there is approx. 500m to Muhunoa East/West Rds intersection. Most of this distance is required to bring the vertical profile down to the existing highway connection to the north and to provide the required sight distance criteria. A "on ramp" can be incorporated under the flyover, but an "off ramp" will need to be developed from the point where the proposed SH1 is back to grade and some 300 - 400m beyond this point – hence well beyond the intersection and into Ohau Village – rules this possibility out on safety and geometric layout grounds.

Given the above, I believe that interchange locations 1a, 1b and 2 and on TO15 are able to be discounted in favour of TO Options 1, 2, 4."

Notes prepared by Sylvia Allan

28th July 2015

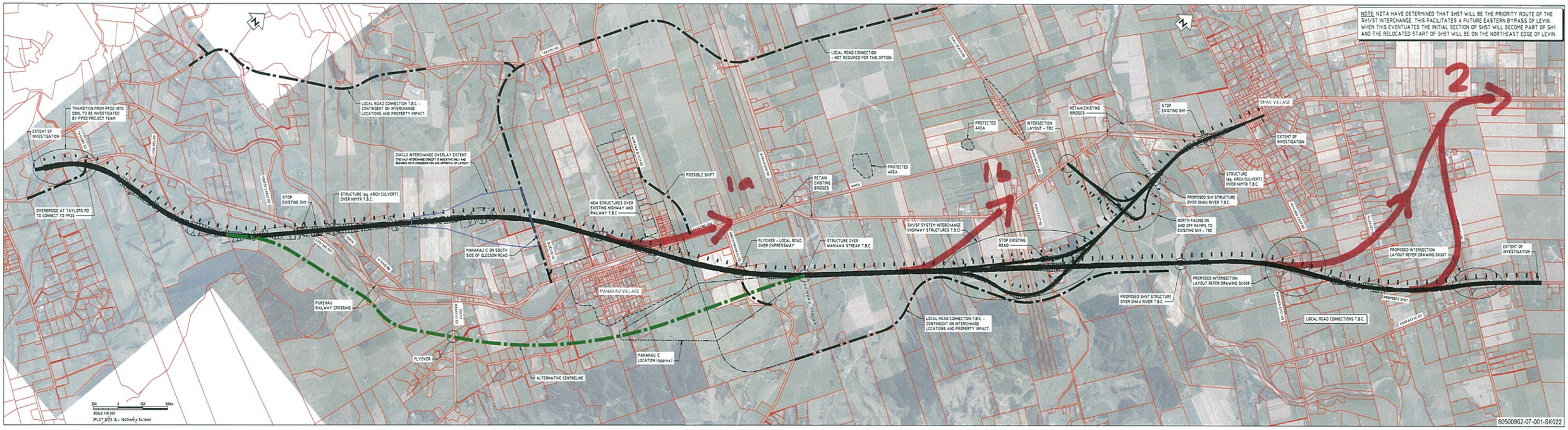
Revised with small corrections/clarifications 17th August 2015

List of Attachments (Attachments 1 to 3 – provided separately)

Attachment 1 O2L RoNS – Taylors Road to Ohau Section (Manakau Bypass) Option TO15
Attachment 2 O2L RoNS – Taylors Road to Ohau Section Option TO16
Attachment 3 O2L RoNS – Taylors Road to Ohau Section Greg Lee Sketch
Attachment 4 Marten Oppenhuis Notes (see following page)

Attachment 4 – Marten Oppenhuis Notes

No.	Issue	Option Affected	Fatal Flaw?
1	Proximity to Manakau Rail OB (and Whakahoro Rd)	TO16	
2	Lengthening of SH1	Both, but TO16 worse	
3	Not preferred location for Manakau interchange	Both	
4	Local Rd connection to quarry problematic	Both	
5	Severance between SH1 and SH57 south of Ohau R	Both	
6	Ramps widen Ohau R Br on SH1 leg	Both	
7	Gleeson Rd focus for Manakau interchange - problematic geometry/priority/property impact	Both	
8	Manakau Village severance, noise (expressway elevated over road/rail) and development hindrance	TO15	
9	Proximity to Mohena Kohere St and Waikawa Beach Rd	TO15	
10	Property ownership and physical building status not known (could mitigate?)	Both	
11	Manakau North Rd - vertical profile tricky (level xing, etc)	TO15	
12	Horticultural severance west side of Manakau Village	TO15	
13	Vertical profile from railway O/B on proposed SH1 to fringe of Ohau Village - separation marginal	Both	



OTAKI TO NORTH LEVIN (RONS)
TAYLORS ROAD TO OHAU SECTION
(MANAKAU BYPASS) OPTION TO15
SCALE 1:10,000

APPENDIX 12 – DELPHI INSTRUCTIONS FOR PARTICIPANTS

CONFIDENTIAL

Memo to: O2L Participants in the Southern End MCA Workshop – 29th April 2015

From: Sylvia Allan, Allan Planning and Research Ltd
Subject: Further Route Options, Taylors Road to Ohau
Date: 20th July 2015

As a result of ongoing consultation with Ngati Tukorehe and Ngati Wehi Wehi, we have developed three further route options, specifically designed to minimise effects on land held under the Te Ture Whenua Maori Land Act (note that it is not possible to completely avoid all such land – at least two parcels are unavoidable with these options). The Options have been labeled TO15, TO16 and TO17 and I am sending them in separate emails, as they are quite big. Although Options TO15, TO16 and TO17 are presented in some detail, this is not based on detailed engineering design, so please do not dwell on the detail of the attached plans, including the indicative local road network). Also, please note that these are Confidential and should not be shared with anyone else.

Rather than having a further MCA Workshop to evaluate these options, we are applying the Delphi technique where people undertake their own separate scoring and I will be responsible for bringing the information you provide together into a MCA framework (along with the views of the others who attended the last workshop). I am seeking a response from everyone who was at the last Workshop[1].

You will recall that we discussed most of the area in detail last time, and it will be familiar to you. The additional areas which have been included are in the south-east of the southern part of the original "Area" and the area between the two parts of Manakau settlement (near to SH1 and crossing the railway line here in one option).

We will be using the same criteria and scoping as in our MCA exercise of 29th April 2015. The criteria descriptions and scopes are set out below.

CRITERIA

1. **Landscape/Visual** – This took into account existing landscape character (including degree of modification and presence of structures), route length and presence of dwellings nearby, any outstanding landscape or natural character components, and important landscape/natural features. It also considered urban design type effects where a route was close to settlements.

[1] A separate Memo and instructions has gone out to the technical specialists, as they have specific inputs.

2. **Ecology** – This criterion focused on terrestrial ecology values[2], particularly those relating to patches of indigenous vegetation which are nationally, regionally or locally significant in terms of habitat values and presence of known species.

3. **Archaeology/Heritage** – This criterion took into account presence of known archaeological and heritage sites and features, and also archaeological risks (i.e. the likelihood of encountering archaeological sites).

4. **Tāngata Whenua Values** – This took into account Maori owned land and the range of cultural values including values relating to the natural environment (waterways and wetlands, areas of indigenous vegetation), key areas of settlement (marae, papakainga) and use (food gathering areas), and known wāhi tapu.

5. **Productive Land Uses** – As reported and discussed at the workshop, this criterion took into account soils and the New Zealand Land Use Capability Classification, in particular classes 1 to 4 (productive land), the current productive landuse pattern, and potential severance effects on productive units.

6. **Social/Community Impacts** – This incorporated a range of considerations including severance effects, access to and from settlement areas and townships, general urban amenity, connectivity to community services and facilities, recreational effects, and construction impacts. (Note direct effects on land including dwellings were included under specific land ownership effects).

7. **District and Regional Plans and Consentability** – This criterion includes consideration of both zoning and plan objectives and policies, and any major impediments through the plans to a route location. It also considered regional consent requirements.

8. **Fit to Project Objectives** – This criterion covered levels of service, and efficiency and effectiveness (in terms of best value solutions). The assessment took into account the local network and the various state highway components.

9. **Specific Land Owner/Land Use Effects** – This criterion considered impacts on areas which could potentially pose difficulties for the location of an option – including Crown Land, Māori multiple-owned land and QEII Trust conservation land, as well as particular land uses.

10. **Engineering Degree of Difficulty** – This was assessed on the basis of physical components such as volume and balance of earthworks (cut and fill suitability / issues with materials), structures, temporary works, access management, risks around “unknowns”, additional provisions to address natural hazards such as hydrological impact, flooding, geology and general degree of difficulty in construction.

11. **Costs** – Costs took into account the actual capital construction costs, including the range of matters identified under constructability, plus contingencies.

The scoring table is over the page.

[2] While aquatic ecological values were considered, it was determined that effects would be localised and similar between all options. They would be largely mitigated through design and managed through the construction stage.

SCORING DESCRIPTIONS

Score	Description
1	The option presents few difficulties on the basis of the criterion being evaluated, taking into account reasonable mitigation proposals. There may be significant benefits in terms of the attribute.
2	The option presents only minor areas of difficulties on the basis of the criterion being evaluated, taking into account reasonable mitigation proposals. There may be some benefits in terms of the attribute.
3	The option presents some areas of reasonable difficulty in terms of the criterion being evaluated. Effects cannot be completely avoided. Mitigation is not readily achievable at reasonable cost, and there are few or no apparent benefits.
4	The option includes extensive areas of difficulty in terms of the criterion being evaluated, which outweigh perceived benefits. Mitigation is not readily achievable.
5	The option includes extreme difficulties in terms of achieving the project on the basis of the criterion being evaluated.

We need your input to help with the Delphi analysis of the three new route options. Please could you have a go at scoring all the criteria you feel comfortable to do so for the three new options (don't so the cost one – that will be provided by MWH advisers) on the same basis as we did for the previous exercise back in late April. If you think you identify any Fatal Flaws, please let me know of these and the criterion they are related to. If you feel you do not know enough about a specific criterion, then just leave it out. For any criterion, make sure you score each option.

The scoring from the workshop for the last options is set out on the next page, and I have also added the criteria notes. FYI – please use this table to add to if you wish and provide some brief comments on the basis for your score. The comments you make should be along the same lines/level of detail as those below.

Option	Landscape Visual	Ecology	Archaeology/Heritage	Tangata Whenua Values	Productive Land Values	Social/Community	District & Regional Plan Fit/Consentability	Project Objectives	Specific Landowner Effects	Engineering Degree of Difficulty	Cost
TO1	4	3	3	4	2	2	2	1	2	2	2
TO1A	4	5	4	4	2	2	4	1	2	3	2
TO2	4	3	3	4	2	2	2	1	2	2	2
TO2A	4	5	4	4	2	2	4	1	2	3	2
TO3	4	4	3	4	2	2	3	1	2	2	2
TO3A	4	5	4	4	2	2	4	1	2	3	2
TO4	3	3	3	4	2	3	3	1	2	3	3
TO4A	3	5	4	4	2	3	4	1	2	4	3
TO5	5	4	3	5	2	4	3	1	2	3	4
TO5A	5	5	4	5	2	4	4	1	2	4	4
TO15											
TO16											
TO17											

Please could you undertake this task and get back to me by Friday 24th July. If you have questions or concerns please contact me by phone (021 665 155) or email.

Kind regards
Sylvia

CONFIDENTIAL

Memo to: O2L Technical Experts (Morrie Love, Gavin Lister, Adam Forbes, Daniel Parker, Lauchie Grant)
From: Sylvia Allan, Allan Planning and Research Ltd
Subject: Further Route Options, Taylors Road to Ohau
Date: 17th July 2015

As a result of ongoing consultation with Ngati Tukorehe and Ngati Wehi Wehi, we have developed three further route options, specifically designed to minimise effects on land held under the Te Ture Whenua Maori Land Act (you will be able to check the locations of this land on maps of previous alignments - note that it is not possible to completely avoid all such land). Although Options TO15, TO16 and TO17 are presented in some detail, this is not based on detailed engineering design, so please do not dwell on the detail of the attached plans.

Rather than having a further MCA Workshop to evaluate these options, we are applying the Delphi technique where people undertake their own separate scoring and I will be responsible for bringing the information you provide together into a MCA framework (along with the views of the others who attended the last workshop).

I think that you will have covered most, or all of the areas affected in your earlier studies. The main exception is likely to be the south-eastern end and the area between Manakau settlement and the Tararuas to the east. We did look at those areas within the Area Stage and hopefully it will not be difficult for you to consider this area and its values. There may be some small bush areas affected (from the ecologist point of view) north of Manukau by T016 and T017. Adam, I hope you can check these – they did not feature in earlier studies.

We will be using the same criteria and scoping as in our MCA exercise of 29th April 2015.

Whereas last time we asked you to provide an indication of scores on the basis of "+ +" to "- -" so that the actual scoring could be done by the workshop, this time we are asking you to go straight to numeric scoring (on the 1 good, 5 bad basis as in the past) for your attribute (and if you wish to score other attributes please feel free to do so). Please could you send me these scores, and brief notes which set out the basis for this scoring. If you find there are any fatal flaws in any options, please advise on those as well.

The scoring from the workshop for the last options is set out below, and I have also added the criteria notes from the draft report. FYI – please use this table to add to if you wish. The comments you make should be along the same lines/level of detail regarding your scoring.

Option	Landscape Visual	Ecology	Archaeology/Heritage	Tangata Whenua Values	Productive Land Values	Social/Community	District & Regional Plan Fit/Consentability	Project Objectives	Specific Landowner Effects	Engineering Degree of Difficulty	Cost
TO1	4	3	3	4	2	2	2	1	2	2	2
TO1A	4	5	4	4	2	2	4	1	2	3	2
TO2	4	3	3	4	2	2	2	1	2	2	2
TO2A	4	5	4	4	2	2	4	1	2	3	2
TO3	4	4	3	4	2	2	3	1	2	2	2
TO3A	4	5	4	4	2	2	4	1	2	3	2
TO4	3	3	3	4	2	3	3	1	2	3	3
TO4A	3	5	4	4	2	3	4	1	2	4	3
TO5	5	4	3	5	2	4	3	1	2	3	4
TO5A	5	5	4	5	2	4	4	1	2	4	4
TO15											
TO16											
TO17											

Please could you undertake this task and get back to me by Friday 24th July. If you have concerns please contact me by phone (021 665 155) or email.

Kind regards
Sylvia

APPENDIX 13 – TECHNICAL EXPERTS' COMMENTS FOR DELPHI ANALYSIS

isthmus

OTAKI TO LEVIN ROAD OF NATIONAL SIGNIFICANCE

TAYORS ROAD TO OHAU **FURTHER ALTERNATIVES TO15-TO17**

URBAN DESIGN + LANDSCAPE + VISUAL

Client:	MWH on behalf of NZTA
Project:	Otaki to Levin RoNS: Further Alternatives TO15-TO17
Code:	2923
Report:	Landscape + Visual + Urban Design
Status:	Draft
Date:	29 July 2015

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No.	Date	Details	Author	QA
1	29/07/15	Draft to MWH	Gavin Lister	GL
2				
3				

1 SUMMARY

1.1 This landscape + visual + urban design report assesses three further alternative route options (TO15, TO16, TO17) between Taylors Road and Ohau.

1.2 **TO17** is preferred of these further options in landscape and urban design terms. While it affects the greatest number of properties, TO17 also has the best 'fit' with the topography, cadastral pattern, and is located 'behind' Manakau. The option also has least impact on local connectivity by keeping to the edge of the plains. There is some similarity between TO17 and the earlier option TO3 to the extent that both routes achieve a good fit with landscape by keeping either west or east.

1.3 **TO15** is the least preferred. It affects a relatively high number of individual properties, will result in a flyover bridge near the northern boundary of Manakau School, and spreads effects across a wide area by criss-crossing the plain from east to west.

1.4 **TO16v** affects fewer individual properties, but similarly spreads effects across a wide area. The **TO16 base option** will be on an elevated structure adjoining the northern boundary of the Ngāti Wehi Wehi Marae, the effects of which are likely to be unacceptable given the alternative of TO16v.

1.5 The further alternatives were scored using the same approach as the earlier options (i.e. TO1-TO5). Recommended scores for the MCA process are:

	TO15	TO16	TO17
Landscape	5	4	4 (3.5)

1.6 Design measures are recommended to reduce potential effects including:

(a) Replacing the Kuku link with ramps to the existing SH1 south of Ohau;

(b) Designing the bifurcation interchange to avoid severing Kuku East Road (and thereby avoiding the need for a parallel link road to North Manakau Road;

(c) Fine-tuning the TO17 alignment at Manakau Heights Road, and carrying out bunding and planting;

(d) Fine-tuning the alignment to avoid the totara stand at Muhunoa East Road; and

(e) Fine-tuning the TO16v alignment at Waikawa Stream.

2 INTRODUCTION

2.1 This report compares **three further alternative alignments** (TO15, TO16, TO17) for a possible future four lane expressway between Taylors Road and south of Ohau. It is one of several landscape assessments carried out with respect to the Otaki to Levin section of the 'Roads of National Significance' ('RoNS'). The further alternatives arose from consultation with Ngāti Tukorehe and Ngāti Wehi Wehi and are designed to minimise effects on land held under Te Ture Whenua Maori Land Act.

3 CONTEXT

3.1 The area is described in a 'Landscape and Urban Design **Baseline Report**' (Isthmus April 2011), with further specific detail contained in subsequent reports. In summary, the area is **gently-rolling-to-flat coastal plain and river terraces**, with a backdrop of the Tararua Ranges foothills. It is a **productive rural landscape** including dairying and other pastoral farming, substantial areas of cultivated ground, a vineyard, and more intensive uses such a stud farm and a nursery.

3.2 The main natural features are the **streams and rivers** which run generally from east to west across the plain, including the Ohau River and Waikawa Stream; and smaller streams and watercourses such as the Manakau, Waiauti and Kuku Streams.

3.3 There are **remnant stands of totara forest** on the terraces north of Ohau River.

3.4 State highway 1 ('**SH1**') and the 'North Island Main Trunk' ('**NIMT**') railway run north-south across the coastal plain, perpendicular to the rivers and streams. Local roads typically branch off SH1 either west toward the coast or east toward the hills.

3.5 **Manakau and Ohau** are historical settlements on SH1. The alternative routes all skirt Manakau and finish south of Ohau. However, the routes pass close to, or through, scattered rural houses and subdivisions.

3.6 There are **two maraes** with associated settlements and urupa. Ngāti Wehi Wehi Marae is between North Manakau Road and Whakahoro Road, and Tukuorehe Marae is north of Kuku Road.

4 DESCRIPTION OF ALTERNATIVE ROUTES

4.1 The alternative routes are depicted on plans 'Taylors Road to Ohau Section (Manakau Bypass) (MWH) and labelled Options TO15, TO16 and TO17.

4.2 All three options are similar north of Waikawa Stream: They follow a route close to the foothills on the eastern side of the plain, with a 'bifurcation interchange' at

which the highway splits into two sections with separate bridge crossings over the Ohau River. The western section connects with the existing SH1 south of Ohau, the eastern section connects with SH57 north of Kimberley Road.

4.3 The differences between the three options fall within in the southern half of the study area, south of Waikawa Stream:

(a) Option TO15 and TO16 follow routes around the base of Pukehou Hill, crossing SH1 and the NIMT to the open plain west of Manakau, similar to that of previous options TO1-TO5. However, rather than continuing west of SH1 like TO1-TO4, TO15 and TO17 cut back across the NIMT and SH1 north of Manakau: TO15 crosses SH1 immediately north of Manakau (between the outskirts of the township and Waikawa Beach Road), while TO16 continues around the 'outside' of the cluster of houses along Waikawa Beach Road, before sweeping east to cross SH1 near North Manakau Road.

(b) Option TO17 remains west of SH1 throughout: After following around the base of Pukehou Hill, it descends into a rural residential valley south-east of Manakau, and passes 'behind' Manakau –between the township and the hills. A full diamond interchange would be located on the northern outskirts of the township.

4.4 TO16 has a base option and a **variant** in its middle section. The base option passes immediately adjacent to the Ngāti Wehi Wehi Marae, so that there would be an overbridge looming on its the northern boundary. In my opinion such effects would be unacceptable given that there is an alternative variant 400m to the south. Therefore my conclusions **assume the TO16 variant**.

5 COMPARISON BETWEEN ROUTES

Approach and Method

5.1 The three further alternative routes were assessed taking into account potential effects on the same maters considered for earlier options as follows:

- **Natural character of the streams and river** - (including proximity of crossings to existing bridges, the extent of modification at crossing points, and in the number of crossings required);
- **Other natural features** - (there turned out to be no difference between the further options in this case);
- **Rural character and amenity-** (this concerned the extent to which the proposal widened the transport corridor to greenfields route, the 'fit' with the cadastral and paddock pattern, the fit with topography, and the prominence of the overbridges);
- **Settlements -** (the main focus was Manakau and the associated string of houses at Waikawa Beach Road, the Ngāti Wehi Wehi marae and its associated

settlement, the scattered settlement at Whakahoro Road, and Tukorehe Marae and its associated settlement along SH1 at Kuku);

- **Connectivity** - (in this case the main focus was South Manakau Road, Manakau Heights Road, North Manukau Road, Kuku East Road, Waikawa Beach Road, and future local connections along the existing SH1); and
- **Houses** - (direct effects (i.e. that would require purchase), and indirect visual amenity effects).

Findings

5.2 **Appendix One** is a section-by-section analysis of the alternative routes. The following section of the report synthesises the analysis in terms of the landscape issues.

Section 6 Matters

Natural Character

5.3 The main natural features are the river and streams, which all options by necessity must cross.

(a) **Ohau River**: All three further options require two bridges, in similar locations to TO5. The western crossing is close to a concrete plant and the existing SH1 and NIMT bridges. The eastern crossing is in a greenfields location in modified farmland setting -although near a quarry.

(b) **Kuku Stream**: All three options cross the stream at the same location. The stream is in modified farmland. There are no obvious means of differentiating TO15, TO16 and TO17 from the earlier options in this regard.

(c) **Waikawa Stream**: All three options cross the stream in similar locations. TO16v is slightly worse than TO15 and TO17 because it crosses a wider meander where there is deeper vegetation –however, it appears likely that the alignment could be fine-tuned to remedy such effects.

(d) **Manakau Stream / Waiauti Stream**: Although each of the three options crosses several tributaries at different locations there are no obvious means of differentiating between them (or the earlier options). The tributaries are modified and located in farmland. However, the TO16 interchange will encroach over a cluster of incised gullies in the vicinity of Takapu Road.

5.4 Both existing SH1 bridges would be retained so there is no offset benefit to natural character from bridge removal for any of the options.

5.5 In summary, the three options rank similar to **TO5** in this attribute, because they all require two crossings of the Ohau River. As discussed previously, however, such differences need to be kept in perspective. The river is in modified farmland, and

bridge design and riparian mitigation are likely to be more significant than whether there are one or two bridges.

Other Natural Features

5.6 The other main natural feature is the scattered remnant forest stands which are distinctive features in certain places. TO15, TO16 and TO17 all pass through one of these stands at Muhunoa East Road. However, it appears there is ample scope to fine-tune the alignment to avoid these trees. I have therefore not taken this in account in differentiating TO15-TO17 from the previous options.

5.7 There are no outstanding natural features or landscapes in terms of RMA s6(b) that are affected by any of the options.

Section 7 Matters

Rural character and amenity

5.8 Each of the options follows a 'green fields' route, separate from the existing SH1 or NIMT. While this means new areas are affected (rather than confining effects within an existing corridor).

5.9 The receiving landscape east of SH1 has somewhat higher amenity than the area to the west (i.e. TO1-TO4) because of the proximity to the foothills backdrop. The bifurcation interchange (which is common to TO15, TO16 and TO17) will be reasonably prominent but will be visually anchored by a modest stand of trees and backdrop hills.

5.10 **TO17** crosses the area of highest amenity, tracing the toe of the foothills. Specifically, it traverses a reasonably high amenity landscape between Manakau township and the foothills. However, there are only modest differences between all options in relative amenity of the receiving landscapes.

5.11 The extent to which **TO17** follows the topography has some aesthetic benefits; the option follows what will seem a 'natural route' along the foothills near the edge of the plain. The hills will help anchor the highway. It will also be the most attractive of all the options for future motorists.

5.12 Conversely, while **TO15** and **TO16** avoid the higher amenity area south-east of Manakau, they spread the effects of the highway over a larger area of the plains by criss-crossing from the east to west to east again. This effect of a wide footprint is exacerbated by the bifurcation north of Kuku East Road.

Connectivity

5.13 Options **TO15, TO16 and TO17** avoid the impacts other options had on local connectivity along Waikawa Beach Road, Whakahoro Road and Kuku Beach Road (TO1-TO4).

5.14 All three options will sever Kuku East Road. The suggested remedy is a new local road parallel to the east side of the highway linking the orphaned section of Kuku East Road to North Manakau Road. This is an awkward arrangement that will add to clutter of roads, spread the works footprint, and disrupt the existing connections. It may be possible to remedy this with a revised interchange design that retains connections along Kuku East Road.

5.15 All three further options also interrupt connectivity along the existing SH1 by severing the road north of Ohau River and (TO15 and TO16) south of Manakau. This will disrupt the historical connections between Ohau, Kuku, the settlement cluster around Te Wehi Whehi Marae and Manakau. This could be addressed by changes to design (see below)

5.16 Otherwise there will be relatively low effects on local connectivity as follows:

(a) **TO15**: The half-diamond interchange will be tie into the existing road network via Gleeson Road. Connections along North Manakau Road will be retained (albeit by an overbridge).

(b) **TO16**: The full-diamond interchange will be tie into the existing road network via Gleeson Road. Waikawa Beach Road will be stopped but beyond the scattered settlement of houses on this road –the replacement route via Gleeson Road will be just as direct.

(c) **TO17**: The connection between the Manakau Interchange, the township and existing SH1 is yet to be resolved but it is apparent there are good connections available. Connections along South Manakau Road will be retained (albeit by an overbridge). North Manakau Road will be severed but replaced with a parallel road close by. Manakau Heights Road is likely to be severed (this is to be resolved yet –there are opportunities for an overbridge if the main highway is in cut).

Amenity of Individual Properties

5.17 **TO17** has the greatest effects on individual properties of any of the options in terms of both the number of houses that would be removed, and number of houses near the route. The main reason for this is that the route traverses the valley south-east of Manakau which has been subdivided for rural-residential properties and which has houses on hillslopes overlooking the route.

5.18 **TO15** also affects a high number of individual properties. Of particular note, it will be prominent on an elevated structure approximately 50m north of Manakau School.

5.19 **TO16v** is in the middle of the range of all the previous options. The TO16 base option would loom above the Ngāti Wehi Wehi Marae on its northern boundary. I consider the effects would be unacceptable given that TO16v is a feasible alternative.

Conclusion on TO15-TO17

5.20 **TO17** is preferred of the three further options. While it affects the greatest number of properties, this is offset by the fact the route has the best 'fit' with the topography, cadastral pattern, and is located 'behind' Manakau. The option also has least impact on local connectivity by keeping to the edge of the plains. There is some similarity between TO17 and TO3 to the extent that both routes achieve a good fit with landscape by keeping either west or east.

5.21 **TO15** and **TO16** spread effects across a wider area by criss-crossing from east to west.

(a) **TO15** affects a relatively high number of individual properties and will result in a flyover bridge near the northern boundary of Manakau School.

(b) **TO16v** affects fewer individual properties. The **TO16 base option** will be on an elevated structure adjoining the norther boundary of the Ngāti Wehi Wehi Marae, the effects of which are likely to be unacceptable given the alternative of TO16v.

5.22 Options **TO15**, **TO16** and **TO17** (together with TO5) are scored down in terms of s6(a) matters because they require two separate bridges over the Ohau River. However, this should be kept in perspective: the rivers flow through a modified landscape and the bridge design and riparian rehabilitation may have more influence on outcomes than whether there are one or two bridges.

Recommended MCA scores

5.23 The conclusion is reflected in the following table:

	TO1	TO2	TO3	TO4	TO5	TO15	TO16	TO17
Natural character (s6)	0	+	0	+	-	-	-	-
Landscape (s7) (rural character, settlements, connectivity, amenity from houses	+	0	++	++	--	--	-	+

5.24 I recommend the following overall MCA scores for 'landscape':

	TO15	TO16	TO17
Landscape	5	4	4 (3.5)

6 ALTERNATIVE METHODS

6.1 The following specific design measures are suggested as methods of reducing adverse landscape and urban design effects that would arise from these further options:

(a) Deleting the link between the highway and existing SH1 at Kuku in favour of ramp connections to the existing SH1 north of the Ohau River. This would reduce the clutter of highway infrastructure on the open plain south of the Ohau River –in particular removing a flyover bridge from this location. Ramps north of the Ohau River would be less prominent and would better retain local connectivity along the existing SH1.

(b) Designing the bifurcation interchange to avoid severing Kuku East Road. This would retain local connectivity and avoid a parallel road along the toe of the foothills which would spread the footprint of works.

(c) Fine-tuning the alignment of TO17 in the vicinity of Manakau Heights Road (slightly to the west) to reduce impacts on properties located on this road. Objectives would be to tuck the highway into the toe of the slope, embed it within cut, use bunding to further embed the highway, and extensive screen planting.

(d) Fine-tuning the alignment to avoid the totara stand at Muhunoa East Road; and

(e) Fine-tuning the TO16v variant alignment at Waikawa Stream to avoid wide meander.

6.2 A range of more general design matters is discussed in the report of 22 June 2015, and would likewise apply to these further options.

Gavin Lister
Isthmus
29 July 2015

APPENDIX ONE: SECTION BY SECTION ANALYSIS

TO15	(1) Terraces at toe of Pukehou Hill to SH1 crossing: (Similar to TO1) The hill itself is reasonably distinctive local landmark, but alignment does not encroach onto hill. Modified pasture land use. Cuts across paddock pattern. Rolling topography with incised stream gullies (mostly near heads of watercourses). Stream margins modified. Will require removal of 1 house near south end, and will pass close (<100m) in front of 1 house. Otherwise route passes moderate distance from and behind approximately 7 houses that are accessed from SH1. (2) Plain south-west of Manakau to Gleeson Rd: (Similar to TO4) Rolling to flat, with incised meandering watercourse gullies. May require substantial earthworks to cross gullies. Productive land uses (dairying, cropping, nursery). Reasonable fit with paddock patterns. Well beyond houses in Atkins Road. Passes well to east (200m) from house on Forest Lakes Road). Interchange depicted as half diamond in relatively unobtrusive location behind west outskirts of Manakau. Will encroach on Manakau Stream although the stream is heavily modified. The route skirts the settled area accessed from SH1. Interchange would probably require removal of at 3 houses (48, 57, 58 Gleeson Rd). (3) Plain north-east of Manakau to North Manukau Road: Mainly flat with watercourses. Productive pasture landscape (mainly dairying and some cropping). Diagonal to paddock pattern. Route cuts diagonally across SH1 between northern outskirts of Manakau and the cluster of houses at Waikawa Beach Road. Reasonably high density. Will require flyover bridge as prominent feature over SH1 close (50m) to northern outlook from Manukau School. Will require likely removal of 4 houses west of SH1 and will pass behind row of houses on SH1 at distances ~100m-200m. Will remove 2 houses at SH1, and will pass in front of cluster of houses at intersection of SH1 and Waikawa Beach Road at distance of ~90-200m. Will remove of 3 houses at North Manakau Road and will pass reasonably close (100m-150m) to 2 others. (4) Plains west of SH1 –North Manakau Road to Kuku East Road: Backdrop hills to east. Productive land use (cropping, dairying). Route relatively square to cadastral pattern. Main natural feature is Waikawa Stream. Crossing point is at relatively narrow, straight and open section, but remote from existing crossings. Route is distant from existing SH1, closer to toe of backdrop hills to east. Interchange close to hills. Interchange has wide footprint with sweeping curves and overbridges. Will remove 5 houses at Kuku East Road and pass close to 2 others. (5) River terrace plains. Kuku East Road to Muhunoa East Road. (Similar to TO5) Flat. Backdrop hills to east. Productive land use (cropping, dairying). Reasonably good fit with paddock pattern. Route well behind (>500m) Tukorehe Marae and houses on existing SH1. Main natural feature is Ohau River. Western crossing point near concrete plant, short distance upstream of NIMT and existing SH1 bridge. On north side of Ohau River route crosses SH1 and NIMT railway at oblique angle. Overbridge will be long and relatively prominent from Ohau and vineyard subdivision. Will remove 4 houses at SH1 (near vineyard). Requires second crossing of Ohau River. Crossing point incised, narrow section of river, reasonably close to quarry. Route requires removal of bush stand at Muhunoa East Road –although alignment might be possible of fine-tuning to avoid bush. Will remove 6 houses at Mahunoa East Road, and pass 50m-200m from 4 others.

	(6) Additional link to route proposed from new motorway to existing SH1 near Tukorehe Marae. Flat, pastoral farmland. Will require flyover bridge and sweeping ramp which will add to clutter of highway elements on land south of Ohau River. Link road passes between craft centre and 1 house where link road meets existing SH1.
TO16 (variant)	(1) Terraces at toe of Pukehou Hill to SH1 crossing: Same as TO15 (2) Plain south-west of Manakau to Gleeson Rd: (Similar to TO1) Plain south-west of Manakau. Gently rolling to flat but with incised watercourses. Modified watercourse margins. Landuse mainly pasture (dairying) and some cropping. Low settlement density. Full diamond interchange in open land, centred on Glesson Road extension. Interchange will encroach on network of distinctive gullies south of Waikawa Beach Road. Interchange may remove 2 houses (53, 57 Takapu Road) and will be close (50-100m) to 3 others. (3) Plain north of Manakau to North Manukau Road: Mainly flat, with meandering, incised watercourses. Landuse mainly pasture (dairying) and some cropping. String of houses along Waikawa Beach Road. **TO16 variant** route sweeps in large bend parallel to, and approximately 200m-400m north of Waikawa Beach Road. Crosses SH1 almost at right angles on overbridge adjacent to intersection of existing SH1 and North Manakau Road. Would sever North Manakau Road but alternative link to opposite Waikawa Beach Road would retain similar connections. Likely remove 1 house at SH1 (952 SH1) and 3 at North Manakau Road (5, 11, 35), and pass close to 2 others. Will be moderately distant (200m-250m) south of Ngāti Wehi Wehi Marae. Main natural feature is Waikawa Stream. The crossing point of Waikawa Stream is at a distinct meander loop of the stream with vegetated margins –could be fine-tuned to less sensitive crossing point either upstream or downstream. The **TO16 base option** is parallel to, but 400m north of, the TO16 variant. It would immediately adjoin the north boundary of Wehi Wehi Marae on an elevated embankment or bridge. Would also immediately adjoin 3 houses (920, 924, 926), and be within 100-200m of 6 others on SH1 and North Manakau Road. Would remove 1 house near the crossing of Waikawa Stream (13 North Manukau Road). It would avoid severance of North Manakau Road. The crossing point of Waikawa Stream is slightly downstream of TO16 variant, slightly less sensitive location. (4) Plains west of SH1 –North Manakau Road to Kuku East Road: (Same as TO15). (5) River terrace plains. Kuku East Road to Muhunoa East Road. (Same as TO5)
TO17	(1) Terraces at toe of Pukehou Hill to SH1 crossing: (Similar to TO15 and TO16) The hill itself is reasonably distinctive local landmark, but alignment does not encroach onto hill. Rolling topography with incised stream gullies (mostly near heads of watercourses). Stream margins modified. Modified pasture landuse. Cuts across paddock pattern. Sweeps around the base of Pukehou Hill. Will require removal of 4 houses (170, 222, 424, 426A SH1) and will pass close (<100m) in front of 1 house (114 SH1) and close behind 1 house (426 SH1). Otherwise route passes moderate distance from and behind approximately 7 houses that are accessed from SH1.

	(2) Valley south-east of Manakau, South Manakau Road to North Manakau Road: Relatively picturesque gently rolling area close to backdrop hills. Is more enclosed and has finer scale compared with more open parts of plains. Reasonably close settlement of rural residential properties. Alignment passes 'behind' Manakau, between township and backdrop hills. Full diamond interchange would be on north-east outskirts of township. Require local bridge over expressway at South Manakau Road. Would sever North Manakau Road and probably Manakau Heights Drive. Will require removal of approximately 5 houses and will pass close to some 25 houses in the rolling country that includes the Manakau Heights Road area and the eastern outskirts of Manakau itself. However, this is based on existing aerial photos. This area has been closely subdivided so the number of properties affected is likely to be greater. There are also properties higher on the foothills that are further away but will have outlook over the highway. Will require removal of 5 houses and will pass close to 6 others at North Manakau Road. (4) Plains west of SH1 –North Manakau Road to Kuku East Road: Similar to TO15. Only difference is at southern end at the Waikawa Stream. Crossing point is relatively narrow and has sparse vegetation. Slightly better than TO15 and TO16. (5) River terrace plains. Kuku East Road to Muhunoa East Road. (Same as TO5)

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18 July 2015

Sylvia Allan
Allan Planning & Research Ltd
26 Patrick Street
Petone
Lower Hutt, 5012

Hi Sylvia,

Below is the requested scoring for the new options that have been provided. Please let me know if you would like any more detail in regards to the reasons for my scores.

Options TO15 and TO16

Up to the first crossing of the NIMTR (coming from the south) the main archaeological risk relates to the need to cross land that was formerly marked as a 'Native Reserve' (Figure 7, page 22). North of the first crossing of the NIMTR, TO15 is likely to pass through the Ketemaringi Clearing to the west of Manakau (page 23). There do not appear to be any known archaeological risks along either alignment to the east of the existing SH1 until they cross the Ohau River. Each option has major or intermediate issues or concerns in terms of archaeology (– –), but these are fewer and of a lesser level than those raised by the former A-variant options that were scored as 4s. I have scored both of these options a 3 in keeping with the non-A options TO1 to TO5.

Option TO17

TO17 avoids all of the major known archaeological risks associated with the previously studied options aside from the 'Native Reserve' at Pukehou and the Māori and European sites on the north bank of the Ohau River. While there are other known archaeological sites located east of SH1 it appears these will not be affected. There is a high likelihood of encountering previously unknown sites along this alignment and the easternmost portions of TO15 and TO16, but these are likely to be smaller sites of low archaeological value such as bush camps or small horticultural clearings.

There are some major or intermediate issues or concerns in terms of archaeology (– –), but these are of a lesser number than all other options reviewed to date. All of the reviewed options have had multiple major or intermediate issues or concerns, with scores differentiated on the basis of the number of known or potential issues associated with each option (5s for fatal flaws,

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4s for greater numbers of issues/concerns and 3s for lesser numbers). In order to differentiate TO17 as the best option above all others, from an archaeological perspective, I would give this alignment a score of 2. This would push the score for TO17 in to the minor benefits category (?), but I believe this is justifiable due to significant benefits for archaeological site preservation should this option be adopted.

Option	Landscape Visual	Ecology	Archaeology/Heritage	Tangata Whenua Values	Productive Land Values	Social/Community	District & Regional Plan Fit/Consentability	Project Objectives	Specific Landowner Effects	Engineering Degree of Difficulty	Cost
TO1	4	3	3	4	2	3	2	1	2	2	2
TO1A	4	5	4	4	2	3	4	1	2	3	2
TO2	4	3	3	4	2	3	2	1	2	2	2
TO2A	4	5	4	4	2	3	4	1	2	3	2
TO3	4	4	3	4	2	3	3	1	2	2	2
TO3A	4	5	4	4	2	3	4	1	2	3	2
TO4	3	3	3	4	2	4	3	1	2	3	3
TO4A	3	5	4	4	2	4	4	1	2	4	3
TO5	5	4	3	5	2	5	3	1	2	3	4
TO5A	5	5	4	5	2	5	4	1	2	4	4
TO15			3								
TO16			3								
TO17			2								

Regards,

Daniel Parker

Raukura Consultants
PO Box 16147
Wellington South

Raukura Consultants

November 5, 2015

Otaki to Levin Road of National Significance

Otaki - Taylors Road to Ohau/SH57 Roading Alternative – Cultural Assessment

Further Options for Assessment TO15, TO16 and TO17

Summary

1. This report will evaluate 3 further alternative routes linking the RoNS to just north of Otaki at Taylors Road to Ohau/Arapaepae Road vicinity on SH57.

2. The route TO 15 at its southern end goes to the west of the existing SH1. It is looking to avoid Maori land blocks and then cross SH 1 just north of Manakau Village. It then on part heads north-east generally directly towards Arapaepae Road and SH 57. SH I exiting around a point due east of Tukorehe Marae, but well to the east of the marae and heading to meet the existing SH1 at Ohau Village.

3. Route option TO16 follows the other routes in the southern section however it proceeds due north at Pukehou. At Waikawa Beach Road it turns sharply to the east to cross the existing SH 1 just south of Wehiwehi Marae then crossing the Waikawa Stream east of SH 1 largely avoiding any Maori land. The route would then proceed northeast with the route going in a straight line to Arapaepae Road and SH 1 splitting off east of Tukorehe Marae.

4. Route option TO 17 could be described as the easternmost route staying southeast of SH I throughout rejoining the existing SH 1 at Ohau. This route clearly avoids the most blocks of Maori lands as well as Maori sites of significance.

5. It is noted that all the alternatives will cross Maori land to a greater or lesser degree although largely they all cross the same Ohau blocks. For this analysis all Maori land is generally regarded as equal, with the exceptions being Maori reservations, Marae, urupa and sites of cultural significance.

6. Particular consideration is given to potential effects on the two main functioning Marae in this area close to these routes along with their associated urupa. Both Tukorehe Marae and Wehiwehi Marae and currently located adjacent to SH 1. These options will generally avoid Tukorehe Marae, however option TO16 would pass close to Wehiwehi Marae but probably far enough away as to not create any adverse effects.

7. Consideration is also given to potential effects on waterways including the main rivers, streams and some water races, along with any wetlands, along the routes. The indigenous fish in the waterways are of some significance in this region.

8. Consideration is also given to remnant patches of indigenous forest and scrub along the routes. These considerations are not only looking at the flora but also the fauna, and in particular the indigenous birdlife.

9. The principle differences between the three alternate route options are as follows.

Comparison between the Options

10. The issues that affect the selection of the preferred option in this area are dominated for the tangata whenua by Maori land ownership. What makes this area particularly difficult in this respect is that by and large the land blocks run largely in a west – east direction and were partitioned into ever narrower blocks running in that direction. The as the roads runs north-south every road alignment will cross those Maori land blocks.
11. All Maori land is regarded as equal with the exception of pieces which generally should be avoided if possible and cannot be mitigated including the two working marae, Wehiwehi and Tukorehe, the urupa including those in current use and the older ones which may no longer be used. Other places to avoid are old historical Pa or kainga sites, waahi tapu and sacred puna/springs. By and large this category of sites have been avoided by most options. However some routes are likely to have effects such as noise on Marae even though they do not physically encroach on the Marae land.
12. In looking at the Maori land much is leased for farming purposes (often to non-Maori farmers) and routes that bisect blocks will often have greater effects than those which may cross the extremities of blocks.
13. Also to be avoided are the remnant stands of indigenous bush which are important both for cultural reasons along with the significant flora and fauna that still exist in the stands. These by and large are avoided by all route alternatives.
14. There are issues associated with waterways from the major rivers, stream, drains and wetlands. These largely run from east to west and are crossed by the north-south route proposals. There are some places where river and stream crossings should be avoided.

Individual Route Options

15. **TO 15** shares a common route at the southern end from Taylors Road to Pukehou generally going to the east of the existing SH 1 curving around to cross SH 1 in a north easterly direction. Across NIMT Railway as far as Gleeson Road. In this section it is unlikely to affect any Maori land or any Maori sites of significance. The road then move to cross the existing SH 1 diagonally just north of Manakau Village to cross North Manakau Road east of SH 1 and then head north east in the direction of Arapaepae Road with the exit for SH 1 at a point due east of Tukorehe Marae, but well east of that marae. At that point the highway will have three separate parts of the highway crossing two main blocks of Maori land requiring significant taking of that land for one of the blocks. These blocks run from the existing SH 1 to the hills to the east and are impossible to avoid in any route to the east of the existing SH 1.

16. TO 15. The part which would take SH1 will head due north to connect with the existing highway at Ohau Village. In this section it will avoid one of the larger Maori land blocks to cross the Ohau River to the east of the existing highway bridge.
17. While avoiding much of the Maori land blocks it also avoids many of the Maori sites of significance which are most common west of the NIMT Railway line.
18. This is probably not the best option of the three from the Maori perspective but it terms of the Maori land involved is the same as TO 17

19. **TO 16** starts from Taylors Road and follows a similar route to TO 15 being firstly south of the existing SH1 and then going due north by Pukehou though to Waikawa Beach Road. This section probably avoids all Maori land blocks and probably any Maori sites of significance. In the section from Waikawa Beach Road the route swings almost due east just past Waikawa Beach Road and crosses (red route) SH 1 just south of Wehiwehi Marae and clear of the large blocks of Maori land along Whakahoro Road. So this section will largely avoid both Maori land and most Maori sites of significance. After crossing SH 1 in an almost perpendicular fashion the route will cross the Waikawa stream around the centre of the curve as it swings to a more northerly direction. From here the route is similar to the other two routes involving the same taking of Maori land however largely avoiding any known Maori sites of significance.

20. **TO 17** could be described as the eastern or hills option being at all points east of the existing SH 1. This departs from the other two options at Pukehou and keeps east and as a result avoids most Maori land 9except perhaps for a small block in North Manakau Road and most Maori sites of significance. This is until, like the other options, the route is about to bifurcate just north of the Waikawa Stream. Each option will pass through the same blocks of Maori land and will require to take land but each option is identical in this respect.
21. In all three options the blocks of Maori land which extend from the current SH 1 to the east extend into the foothills. These blocks appear to be leased to local farmers with a mix of grazing and some market gardening. There doesn't appear to be any Maori involvement in these Maori land blocks however that would need to be confirmed.

22. The rating system for this analysis rates the routes on a 1 – 5 scale with 1 being the best and 5 the worst.

	T015	T016	T017
Impact on Maori Land	3	3	3
Maori sites of significance	2	3	1
Rivers, streams and wetlands	2	2	2
Totals	7	8	6

Conclusions

1. From the Maori cultural perspective the alternative that would be favoured is T017 in that it affects the least amount of Maori land although the differences with three other alternatives are quite small. It is noted that the Maori sites interest generally decreases the further east one goes. The northern end of the routes are common in their need to take the same pieces of Maori land in the Ohau blocks.

2. T016 is probably the worst option in that it has potential to affect Maori sites by being for a large part out to the west of the existing state highway.

3. Route option T015 has the same issues as the others in the northern section and does largely avoid the Maori land blocks elsewhere, however being partially to the west in the southern section may have some issues with Maori sites of significance although at this stage none has been identified.

Brief Comments on the Ohau Blocks

In these three options the routes would go through several land blocks which have been partitioned (sub-divided) generally in a west- east direction. The blocks are summarised in this way:

Block Name	Land Area (ha)	Administration	Land Status	Other matters
Ohau 3 No 4B2B	17.07	Ahu Whenua Trust	Maori freehold land	4 Responsible Trustees
Ohau 3 Subs 15 & 16 No 2B	20.13	Ahu Whenua Trust	Maori freehold Land	4 Responsible trustees
Ohau 3 Subs 15 &16 No 1	20.23	Ahu Whenua Trust	Maori freehold land	Maori Trustee + 1 advisory trustee
Northern most blocks				
Ohau 3 A Sec 2 sub 4A 1A	7.79	None vested in owners		3 responsible trustees
Ohau 3A2 Sub 4A1B2	7.81	None	Maori freehold land	9 owners
Ohau 3A Sec 2 Sub 4A1C2	7.70	None	Maori freehold land	20 owners
Avoided by TO16 – red line				
Manawatu-Kukutauaki 4ER No 3 Sub 2A 1A	4.356	None -	Maori freehold land	4 responsible Trustees 81 owners

11 September 2015
By Email

Forbes Ecology
Adam Forbes
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Allan Planning and Research
Petone
Lower Hutt 5012

Attn: Sylvia Allan

Dear Sylvia,

New Zealand Transport Agency RoNS, Otaki to Levin – Additional Possible Future Route Options Between Taylors Road and South of Ohau/Arapaepae Road – TO15, TO16, & TO17

Many thanks for the instructions contained in the Memo dated 17th July 2015, regarding three additional possible future route options in relation to the above mentioned project. I have undertaken desktop assessment of the ecology values and constraints associated with those three options. My notes and scores are tabulated below. These results are based on my understanding of confirmation from design Engineers that most of the indigenous forest remnants would be avoided, including those in the vicinity of East Muhunua Road. In summary, and for clarity, I consider based on the ecology features relevant to each option, the following scoring is appropriate:

- TO15 = 3
- TO16 = 4
- TO17 = 4

Please refer to my notes below for details supporting these scores, and as always, I am happy to discuss this with the project team. Please do not hesitate to contact me should you wish to discuss.

Yours sincerely

Adam Forbes
Principal Ecologist
Forbes Ecology

Table 1. High-level description of constraints and rankings relevant to route options.

Section(s)	Constraints	Comments	Rating (-/+)
TO15	• Crossings of minor unnamed tributary streams. • Minor indigenous vegetation affected at SH1 and railway crossings. • Wetland/stream habitat (tributary of Manakau Stream). • Manakau Stream crossing. • Waikawa Stream crossing. • Kuku Stream tributary crossing. • Kuku Stream crossing. • Alignment close to scattered indigenous forest north of Kuku stream.	• Comes close to but avoids a considerable number of indigenous forest remnants. A one unit reduction in constraint score has been possible as avoidance of most indigenous forest remnants has been confirmed.	**3**
TO16	• Crossings of minor unnamed tributary streams. • Minor indigenous vegetation affected at SH1 and railway crossings. • Wetland/stream habitat (tributary of Manakau Stream). • Manakau Stream crossing. • Waikawa Stream crossing. • Kuku Stream crossing. • Alignment close to scattered indigenous forest north of Kuku stream. • Two Ohau River crossings.	• Comes close to but avoids a considerable number of indigenous forest remnants. A one unit reduction in constraint score has been possible as avoidance of most indigenous forest remnants has been confirmed.	**4**

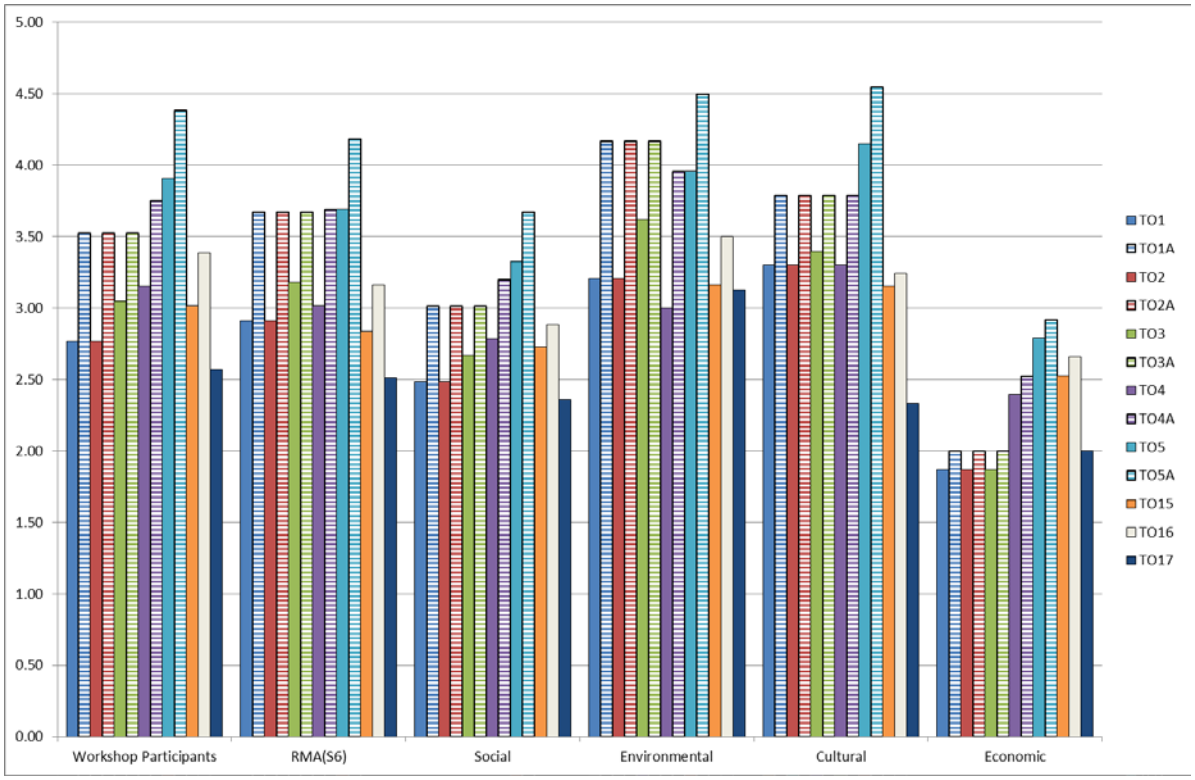
	• Alignment close to scattered indigenous treeland to north of eastern Ohau River crossing. • Close to but not affecting DoC RAP 12 "Fordwich Bush" – kohekohe forest on terrace tread (0.5 ha). • Indigenous forest remnant next to gravel plant/north of western most Ohau River crossing possibly affected. • Alignment close to relatively high value forest remnant south of right-angle bend in Muhunoa East Road. The patch immediately to the northwest at this location is DoC reserve. • Alignment close to indigenous forest remnant south of Mcleavey Road (0 39 43.06 S 175 16 32.93 E WGS).		
T017	• Crossings of minor unnamed tributary streams. • Alignment close to two relatively high quality indigenous forest remnants in the area between the pine plantation and Atkins Road at around 40 44 15.19 S 175 11 59.24 E WGS. • Waiauti Stream crossing. • Crosses a number of Manakau Stream tributaries (east of Manakau Village). • Waikawa Stream crossing.	• Comes close to but avoids a considerable number of indigenous forest remnants. A one unit reduction in constraint score has been possible as avoidance of most indigenous forest remnants has been confirmed.	**4**

	• Two Ohau River crossings. • Possibly scattered indigenous treeland affected to north of eastern Ohau River crossing. • Close to but not directly affecting DoC RAP 12 “Fordwich Bush” – kohekohe forest on terrace tread (0.5 ha). • Indigenous forest remnant next to gravel plant/north of western most Ohau River crossing possibly affected. • Alignment close to relatively high value forest remnant south of right-angle bend in Muhunoa East Road. The patch immediately to the northwest at this location is DoC reserve. • Alignment close to indigenous forest remnant south of Mcleavey Road (0 39 43.06 S 175 16 32.93 E WGS).		

APPENDIX 14 – TABULAR AND GRAPHIC REPRESENTATION OF VARIOUS ANALYSES, INCLUDING SENSITIVITY ANALYSES

Analysis of Options (using low figures where there is more than one score for a criterion)

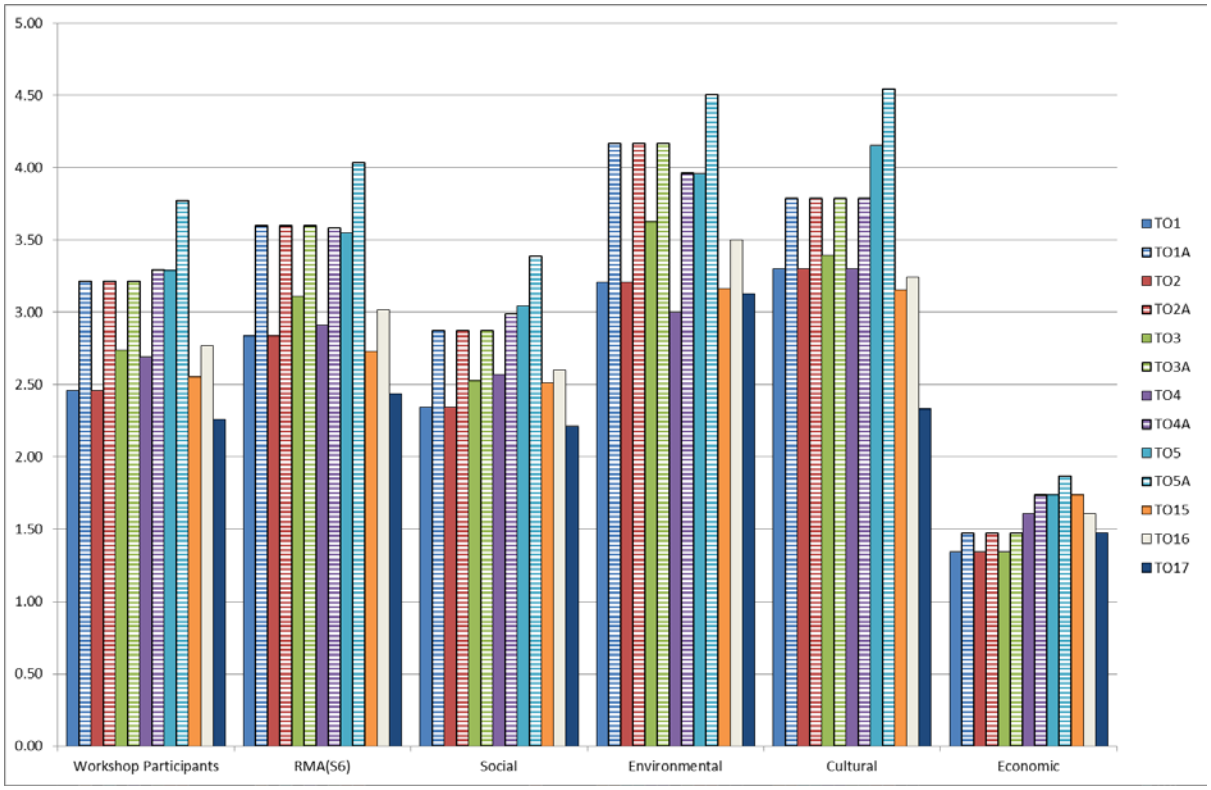
Analysis Including Costs:



	Workshop Participants	RMA(S6)	Social	Environmental	Cultural	Economic
TO1	2.77	2.91	2.49	3.21	3.30	*1.87
TO1A	3.52	3.67	3.01	4.17	3.79	2.00
TO2	2.77	2.91	2.49	3.21	3.30	*1.87
TO2A	3.52	3.67	3.01	4.17	3.79	2.00
TO3	3.05	3.18	2.67	3.63	3.39	*1.87
TO3A	3.52	3.67	3.01	4.17	3.79	2.00
TO4	3.15	3.02	2.79	*3.00	3.30	2.39
TO4A	3.75	3.69	3.20	3.96	3.79	2.53
TO5	3.91	3.69	3.33	3.96	4.15	2.79
TO5A	4.38	4.18	3.67	4.50	4.55	2.92
TO15	3.02	2.84	2.73	3.17	3.15	2.53
TO16	3.38	3.16	2.89	3.50	3.24	2.66
TO17	*2.57	*2.51	*2.36	3.13	*2.33	2.00

Note: Asterisks indicate preferred options under the weighting

Analysis with Costs Excluded:

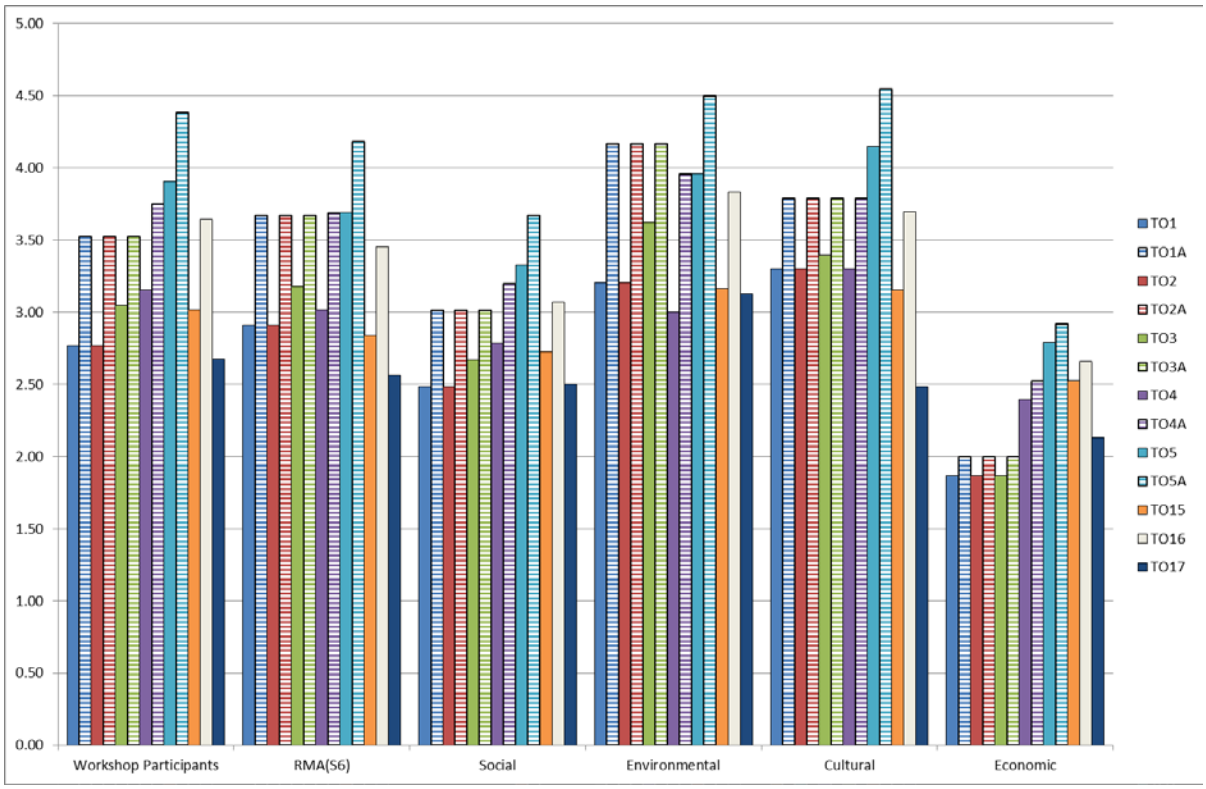


	Workshop Participants	RMA(S6)	Social	Environmental	Cultural	Economic
TO1	2.46	2.84	2.34	3.21	3.30	*1.34
TO1A	3.22	3.60	2.87	4.17	3.79	1.47
TO2	2.46	2.84	2.34	3.21	3.30	*1.34
TO2A	3.22	3.60	2.87	4.17	3.79	1.47
TO3	2.74	3.11	2.53	3.63	3.39	*1.34
TO3A	3.22	3.60	2.87	4.17	3.79	1.47
TO4	2.69	2.91	2.57	*3.00	3.30	1.61
TO4A	3.29	3.58	2.99	3.96	3.79	1.74
TO5	3.29	3.55	3.04	3.96	4.15	1.74
TO5A	3.77	4.04	3.39	4.50	4.55	1.87
TO15	2.55	2.73	2.51	3.17	3.15	1.74
TO16	2.77	3.02	2.60	3.50	3.24	1.61
TO17	*2.26	*2.44	*2.21	3.13	*2.33	1.47

Note: Asterisks indicate preferred options under the weighting

Analysis of Options (using high figures where there is more than one score for a criterion)

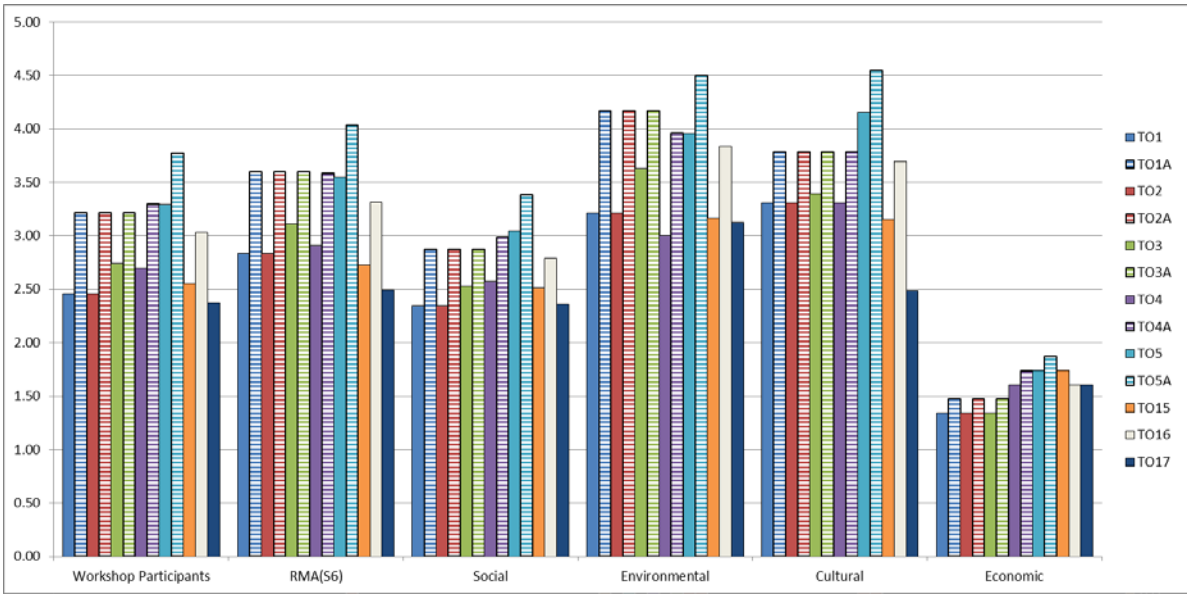
Analysis Including Costs:



	Workshop Participants	RMA(S6)	Social	Environmental	Cultural	Economic
TO1	2.77	2.91	*2.49	3.21	3.30	*1.87
TO1A	3.52	3.67	3.01	4.17	3.79	2.00
TO2	2.77	2.91	*2.49	3.21	3.30	*1.87
TO2A	3.52	3.67	3.01	4.17	3.79	2.00
TO3	3.05	3.18	2.67	3.63	3.39	*1.87
TO3A	3.52	3.67	3.01	4.17	3.79	2.00
TO4	3.15	3.02	2.79	*3.00	3.30	2.39
TO4A	3.75	3.69	3.20	3.96	3.79	2.53
TO5	3.91	3.69	3.33	3.96	4.15	2.79
TO5A	4.38	4.18	3.67	4.50	4.55	2.92
TO15	3.02	2.84	2.73	3.17	3.15	2.53
TO16	3.65	3.45	3.07	3.83	3.70	2.66
TO17	*2.68	*2.56	*2.50	3.13	*2.48	2.13

Note: Asterisks indicate preferred options under the weighting

Analysis with Costs Excluded:

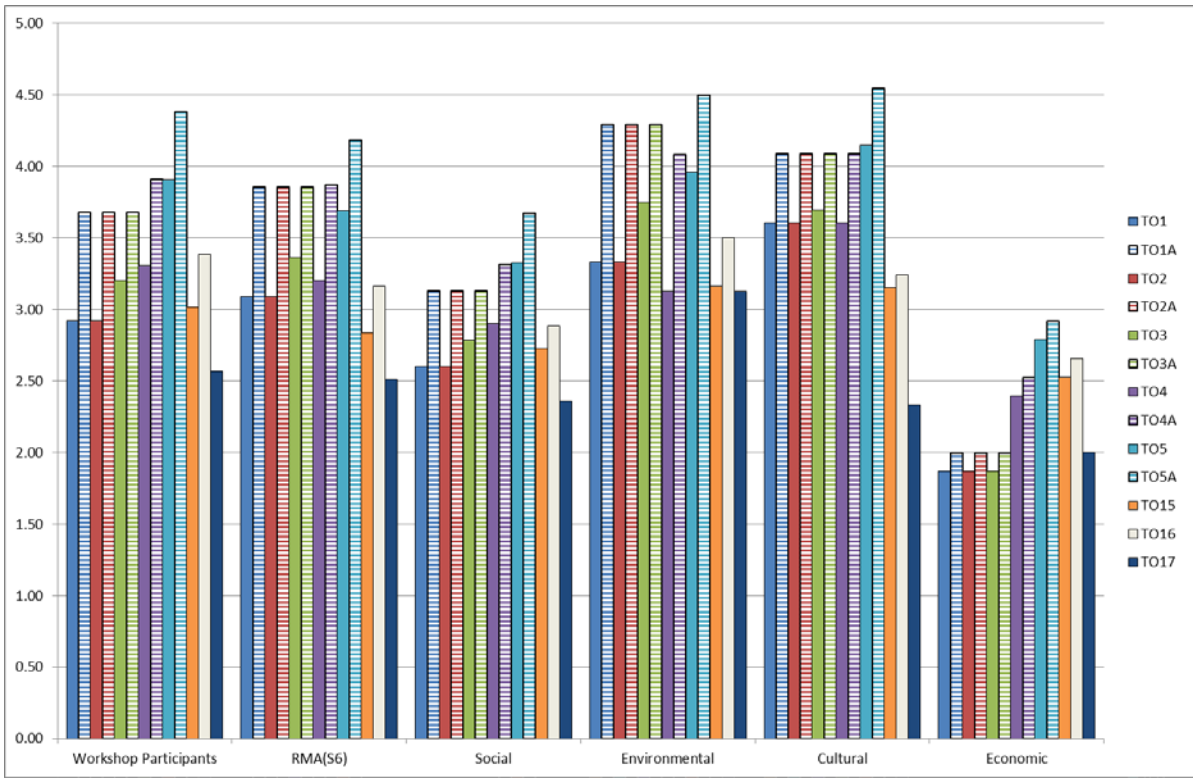


	Workshop Participants	RMA(S6)	Social	Environmental	Cultural	Economic
TO1	2.46	2.84	*2.34	3.21	3.30	*1.34
TO1A	3.22	3.60	2.87	4.17	3.79	1.47
TO2	2.46	2.84	*2.34	3.21	3.30	*1.34
TO2A	3.22	3.60	2.87	4.17	3.79	1.47
TO3	2.74	3.11	2.53	3.63	3.39	*1.34
TO3A	3.22	3.60	2.87	4.17	3.79	1.47
TO4	2.69	2.91	2.57	*3.00	3.30	1.61
TO4A	3.29	3.58	2.99	3.96	3.79	1.74
TO5	3.29	3.55	3.04	3.96	4.15	1.74
TO5A	3.77	4.04	3.39	4.50	4.55	1.87
TO15	2.55	2.73	2.51	3.17	3.15	1.74
TO16	3.03	3.31	2.79	3.83	3.70	1.61
TO17	*2.37	*2.49	*2.36	3.13	*2.48	1.61

Note: Asterisks indicate preferred options under the weighting

Analysis of Options (with tangata whenua criterion set at 5 for all Options TO1 to TO5 and "A" variants)

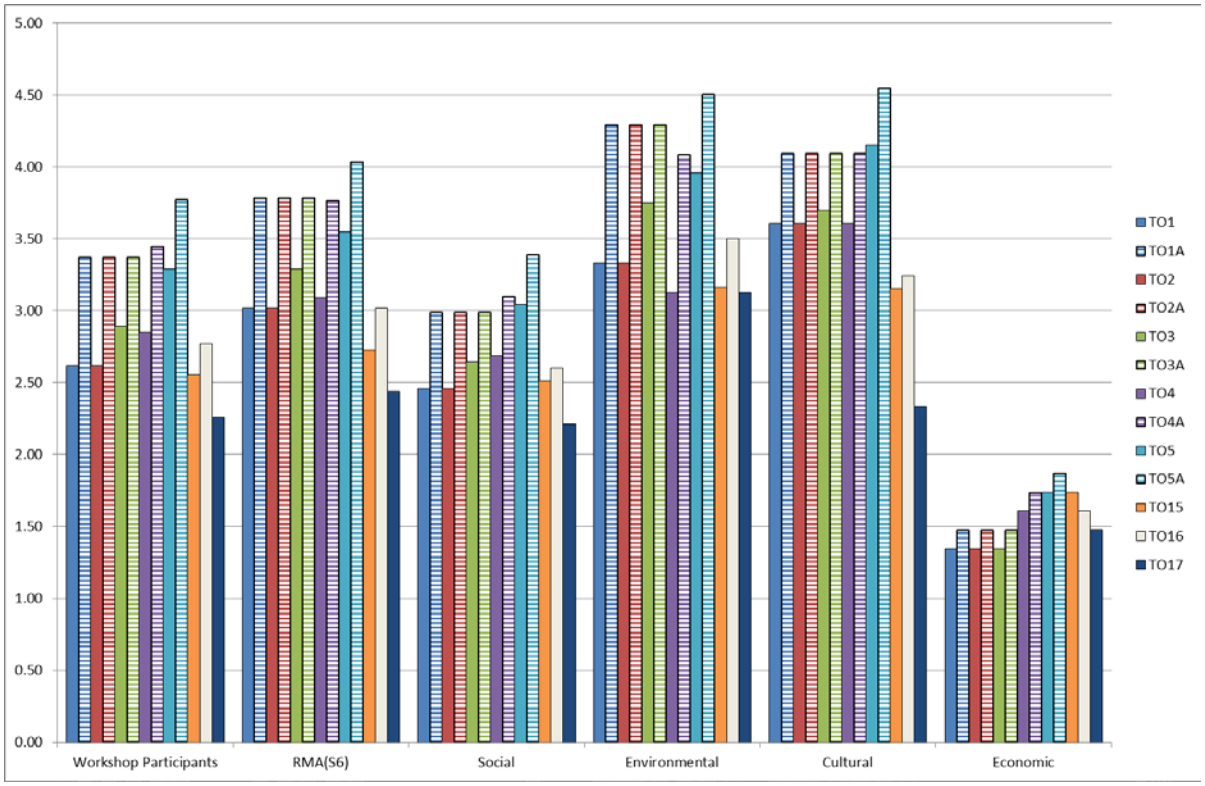
Analysis Including Costs:



	Workshop Participants	RMA(S6)	Social	Environmental	Cultural	Economic
TO1	2.92	3.09	2.60	3.33	3.61	*1.87
TO1A	3.68	3.85	3.13	4.29	4.09	2.00
TO2	2.92	3.09	2.60	3.33	3.61	*1.87
TO2A	3.68	3.85	3.13	4.29	4.09	2.00
TO3	3.20	3.36	2.79	3.75	3.70	*1.87
TO3A	3.68	3.85	3.13	4.29	4.09	2.00
TO4	3.31	3.20	2.90	*3.13	3.61	2.39
TO4A	3.91	3.87	3.31	4.08	4.09	2.53
TO5	3.91	3.69	3.33	3.96	4.15	2.79
TO5A	4.38	4.18	3.67	4.50	4.55	2.92
TO15	3.02	2.84	2.73	*3.17	3.15	2.53
TO16	3.38	3.16	2.89	3.50	3.24	2.66
TO17	*2.57	*2.51	*2.36	*3.13	*2.33	2.00

Note: Asterisks indicate preferred options under the weighting

Analysis with Costs Excluded:



	Workshop Participants	RMA(S6)	Social	Environmental	Cultural	Economic
TO1	2.62	3.02	2.46	3.33	3.61	*1.34
TO1A	3.37	3.78	2.99	4.29	4.09	1.47
TO2	2.62	3.02	2.46	3.33	3.61	*1.34
TO2A	3.37	3.78	2.99	4.29	4.09	1.47
TO3	2.89	3.29	2.64	3.75	3.70	*1.34
TO3A	3.37	3.78	2.99	4.29	4.09	1.47
TO4	2.85	3.09	2.69	*3.13	3.61	1.61
TO4A	3.45	3.76	3.10	4.08	4.09	1.74
TO5	3.29	3.55	3.04	3.96	4.15	1.74
TO5A	3.77	4.04	3.39	4.50	4.55	1.87
TO15	2.55	2.73	2.51	*3.17	3.15	1.74
TO16	2.77	3.02	2.60	3.50	3.24	1.61
TO17	*2.26	*2.44	*2.21	*3.13	*2.33	1.47

Note: Asterisks indicate preferred options under the weighting

APPENDIX 15 – ADDITIONAL EVALUATIONS – AIR QUALITY AND NOISE

MWH

BUILDING A BETTER WORLD

MWH Ref: 80500902
Client Ref: L001

15 September 2015

Allan Planning & Research Limited
26 Patrick St
Petone
Lower Hutt 5012

Attention: Sylvia Allan

Dear Sylvia

RE: Ōtaki to Levin Manakau Bypass Option T017—Screening Level Air Quality Assessment

This letter contains a screening-level air quality assessment of the New Zealand Transport Agency's Ōtaki to North Levin Taylors Road to Ohau Section (Manakau Bypass) Option 'TO17' (part of the Wellington Northern Corridor Roads of National Significance (RoNS) programme).

Commencing at Taylors Road, the proposed route alignment for Option T017 will be situated to the east of the existing State Highway 1 (SH1) and will remain east of the existing SH1 all the way north to Mahunoa West Road, Ohau. The proposed route alignment will be situated approximately 200 m to the south-east of the existing SH1 / Forest Lakes Road intersection and will remain within 1 km of the existing SH1 corridor. The length of the route alignment between Taylors Road and Mahunoa West Road (proposed route of SH1) is approximately 12.7 km.

The alignment bypasses the Manakau township. Prior to crossing Kuku East Road (approximately 700 m east of the existing SH1), the alignment will bifurcate with a 2-lane connection heading north back to the existing SH1 (Mahunoa West Road, Ohau) and the SH57 will continue north from the bifurcation, crossing the Ohau River before connecting to Arapaepae Road (the existing SH57, north of Kimberley Road). A proposed spread diamond interchange will provide local road connections and will be located approximately 600 m north-east of the Manakau township and 900 m south-west of the Waikawa Stream. The length of the route alignment between Taylors Road and Arapaepae Road (proposed route of SH57) is approximately 15.2 km.

A more detailed description of the project is provided on the NZ Transport Agency website[1] and in the following documents:

- Manakau and Ohau Scheme Assessment Report, prepared by MWH for the NZ Transport Agency, November 2013; and,
- Indicative Business Case—North of Ōtaki to North of Levin, prepared by MWH for the NZ Transport Agency, June 2015.

[1] https://www.nzta.govt.nz/assets/projects/otaki-to-north-of-levin/docs/poster-8.pdf

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1. Project Site Location

The location of the project site (or 'study area') is shown in **Figure 1**. The study area is situated within the Wellington and Manawatu-Wanganui regions of New Zealand. The basemap (Maptoolkit-Topo) was centred on Universal Transverse Mercator (UTM) 350400 m East and 5493100 m North (Zone 60 South), which is approximately 1.8 km north-east of Manakau.

The figure was produced for a 15 km by 15 km basemap using OpenStreetMap (OSM) under the open Database License. OpenStreetMap has been used throughout this report and MWH has acknowledged OpenStreetMap and its contributors where relevant. The Open Database License can be read in full on the OpenStreetMap website[2].

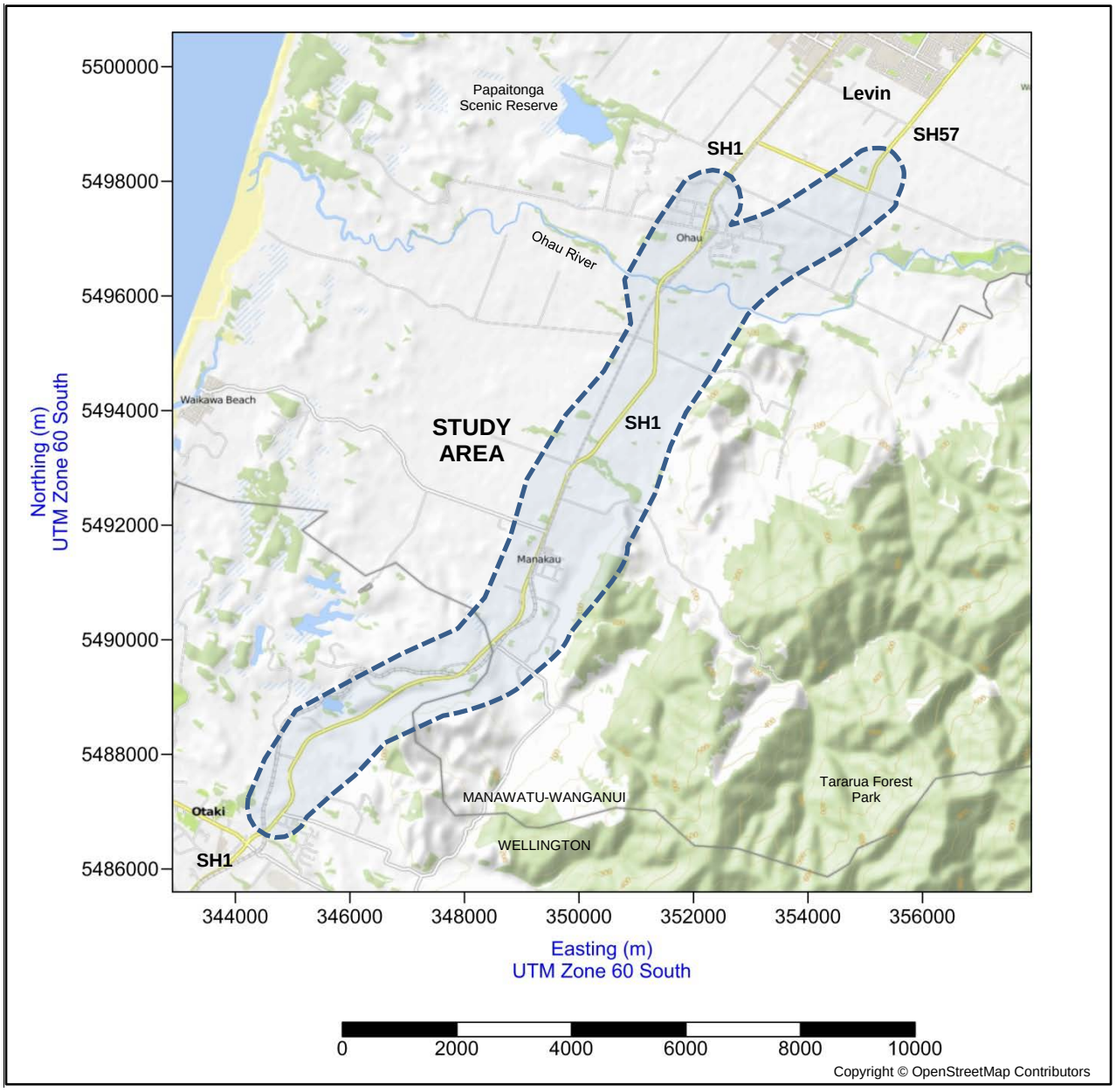


Figure 1 Project Site Location Showing a Maptoolkit-Topo Basemap

[2] http://opendatacommons.org/licenses/odb1/1.0/

Figure 2 shows the same 15 km by 15 km area as **Figure 1** but for a Mapquest basemap.

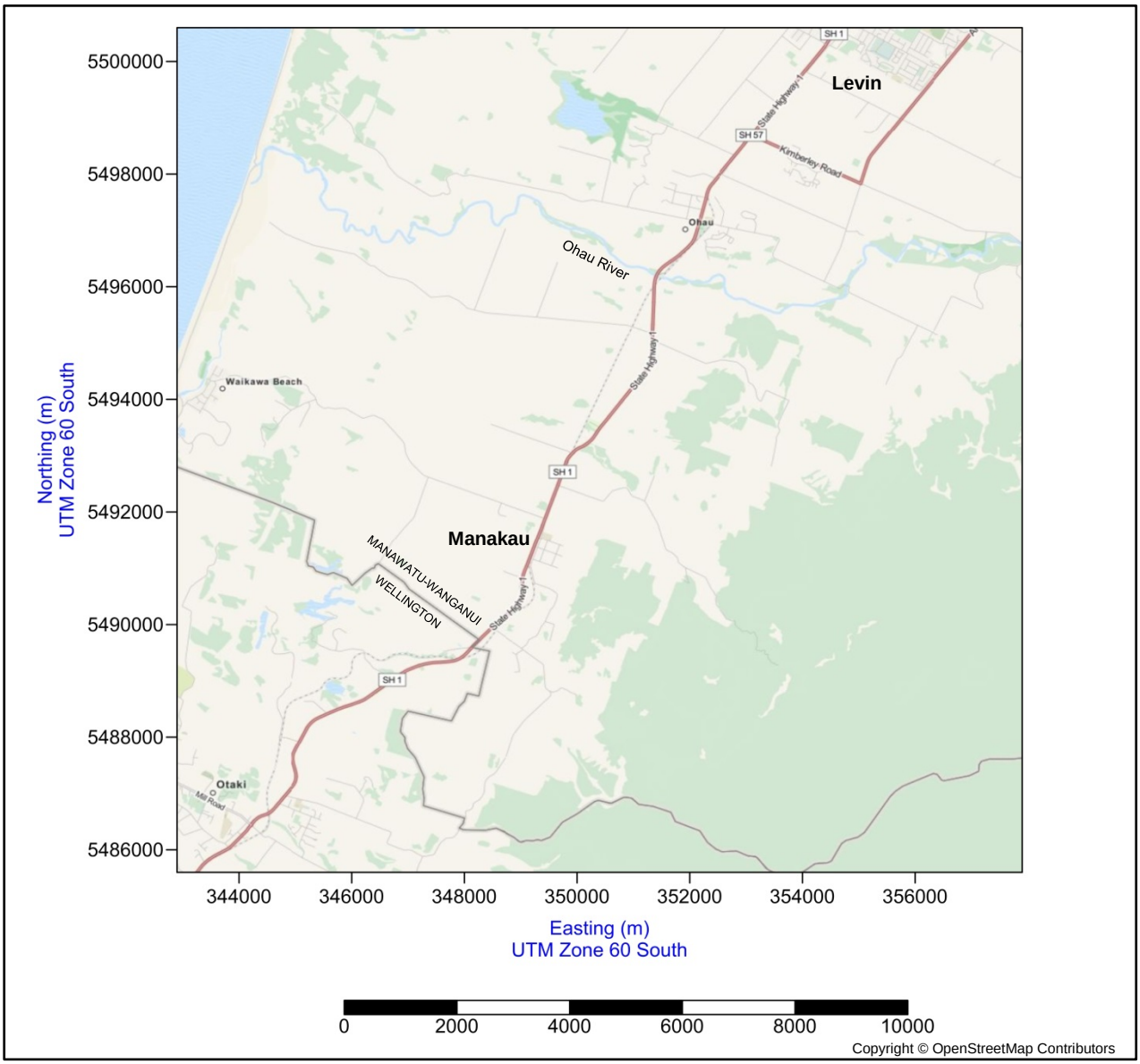


Figure 2 **Project Site Location Showing a Mapquest Basemap**

2. Assessment Criteria

Table 1 summarises the ambient air quality assessment criteria relevant to this assessment. The key pollutants of concern in this study are particulate matter (as PM_{10} and $PM_{2.5}$)[3,4] and nitrogen dioxide (NO_2), and to a lesser extent carbon monoxide (CO) and benzene (C_6H_6).

Table 1 Ambient Air Quality Assessment Criteria

Pollutant	Averaging Period	Ambient Air Quality Standard or Guideline	Reference
Carbon monoxide	1-hour 8-hour*	30 mg/m^3 10 mg/m^3	AAQG NES / AAQG
Nitrogen dioxide	1-hour** 24-hour Annual	200 µg/m^3 100 µg/m^3 40 µg/m^3	NES / AAQG AAQG WHO
Particulate matter <10 µm (PM_{10})	24-hour* Annual	50 µg/m^3 20 µg/m^3	NES / AAQG AAQG
Particulate matter <2.5 µm ($PM_{2.5}$)	24-hour Annual	25 µg/m^3 10 µg/m^3	WHO WHO
Benzene	Annual	3.6 µg/m^3	AAQG

N.B. * One exceedance permitted in a 12-month period

** Nine exceedances permitted in a 12-month period

Pursuant to Section 43 of the Resource Management Act 1991 (RMA), the Ministry for the Environment (MfE) first promulgated the Resource Management (National Environmental Standards for Air Quality) Regulations on 6 September 2004 ('the NES' or 'the Regulations'). Since that time there have been a number of amendments to the NES, with the most recent amendment occurring in 2011. The NES applies standards to five air pollutants: particulate matter (as PM_{10}), CO, NO_2, sulphur dioxide (SO_2) and ozone (O_3). The NES standards for CO, NO_2 and PM_{10} are presented in **Table 1**.

The Ambient Air Quality Guidelines (AAQG) were published by the MfE in 2002 following a comprehensive review of international and national research, and are widely accepted among New Zealand air quality practitioners. The AAQG criteria provide the minimum requirements that ambient air quality should meet in order to protect human health and the environment. The AAQG standards for CO, NO_2, PM_{10} and benzene are presented in **Table 1**.

The World Health Organisation (WHO) has recommended a set of ambient air quality guidelines for $PM_{2.5}$. The WHO's ambient air quality guidelines for the remaining pollutants are the same as the NES/AAQGs. It is noted that there is currently no annual mean NES or AAQG for NO_2, and, therefore, the WHO's annual mean guideline has been adopted in this study. The WHO's ambient air quality guidelines for $PM_{2.5}$ and NO_2 are shown in **Table 1**.

[3] 'PM_{10}' refers to coarse particles less than 10 microns (µm) in diameter.

[4] '$PM_{2.5}$' refers to fine particles less than 2.5 µm in diameter.

3. Sensitive Receptors

In the context of this air quality assessment, the term 'sensitive receptor' includes any persons, locations or systems that may be susceptible to changes in abiotic factors as a consequence of discharges to air associated with the project, both during the construction phase and the operational phase of the scheme.

Typical locations for sensitive receptors include:

- Residential properties
- Retirement villages
- Hospitals or medical centres
- Schools
- Marae
- Libraries
- Public outdoor locations (e.g. parks, reserves, sports fields).

Sensitive receptors do not include locations that are: indoors (e.g. within residences); inside vehicles; within indoor workplace environments; or within outdoor workplace environments where the public are not typically exposed. It is beyond the scope of this study to determine the potential air quality impacts at every discrete sensitive receptor located along the project corridor.

Figure 3 shows a Google Earth aerial basemap for the same 15 km by 15 km area with the addition of a 200 m buffer line (shown in yellow) from the proposed TO17 route alignment (shown in blue) with terrain data superimposed over the basemap. Note that the route alignment is indicative only and is based on drawing number *80500902-07-001-SK024* shown in **Appendix A**. The UK Highways Agency's (HA) Design Manual for Roads and Bridges (DMRB) considers any receptor within 200 m of a road source to be potentially affected by that operation.[5]

Receptor locations deemed sensitive to baseline air quality as a result of the project were identified from a desktop GIS study. These include a scattering of residential properties and lifestyle blocks located within the 200 m buffer distance from the proposed route alignment. The closest receptor (residential property) is approximately 30 m from the proposed route alignment and is located in Manakau.

[5] Highways Agency, 2007. Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 1 Air Quality HA 207/07, UK Highways Agency (HA), May 2007.

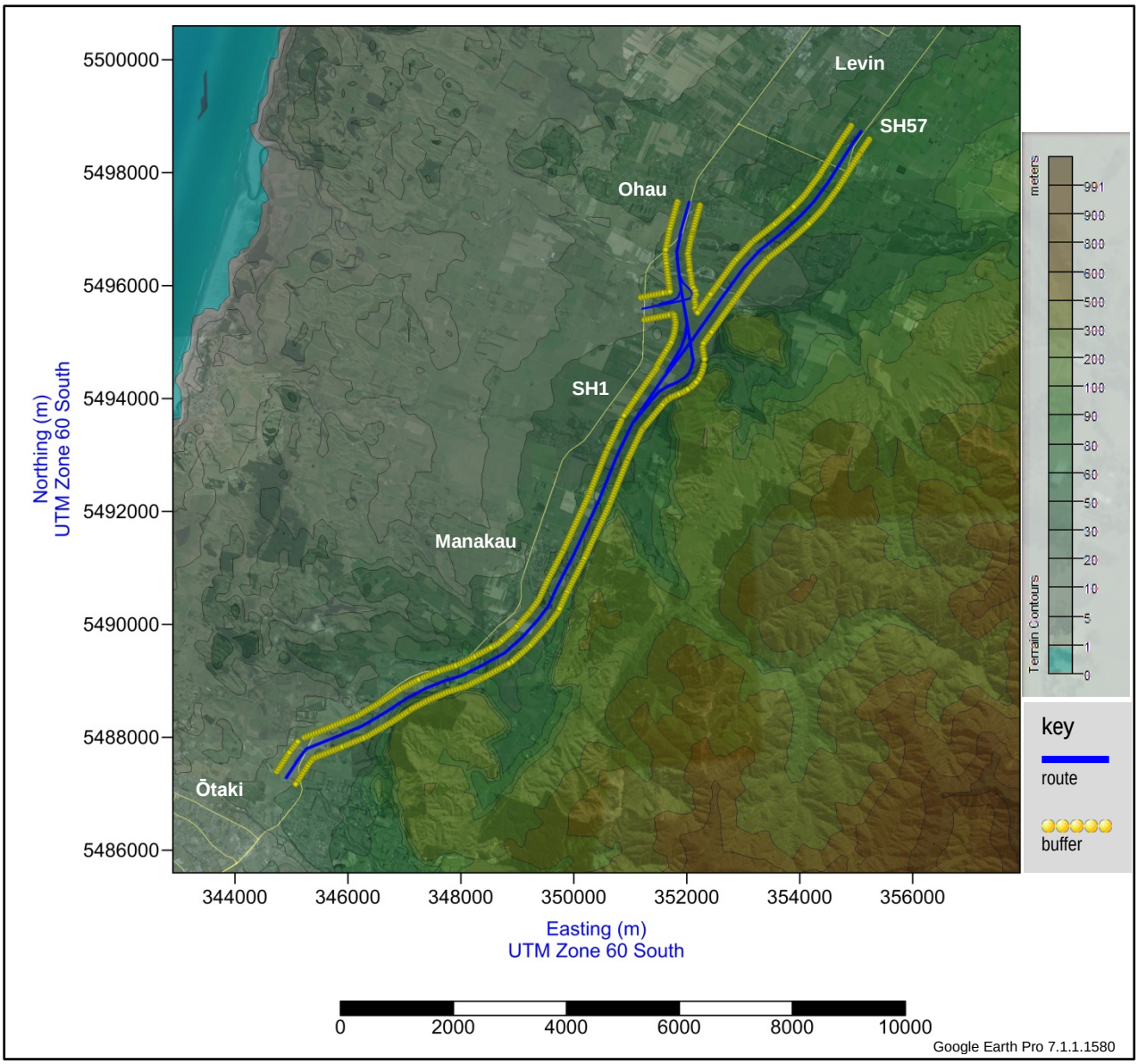


Figure 3 **Aerial Basemap of the Project Site Showing Proposed Route Alignment (TO17)**

Figure 4 shows the same Google Earth basemap as **Figure 3**, however, the terrain data (contours) are shown in more detail. The surface elevation (terrain) data were taken from Lakes Environmental Software's website (www.webGIS.com), and were based on the Shuttle Radar Topography Mission (SRTM-3) digital elevation model (90 m resolution) data (Version 2) originally produced by NASA. The figure shows that there are significant terrain features (Tararua Forest Park) located to the south-east of the route.

Figure 5 shows the terrain data along a 5,000 m cross-section starting at the existing SH1 and heading south-east (135 ºN), passing through Manakau and the proposed route and ending in the Tararua Forest Park. Along this cross-section, the terrain changes from 38 m above mean sea level at the proposed route to 200 m above mean sea level (approximately 1,000 m south-east of the route), which represents a change in gradient of 16%. Therefore, the terrain to the south-east of Manakau could be described as being complex (i.e. an elevation change of greater than 10%).

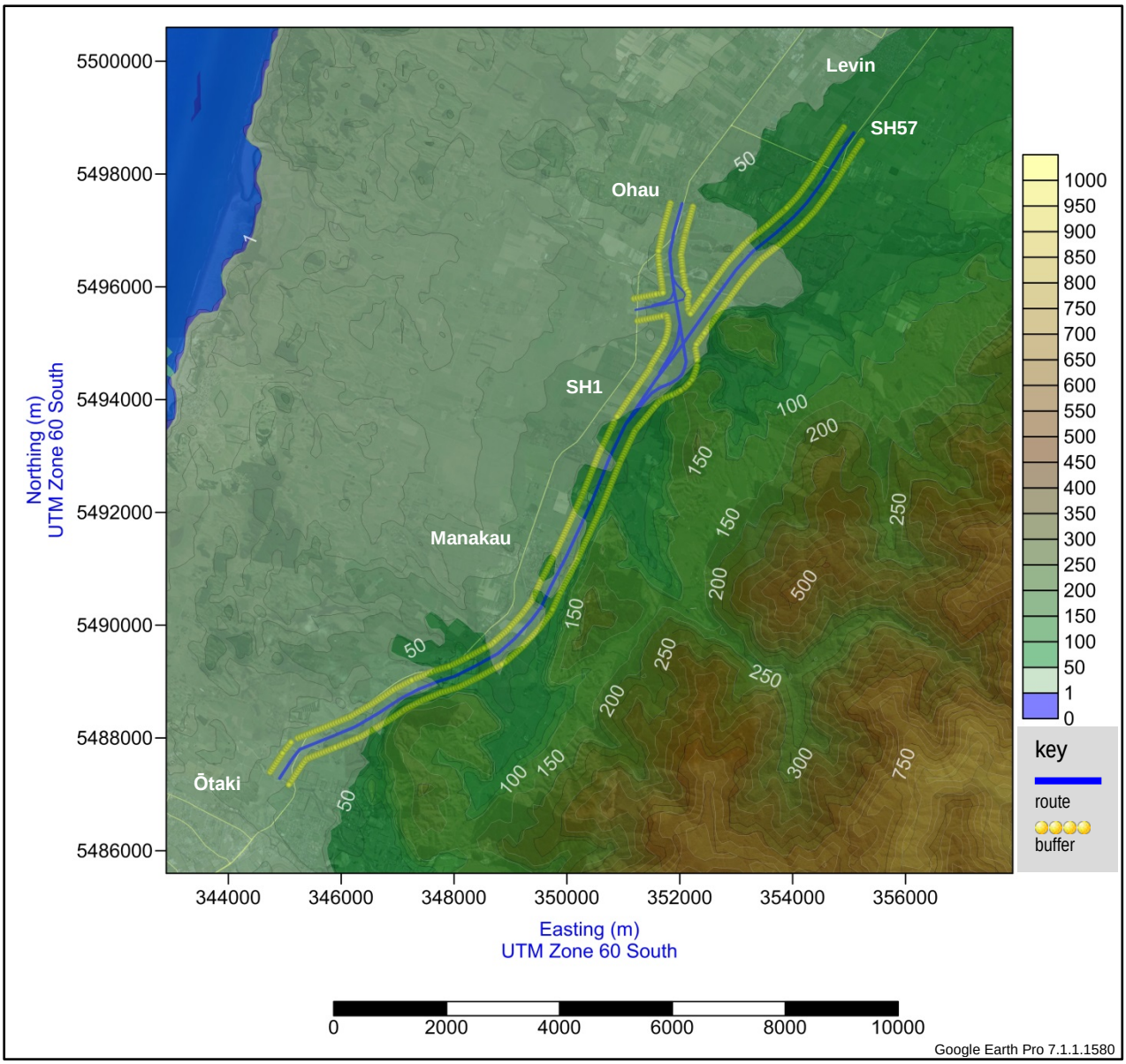


Figure 4 **Aerial Basemap Showing Proposed Route Alignment (TO17) and Terrain**

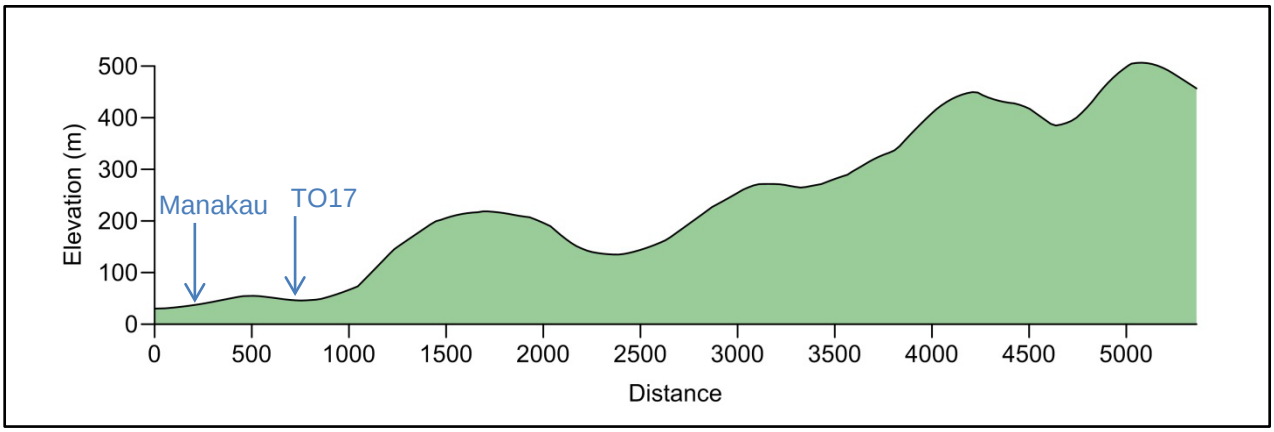


Figure 5 **Terrain Profile (Elevation) from the Existing State Highway 1 Heading South-East**

4. Existing Situation

4.1. Local Meteorology

Hourly wind speed and wind direction data for the Levin Automatic Weather Station (AWS), which is the closest meteorological station to the project site and is operated by the MetService, were analysed for the years 2008 to 2012.[6] The Levin AWS is approximately 1.4 km to the north of the study area.

The wind rose shown in **Figure 6(a)** presents the hourly wind speed and direction data for Levin AWS from 1 January 2008 (Hour 1) to 31 December 2012 (Hour 24), while **Figure 6(b)** presents the hourly wind speed and direction data for the year 2012 only. The figure indicates that whilst winds from all directions are experienced in Levin, the predominant wind directions are from the west-north-west (WNW), east (E), east-north-east (ENE), west (W) and north-west (NW). The mean wind speed for 2008 to 2012 was 2.8 m/s, while the annual mean wind speed for 2012 was 2.7 m/s. The highest wind speeds (>10.5 m/s) were from the WNW and NW. The wind roses for the period 2008 to 2012 and for 2012 are very similar.

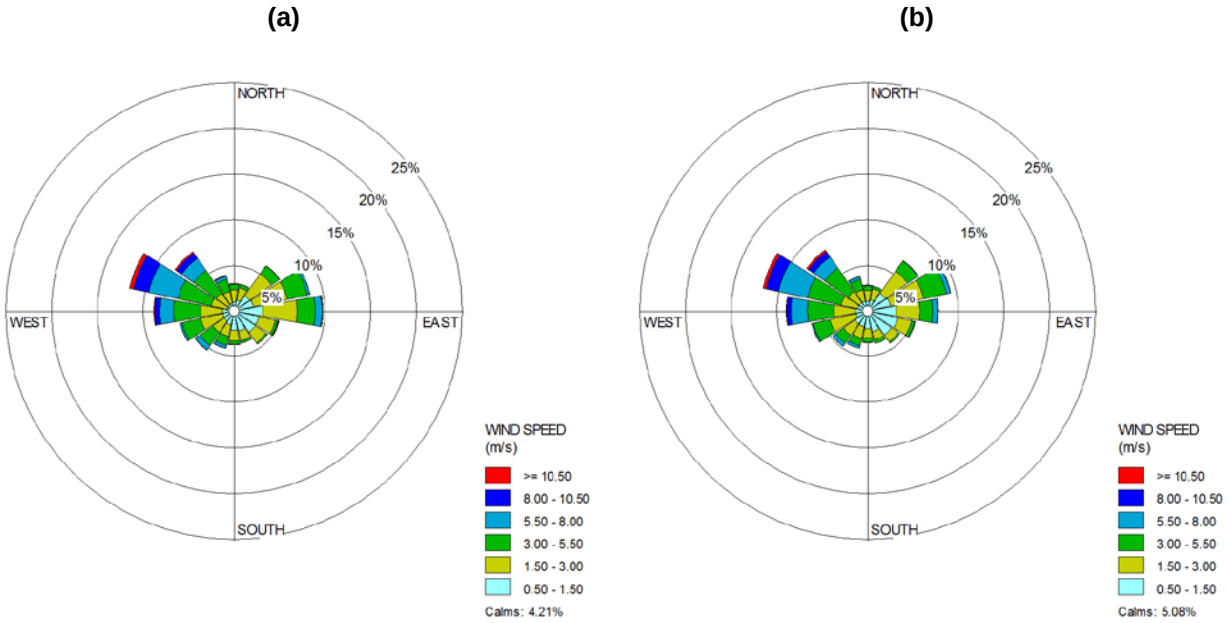


Figure 6 Wind Roses for Levin AWS: (a) 2008 to 2012 and (b) 2012

The wind speed frequency distributions for the Levin AWS for 2008 to 2012 are shown in **Figure 7**.

Over the five-year period, the majority of the wind speeds (88%) were calm to moderate:

- Approximately 4% of winds were calm (less than 0.5 m/s);
- Approximately 36% of winds were between 0.5 m/s and 1.5 m/s (low wind conditions);
- Approximately 25% were between 1.5 m/s and 3 m/s (light wind conditions); and,
- Approximately 23% were between 3 m/s and 5.5 m/s (light to moderate wind conditions).

Only 12% of wind speeds were above 5.5 m/s (moderate to strong wind conditions).

[6] National climate database (CliFlo) operated by NIWA: www.cliflo.niwa.co.nz

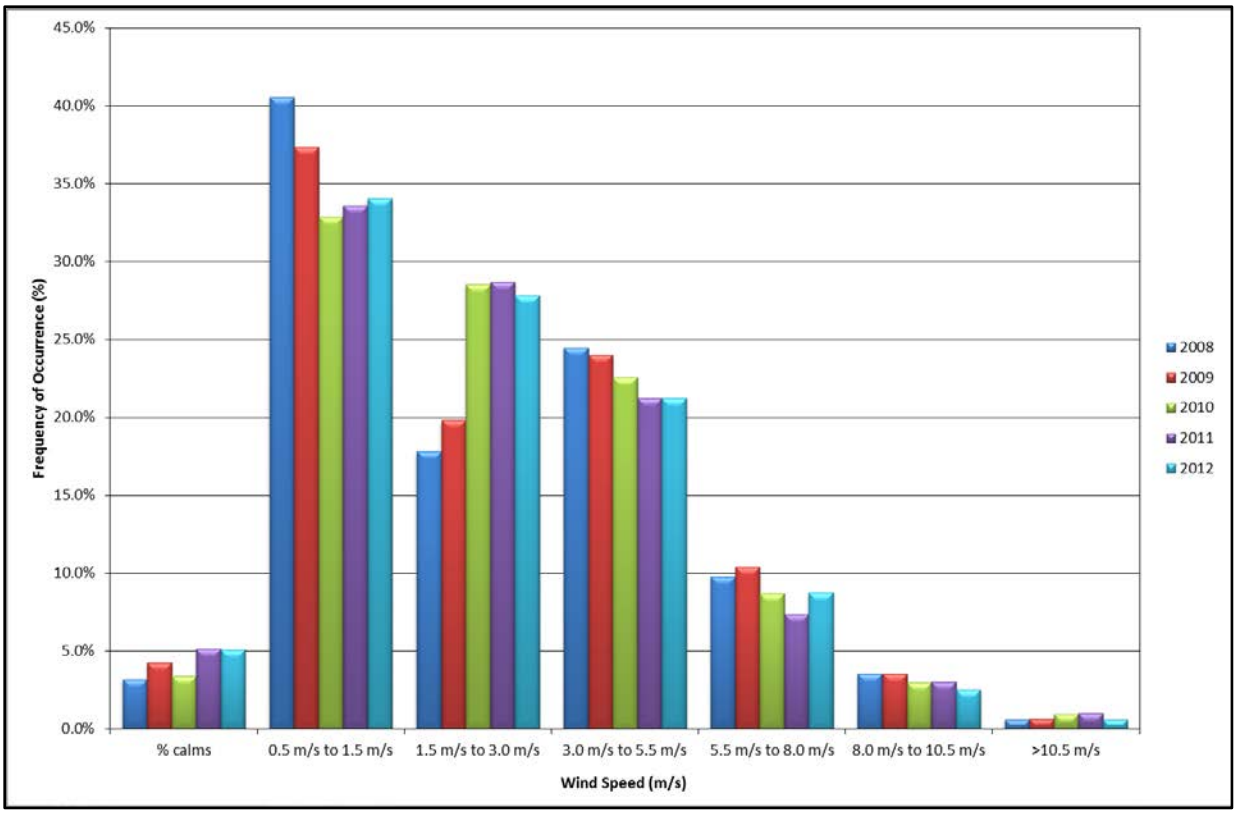


Figure 7 Wind Speed Frequency Distribution at Levin AWS for 2008 to 2012

CALMET (Version 6.4.0, Level 121203) was used in this study. CALMET is a meteorological model which includes a diagnostic wind field generator containing objective analysis and parameterised treatments of slope flows, kinematic terrain effects, terrain blocking effects, and a divergence minimisation procedure, and a micro-meteorological model for overland and overwater boundary layers. CALMET forms part of the US Environmental Protection Agency's CALPUFF dispersion modelling suite.

Hourly surface meteorological data were extracted from TAPM[7] for the closest grid receptors to the Paraparaumu Airport AWS and Levin AWS for comparison against the observation (CliFlo) data. SMERGE Version 5.7.0 Level 121203 was used to produce the CALMET-formatted surface meteorological data input file. A CALMET-formatted upper air meteorological data input file for Levin was developed and used as input into CALMET (see below for further details).

The CALMET modelling domain was centred at UTM 347500 m E, 5486000 m N (zone 60 south). A 40 km by 40 km Cartesian grid was used at a resolution of 200 m, and included the surface meteorological stations and one upper air station. Land use and terrain data were input into CALMET.

Hourly surface meteorological data were extracted from CALMET for the Levin AWS and for the Manakau township (UTM 350000 m E, 5491100 m N) for the year 2012. Manakau is approximately 11 km SSW of the Levin AWS. The annual average wind speed predicted by CALMET for 2012 for Levin AWS was 2.7 m/s (i.e. the same as the NIWA observation data input into the TAPM model to generate the CALMET data file), whilst the annual average wind speed predicted by CALMET for 2012 for Manakau was 2.5 m/s. The annual mean wind roses predicted by CALMET for 2012 for Levin AWS and Manakau are shown in **Figure 8(a)** and **Figure 8(b)**, respectively. The data shown in **Figure 8(a)** are in good agreement with the data shown in **Figure 6(a)**, which indicates that CALMET has performed well. However, the wind rose predicted for Manakau indicates that the predominant wind directions are from the E, ENE and south-south-east (SSE), which indicates that local terrain features have the potential to influence the dispersion of pollutants within the study area.

[7] TAPM (The Air Pollution Model) is a prognostic model which is used to predict three-dimensional meteorological data, with local meteorological data used as input. TAPM Version 4.0.5 was used in the present study and was developed in Australia by the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

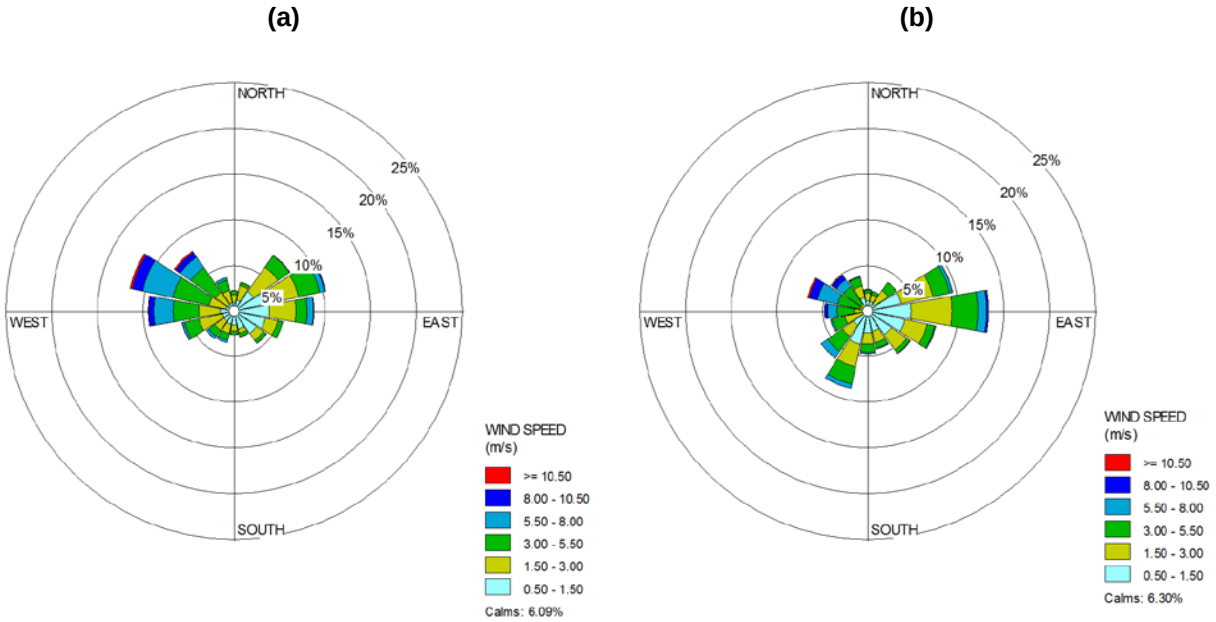


Figure 8 CALMET Wind Roses for 2012 for (a) Levin AWS and (b) Manakau

4.2. Background Air Quality

The background concentrations of PM_{10} (as a 24-hour mean) and NO_2 (as an annual mean) used in this assessment are shown in **Table 2** and were taken from the NZ Transport Agency's online background air quality map[8] for Ōtaki Forks and Mangaore-Manakau (PM_{10}) and for 'rural area' (NO_2).

The background concentrations are relatively low compared with other parts of New Zealand (e.g. urban or industrial areas).

Table 2 Background Air Quality Used in this Assessment

Pollutant	Averaging Period	Concentration (µg/m^3)	Reference
NO_2	Annual	4	NZ Transport Agency
PM_{10}	24-hour	19	NZ Transport Agency

5. Operational Phase

During the operational phase, the principal emissions to air are likely to be generated by vehicles using the proposed scheme (TO17), including the proposed interchanges and local road connections. A screening-level assessment was undertaken to assess the potential air quality effects associated with additional vehicles travelling along TO17 following the opening of the scheme. The NZ Transport Agency's online air quality screening model (Version 2.0)[9] was used in this assessment. Whilst this particular screening model only allows for the assessment of NO_2 and PM_{10} it is considered unlikely that the assessment criteria for other traffic-related pollutants such as CO, $PM_{2.5}$ and benzene will be exceeded as a result of the scheme, providing that the criteria for NO_2 and PM_{10} are met.

8 http://air.nzta.govt.nz/background-air-quality. Refer to: NZ Transport Agency, 2014, Background Air Quality Guide, Draft June 2014.

9 http://air.nzta.govt.nz/screening-model. Refer to: NZ Transport Agency, 2014, Air Quality Screening Model Users' Notes, June 2014.

According to traffic data provided by Dhimantha Ranatunga (Transportation Engineer, MWH) on 9 September 2015 (see **Appendix A**), the bidirectional annual average daily traffic (AADT) flow south of the bifurcation following the opening of the scheme in 2021 will be 17,200 vehicles per day, while the average vehicle speed and percentage heavy goods vehicles (HGVs) will be 100 km/hr and 12%, respectively. The highest AADT flows have been predicted for the section of the scheme south of the bifurcation.

For the purposes of a conservative (worst-case) assessment, it was assumed in the screening model that a sensitive receptor was located 30 m from the proposed route alignment (i.e. the closest sensitive receptor identified from the desk-top study). No assessment was undertaken for a 'base year' scenario or for a 'do minimum' scenario (opening year without the scheme).

The results from the screening assessment are shown in **Table 3** and in **Figure 9**. The figure shows the road contribution predicted at a distance of 30 m from the proposed route plus the background concentration (i.e. the sum of the two values equals the *total predicted concentration* at this receptor location). The results indicate that there are unlikely to be any exceedances of the ambient air quality criteria at any sensitive receptor location following the opening of the scheme.

Table 3 Predicted Worst-Case Air Quality Impacts During the Operational Phase

Pollutant	Averaging Period	Background Concentration ($\mu g/m^3$)	Road Contribution *TO17* ($\mu g/m^3$)	Total Predicted Concentration *With Scheme* ($\mu g/m^3$)
NO_2	Annual	4.0	1.5	5.5
PM_{10}	24-hour	19.0	0.7	19.7

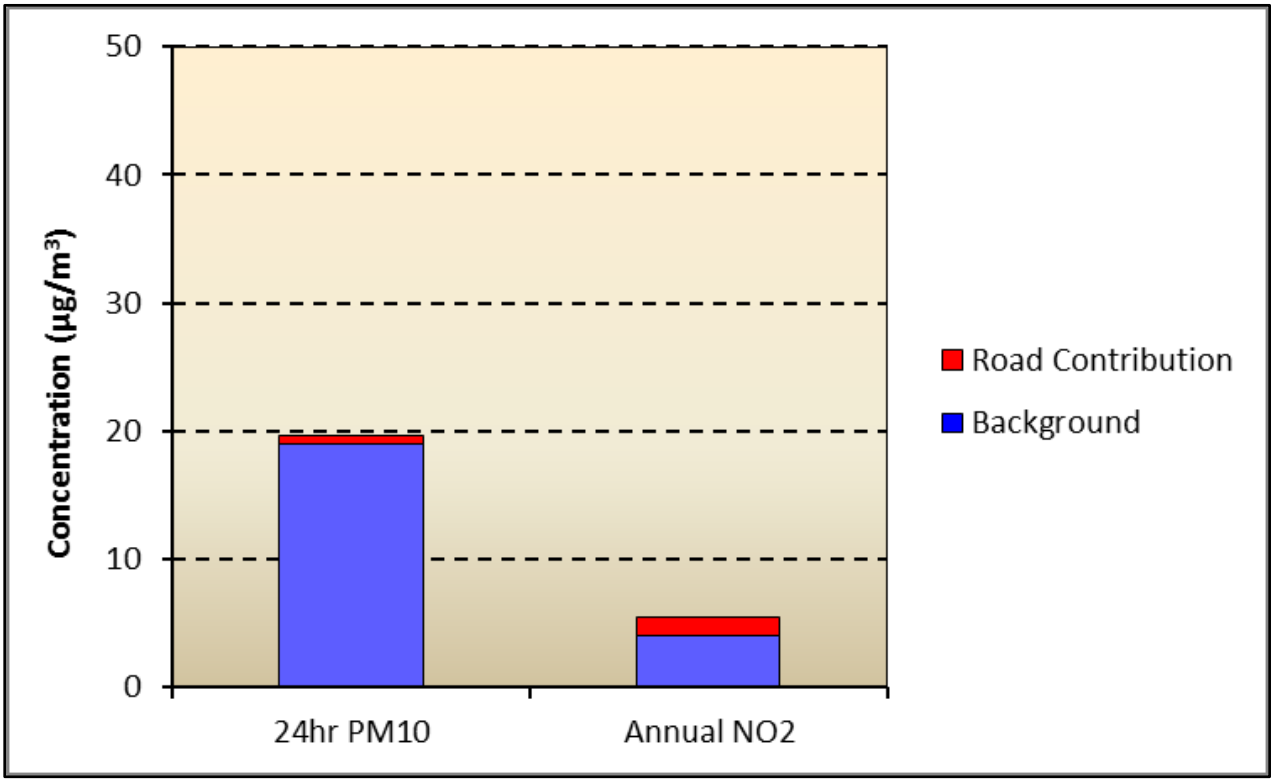


Figure 9 Predicted Air Quality Impacts Following the Opening of the Scheme (TO17)

The MfE has recommended a set of criteria to determine whether the predicted concentrations of road traffic pollutants are likely to be 'significant' (MfE, 2008).[10] These are absolute criteria, are not related to the existing air quality and are for *incremental analysis* only.

The significance criteria relevant to this assessment are essentially 5% of the 24-hour mean NES for PM_{10} of 50 µg/m³ and the WHO's annual mean guideline for NO_2 of 40 µg/m³ and are as follows:

- NO_2 2.0 µg/m³ Annual mean; and,
- PM_{10} 2.5 µg/m³ 24-hour mean.

For the receptor located at a distance of 30 m from the proposed route alignment, the screening results indicate that following the opening of the scheme in 2021:

- The total predicted annual mean NO_2 concentration (background plus road contribution) will be 6 µg/m³, which is only 14% of the assessment criterion (WHO) and the predicted road contribution is less than the MfE significance criterion; and,
- The total predicted 24-hour mean PM_{10} concentration will be 20 µg/m³, which is only 39% of the assessment criterion (NES for PM_{10}) and the predicted road contribution is less than the MfE significance criterion.

Figure 10 shows the predicted annual mean NO_2 and 24-hour mean PM_{10} road contributions (i.e. excluding background concentrations) at 10 m intervals from the proposed route alignment. The figure indicates that concentrations are predicted to decrease with distance from the new road.

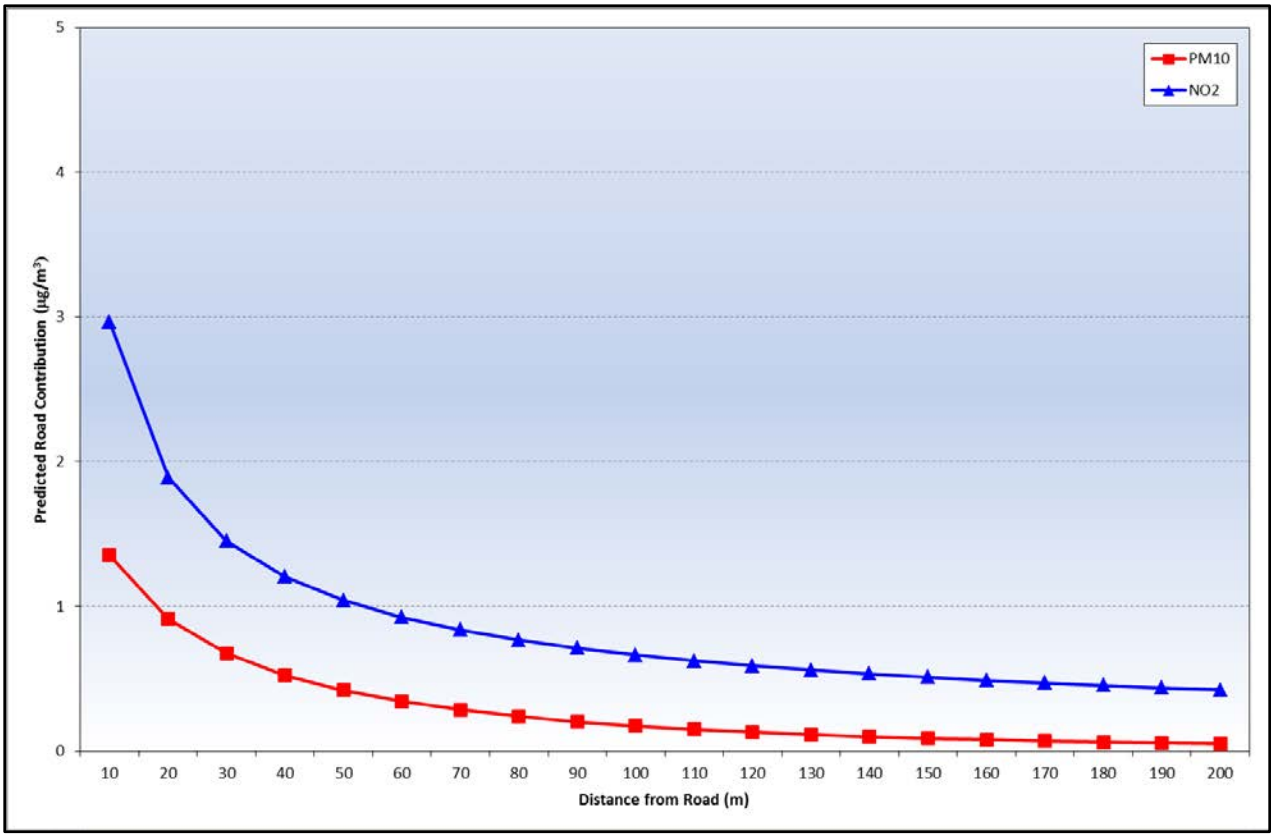


Figure 10 Predicted Road Contributions of Annual Mean NO_2 and 24-hour Mean PM_{10}

[10] Good Practice Guide for Assessing Discharges to Air from Land Transport, Ministry for the Environment, June 2008.

Figure 10 indicates that even for a worst-case receptor located 10 m from the proposed route alignment:

- The total predicted annual mean NO_2 concentration (background plus road contribution) will be 7 µg/m^3, which is only 18% of the assessment criterion (WHO). However, whilst the predicted road contribution is greater than the MfE significance criterion, no health effects are considered likely as the WHO criterion is likely to be met; and,
- The total predicted 24-hour mean PM_{10} concentration will be 20.4 µg/m^3, which is only 41% of the assessment criterion (NES for PM_{10}) and the predicted road contribution is less than the MfE significance criterion.

The outputs from the NZ Transport Agency's online air quality screening model (accessed in September 2015) are shown in **Appendix B** for the worst-case receptor located at a distance of 30 m from the proposed route alignment.

Despite the fact that complex terrain is situated in close proximity to the south-east of the proposed Manakau bypass, it is considered unlikely that this will have a significant effect on the ambient air quality in Manakau given that the concentrations predicted in this screening assessment are well below the NES and WHO assessment criteria.

6. Summary and Conclusions

The operational phase road traffic emissions that will be generated along the proposed Manakau bypass (Option TO17) have been assessed on a quantitative basis using a screening-level model.

The results indicate that the significance of potential operational phase air quality impacts in the vicinity of the proposed Manakau bypass are likely to be *negligible* for PM_{10} and NO_2, as the ambient air quality criteria (including MfE significance criteria) are likely to be met at all sensitive receptor locations. The project road contributions and background concentrations were predicted to be low.

7. Limitations

MWH acknowledges that no predictions have been undertaken for a 'base year' scenario or for a 'future' assessment year without the scheme, as the focus in the present study was on the 'opening year 2021' with the scheme ('do something').

The assessment detailed in this letter was based on the results of the NZ Transport Agency's online air quality screening assessment tool, and a more detailed air quality assessment (involving atmospheric dispersion modelling) may be required at a later date should there be a significant change in the 'do something' (with scheme) predicted traffic flow and/or %HGV composition.

8. Closure

Should you require any additional information or clarification, please do not hesitate to contact me on (09) 580 4575 or 021 766 576.

Yours sincerely

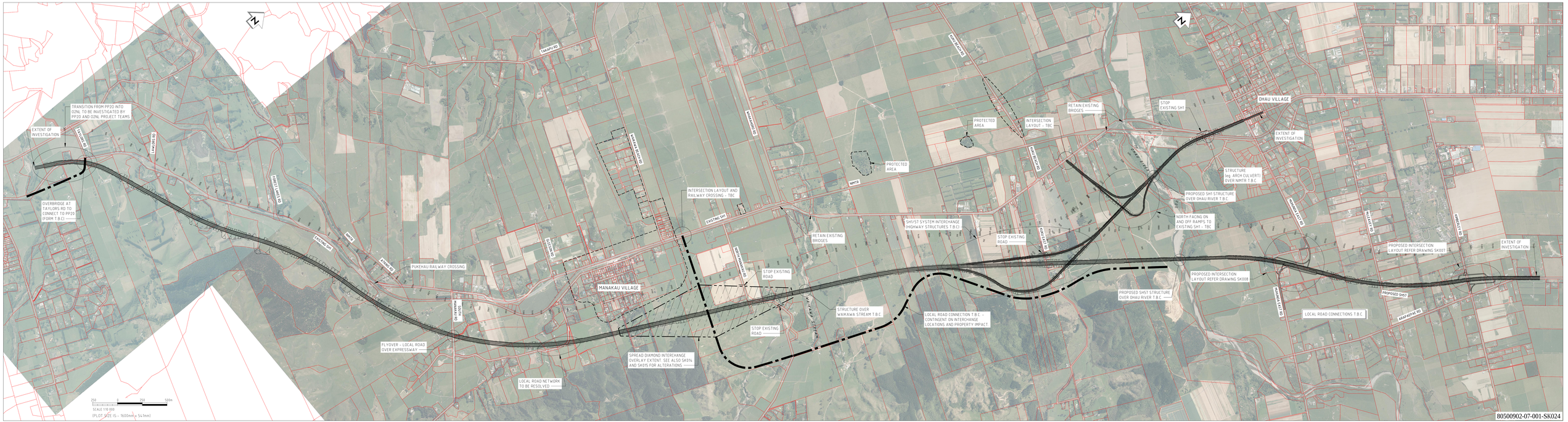
Dr Doug Boddy
Senior Air Quality Scientist

This letter was peer-reviewed by Dr Paul Heveldt on 15 September 2015, in accordance with MWH's project management and quality procedures.

APPENDIX A

Traffic Data and Scheme Alignment


Otaki to North of Levin
Traffic Volumes and Growth
(Taylors to South Levin Four Laning Option TO17)
SH1 45%
SH57 55%
TO17 - SH1 North of Bifurcation 2
Volumes:
Expressway: 2021 – 8,400 vpd (Modelled)
%HCV = 12
Average speed = 100km/h
TO17 - SH1 North of Bifurcation 1
Volumes:
Expressway: 2021 – 6,400 vpd (Modelled)
%HCV = 12
Average speed = 100km/h
TO17 – New SH57 North of Bifurcation
Volumes:
2021 – 10,800 vpd (Modelled)
%HCV = 12
Average speed = 100km/h
TO17 – SH1 South of Bifurcation
Volumes:
Expressway: 2021 – 17,200 vpd (Modelled)
%HCV = 12
Average speed = 100km/h
TO17
Waitarere
Waitarere Beach Rd
Koputaroa
Koputaroa Rd
Hokio Beach
Hokio Beach Rd
Lake Horowhenua
Levin
Queen St
Liverpool St
Kawiu Rd
Lindsay Rd
Tararua Rd
Bruce Rd
Perth St
Buller Rd
Ohau
McIeavey Rd
Muhunoa E Rd
Manakau
State Hwy
MANAWATU-WANGANUI
WELLINGTON



OTAKI TO NORTH LEVIN (RONS)
TAYLORS ROAD TO OHAU SECTION
(MANAKAU BYPASS) OPTION TO17
SCALE 1:10,000

NOTE: HIGHLY INDICATIVE CONCEPT DESIGN OPTION ONLY.

APPENDIX B

Outputs from the NZ Transport Agency's Air Quality Screening Model (V2.0)

Date website accessed: 14/09/2015

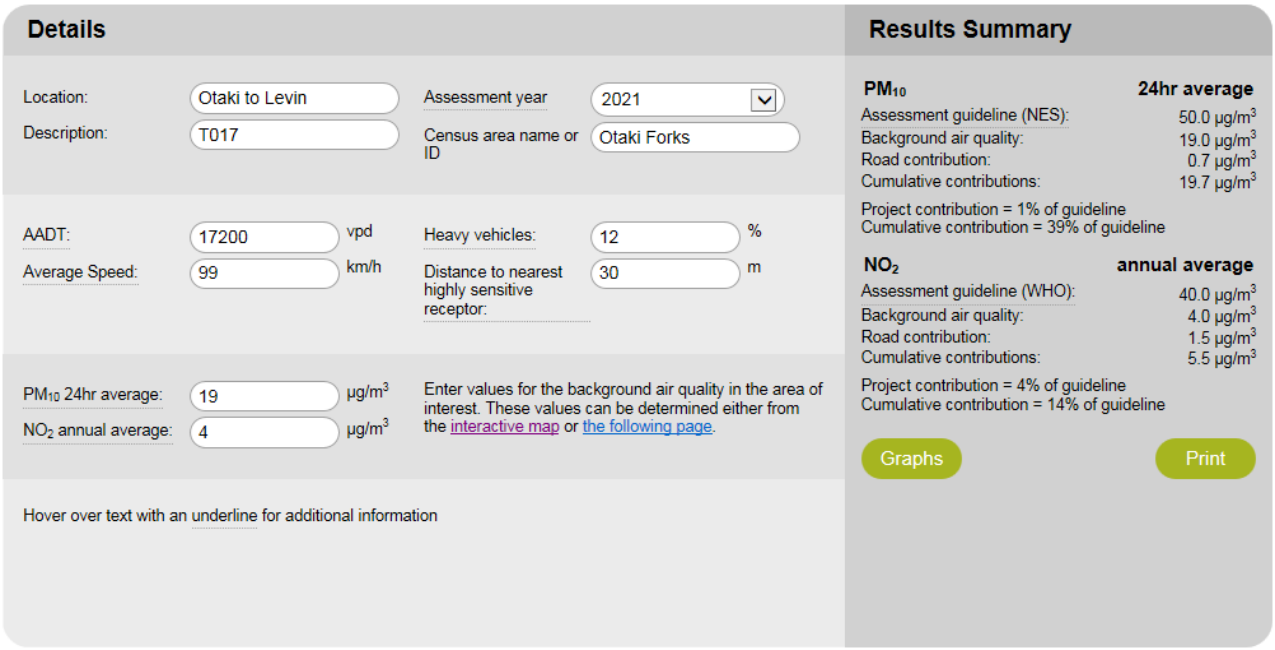


Figure A–1 Data Input into the NZ Transport Agency Screening Model

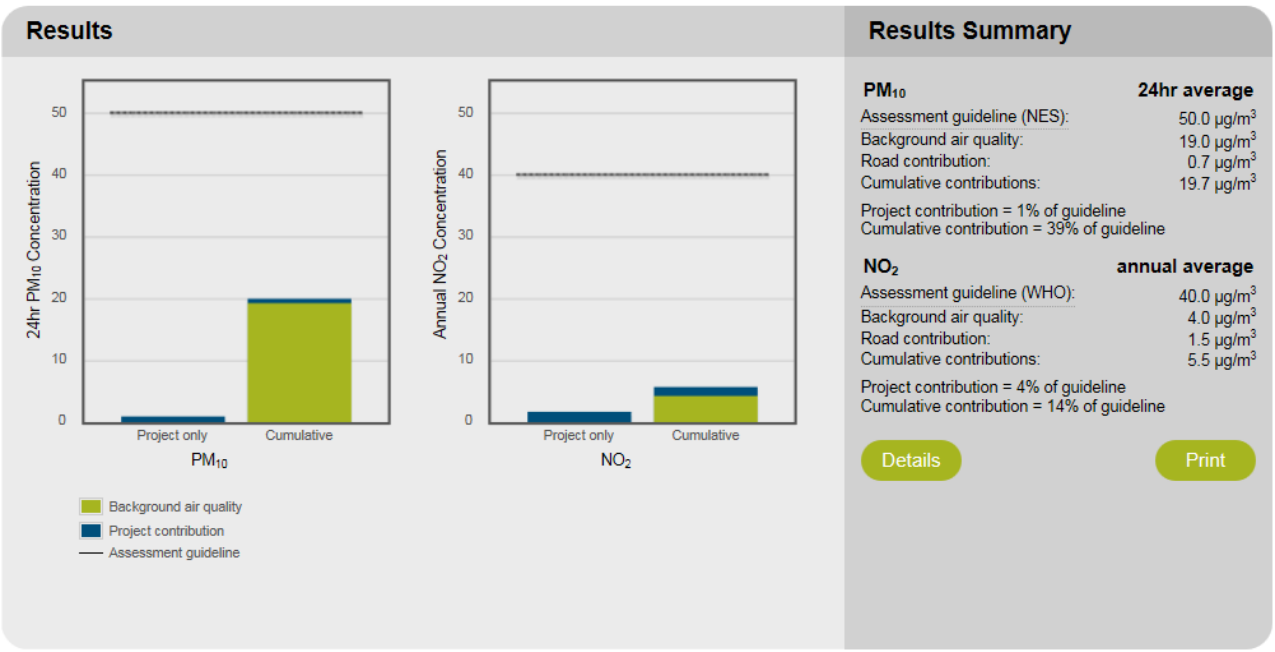


Figure A–2 Predicted Air Quality Impacts for Opening Year 2021

MalcolmHuntAssociates
noise and environmental consultants
Arco House, 47 Cuba Street, PO Box 11-294, Wellington
mha@noise.co.nz www.noise.co.nz

Sylvia Allan
Allan Planning & Research Ltd
26 Patrick Street
Petone
Lower Hutt 5012

Date of Issue: 13 September 2015

Dear Sylvia,

Re: Preliminary Scoping Assessment - Traffic Noise & Vibration Ōtaki to North of Levin Taylors to South Levin Four Laning Option TO17

1.0 Introduction

The NZ Transport Agency is investigating improvements to a section of State Highway 1 from Ōtaki to north of Levin as part of the Wellington Northern Corridor which has been identified by the government as a road of national significance. Following consultation the Agency identified preferred option for proposed improvements to the state highway between Manakau and Levin. We set out below our preliminary scoping assessment of the noise and vibration issues which provides an overview of the existing environment, the relevant noise and vibration assessment criteria and generic comments around the likely findings of detailed studies which have not yet been conducted.

2.0 Route Description

We have assessed the preliminary noise and vibration issues associated with the preferred route for Option T017 which is shown diagrammatically in **Figure 1** below.

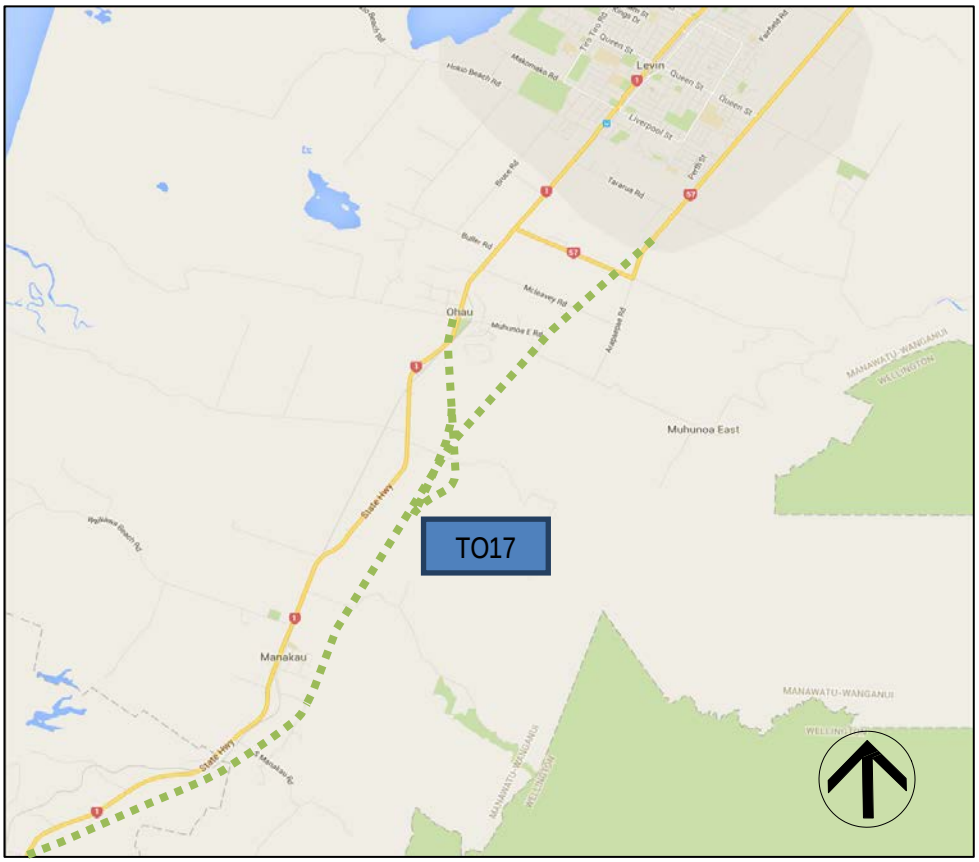


Figure 1: Alignment of preferred option for four lane [T017] Taylors Road to South Levin. NTS.

The route commences at Taylors Road [the northern extent of the Peka Peka to Ōtaki project] with the proposed route alignment situated to the east of the existing State Highway 1 [SH1] and will remain east of the existing SH1 all the way north to Mahunoa West Road, Ohau. The proposed route alignment will be situated approximately 200m to the south-east of the existing SH1/Forest lakes Road intersection and will remain within 1km of the existing SH1 corridor. The length of the route alignment between Taylors Road and Mahunoa West Road [proposed route of SH1] is approximately 12.7km.

The alignment will by-passes the township of Manakau, prior to crossing Kuku East Road [approximately 700m east of the existing SH1]. The alignment will bifurcate with a 2-lane connection heading north back to the existing SH1 [Mahunoa West Road, Ohau] and the SH57 will continue north from the bifurcation, crossing the Ohau River before connecting to Arapaepae Road [the existing SH57, north of Kimberley Road].

A proposed spread diamond interchange will provide local road connections and will be located approximately 600m north-east of the Manakau township and 900m south-west of the Waikawa Stream. The length of the route alignment between Taylors Road and Arapaepae Road [proposed route of SH57] is approximately 15.2km.

3.0 Noise & Vibration as Environmental Effects

The World Health Organization[1] identified a range of health effects associated with exposure to elevated levels of noise including:

- Noise-induced hearing impairment;
- Interference with speech communication;
- Disturbance of rest/sleep;
- Physiological, mental health and performance effects.

Noise from road traffic has the potential to cause these effects and is an important consideration in the assessment of the environmental effects of new or altered roads. The RMA includes “vibration” within the definition provided for “noise”.

4.0 Criteria – Traffic Noise

The Operative Horowhenua District Plan identifies noise from public roads as an issue in Chapter 10 “Land Transport” however no district plan noise performance apply to transport noise generated on public roads. The Proposed District Plan identifies New Zealand Standard NZS 6806:2010 “*Acoustics: Road Traffic Noise – New and Altered Roads*” [NZS 6806:2010] as a document incorporated by reference however there are no specific rules requiring the mandatory application of this Standard to assess noise from new or altered roads in the district.

Notwithstanding this, NZS6806:2010 is recommended by NZTA for asset improvement projects for assessing and, where required, determining appropriate mitigation for road-traffic noise[2]. As such, this Standard is considered the most appropriate Standard to assess the effects of traffic noise associated with the proposed project.

New Zealand Standard NZS 6806:2010 provides criteria based performance targets and requires assessment of a number of different options for noise mitigation [such as purpose-built barriers and low-noise road surfaces]. These options are subject to an integrated design process in which the costs and benefits are considered. The performance targets in NZS 6806 are said to be reasonable, taking into account adverse health effects associated with noise on people and communities, the effects of relative changes in noise levels, and the potential benefits of new and altered roads.

The criteria apply to noise received at PPF’s in the future, at a design year 10 to 20 years after the completion of the new or altered road.

The recommended noise criteria are designed to protect sensitive receiver sites [termed Protected Premises & Facilities, PPFs] which include:

(a) Buildings used for residential activities including:
- Boarding establishments
- Retirement villages and homes for elderly persons
- Buildings used as temporary accommodation in residentially zoned areas, including hotels and motels, but excluding camping grounds;

[b] Marae;
[c] Spaces within buildings used for overnight patient medical care; and
[d] Teaching areas and sleeping rooms in buildings used as educational facilities.

[1] World Health Organization. Guidelines for community noise. 1999
[2] NZTA Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects. Version 1.0, October 2011.

As the proposed route passes through rural land, PPFs to be assessed are likely to consist entirely of rural dwellings. At this stage no surveys have been conducted to define the number and location of PPFs that will be required to be assessed as part of this project. The recommendations only apply to existing PPFs however the Standard is intended to apply to PPFs where a building consent has been granted, but not yet implemented

The recommendations of NZS6806 apply the following noise criteria to protect PPFs:

Category	Criterion	New Roads	Altered Roads
A	Primary	57 dB $L_{Aeq\ (24h)}$	64 dB $L_{Aeq\ (24h)}$
B	Secondary	64 dB $L_{Aeq\ (24h)}$	67 dB $L_{Aeq\ (24h)}$
C	Internal	40 dB $L_{Aeq\ (24h)}$	40 dB $L_{Aeq\ (24h)}$

Table 1: NZS 6806 noise criteria

Under NZS6806:2010 noise mitigation options are to be assessed, and if practicable implemented, for any PPF where the **Category A** criterion cannot be achieved under the "Do Minimum" scenario. Where it is not practicable to meet even **Category B**, then mitigation should be implemented to ensure the internal criterion in **Category C** is achieved. Depending on the specific building, mitigation in Category C could include ventilation and/or noise insulation improvements ranging from upgraded glazing through to new wall and ceiling linings. In Category C there is no protection of outdoor amenity.

For existing roads, the noise limits are set at a higher level than for new roads reflecting noise levels in areas near existing roads are often already exceeding the noise criteria for new roads. In these circumstances noise mitigation options, which could reduce noise levels to those provided for in the criteria for new roads with lower traffic flows, are very limited and generally uneconomic.

For the current project, the majority of route is classified as a "new road" however [as discussed below] there are possible situations where existing roads are altered where the new route ties into existing highways. Issues surrounding which criteria to apply are discussed below in Section 6. An over-riding consideration of the NZS6806:2010 is the RMA requirement to adopt the Best Practicable Option [BPO] to avoid unreasonable noise. NZS 6806 provides a procedure for assessing the benefits and costs of mitigation options to help determine the BPO. NZS6806:2010 only assesses noise impacts for PPFs located within 200 m from the edge of the closest traffic lane for the new or altered road. The 400 metre wide [total] strip within which PPFs are assessed is shown in **Figure 2** below.

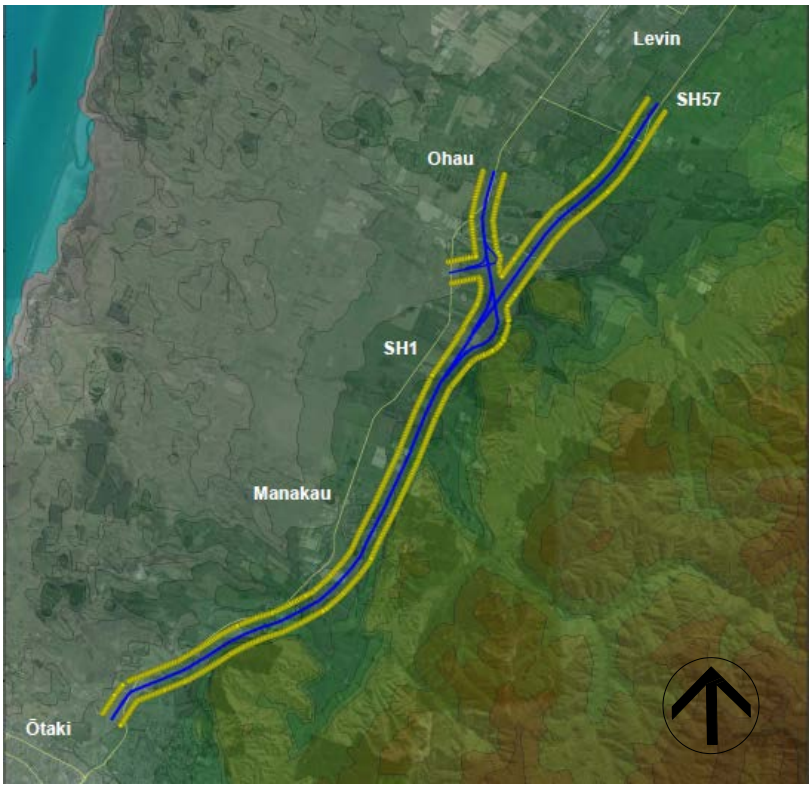


Figure 2: Proposed alignment [blue line] showing 200 m [yellow line] to each side of the proposed road.

Generic predictions of future traffic noise for various sections of the proposed new route are provided in Section 6 below. These predictions show the above criteria which require mitigation options to be examined are only likely to be found for PPFs within 200 metres from the edge of the new road.

5.0 Existing Environment

The criteria adopted in NZS 6806 to assess road-traffic noise are not dependent on the existing noise levels. Measurements of existing levels are therefore not required for assessing mitigation requirements. However, an appreciation of the existing environment is required to judge the potential noise effects of new roading projects, regardless of compliance with any particular noise criteria[3].

Although no specific measurements of existing noise levels have been taken for the purposes of this study, Malcolm Hunt Associates have on file data from a 2009 survey of environmental noise levels taken at 14 sites in the Horowhenua and Kapiti District which provides information on noise levels taken at four rural sites. These summary results are shown in the following **Figure 3**.

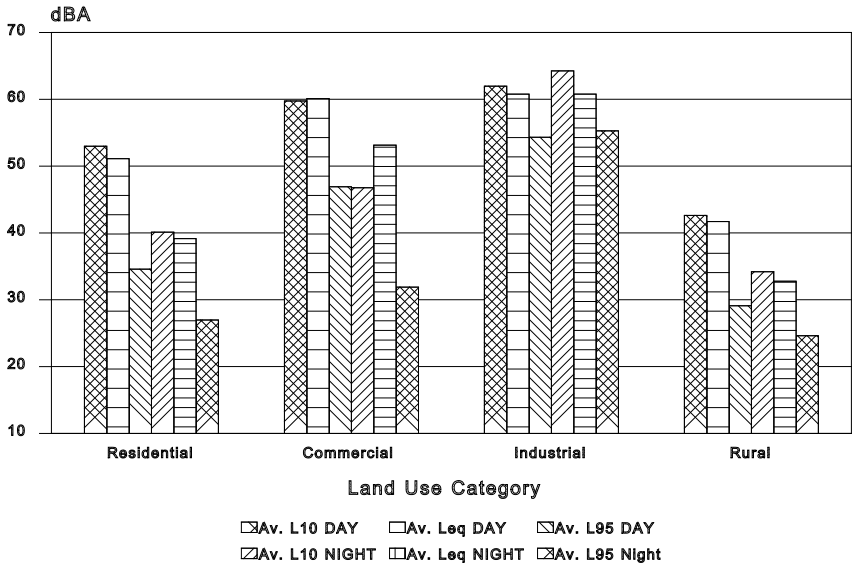


Figure 3: Summary results of 2009 Horowhenua district-wide environmental noise survey.

These results show how low ambient sound levels are found in rural areas. As a generalisation, $L_{Aeq\ (24\ hr)}$ sound levels in rural areas would typically measure around 40 dB where the receiver site is located well away from existing the highway. The effect of allowing PPFs to receive noise from new roads at levels 57 dB [17 dB above existing levels] are discussed in ***Section 6*** below.

6.0 Construction Effects

Construction and maintenance activities can produce significant levels of noise and vibration. Close proximity to residential properties and other sensitive buildings, and occurrence during the night, can exacerbate the effects.

Adverse effects from high levels of noise and vibration include:

- Annoyance
- Loss of concentration, including effects on learning performance
- Sleep disturbance
- Increased risk of mental and physical health problems
- Building damage.

NZTA's *Environmental plan* sets out the Agency's objectives regarding noise and vibration from construction and maintenance of the state highway network as follows:

- Manage construction and maintenance noise to acceptable levels;
- Avoid or reduce, as far as is practicable, the disturbance to communities from vibration during construction and maintenance.

[3] The RMA 4th Schedule requires that an "Assessment of Environmental Effects" give consideration to the sensitivity of the receiving environment.

The operative District Plan refers to measurement and assessment of construction noise using NZS6803:1999 "*Acoustics – Construction noise*" which is NZTA's preferred method for measuring and assessing construction noise. As with all District Plan provisions, construction noise rules in district plans do not apply to designations however consistent with best practice, construction noise is assessed below in accordance with as this is the most appropriate Standard available for this purpose.

While details of the works to be undertaken are not yet known, a critical factor to manage construction noise and vibration issues is the communication and liaison with the public. Thus, communication plans and contact with affected residents is as important as the technical aspects of mitigation to achieve particular noise or vibration levels. This is likely to be so where intensive works such as bridge abutments, over-passes or other structures are required to be built in close proximity to rural dwellings.

7.0 Issues

7.1 Significant Allowable Noise Increase under NZS6806

In order to ascertain likely future traffic noise levels at rural dwellings and other PPFs found within the 200 metre setback from the proposed route, the following generic traffic noise predictions have been made based on traffic volumes and data provided by MWH traffic engineers. Summary data employed in the generic traffic noise predictions are set out within Figure 4 as flows;

Figure 4: Summary traffic data employed within generic traffic noise predictions [Ref MWH].

Figure 4 indicates a split in road traffic of approximately 50/50 north of the bifurcation. The result of this split is to spread traffic noise over wider areas than found currently. Whereas the reduction of 50% traffic volumes on the existing highway will only cause a 3 dB drop in traffic noise levels received at roadside locations, "new" road will cause noise levels at PPFs located at 100 metres to increase by around 17 dB. For PPFs located within 50 metres of the new alignment will increase by 20 to 25 dB above current ambient sound levels. Studies have shown that changes in noise levels of three decibels or less are not typically detectable by the average human ear. An increase of five decibels is generally readily noticeable by anyone, and a 10-decibel increase is usually felt to be "twice as loud" as before. A 20 to 25 dB increase is expected to be perceived as a vast increase in noise, although the "degree of increase" is not a factor that NZS6806:2010 takes into account when assessing the need for mitigation measures. As below, NZS6806 requires mitigation measures be investigated once certain stated threshold levels are predicted to be exceeded.

Traffic noise levels have been predicted using NZTA's traffic noise calculator[4]. The predictions are based on NZTA policy of assuming a 2 coat seal grade 3/5 road surface as a base case, with the summary data shown in **Figure 4** above used within the predictions. The predicted $L_{Aeq\ (24\ hr)}$ traffic noise levels versus distance from the road are shown in **Figure 5** as follows;

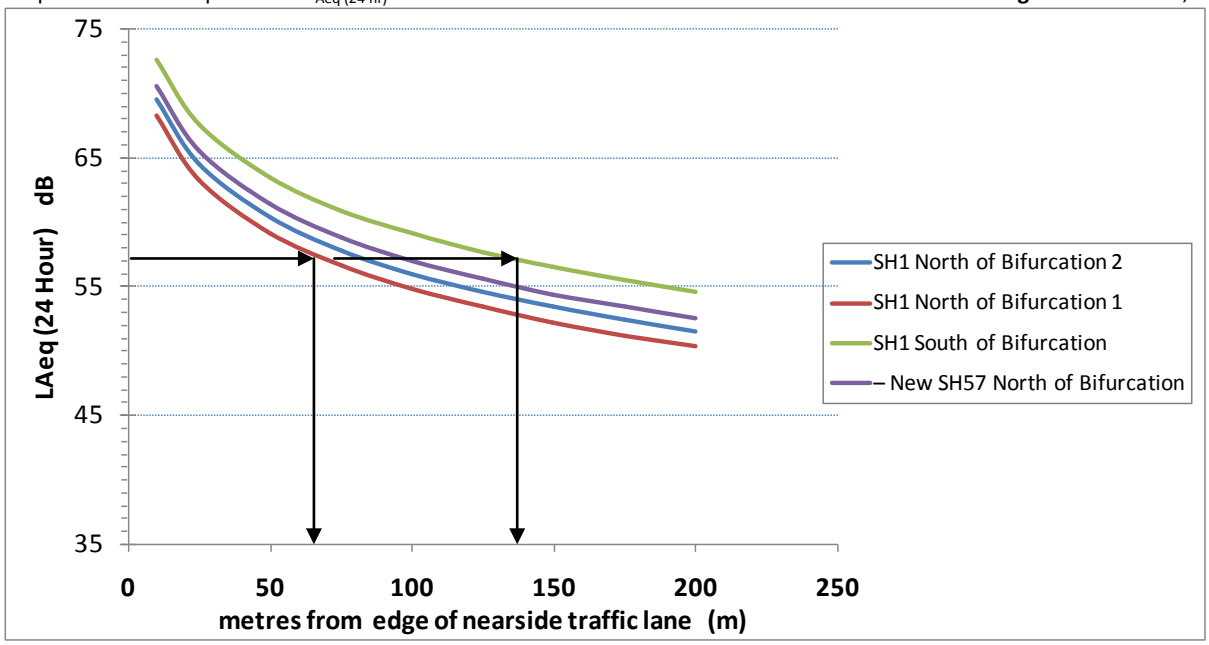


Figure 5: Predicted $L_{Aeq\ (24\ hr)}$ traffic noise levels for four elements of the proposed route. Arrows show the distance to "Category A" criteria of 57 dB lies between 60 metres to 140 metres from the edge of the nearside traffic lane.

Figure 5 indicates the "**Category A**" trigger level for requiring noise mitigation measures to be investigated [57 dB]will be received at PPFs located at as follows;

SH1 North of Bifurcation 2	60 metres
SH1 North of Bifurcation 1	78 metres
SH1 South of Bifurcation	140 metres
New SH57 North of Bifurcation	100 metres

Similarly, the same calculations indicate "**Category B**" trigger level for requiring noise mitigation measures to be investigated [64 dB]will be received at PPFs located at as follows;

SH1 North of Bifurcation 2	32 metres
SH1 North of Bifurcation 1	20 metres
SH1 South of Bifurcation	47 metres
New SH57 North of Bifurcation	35 metres

As above, at this stage there are no available data on the number of PPFs located within 200 metres of the proposed route alignment, nor the number of PPFs located within the above setback distances to the Category A and B criteria of NZS6806:2010. The above distances are a worst case. Where the new alignment passes through cuttings or where safety barriers are constructed at the edge of the road, the above generic distance / noise effect relationship will be significantly reduced.

It should be noted the above indicates noise effects will in fact be confined to a relatively narrow corridor. The distance / noise effect relationship means many built up areas such as Manakau will not be likely to receive significant noise from the proposed new route. In some cases, traffic remaining on the existing SH1 will provide a masking effect such that "new" noise may not be noticeable.

7.2 Limited Noise Mitigation for "Scattered" Dwellings in Rural Areas

Under NZS6806:2010 recommended procedures for assessing appropriate noise mitigation measures PPF assessment locations are grouped geographically into "clusters" which are defined as being where 2 or more PPF assessment locations are located within 100 metres of each other. This is to ensure only the most cost-effective mitigation options are considered. NZS6806:2010 clause 8.2.2 states that mitigation should only be implemented if the mitigation measures used would achieve the following:

[4] See https://acoustics.nzta.govt.nz/road-noise-calculator

[a] An average reduction of at least 3 dB $L_{Aeq\ (24\ hr)}$ at the relevant assessment positions of all PPFs that are part of a cluster;
[b] A minimum reduction of 5 dB $L_{Aeq\ (24\ hr)}$ at any assessment position[s] for each PPF that is not part of a cluster.

This has a significant effect on the application of traffic noise mitigation measures in rural areas where scattered dwellings are present but are located at distances usually greater than 100 metres of each other. Similarly, the above 5 dB threshold for mitigation effectiveness will limit the selection of available mitigation measures for many single PPFs such as is likely to be found within the above 200metre corridor adjacent to each side of the proposed route.

For isolated dwellings [not forming clusters] structural mitigation measures such as roadside barriers or quiet road surfaces are often not considered as structural mitigation measures where they fail to provide the required 5 dB of attenuation.

The BPO concept is used within the NZS6806:2010 to identify the most efficient noise mitigation option. The basis of the assessment are cost-benefit procedures set out in Appendix D NZS6806:2010 which provides a consistent basis for NZTA to calculate the costs and benefits of mitigation for various engineering designs for projects across New Zealand

Guidance on the costs of noise affecting dwellings for determining the benefits of noise mitigation is provided in the NZTA Economic evaluation manual [EEM] and NZS 6806. The monetised benefit of reducing road noise, per decibel, is valued at 1.2% of the market value of the national median house price. NZS6806:2010 states that the national value is to be used so that benefits of noise mitigation are calculated equally for all residences across New Zealand. Adopting a national median house price has a positive effect on valuing the benefits of noise mitigation measures for this project as the median house price in the Levin area is $165,000 [August 2015] which is well below the national median house price of $465,000 [August 2015][5] .

7.3 Where a New or Altered Road Reconnects With an Existing Road

For new or altered roads, noise from existing roads is ostensibly ignored under NZS6806:2010. Clause 6.2.2 of NZS6806:2010 states

> *6.2.2 Where PPFs are affected by noise from an existing road, mitigation is only required for road-traffic noise generated on the new or altered road.*

Section 6.2.1[c] of NZS 6806 states that for PPFs which are significantly affected by noise from another existing road in the vicinity, it may be appropriate to apply different criteria and this is not mandatory under the Standard. This is likely to be the case where the new route ties into the existing highway. Although a PPF may be affected by noise form an existing road altered in order to receive the tie-in of the new route, it may be more logical to apply the "new road" criteria to assess mitigation options, even though the noise is on the face of it arising from an "altered road" [which has much higher trigger for noise mitigation under NZS6806:2010 compared to the criteria for "new roads"].

8.0 Summary

A review of potential noise and vibration issues has been carried out for proposed improvements to the state highway between Manakau and Levin.

In line with NZTA policy, potential noise effects are recommended to be investigated using NZS6806:2010 *Acoustics – Noise From New or Altered Roads*. Generic noise level predictions are provided above based on information sourced from MWH traffic engineers on traffic flows, speeds and traffic parameters. The predictions indicate noise effects will in fact be confined to a relatively narrow corridor however the degree in "increase over existing" could be quite significant where the route passes through quiet rural areas.

The distance / noise effect relationship means many built up areas such as Manakau will not be likely to receive significant noise as the new route is proposed at a suitable separation distance [this ignores potential acoustic screening due to the route passing through cuttings or where roadside safety barriers are provided]. Several issues are discussed around the approach to procedures recommended within NZS6806:2010 for deciding upon the BPO for noise mitigation; however no specific areas of concern can be identified at this generic review stage.

The effects of construction noise and vibration are briefly discussed. While the methods and procedures of NZ NZS6803:1999 are recommended as the preferred means of measuring and assessing noise effects during the construction works, experience shows effective neighbourhood communications and management plans are just as important as physical mitigation measures.

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[5] See https://www.reinz.co.nz/reinz/public/reinz-statistics/reinz-statistics_home.cfm