Mt Messenger Bypass

VOLUME 4 - CONSIDERATION OF ALTERNATIVES

(VOLUME 4B - SHORTLIST REPORT)

DECEMBER 2017

NZ TRANSPORT AGENCY
WAKA KOTAHI

Mt Messenger Bypass

New Zealand Government

Mt Messenger Alliance

Te Ara o Te Ata

Mt Messenger bypass Project

Multi-criteria analysis: Shortlist report

August 2017

Peter Roan

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1 Introduction

The Mt Messenger bypass Project (the Project) is part of the State Highway 3 (SH3) improvements programme. The general project area is located adjacent to SH3 in the vicinity of Mt Messenger, in North Taranaki. Mt Messenger is located approximately 58km northeast of New Plymouth and 183km south of Hamilton. The existing 5.4km Mt Messenger section of SH3 rises to a height of 185m above sea level as it crosses Mt Messenger on a winding alignment which includes a short length of two-lane tunnel near the summit.

The New Zealand Transport Agency ('the Transport Agency') is progressing the project from statutory approvals through to construction, including consideration of alternative options for upgrading or bypassing the Mt Messenger section. This work is currently being undertaken by the Mt Messenger alliance.

Project Objectives approved by the Transport Agency in August 2016 are as follows:

1. To enhance safety of travel on State Highway 3.
2. To enhance resilience and journey time reliability of the state highway network.
3. To contribute to enhanced local and regional economic growth and productivity for people and freight by improving connectivity and reducing journey times between the Taranaki and Waikato Regions.
4. To manage the immediate and long term cultural, social, land use and other environmental effects of the Project by so far as practicable avoiding, remedying or mitigating any such effects through route and alignment selection, highway design and conditions.

The process of alternatives assessment has been led by Mr Peter Roan, who has been engaged by the Alliance as the Planning and Environmental Manager to lead planning and the options assessment process for the Mt Messenger project. As part of this role, Mr Roan has been responsible for designing and co-ordinating the process for the Multi Criteria Analysis (MCA) of the alternative corridor / route options for the project, and for providing an analysis of the results of the assessment of the options by the various subject-matter experts.

This report builds on the previous MCA applied to the longlisted options (see report entitled Multi-criteria analysis: Longlist report, MMA-PLA-OPT-RPT-308, August 2017 ('the longlist report'), and forms part of the assessment of alternatives undertaken for this project in relation to Section 171(1)(b) and Schedule 4 of the Resource Management Act 1991 (RMA). The report details the methodology for, and results of, the MCA applied to the shortlisted options which are as follows:

1. Option A
2. Option E
3. Option F
4. Option P
5. Option Z ('online' option).

2 Background

2.1 Previous options assessment work

Alternative routes were originally considered in 2002, and in 2016. Public consultation on three corridors occurred from November 2016 to January 2017, following a high-level Multi-Criteria Analysis (MCA) process in 2016 completed by others.

2.2 Longlist assessment of options

As set out in the longlist report, 24 new long-listed options were developed by the Mt Messenger Alliance in 2017 (11 offline and one online corridor, with an 'earthworks' and 'structures' option for each corridor), to a significantly greater level of detail than for the 2016 MCA. The options are shown on Figure 2.1 below.

These 24 options were assessed through an MCA process (referred to as 'MCA1' and set out in detail in the longlist report). Nine assessment criteria were used, covering key environmental and transport issues:

- Constructability
- Transport
- Resilience
- Landscape
- Historic Heritage
- Community
- Property
- Ecology
- Cultural Heritage

Technical experts assessed and scored the options against the nine criteria, including at a two-day MCA workshop. Ngāti Tama representatives attended and provided scores for the 'cultural heritage' criterion. The technical experts provided reports providing the detail of their assessments of, and scores for, each option.

After the MCA workshop, the scores were totalled for each option, and weightings applied as a sensitivity test in analysing option performance. The longlist report sets out the detailed results and scores received for each option. Figure 2.2 below shows the relative rankings of each option when the raw scores from the workshop are added, alongside the rankings when each of the three weightings used by the alternatives expert are applied. Figure 2.2 also notes the options that received one or more 'fatal flaw' scores in the longlist assessment.

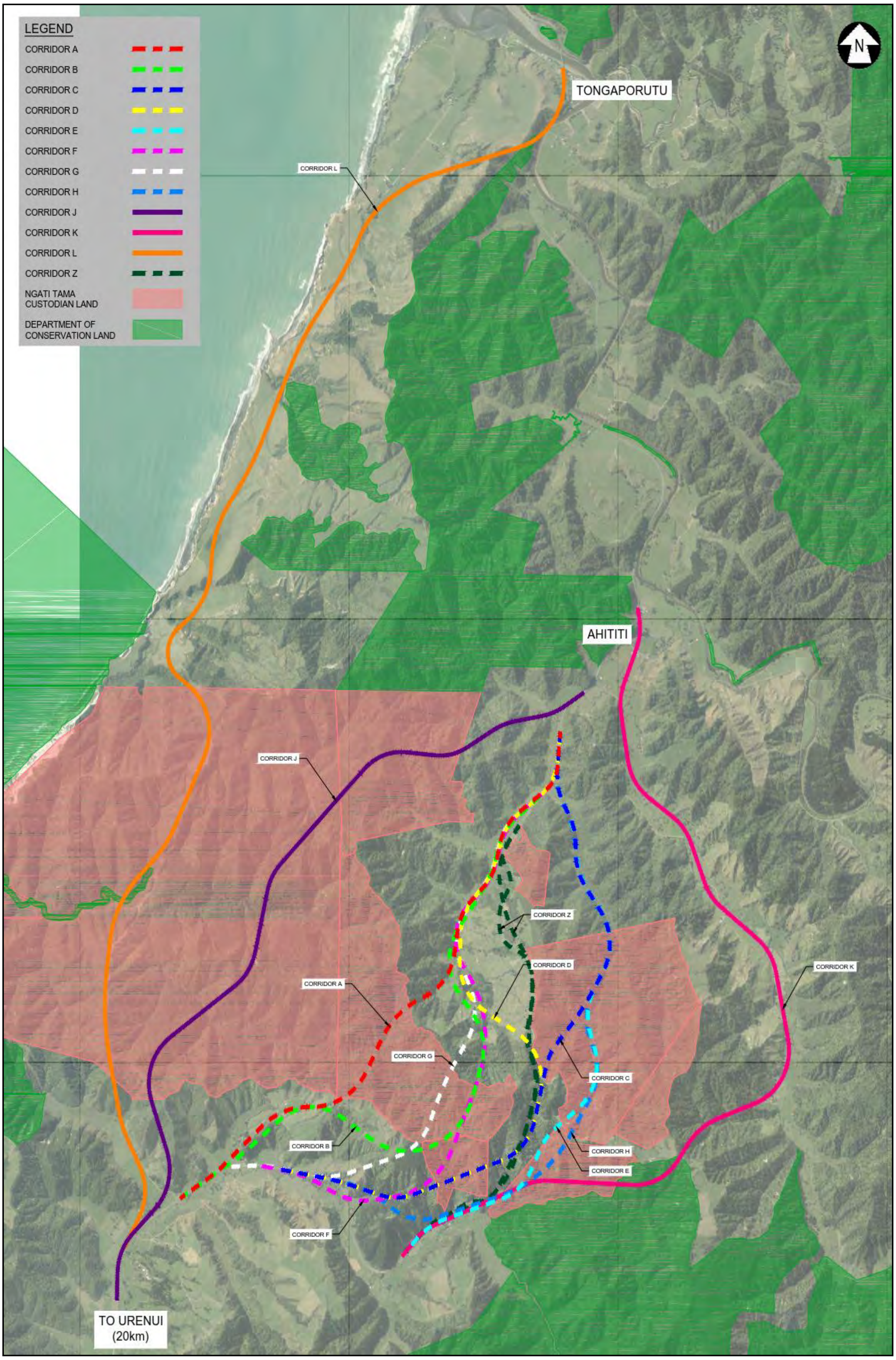

Figure 2.1: Map of longlist options considered at MCA1

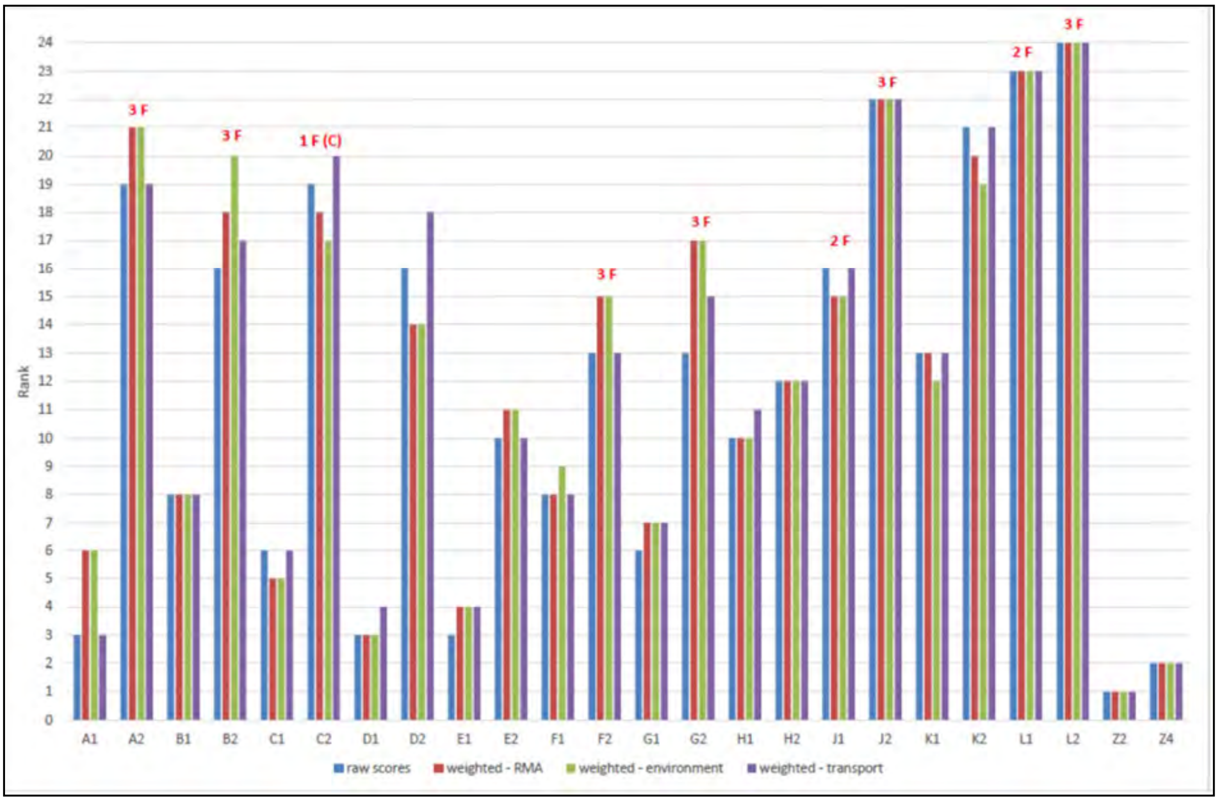

Figure 2.2: MCA1 ranking of the 24 options

2.3 Selecting and refining options for the shortlist

2.3.1 Selection of the shortlisted options

Following the MCA workshop process, a summary of the results were presented to the Mt Messenger Alliance Board, along with cost estimates for each of the longlisted options (noting that costs were not directly considered through the MCA1 process, but that these are provided in the longlist report).

The Alliance Board endorsed the following recommendation in respect of options to be included in a shortlist, for further consideration through a second MCA process ('MCA2'):

"Based on the outcome from the MCA1 process and affordability considerations, the options, or associated hybrids of these which optimise earthworks but minimise environmental impacts, recommended to be taken forward into the short list for further consideration are:

- *Option A1;*
- *Option E1 / E2;*
- *Option F1;*
- *A hybrid option, which focuses on a combination of the B, F and G corridors;*
- *On-line Option (taking in D1, D2, Z2 and Z4)."*

2.3.2 Refinement of the shortlisted options

During the period between the MCA1 and MCA2 workshop, design investigation and refinement / optimisation work continued in respect of the five of the shortlisted options. Various elements of the design were reviewed, including:

- Cross-section of the road cutting (with optimisations made to reduce the footprint of the road);
- Climbing lanes (on grades greater than 8%);
- Tunnels (kept to below 240m following guidance from tunnel specialists);
- Bridges (crossing sensitive receiving environments); and
- Design speed (a 100kmh design speed was retained).

The Transport Agency's National Design Engineer[1] was consulted with and informed of the process and level of detail being applied across the routes being considered for the MCA2 workshop.

2.4 Shortlisted options

During the period between the MCA1 and MCA2 workshop, design investigation and refinement / optimisation work continued in respect of the five of the shortlisted options. The five refined options assessed at the MCA2 workshop were:

- **Option A:** this option is a refined version of longlist Option A1 (which was one of the best performing offline options in MCA1). Between the MCA1 and MCA2 workshops, refinements to this option were carried out, including to take into account constructability (noting a significant area of instability was identified) and cost issues. The refined option involves a tunnel through the northern ridgeline of the Waipingao Valley and a very long, straight bridge (610 m) across the Valley itself, which responds to a landslide area identified in the southern part of the Valley. The northern end of Option A, through the farmland, has been shifted out of the valley floor to respond to geotechnical issues (landslide), with two bridges were added to cross small gullies.
- **Option E:** this option is a refined version of longlist Option E1 (which again was one of the best performing offline options in MCA1). Of particular note is that a bridge structure was added in response to comments from the ecologists, to minimise effects on the southern high-value wetland (the MCA1 option involved an earthworks embankment at this location). As signalled in the recommendation to the Alliance Board, some of the earthworks (fill) elements of E2 were incorporated in the shortlisted option (outside of the wetland area of significance identified through the MCA1 process). Option E follows SH3 at its southern end, running into tunnel east of the peak of Mt Messenger before traversing northwards along the Mangapepeke Valley. A series of bridges along the Valley were used to respond to geotechnical issues.

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[1] Mr James Hughes

- **Option F:** this option is a refined version of longlist Option F1 (which performed relatively well in MCA1). Between the MCA1 and MCA2 workshops, the design team carried out further refinements to this option. This is a relatively direct route at the southern end, involving a series of cuts rising from SH3 towards a short straight bridge over the Waipingao Valley. The southern tunnel portal is located approximately 240 m west of the peak of Mt Messenger. Option F follows a similar path to Option A north of the tunnel, running along the western side of the valley over two bridges before tying into SH3.
- **Option P:** this is the "hybrid option", focussing on "a combination of the B, F and G corridors". It is based primarily on the 'structures' (B1, F1 and G1) rather than 'fill' (B2, F2 and G2) versions of those corridors. These three options performed relatively well in the MCA1 assessment, and traverse similar routes. The indicative Option P alignment was established after a walk over of the potential route by a Ngāti Tama rūnanga member (Conrad O'Carroll), followed by an assessment from the Design team. While a similar alignment to Option F, it avoids the southern gulley with its technically challenging sidling fill or curved bridge, and hence was deemed worthy of further consideration.

  In addition, the Option P route avoids a stand of significant podocarps on the southern ridgeline. Option P involves a long cut to the south of the Waipingao Valley, and a slightly longer bridge than Option F over the Valley towards the southern tunnel portal, which is located approximately 480m from the peak of Mt Messenger.
- **Option Z:** this option is the 'online' option for the shortlist assessment. Option Z2, Z4, and the D corridor (primarily option D1, which was one of the best performing options in MCA1) are represented in the shortlist through this option. Work was carried out to develop this refined online option during the period between the MCA1 workshop and the MCA2 workshop. The online option was refined to be level with SH3 where it interacts with the existing route, including at the northern and southern portals of the tunnel.

The best eight performing options in the MCA1 process are all represented in the shortlisted options, whether through a refined version of the option being carried through to the shortlist, or through a hybrid shortlist option. The shortlisted options also provide for a geographic spread of the longlisted options, while omitting the far western (J, L) and far eastern (K) corridors which performed poorly in MCA1. Figure 2.3 below shows the five shortlisted options considered at MCA2. Table 2.1 sets out the option parameters, as provided to the specialists for MCA2. **Appendix A** sets out high level details of each shortlisted option (alongside the shortlist outcomes).

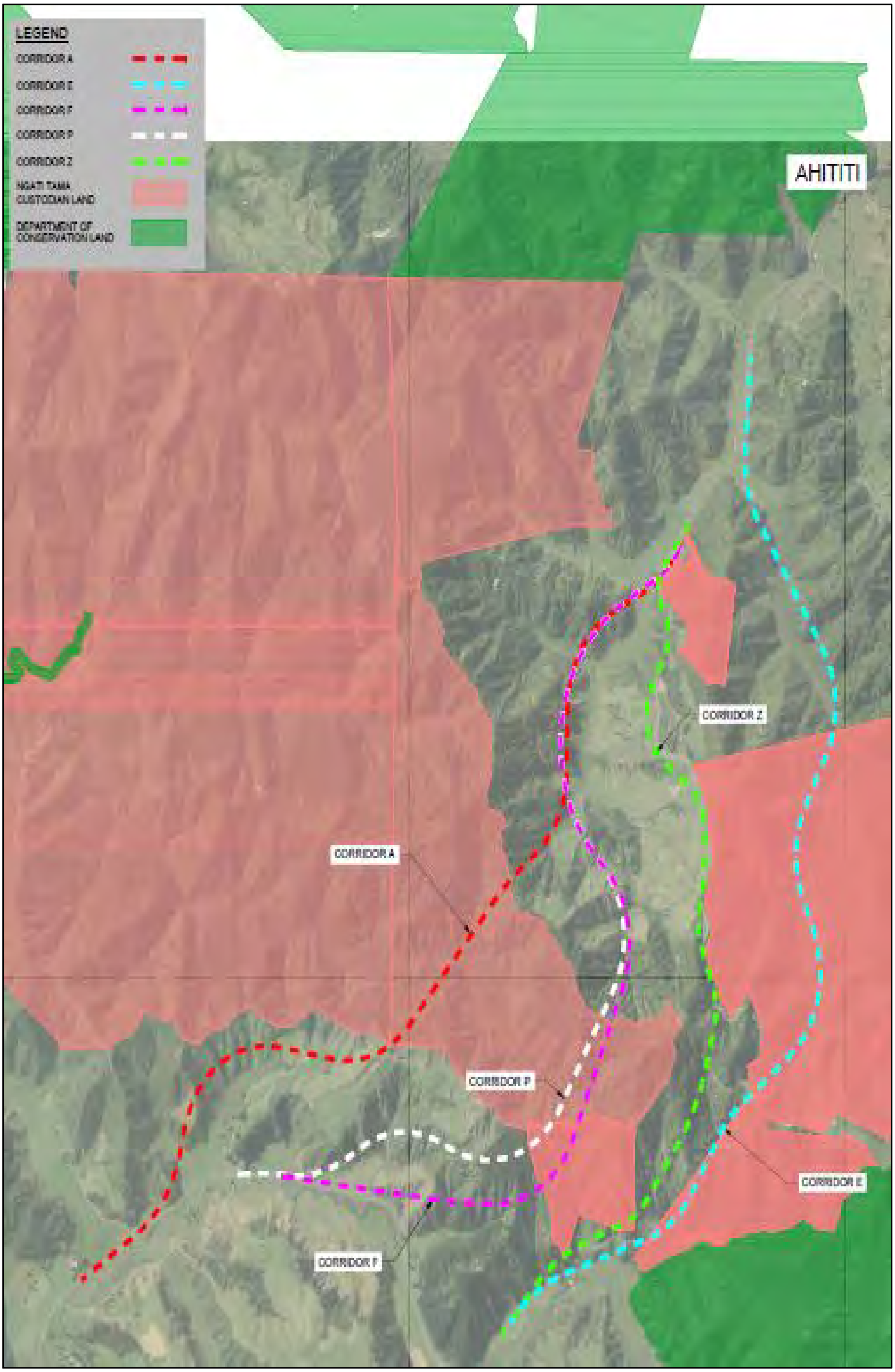

Figure 2.3: Map of shortlisted options considered at MCA2

Table 2.1: Option parameters

Option	Route length (km)[2]	Length [3] (km)	Area			Grades (max)		Total Earth Shifted (M m³)	Bridges (total)	Tunnel (m)[4]
			Plan area (ha)	Bulk Cut (ha)	Bulk Fill (ha)	Up	Down			
A	17.9	5.94	25.9	20.7	5.20	7%	-10%	1.78	3	235
E	20.4	5.25	29.7	21.0	8.7	8.5%	-8%	2.05	5	230
F	19	5.03	32.3	23.4	8.9	7.15%	-9%	2.32	3	250
P	18.8	4.77	32.5	23.8	8.7	7%	-10%	2.48	3	220
Z	20.2	4.23	17.8	13.0	4.8	8%	10%	0.80	3	240

[2] From Tongapurutu to Uruti (existing route length 21.4km)

[3] Length of road to be constructed, measured from where it would join existing SH3 to the north and south

[4] All options have one tunnel

3 Multi-criteria analysis methodology

3.1 Outline of methodology

The shortlisted options were examined on a similar basis to the longlist MCA1 process (set out in detail in the longlist report), as follows:

- **Development of assessment criteria**: Assessment criteria were developed during the longlist by the Alliance's Lead Planner Mr Roan, (with input as appropriate from project team members and subject matter experts). The same overall criteria were used for MCA2, except that , the ecology criteria was split into two components: water environment and terrestrial ecology (see Section 3.2 below for further detail)
- **Specialist briefing:** Relevant specialists were provided with an information pack outlining the five routes, along with an outline of the scoring methodology and expectations / assumptions (briefing material attached in **Appendix B**).
- **Assessment of short-listed routes against criteria:** Specialists assessed each route against the criteria relevant to their area of expertise, provided an overall score and recorded reasons for the given score.
- **Workshop**: Scores were presented and critically examined at a two-day workshop. Experts were given the opportunity to amend their scores in light of the discussion at the workshop, if they felt that was appropriate. The design team also attended the workshop, and provided detailed run-through of each option via the 3D digital terrain model. This provided an opportunity for clarification / confirmation of the nature of all the options for the experts in assigning their final scores.
- **Analysis:** additional expert planning analysis was applied to the final scoring, including weighting/sensitivity analysis.
- **Presentation of MCA results:** The results of the MCA were provided to the project team, to assist in reporting to the Alliance and Transport Agency and in the ultimate selection of a preferred option.

3.2 Assessment criteria

Nine assessment criteria were developed for the longlist, with reference to key matters for consideration under the RMA and other relevant statutory documents (key matters include Part 2 of the RMA and the policy framework established through the Regional Policy Statement, and Regional and District Plans), and the four project objectives. Options were scored for criteria which included: constructability, transport, resilience, landscape and natural character, historic heritage, community, property acquisition, cultural and ecology. These were reviewed prior to the MCA2 workshop and were generally considered to be appropriate for the MCA2 process for this project.

The one exception was in relation to the ecological criteria. In previous MCA 1 workshop the scores relating to terrestrial ecology and aquatic ecology/water quality were combined into a single score for 'Ecology'. However, the MCA 1 process highlighted that different routes tended to have different levels of impacts on the terrestrial and water environment. In addition, more information was available on effects on the water environment, including specialist erosion and sediment control inputs. Thus, in assessing the short list of five route options for the MCA 2 workshop, terrestrial ecology and the water environment were scored as separate criteria.

There was also a change made to the 'community' criterion, to provide for the further input of subject-matter experts. For the MCA2 process, the community criterion included three sub-criteria: recreation, social and noise / vibration. Sub-criteria scores were provided by experts in each of those separate subject matters, with an overall community criterion score then agreed between those experts.

In addition, some specialists considered that additional or amended sub-criteria were warranted. The reasons for these additional sub-criteria are set out in the specialist reports attached in **Appendix C-L**. Overall, these additional sub-criteria have assisted in highlighting nuances in the different route options based on the further detail provided on the refined shortlisted route options.

3.2.1 Assessment criteria not included

As set out in the longlist report, a number of other potential criteria were considered, but not included in the list of criteria for the MCA1 assessment. These were reviewed again for the MCA2 assessment. Apart from the additional water environment as detailed above, no additional criteria were considered to warrant inclusion into the MCA2 process, for the same reasons as set out in the longlist report. Potential social / community type criteria, including recreation, social effects, and noise, were captured within the overall 'community' criterion.

3.3 Scoring methodology

For consistency, the same scoring methodology used in the longlist was employed during the shortlist as follows:

- Scores are based on the level of effects (adverse or positive) of each option for each specialist criteria.
- All options were scored on the 9-point (plus "fatal flaw") scale set out in Table 3.1 below, along with reasons for the given score. This scoring scale has been adopted partly in order to provide for differentiation between options. However, scoring was to be carried out on an absolute rather than relative basis. In other words, artificial distinctions in scores between options were not intended, and specialists were instructed to score each option by applying their expertise and against the description of the scores provided below.
- The baseline for scoring was the continued operation of the existing road, with none of the options being constructed. This baseline meant that, for a number of criteria, it was unlikely that positive scores would be assigned for any of the options.
- The scoring scale provides for a "fatal flaw" negative score. This score is intended to be used only where the expert considers that there are unacceptable adverse effects associated with the option, and that there is no reasonable way to appropriately avoid,

remedy or mitigate (including through offsetting) those effects.[5] All fatally flawed options were discarded at the longlist stage and this approach has also been retained through to the shortlist analysis for consistency, and in light of the fact that the shortlisted options were refined options (not identical to the options that has been assessed at MCA1).

- One score was provided for every criterion (or sub-criterion if these have been developed). Where experts employed sub-criteria, they were instructed to arrive at one overall score for their criterion. Those experts were instructed to apply their expertise as to how best to combine sub-criteria scores into an overall score (whether by simply averaging sub-criteria scores, applying weighting, or coming to an overall judgment taking into account the sub-criteria scores).
- The final score for each option assumes what the expert considers to be standard/expected mitigation (e.g. mitigation in accordance with Transport Agency or Council guidelines/technical papers). Bespoke mitigation and offsetting was not be considered in the final score, although experts were encouraged to record the potential for further mitigation / offsetting of identified effects where relevant. The exception in respect of mitigation is the "fatal flaw" score. Before assigning an "F" score, experts were to use their expertise to think about whether it would be possible, in the context of a resource consent application, to propose a solution that would address that effect. That includes reasonably available offsetting.
- In a situation where a number of options received the same score, experts were encouraged to provide additional information as to the relative merits of those options that received the same score.

During the MCA2 workshop process, it became clear that common assumptions in respect of the post-construction role of the current SH3 route and adjacent walkways was required, including to ensure consistency between the property and the community assessment.[6] In this regard, experts were directed to assume that:

- The existing SH3 (ie that portion of the route being replaced by the Project) will not be maintained as road, but that certain levels of access to existing properties will be retained (as detailed in the property MCA2 report)
- Cycling will be provided via the new route
- Where the new road severs an existing public walking track, a new connection (or direction) will be provided.

[5] The "F" score can helpfully be viewed as a proxy for determining the option is "unconsentable" in respect of the relevant criterion.

[6] A decisions on these matters will ultimately be made at some point in the future as part of the wider Project, however, for the purpose of MCA2, these assumptions were considered reasonable, and provide a basis for ensuring consistency at the MCA2 stage.

Table 3.1: Scoring scale

Scoring	Level of effect
F	Fatally flawed - unacceptable adverse effects, that cannot reasonably be appropriately avoided, remedied or mitigated (including via offsetting).
-4	Very high / very significant adverse effects
-3	High / significant adverse effects
-2	Moderate / medium adverse effects
-1	Low / minor adverse effects
0	Neutral / no change
1	Low / minor positive effects
2	Moderate / medium positive effects
3	High / significant positive effects
4	Very high / very significant positive effects

3.4 Weighting

As set out in the longlist report, the three weightings applied were:

- An overall weighting (also referred to in the documents as the 'RMA' weighting). This was developed from analysis of the RMA and statutory documents and an eye to the RMA consenting process and the weight likely to be given to relevant statutory provisions. This weighting took particular account of the key matters reflected in the provisions of Part 2 of the RMA, and also took into account the project objectives.
- An 'environmental' sensitivity analysis weighting, which prioritised those criteria that relate most directly to effects on the natural environment, including as represented in effects on cultural heritage values.
- A 'transport' sensitivity analysis weighting, which prioritised those criteria that relate most directly to the transport performance of the route.

As with scoring, the same weightings used in MCA1 were also used in MCA2, for consistency of approach. The intention of the weightings was to apply three varying, but realistic perspectives to the relative importance of the various criteria. The intention was not to place artificially high or low weights on particular criteria, simply in order to arrive at different overall scores compared to the raw scores.

4 MCA workshop and results

The shortlist MCA2 workshop was held on 26-27 June. It was attended by the experts responsible for carrying out the assessments and providing the scores for each criterion, and members of the project team (including designers). The discussion at the workshop was facilitated by Peter Roan.

Specialist input into the MCA2 workshop included attendance from experts in the following areas:

- Roading design
- Geometrics
- Construction
- Geotechnical
- Drainage
- Transport/traffic
- Property
- Landscape
- Archaeology
- Economics
- Recreation
- Social impact
- Noise and vibration
- Constructions water management (erosion and sediment control)
- Freshwater ecology
- Terrestrial ecology (vegetation and fauna)
- Ecological mitigation
- Planning

Ngāti Tama representatives attended the workshop and provided scores for the 'cultural heritage' criterion. Ngāti Tama also provided valuable local insight into the area, along with a first-hand account of the recent release of kōkako into the Waipingao Valley.

Representatives from the Department of Conservation (DoC)[7] and the Transport Agency's National Design Engineer[8] attended the MCA2 workshop as observers.

As per MCA1, the first part of the workshop was a detailed fly-through of each of the five options via the 3D digital terrain model by the project designers. The experts and project team were able to pose questions in respect of each option, to clarify or confirm the assessments they had carried out. The expert responsible for each criterion then presented to the group – explaining the basis of their assessment (including sub-criteria where

[7] Mr Gareth Hopkins and Mr Rhys Burns

[8] Mr James Hughes

relevant), key general themes, and the overall scores they had assigned. Other participants were able to pose questions to those experts. Where appropriate, in light of the discussion the relevant criterion expert was entitled to alter the scores they had initially assigned.

Appendix B contains the summary of each of the five shortlisted options, including a brief description of the corridor, key scoring considerations, and weighted scores for each of the criteria. Detailed descriptions of the methodology and reasoning for scoring of each criteria are contained in the specialist reports attached as **Appendices C - L**.[9] The overall option scoring spreadsheet is attached as **Appendix M**.

4.1 Raw scores

Results from the shortlist MCA2 workshop are presented in:

- Table 4.1which provides the full set of raw scores for each option (with the sum total also provided) and
- Figure 4.1 below presents comparative rankings for raw scores for each option, based on the sum total of all the raw scores for each option.

No options were given a 'fatal flaw' score by any disciplines during the shortlist process.

Table 4.1: MCA2 Raw scores

Criteria	Option A	Option E	Option F	Option P	Option Z
Constructability	-4	-3	-2	-2	-4
Transport	3	2	2	2	2
Resilience	-3	1	2	2	1
Landscape	-3	-1	-4	-3	-1
Historic heritage	-2	-1	-1	-1	-1
Community	1	1	1	1	0
Property	-3	-3	-3	-3	-2
Terrestrial ecology	-3	-3	-4	-3	-3
Water environment	-3	-3	-3	-3	-2
Cultural heritage	-4	-4	-4	-4	-4
Total Raw Score	**-21**	**-14**	**-16**	**-14**	**-14**
Raw Score Rank	**5**	**1**	**4**	**1**	**1**

[9] While **Appendix B** provides a useful summary, the expert reports in **Appendices C to M** provide the full assessment of the options and should be referred to if any clarification is necessary.

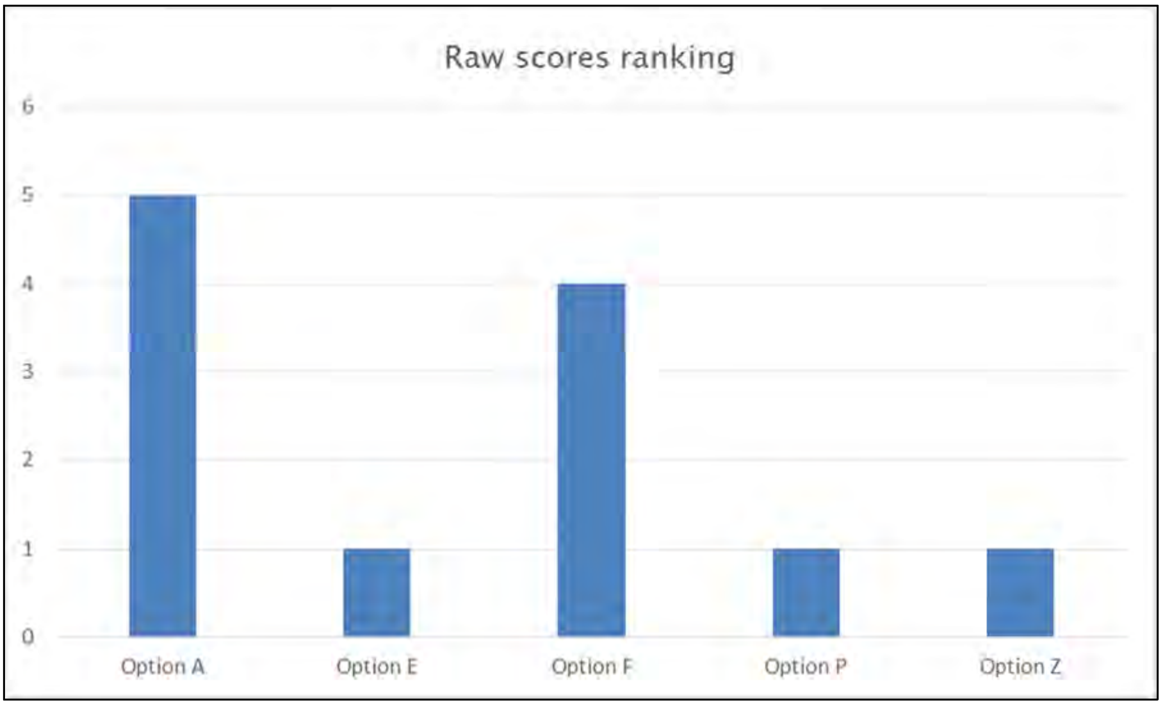

Figure 4.1: Ranking of shortlisted options based on raw scores

4.2 Weighted scores

As explained above, three different weightings were applied to the raw scores. Figure 4.2, Figure 4.3 and Figure 4.4, and Table 4.2 below, show the relative rankings of each option when the raw scores from the workshop are applied, alongside the rankings when each of the three weightings are applied (the spreadsheet in **Appendix M** contains the actual scores for each option, including the scores as adjusted with the various weightings applied).

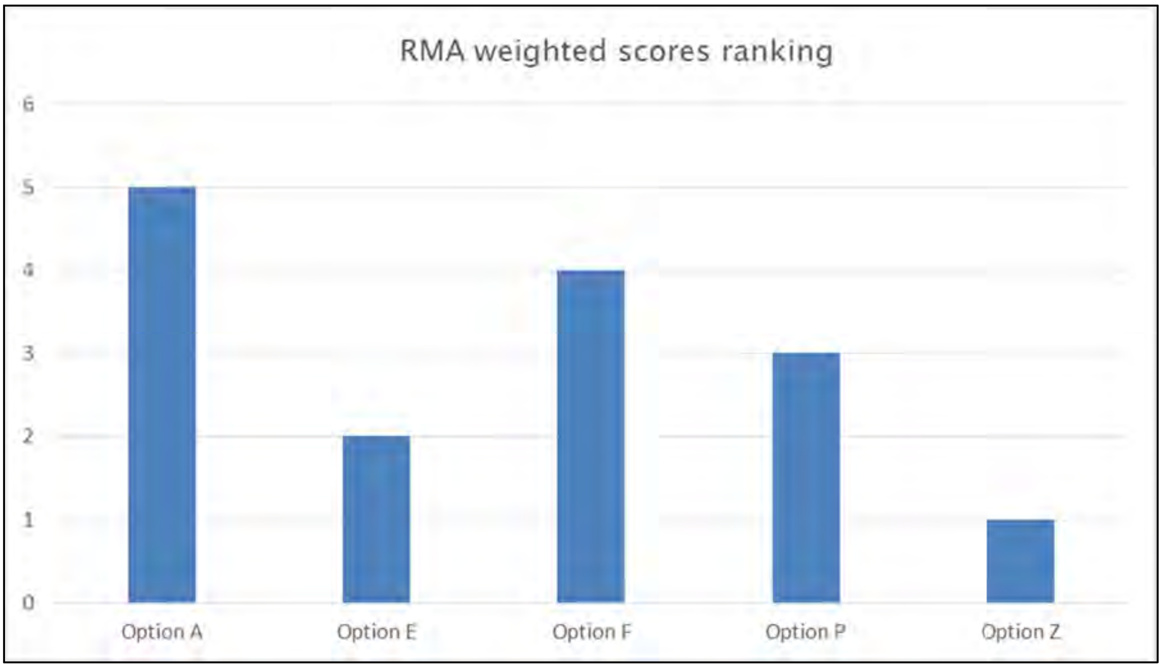

Figure 4.2: Ranking of shortlisted options based on RMA/overall weighting

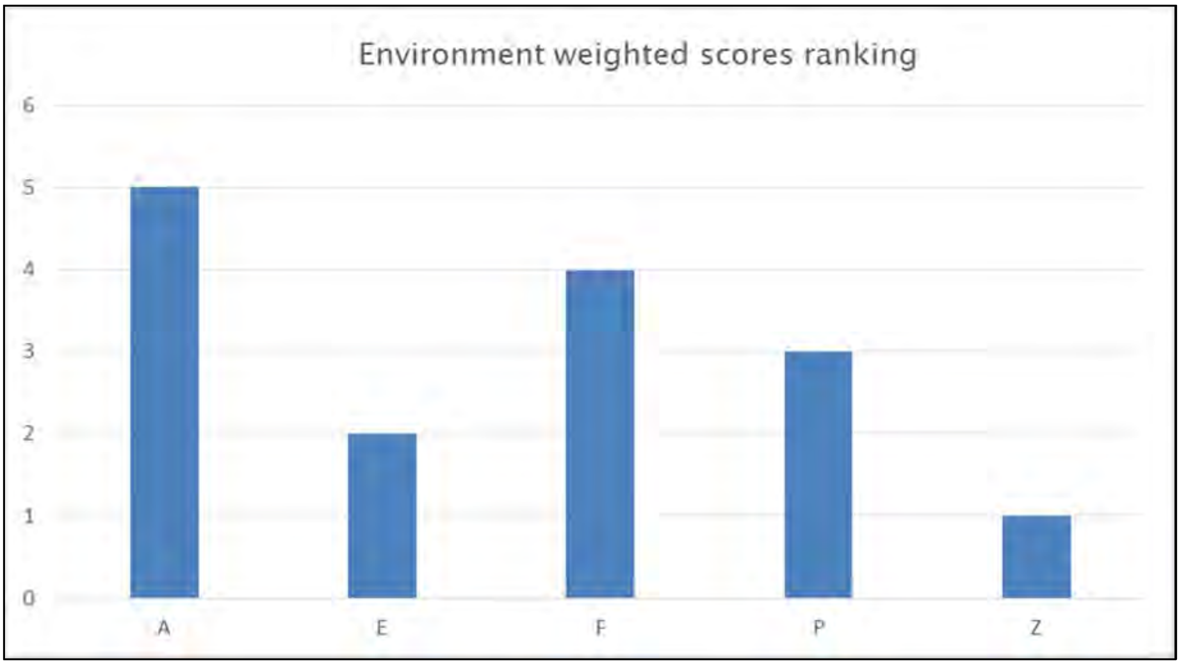

Figure 4.3: Ranking of shortlisted options based on environmental sensitivity analysis weighting

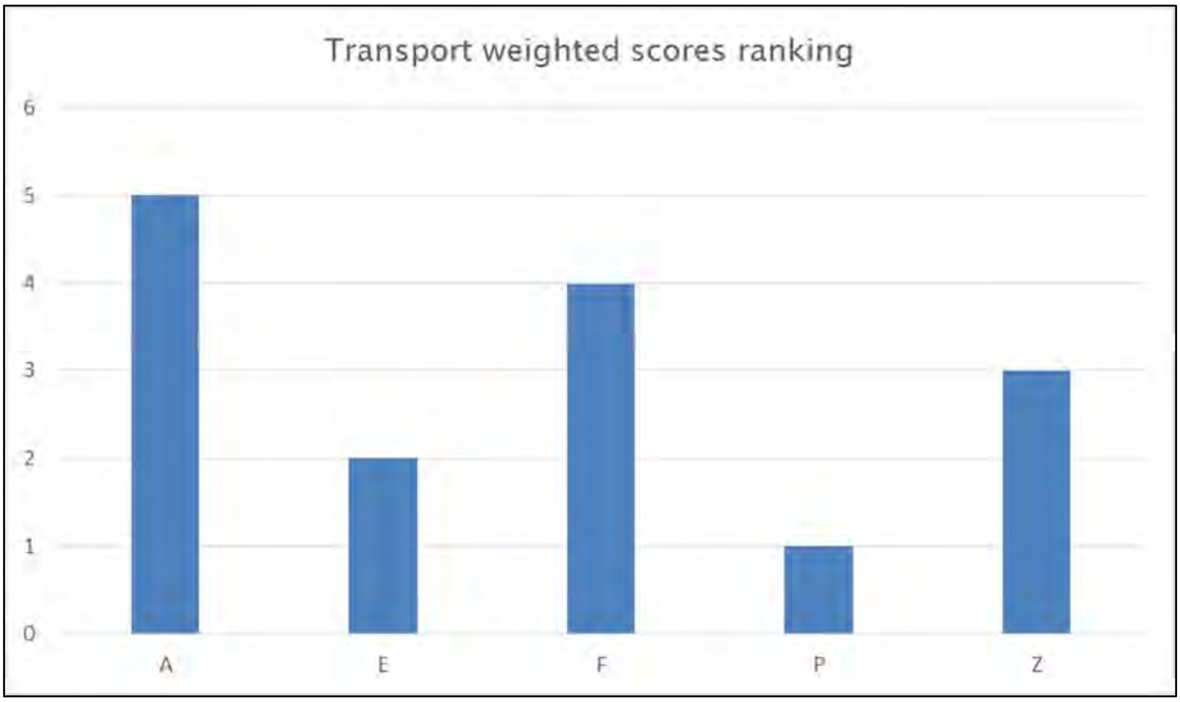

Figure 4.4: Ranking of shortlisted options based on transport sensitivity analysis weighting

Table 4.2: Relative rankings of each option

Option	Option Rank: Raw score	Option Rank: Overall RMA Weighting	Option Rank: Environmental sensitivity analysis weighting	Option Rank: Transport sensitivity analysis weighting
A	5	5	5	5
E	1=	2	2	2
F	4	4	4	4
P	1=	3	3	1
Z	1=	1	1	3

4.3 Scoring analysis

4.3.1 Overall scoring

Based on the scores and ranking (both for raw scores and the weighted scores) set out in Section 4.1and 4.2 above:

- Option A consistently scores the worst out of all the options, and has a significantly lower raw score compared to other options (Option A scores -21 in total compared to Option F on -16 and Options E, P and Z on -14). Weighting does not bring the score for Option A significantly closer to the other options.
- However, scoring for the other options is relatively close. While there were subtleties between each option (explored in the specialist reports attached as **Appendix C-M**), many of the overall scores were similar. Of note:
  - Transport benefits were scored +2 for all options except Option A (which scored +3).
  - Historic heritage generally scored -1 (low risk of archaeological finds) apart from Option A which scored -2.
  - From a community perspective, most options had a minor positive effect apart from Option Z which had an overall neutral effect taking into account the impact of construction on traffic delays for freight, hospital and emergency traffic.
  - Property impact was scored -3 for all options except for Option Z, which affects Ngāti Tama land at the northern end but is otherwise largely contained within the existing designation area.
  - Terrestrial ecology scored all options -3 (high adverse effects), with the exception of Option F which scored -4 due to the impact of this option on an area of significant vegetation (which the nearby Option P avoids).
  - In relation to the water environment, Option E is the worst option from a freshwater ecology perspective due to the length of streams affected by this

option. However, taking erosion and sediment control into account, all options were scored -3 with the exception of Option Z which scored -2 due to the lower impact that the online option has on freshwater ecology.
    - For Ngāti Tama (the cultural heritage criterion), all options have significant adverse effects in some way, and therefore all options scored -4.
- The constructability scoring ranged from -2 (Option F and Option P) to -4 (Option A and Option Z). Option E scored -3. None of the options will be easy to construct. However, there are particular challenges around Option A due to the long bridge proposed to address the landslide area in the Waipingao Valley, and Option Z due to the interaction with existing SH3.
- Most options scored either a 1 or 2 for resilience ie most options would be an improvement in resilience when compared to the existing road. The exception is Option A (-3), which the expert considered would reduce the level of resilience on this part of SH3.
- Landscape scoring varied from -1 (Option E and Option Z), -3 (Option P and Option A) and -4 (Option F). Option E and Option Z would be located within already modified landscapes, with standard mitigation accounting for the low level of adverse effects. On the other hand, the options located in the Waipingao Valley have a high level of adverse effects due to the relatively pristine nature of the area. Option F is has particularly high adverse effects due to the fill on the southern hill slopes (of high natural landscape value), in combination with a large cut in the southern Waipingao ridge.

4.3.2 Option A

As set out above, Option A is consistently the lowest ranked option, both for weighted and raw scores. This option was one of the leading options coming out of MCA1, with a raw ranking of 3 (behind the two online options) and weighted rank of 6 (RMA and environmental weightings) and 3 (transport weighting). Option A still has the highest Transport benefit due to the direct route.

However, Option A scored poorly at MCA2 for most other criteria. Landscape, Resilience, Property and Ecology experts scored this option a -3 (High Adverse Effects). It would be located furthest into the Waipingao Valley and the coastal to highland vegetation progression, so scored poorly from an ecological and cultural perspective. It is the closest to the release site for kōkako, which was a consideration for cultural scoring. The route would be located in a regionally significant landscape area, and disrupts the southern ridgeline landscape feature. This option was the worst of the options for Historic Heritage, noting the recorded archaeology (Maukuku Pa) and other observations in the general vicinity of southern end are indicative of some archaeological potential, and potential also at the northern end which would have been relatively easy access from Tongaporutu in pre-European times and where there are numerous recorded archaeological sites (-2).

In addition, Option A scored poorly for Resilience (-3) and Constructability (-4). This is due to a newly identified significant landslide area on the southern side of the Waipingao Valley, leading to a 600m long bridge and high likelihood of further geotechnical mitigation works required at the southern abutment. The long bridge with the southern abutment adjacent to landslide would be challenging to construct. Through design refinements prior to the MCA2 workshop, the resilience of this option was improved by shifting the northern end out of the valley floor. However, as a result of the risk of landslide at the southern abutment of the long bridge, the Resilience score for Option A was significantly lower than for any other option[10].

4.3.3 Option E

Option E ranks first equal with Options P and Z based on the raw scores, and consistently ranks second across all weighted scoring. This is the easternmost option, and therefore avoids the key landscape, ecological and cultural features in the Waipingao Valley and Mt Messenger. The refinements through the MCA2 design process mean that this option avoided the high value swamp forest (the wetland at the southern end), including a new bridge to reduce terrestrial ecological effects. However, from a water environment perspective, this scores poorly (-3) due to the length of streams affected particularly by the northern component of this option. From a landscape perspective, the location of the road within the already modified area around SH3 and the farmed Mangapepeke is positive (this options scored a -1 for landscape ie low adverse effects taking into account standard mitigation options). The MCA2 process also identified high potential for improvement of the surrounding environment given its degraded state in areas, particularly in the Mangapepeke Valley where there is potential opportunity to revegetate, manage pests and connect Ngāti Tama land.

From a constructability perspective, this option scores reasonably poorly due to its length, bridges in Mangapepeke Valley, and difficulties in accessing works up the Valley. However, there are opportunities for improvement, including access to the top of the Mangapepeke Valley to improve constructability and programme, or replacement of bridges with fill (noting these would need to be located outside the significant wetland area). This option scored a 1 for resilience as it avoids the landslide, and the bridges across the valley floor reduce liquefaction risk; however, it would require a number of culverts serving large catchments. In terms of transport, Option E would have moderate beneficial overall effects (2), with particular benefits associated with operational resilience (sub-criteria score 3) and travel time/efficiency (sub-criteria score 4).

From a property perspective, this option requires the largest area of Ngāti Tama land, along with a significant impact on one private property on the northern part of the route. The impact on Ngāti Tama land was taken into account in the cultural heritage scoring, although the option is also located furthest away from the Mt Messenger, the western Parininihi land and the kōkako release site. The option has a more limited effect on recreation land than those to the west.

[10] All other options considered an improvement on the current situation (rather than a decline

4.3.4 Option F

Option F is ranks consistently 4th in both raw and weighted scores. The overall scores for Option F are relatively close to Options Z, E and P; and clearly better than Option A.

It has a very similar alignment to Option P, with the exception that F has a large sidling fill in the southern valley above the existing SH3. The fill area in the valley and adjacent land in the Waipingao affects substantially more significant trees than Option P. Overall, Terrestrial Ecology and Landscape scores are the worst of any options (-4) and these drive the overall scoring for this option (in terms of Option F ultimately receiving a worse overall score than Options Z, E and P). Culturally, the corridor is also located relatively close to the summit of Mt Messenger traverses the western Parininihi land.

From a constructability perspective, there are some difficulties in series of cuts to the south, and borrow and disposal required to address cut/fill imbalance however, overall this was scored best (-1) out of the five options alongside Option P. A smaller bridge across Waipingao meant it scored slightly better than other options on water environment (erosion and sediment control and freshwater ecology). Resilience scored relatively well, with the bridges replacing fill on liquefiable ground to the north in the refined shortlist option, and lower fill embankments. Similarly, this option scored reasonably well for the Transport criterion due to the relatively direct route which improves travel time and safety.

4.3.5 Option P

Option P follows a similar alignment to Option F, and scores similarly for most criteria. The exception is the Terrestrial Ecology and Landscape scores, as Option P avoids an area in the Waipingao Valley affected by Option F, which contains a large number of significant trees (Option P scores -3 for these criteria). Option P is the highest ranked option when transport weighting is applied, and the third ranked option with RMA and environmental weighting applied, noting that despite the avoidance of a particular area of significant trees, there are still ecological and landscape effects associated with its location in the Waipingao Valley and associated effects on adjoining ridgelines.

4.3.6 Option Z

Option Z is the online option. Design improvements have been made to this option since MCA1, particularly around interactions with the existing SH3. However, this option would still present significant construction issues given the interactions with the existing road (including likely road closures), which has implications both for constructability and for the community score (social impacts of closing SH3 to freight, hospital and emergency traffic).

The northern end runs immediately east of the large landslide which would require lengthy and costly ground improvements. The high steep rock cuts and location at the landslide headscarp were key issues in the resilience scoring. Overall, this option scored a +1 for resilience (ie it would be a minor improvement on the existing route once constructed). Similarly, while there are likely to be significant delays experienced during construction, once built the route would be an improvement over the existing SH3 and therefore this option scored a 2 for the Transport criteria.

Due to the location on or adjacent to the existing route, the online option scores relatively favourably from a landscape and water environment perspective. There would still be high (-3) adverse effects on Terrestrial Ecology due to the presence of high value vegetation at the southern end of this option. In terms of cultural heritage, this option is located away from the Waipingao Valley and kōkako release area, however the tunnel runs close to Mt Messenger and Ngāti Tama indicated at the MCA2 workshop that they considered this to be close to a fatal flaw for this option (overall it was scored a -4).

4.3.7 Statutory planning analysis

A desirable outcome of the options assessment process is to establish an overall sense for the RMA consentability of options. During the shortlist options assessment process, a measure of consenting risk is gained from scores / rankings after application of the overall RMA weighting.

Additionally, and in order to further consider consentability, an overall planning assessment of the shortlisted options has been completed in relation to the relevant District and Regional Plan documents. This analysis took place after the MCA2 workshop (and was not an MCA2 criterion) and did not alter the MCA2 results or the scores assigned, however, the planning analysis has been informed by the assessments made by experts. It establishes, however, an additional layer of information that was considered of value to the Transport Agency in identifying a preferred option.

Appendix N summarises the indicative level of consenting risk / challenge for all options when considered against key relevant matters from the policy framework established by the planning documents[11]. The focus has been on the key provisions which, in light of the nature of the Project, and the relevant plans, are considered to present the most significant potential challenges for the Project in the consenting stage.

The draft New Plymouth District Plan was also included in this analysis. At this stage, the draft Plan has no statutory weight. However, there is a strong prospect that the draft District Plan will be notified (and become a proposed District Plan) during the consenting process – at which stage it will have at least some weight.

Overall, the analysis indicates that the highlighted policy provisions place particular emphasis on landscape, natural character and biodiversity values. In this regard, Options associated with the western Parininihi land (Options A, F and P) perform poorly. Options E and Z perform poorly in terms of the policy provisions relating to biodiversity values. However, Options E and Z traverse land with lower landscape and natural character values and hence perform better against these provisions. Overall, Options E and Z perform better than Options A, F and P in relation to the highlighted policy provisions. In this regard, Option Z is located largely within the existing Transport Agency designation for SH3 which could make consenting of this option more straightforward.

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[11] The provisions highlighted in **Appendix N**, and the assessments made, are based on the expert planning judgment of Mr Roan, in light of his knowledge of the Project.

4.3.8 Cost

The Alliance has prepared cost estimates in line with the Transport Agency's Cost estimation manual[12]. Each option has been established on similar principles to ensure costings may be easily compared from one route to another. Costs were not presented during the MCA2 workshop so as not to influence the discussions.

The estimated costs for each option are set out in Figure 4.5 below.[13] Option Z is significantly more expensive than the other options based on the design presented at the MCA2 workshop, with Option A being the second most expensive option.

Figure 4.5: Cost estimate for MCA2 shortlisted options

[12] NZ Transport Agency's *Cost estimation manual* (SM014), First edition, Amendment 0, Effective from November 2010

[13] In accordance with SM014 a range of potential costs for each option has been estimated. Figure 4.6 also presents the calculated funding risk.

5 Conclusion and recommendations

The main purpose of the shortlist MCA process, and of this summary report, is to provide the NZ Transport Agency with information as to the likely RMA effects, and subsequently performance in a consenting process, of each of the five shortlisted options. The results of the MCA are intended to play an important part in the Transport Agency's decision when selecting a preferred option.

With that in mind, the relative performance of the shortlist options in the MCA2 process is summarised,[14] noting that these comments do not take into account cost (while indicative costs have been presented for information purposes, any such consideration is for the project team and the Transport Agency):

- **Option A** has the worst overall score. While the Option has the highest Transport benefit, due to the direct route, it scored poorly for most other criteria. Landscape, Resilience, Property and Ecology scored this option a -3 (High Adverse Effects). It was the worst of the options for Historic Heritage (-2), Resilience (-3) and Constructability (-4 – very high adverse effects).

  Of particular note, the low Resilience and Constructability scores are due to significant landslide areas on the southern side of the Waipingao Valley, leading to a 600m long bridge and high likelihood of further geotechnical mitigation works required at the southern abutment. Resilience is a key consideration in the Project Objectives and the Resilience score for A was significantly lower than for any other Option.

  As set out in Appendix N, the level of consenting risk for Option A could be reasonably high. Based on the advice provided during MCA2, effects on landscape and indigenous biodiversity could be such that consistency with policies in the relevant statutory documents could be difficult to achieve, particularly in relation to the provisions on Outstanding Natural Landscapes (it is assumed Parininihi will be included in this overlay) and indigenous biodiversity. Taking all these matters into consideration, it is recommended that Option A is not taken forward as a recommended option.
- **Option F** has the second worst score. As shown on the route map (Figure 2.3), it has a very similar alignment to Option P, with the notable exception that F has a large sidling fill in the southern valley above the existing State Highway 3 (SH3). The fill area in the valley and adjacent land in the Waipingao has substantially more significant trees than Option P. It follows that Terrestrial Ecology and Landscape scores for this route are the lowest of any routes. Given that Option F is similar to Option P but scores worse for Terrestrial Ecology and Landscape (both weighted highly due to their RMA and environmental significance), it is considered that Option F can be discarded from further consideration.

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[14] Along with the subsequent planning analysis of key Regional and District Plan documents.

- The other three options (Option E, Option P and Option Z) should all be considered when determining a preferred option. The positives and negatives of all these are set out in detail in the sections above. In summary:
  - **Option E:**
    - Is located on land with lower ecological value than the western Parininihi land (although it does have the longest length of affected stream).
    - Is located on land with lower landscape value than the western Parininihi land
    - Is the best transport outcome of Options E, P and Z in relation to the transport weighting applied to the MCA2 raw scores (noting there is no difference in the overall transport criterion score).
    - Requires multiple bridges and sequencing at the northern end which affected the constructability score
    - Avoids culturally sensitive ridges. However, it affects the largest area of Ngāti Tama land, and Ngāti Tama have indicated that any land take is a significant issue for them.
    - Is more compatible with the statutory provisions than Option P, but slightly less compatible than Option Z).
    - Presents significant opportunities for enhancement across the eastern valley.
  - **Option P:**
    - Has the best constructability score of Options E, P and Z although the southern portal of the tunnel is challenging due to access in Waipingao catchment
    - Is located on Parininihi land, which has high landscape and ecological value.
    - Is located in proximity to culturally sensitive ridges.
    - Is the least compatible with the policy framework set out in the statutory plans.
  - **Option Z:**
    - Is located adjacent to Parininihi land in an area of lower ecological and landscape value.
    - Has the lowest transport benefits of the three options when weighting is applied (noting the overall transport criterion score is the same).
    - Requires the smallest area of Ngāti Tama land take however, Ngāti Tama noted that the tunnel in close proximity to the maunga (Mt Messenger) was almost a fatal flaw.
    - Presents complex constructability issues due to multiple interactions with existing SH3, with consequential impacts on SH3 operability during construction.
    - Is considered the most compatible of the options with key statutory plan provisions (noting also that the existing designation over much of the corridor would also assist in the consenting process).
    - Is the best performing MCA outcome when taking overall scores into account.

Appendices

Appendix A: Shortlist outcomes

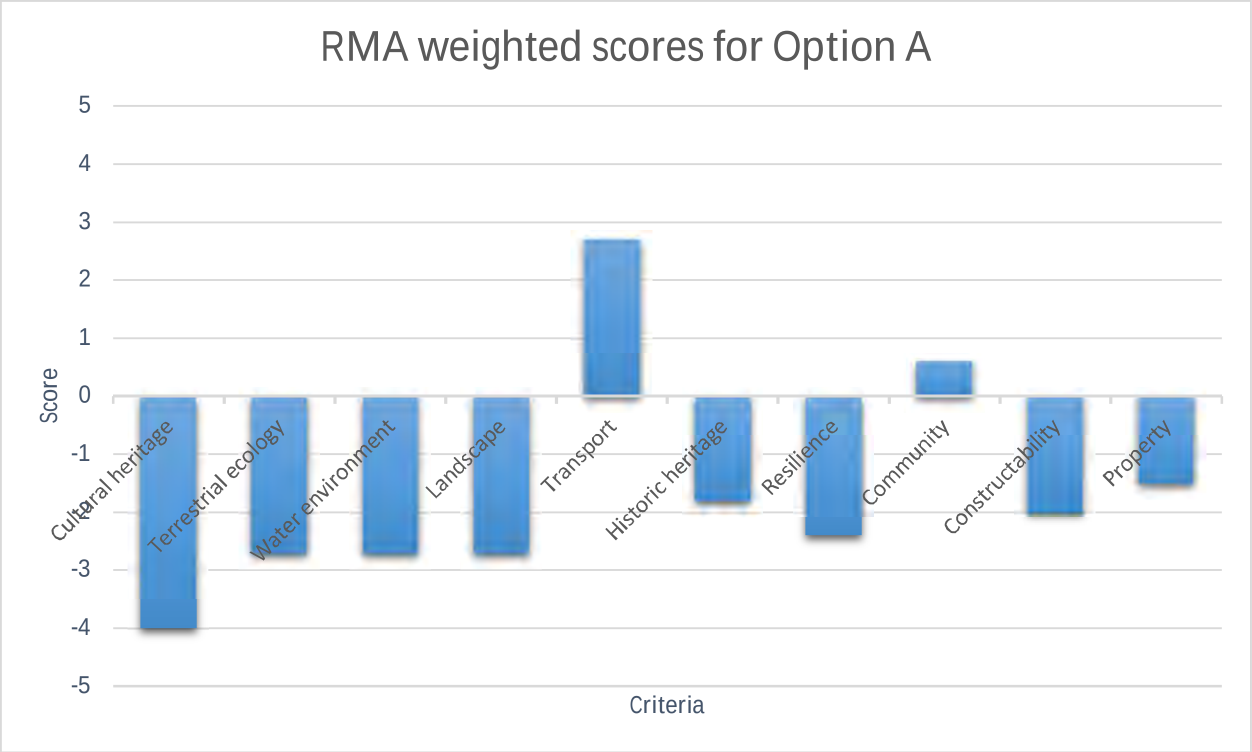
Option A

Figure 1: View towards Option A's long bridge across Waipingao Valley

Figure 2: View along Option A towards the northern tie in to State Highway 3 (SH3)

Description and overall comments

- The most direct realignment route, with the smallest footprint and shortest travel time
- This option involves a tunnel through the northern ridgeline of the Waipingao Valley and a very long, straight bridge (610 m) across the Valley itself (see Figure 1)
- The northern end of Option A has been shifted out of the valley floor to respond to geotechnical issues, and two bridges have been added (see Figure 2)
- Improved resilience by shifting northern end out of the valley floor, but long bridge with the southern abutment adjacent to landslide is highly challenging to construct
- Most disruptive on the Waipingao Valley and the coastal to highland vegetation progression, so scored poorly from an ecological and cultural perspective
- Closest to the release site for kokako, one of the key subcriteria for cultural and terrestrial ecology scoring
- Located in regionally significant landscape area, and disrupts key southern ridgeline landscape feature.



Cultural heritage

Impact on significant Parininihi land, and closest to the kōkako release area.

Terrestrial ecology

Ranked second lowest after F, due to severance of key forest sequence from coast and the quality of vegetation.

Water environment

Smaller stream length, but high value in the Waipingao Valley and connected to marine reserve so needs robust erosion and sediment controls, such as discharging water elsewhere.

Landscape

Key issues identified were the regionally significant landscape in the footprint and the cut to the southern ridge.

Transport

Best score for transport - most direct and therefore safety and time benefits.

Historic heritage

Lowest score out of all of the alignments, as it is the closest to the coast where most archaeology is likely.

Resilience

Scored poorly, with the longer bridge with abutment on landslide material vulnerable to earthquakes and a large steep rock cut.

Community

Impacts recreation land; noise not a major issue; minimal localised social impacts and some wider benefits.

Constructability

A number of changes since MCA1 but still difficult to construct, particularly because of the much longer bridge.

Property

Scored relatively poorly due acquisition of Ngāti Tama land. Severance of Anglesey land requiring significant compensation.

Option E

Figure 1: View towards the north along option E

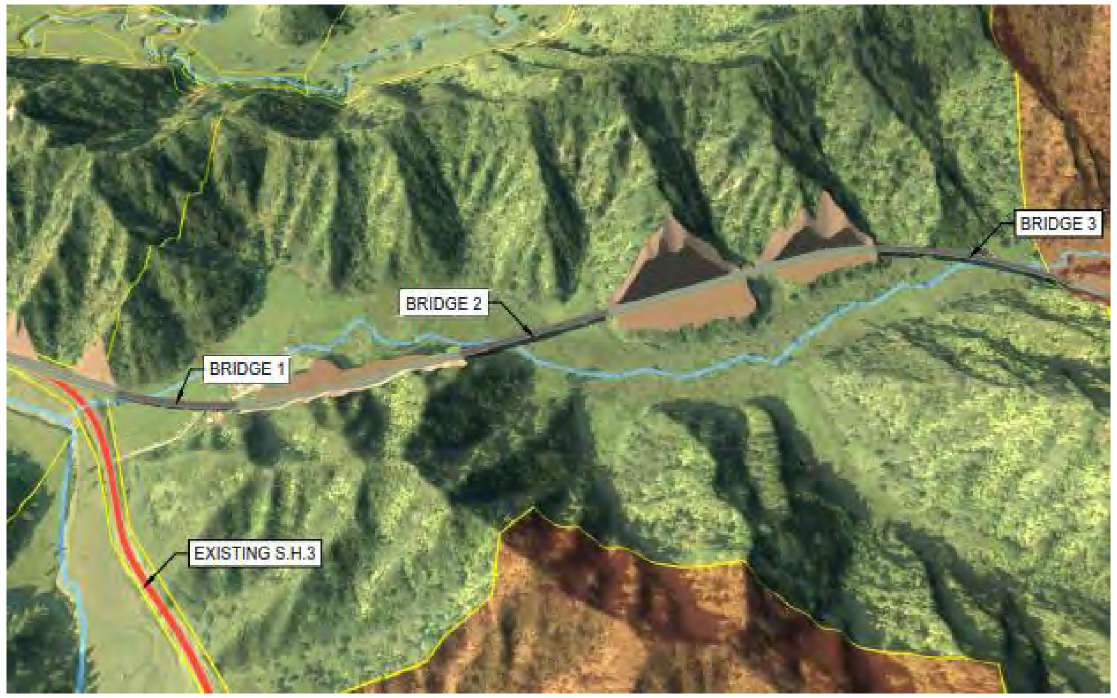
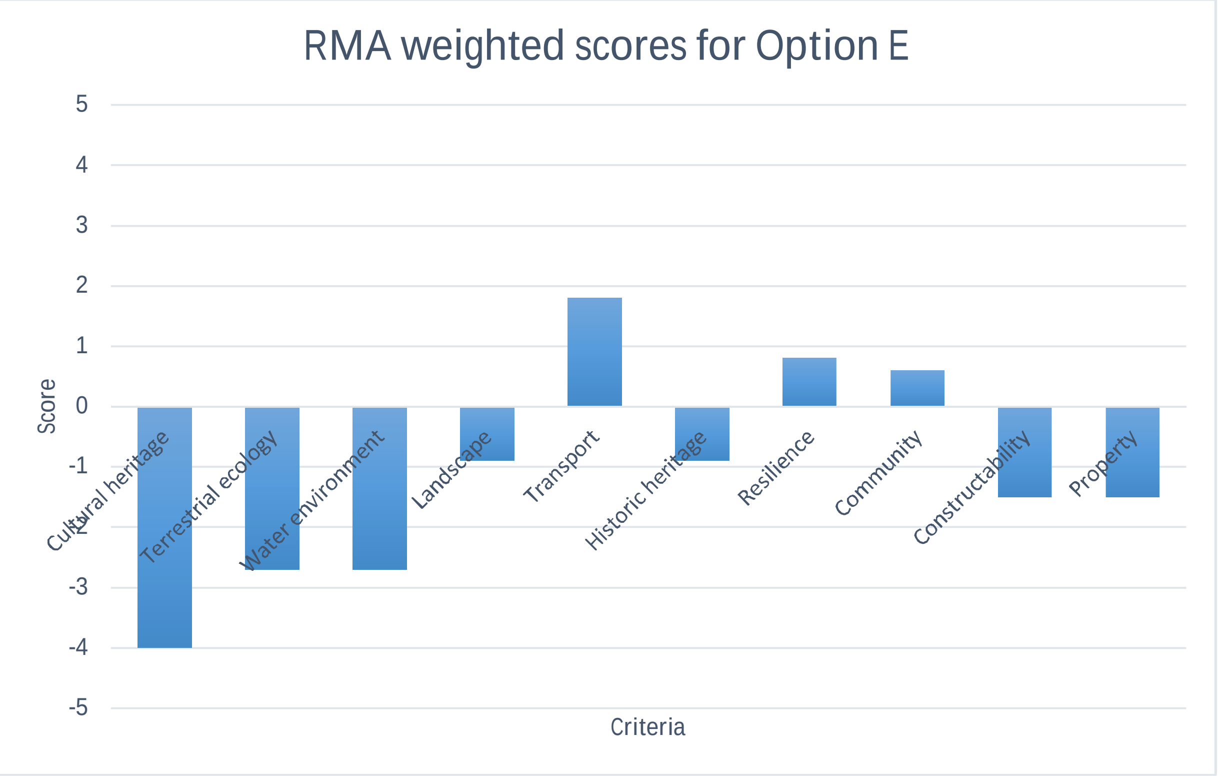


Figure 2: View across northern tie-in with SH3

Description and overall comments

- Follows SH3 at its southern end, has been shifted away from the swamp forest and a bridge added to reduce impacts
- Runs into tunnel portal east of the peak of Mt Messenger before traversing northwards along the Mangapepeke Valley
- Series of bridges along this Valley used to respond to geotechnical issues
- Shifted away from high value swamp forest and new bridge to reduce ecological effects
- Avoids key landscape, ecological and cultural features in the vicinity of the Waipingao Valley and Mt Messenger
- High potential for improvement of the surrounding environment given its degraded state in areas, particularly in Mangapepeke Valley where opportunity to revegetate, manage pests and connect Ngati Tama land
- Opportunities for improvement, including access to the top of the Mangapepeke Valley to improve constructability and programme. Bridge 5 (southwest of Bridge 4 in Figure 1 above) could also be replaced with a fill and still be located outside the adjacent wetland area



Cultural heritage

Still a considerable area of Ngāti Tama land required, although away from Mt Messenger peak and kōkako.

Terrestrial ecology

Second best score, large area but lower value habitat along Mangapekapeka Valley, although still close to swamp forest.

Water environment

Away from Waipingao Valley which is a positive, but longer corridor and wetland particularly sensitive to sediment loading.

Landscape

Scored the best alongside Option Z, given the already modified area around SH3 and the Mangapekapeka Valley.

Transport

Scored well, with passing lanes in both directions benefiting travel times.

Historic heritage

Average score – no recorded archaeological sites within corridor.

Resilience

Scored average, avoids the landslide, and the bridges across the valley floor reduce liquefaction risk. A number of culverts serving large catchments.

Community

More limited effect on recreation land than those to the west, although noise and social impact on Pascoe property.

Constructability

Scored relatively poorly due to length, bridges in Mangapekapeka Valley, and difficulties in accessing works up the Valley.

Property

Lowest scored option, requires Ngāti Tama land, and Pascoe dwelling would need to be removed or demolished.

Option F

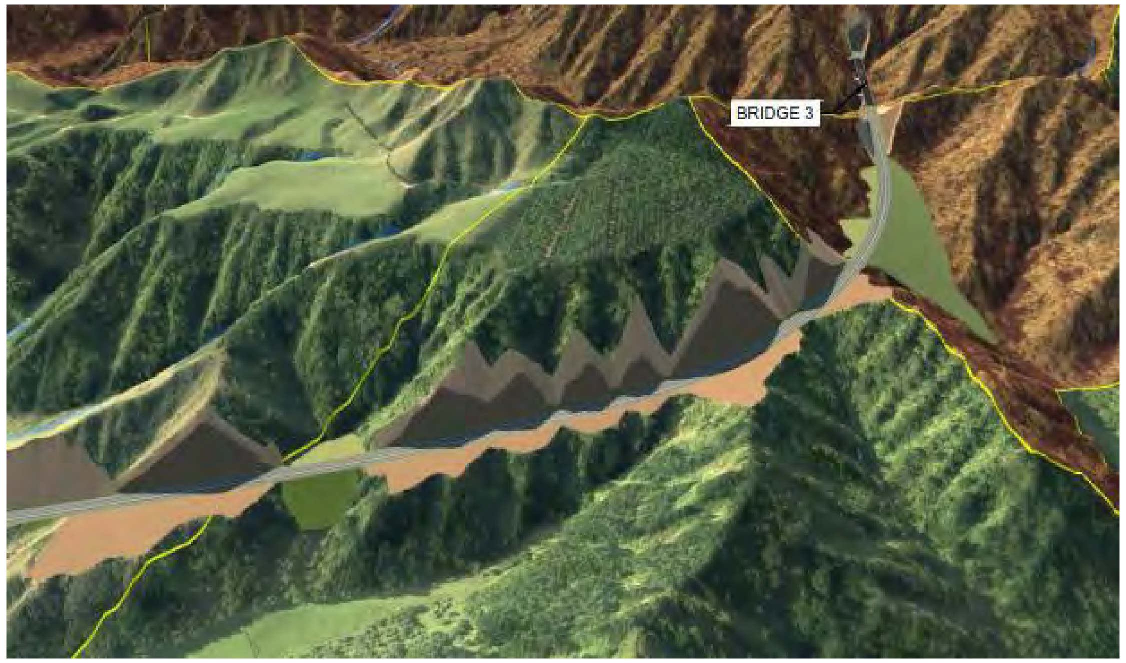


Figure 1: View towards the north along Option F towards bridge and tunnel

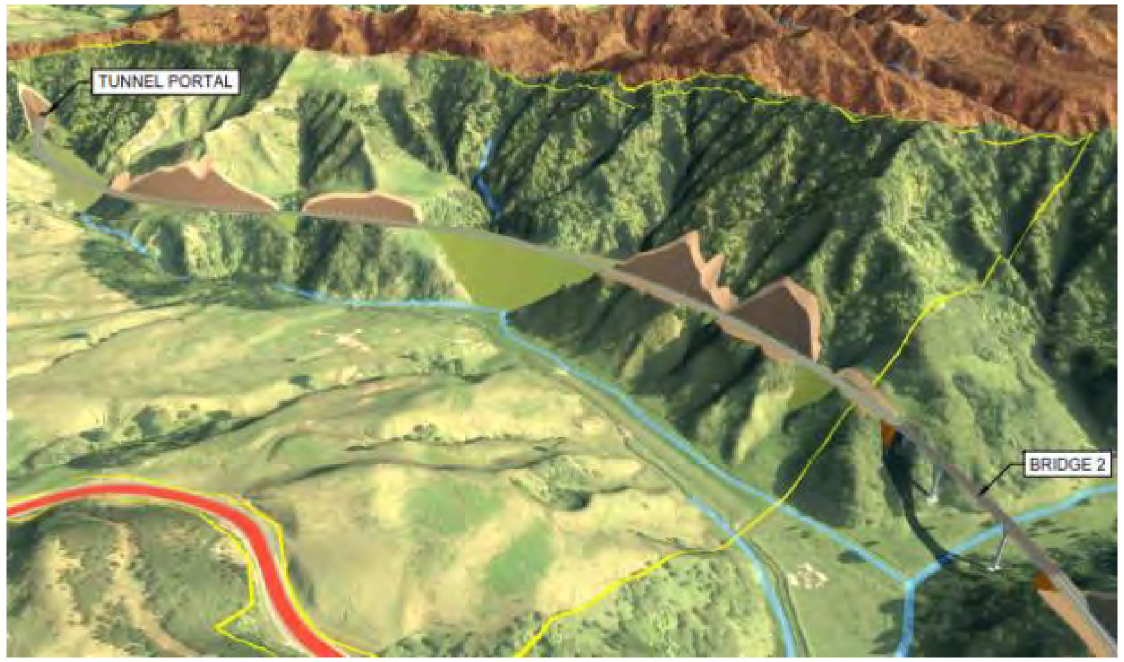
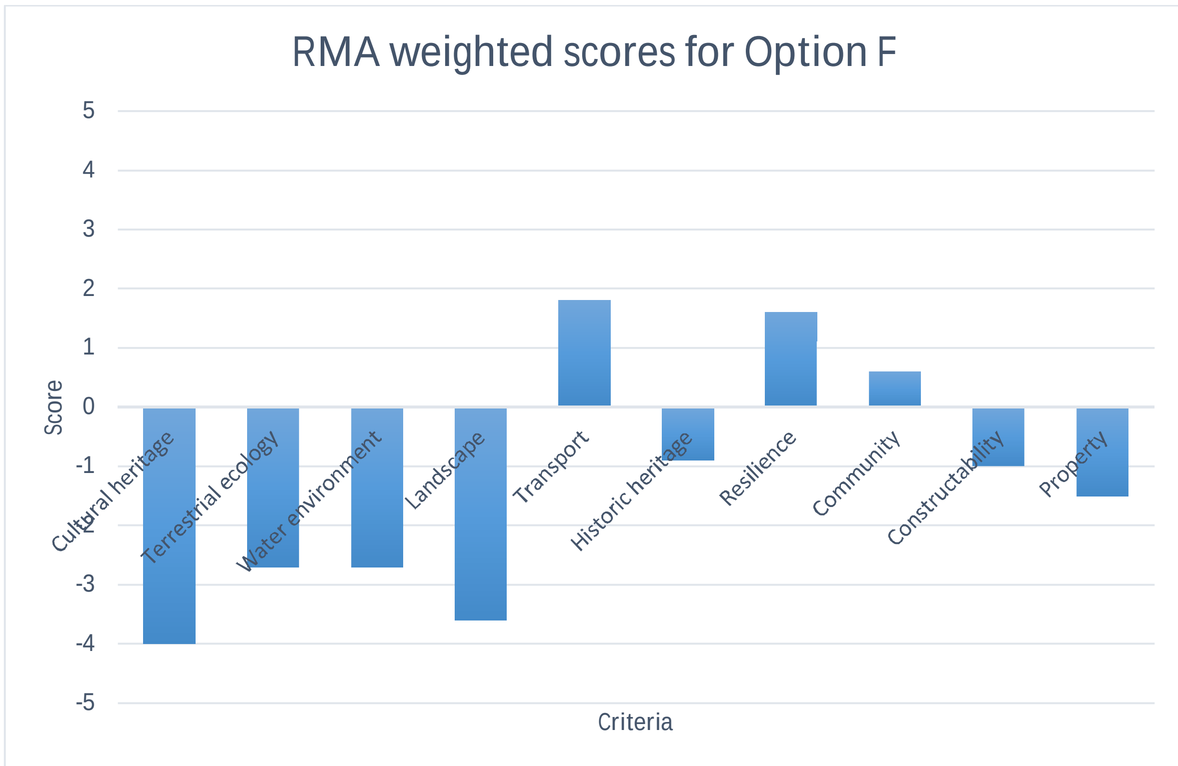


Figure 2: View to the south along Option F towards northern tunnel portal

Description and overall comments

- Relatively direct route involving a series of cuts rising from SH3 towards a short straight bridge over the Waipingau Valley
- Southern tunnel portal is located approximately 240 m west of the peak of Mt Messenger
- Follows a similar path to Option A north of tunnel, running along the western side of the valley, over two bridges before tying in to SH3
- Option F scored most the lowest for landscape and terrestrial ecology, given it disrupts key ridgelines (with ecological connectivity implications) and involves a large series of cuts which are incompatible with the surrounding landscape
- The corridor is also located relatively close to the summit of Mt Messenger, a waahi tapu, so lower cultural values scores
- Smaller bridge across Waipingao meant it scored slightly better than others from an erosion and sediment control perspective
- Improved resilience at northern end due to shifting of alignment out of the valley floor



Cultural heritage

Tunnel is relatively close to Mt Messenger peak, and effects on mana from the take of Treaty settlement land.

Terrestrial ecology

Lowest score – cuts through gully of high quality podocarps, and ecologically valuable forest west of Mt Messenger reduced scores.

Water environment

Effects on Waipingao catchment but a relatively short length of stream affected. Water management at southern end important.

Landscape

The lowest score for landscape, due to cuts and large fill towards the south.

Transport

Scored well on travel time, and relatively direct route so better for safety.

Historic heritage

Average score – no known sites in the proposed corridor.

Resilience

Scored relatively well, with the bridges replacing fill on liquefiable ground to the north, and lower fill embankments.

Community

Severance of walking track, and impact on Gordon dwelling.

Constructability

Highest score along with Option P, with some difficulties in series of cuts to the south, and borrow and disposal required to address cut/fill imbalance.

Property

Scored relatively poorly, Treaty settlement land at both ends as well as Anglesey and Washer compensation.

Option P

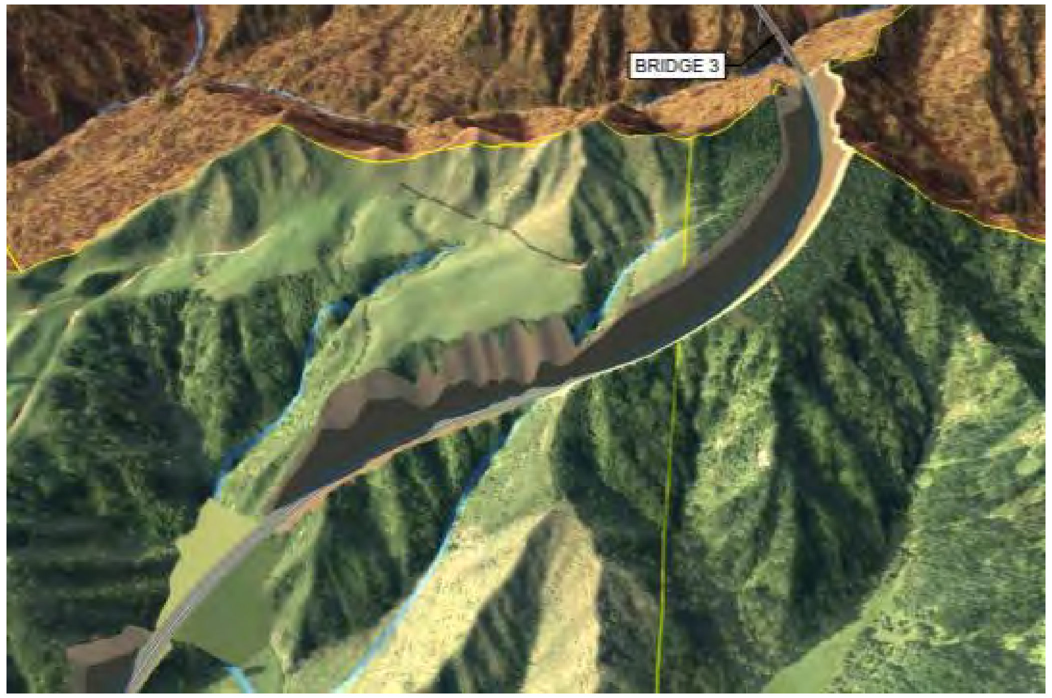
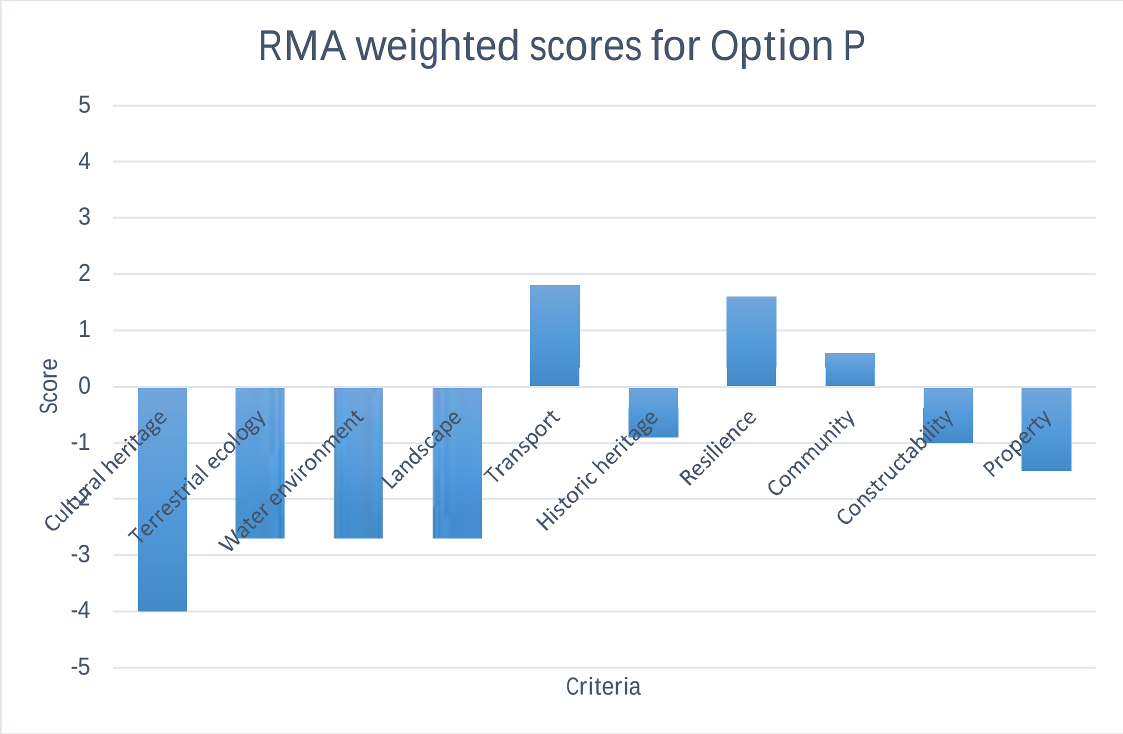


Figure 1: View towards the north along Option P

Figure 2: View across Option P towards the northern tie-in with SH3

Description

- Added to the shortlist following discussions with Ngati Tama, taking elements of previous options B, F and G
- Involves a long cut to the south of the Waipingao Valley, and a slightly longer bridge than F over the Valley towards the southern tunnel portal
- Southern tunnel portal is located approximately 480 m from the peak of Mt Messenger
- Option P scored relatively well for constructability, transport and resilience given its direct route and the removal of the northern end from the valley floor
- Could be difficult to do cut at the southern side of the tunnel – deep excavation with no access
- Ecological and landscape effects of the ridgeline cut south of Waipingao Valley and clearance of area of high value vegetation, although avoids most significant trees
- Higher slopes make erosion and sediment control challenging



Cultural heritage

Tunnel located farther from Mt Messenger peak, but still a considerable land take required.

Terrestrial ecology

Ranked averagely, with high value vegetation clearance proposed, and severance of a key ridgeline.

Water environment

Higher slope angles, such as through the cut south of the Waipingao Valley, mean erosion and sediment control is more difficult, particularly because of vegetation removal on the ridgeline.

Landscape

Scored relatively poorly due to large cut through southern ridgeline of the Waipingao Valley.

Transport

Direct route, with the passing lane a positive for travel time.

Historic heritage

Scored averagely – no registered archaeological sites along corridor.

Resilience

Also scored well for resilience, with less liquefiable road towards the northern end and a relatively short overall length.

Community

Scored averagely – lower on noise than other options.

Constructability

Highest score along with Option F, although difficult cut located south of the tunnel.

Property

Similar score to other options, with Ngāti Tama land take the key issue.

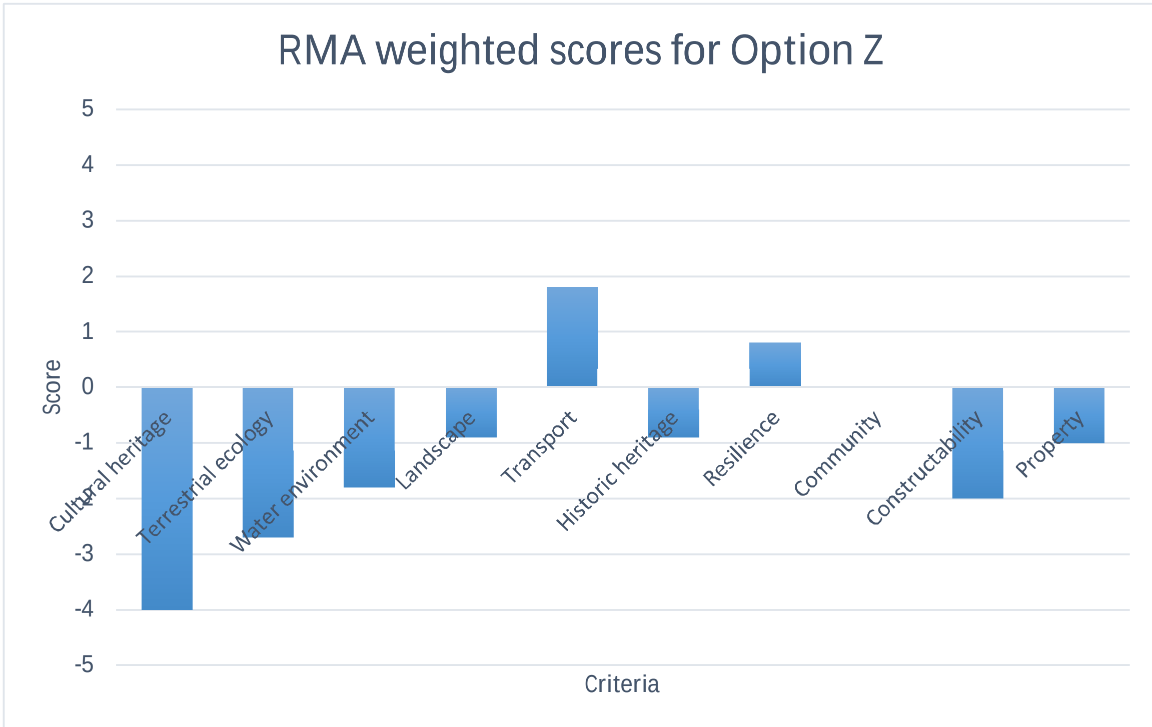
Option Z

Figure 1: View towards the north along Option Z

Figure 2: Northern section of Option Z, adjacent to existing SH3

Description

- The closest to the existing SH3 alignment, involving a number of complex interactions with the existing highway
- Now designed to be level with SH3 where it interacts, including at the northern and southern portals of the tunnel
- Northern end runs immediately east of a large landslide which would require lengthy and costly ground improvements
- Requires closure of SH3 for periods of the construction process
- Passes relatively close to the peak of Mt Messenger
- Difficulties around constructability given the interactions with the existing SH3 requiring likely road closures
- Scores well for landscape and water environment given the already modified nature of the SH3 corridor and surrounds
- Cultural values scored low due to proximity to Mt Messenger peak and loss of mana from Treaty settlement land take
- Ecology score impacted by the high value vegetation towards southern end of Option Z



Cultural heritage

Scored well for kokako and awa as away from Waipingao and release area, but cuts through very close to Mt Messenger peak.

Terrestrial ecology

The ecology has been modified around SH3, but an area of high value vegetation exists towards the southern end.

Water environment

The best score, based on already modified streams and no effects on catchments to the east and west.

Landscape

Scored well for landscape given the already modified landscape around SH3.

Transport

Scored well, but difficult to manage traffic due to SH3 interactions.

Historic heritage

Scored averagely – retains existing tunnel but not used for road purposes.

Resilience

Scored relatively well for resilience, with the high steep rock cuts and location at landslide headscarp being key issues.

Community

Lowest score, largely due to social impacts of closing SH3, such as freight, and hospital and emergency traffic.

Constructability

Scored poorly due to the complex interactions with the existing road, and the length ground improvement work required adjacent to the landslide.

Property

Now requires some Ngāti Tama land which brought score down since MCA1, but highest score among all options.

Appendix B: Shortlist briefing pack

Memorandum

To	All workshop attendees
From	Peter Roan
Date	20 June 2017
Subject	Specialist briefing for Mt Messenger multi-criteria analysis: Workshop 2 (Shortlist)
Reference	MMA-ENV-MEM-494-MCA 2 briefing package

Purpose

This memorandum describes the range of alignment options and assessment approach for New Zealand Transport Agency's (NZTA) Mount Messenger Bypass Project. This information is presented ahead of the second (shortlist) Multi-Criteria Analysis (MCA2) workshop on 26-27 June 2017 for analysis by experts prior to that workshop. The workshop forms part of the options and alternatives assessments phase of the Project.

This memo provides background information on the five potential alignment options to be assessed during the workshop. The memo also provides the structure and assumptions for development of sub-criteria and scoring for each option.

MCA workshop

The MCA workshop will take place from 26 – 27 June 2017. The purpose of the workshop is to test and confirm scoring for each alignment. Prior to this workshop, specialists are expected to:

- Review this memorandum and the attached information.
- Advise Peter Roan / Sarah McCarter by 22 June 2017 if any additional information is required in order to score each option.
- Develop an understanding of each option.
- Review the MCA recording and scoring template.
- Score each of the 5 options on the MCA criteria and record reasons for scoring as per the template.

The reasons provided for scoring are anticipated to be high level only for the purposes of the workshop next week, however detailed reporting of each specialist assessment will be required to support the shortlist report.

Draft reports are required to be provided by 10 July 2017. This is a critical deadline – if you think you will have any issues meeting it (or have any clarifications about reporting requirements), please advise Peter Roan / Sarah McCarter immediately.

Information provided

The following documents are provided in this briefing document to inform technical specialists during the MCA shortlist workshop:

Appendix A:	Overall schematic of shortlisted options
Appendix B:	3D views of options
Appendix C:	Quantity summary (spreadsheet)
Appendix D:	Indicative borrow and disposal sites
Appendix E:	MCA criteria and specialists
Appendix F:	MCA recording and scoring
Appendix G:	Reporting template

Mt Messenger location

The general project area is located adjacent to State Highway 3 (SH3) in the vicinity of Mt Messenger, in North Taranaki. Mt Messenger is located approximately 58 km northeast of New Plymouth and 183 km south of Hamilton (see Figure 1 below).

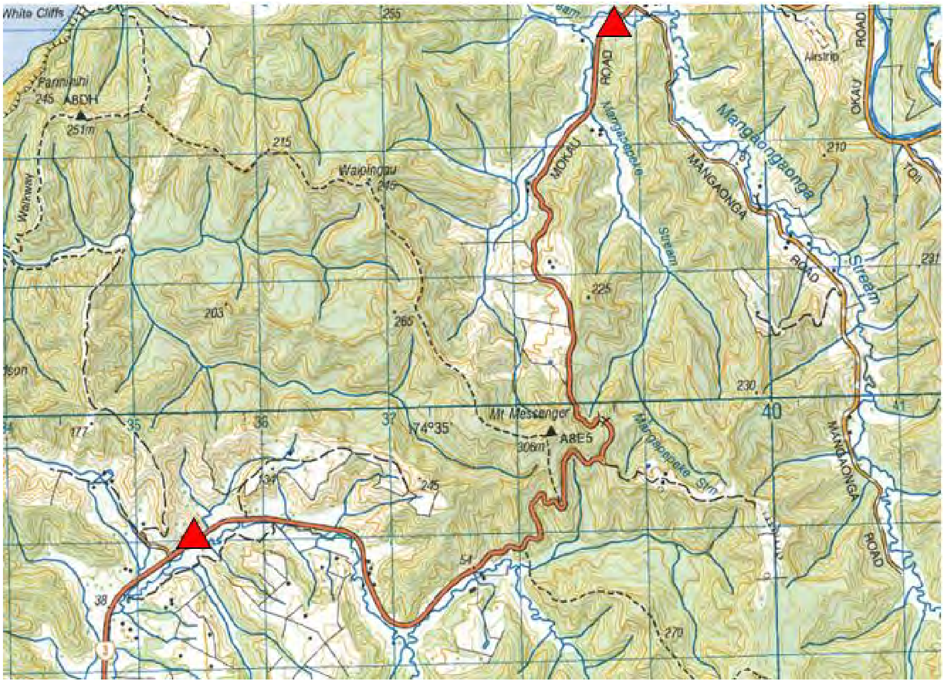


Figure 1: Mt Messenger Bypass location

Background

The Mt Messenger project is focused on improving or bypassing the existing section of SH3. The Mt Messenger bypass forms part of the wider Awakino Gorge to Mt Messenger programme being progressed by NZTA. The existing section of SH3 at Mt Messenger is characterised by a steep, narrow and winding road which NZTA has concluded requires upgrades to improve safety and travel times.[1]

A range of options have previously been considered by the NZTA for the Mt Messenger Bypass prior to the current MCA process, including an MCA process undertaken in 2016. As a result of additional information now available, including feedback received from public consultation undertaken at the end of 2016, the NZTA is conducting further investigations into possible options, including this additional MCA process.

The first MCA workshop (MCA1) took place on 11 – 12 May 2017. Specialists assessed and scored 24 longlisted options against nine criteria, including constructability, transport, resilience, landscape, heritage, community, property, ecology and cultural heritage. Following the completion of the workshop, weighting of the scores was carried out by Peter Roan. The weighted final scores were reported to the Project Advisory Board, which approved the progression of the following options to further design development and then consideration during the second MCA workshop:

1. Option A1
2. Option E1/E2
3. Option F1
4. On-line Option (Z2 and Z4 with some elements of D1/D2)
5. Option P (a hybrid option suggested by Ngāti Tama, a combination of the B, F and G corridors).

Appendix A shows the indicative locations of these corridors.

Design work has progressed following MCA1 workshop, and the alignments of some these options has slightly changed in the interim period. In addition, additional specialists have joined the team. As such, specialists should approach their scoring of the options with an open mind, whilst acknowledging that assumptions and issues discussed in the MCA1 workshop provide a helpful initial basis for assessing and scoring leading in to the MCA2 workshop.

[1] NZTA (2015): SH3 Awakino Gorge to Mt Messenger Programme Business Case, released 30 March 2015.

Options presented

As set out above, five corridors are being considered as part of the MCA shortlist, including works within the existing corridor (the 'online option') and four alternative corridors ('offline options'). Table 1 below outlines the changes that have been made to the alignments of the five shortlisted corridors since they were presented at the MCA1 workshop.

Table 1: Changes to the alignments between the MCA1 and MCA2 workshops

Alignment	Key changes
Across all corridors	· Removal of a 7 m wide berm at the soil/rock interface in cut slopes; · Using rock bolts to steepen soil slopes in cuttings and reduce earthworks volumes; · Providing a 3 m rock fall collection verge in lieu of 7 m; · While curve radii permit the road to be driven safely at 100 kph the above changes reduce the cross section of the road. As a result sight distance in some cuts is restricted to that appropriate for a design speed of 70 kph. Sight distances are to be considered further when the preferred route is identified.
Option A1	· The south end of Option A1 has been realigned westwards onto rock cuts in the side of the valley to avoid expensive ground improvement works in alluvial deposits under a high fill. · A site visit identified a potential landslide to the north of the southern ridgeline, so the bridge over the Waipingao Valley was lengthened to approximately 600 m. Due to constructability questions around the length of this bridge, an earthworks solution is being considered. · North of the tunnel under the northern ridgeline the route has been realigned to the west with cuttings in rock, to avoid ground improvement works in alluvial deposits. · Towards the northern tie-in with the existing road, bridges are now considered a better option (both cost-wise and environmentally) than fills.
Option E1/E2	· The key change has been shifting the alignment westwards away from the ecologically valuable swamp forest. · To reduce the cost of the option, the route has been realigned onto rock spurs to minimise ground improvements which were previously necessary along the valley floor. · Some fills have been replaced by bridges where cost comparisons demonstrated this was beneficial. · Fill volumes have been reduced by using Mechanically Stabilised Earth (MSE) in some locations.

Alignment	Key changes
Option F1	· The difficult to construct and expensive curved bridge south of the cut in the central ridgeline has been replaced by fill. · North of the tunnel, instead of earthworks on an alluvial valley floor, the route follows a similar route to the upgraded Option A1 involving rock cuts and bridges over streams towards the northern tie in.
Online Option (Z2 and Z4 with some elements of D1/D2)	· These options have changed significantly after MCA1, and are much shorter with more of the existing SH3 route at the southern end being used. · The number of bridges has been reduced from 5 and 4 (Options Z2 and Z4 respectively) to 2 or 3 on both options. · Constructability has been improved significantly by realigning the route south of Mt Messenger to the west, so it is now clear of the existing SH3, either laterally or vertically. · However north of Mt Messenger there is still a major construction challenge with the new alignment being over the existing in an area bounded by a steep scarp to the west and land that falls away sharply to the east.
Option P	· A new option put forward by Ngāti Tama, based approximately on a hybrid combination of Corridors B, F and G. · Option P is similar to Option F, but aligned further west across the Waipingao Catchment. · Earthworks volumes are similar to F while the tunnel is slightly shorter and the option requires shorter bridgeworks.

The table attached in Appendix B (and also provided in Excel format) summarises quantity information in respect of each option, including length, area, grades, cut and fill, streamworks, bridges, tunnels, retaining walls and pavement area.

At the workshop, the 3D model ('Humphrey') will be utilised to examine all options. Appendix C includes representative figures of each option taken from Humphrey. Note that you can zoom into these figures to view the options in more detail. A review of the complete model for each option will take place at the start of the workshop, before scores can be finalised.

Experts are instructed to assign scores (and explanations) for each option ahead of the workshop, based on the information being provided now. However, you will need to approach the viewing of the 3D model (and the workshop generally) with an open mind, so that if necessary you are in a position to update your scores and / or accompanying descriptions.

Appendix D shows indicative locations of potential borrow and disposal sites. Note these are indicative locations only. Fill disposal is an issue that will be considered in due course, and at this stage, experts are instructed to not factor the need to dispose of fill (and any potential environmental effects of that) into their scoring of the options. However, if there are any significant concerns, please identify these for discussion.

Methodology for criteria development and scoring

Nine criteria have been developed in total, including transport, resilience, constructability, landscape and natural character, historic heritage, community, property, ecology and cultural heritage. These criteria, along with example/draft measures for scoring and the overall owner of each of the criteria are set out in the table attached in Appendix E.

The effects of each option in relation to these criteria will be scored by the relevant specialists. The scoring and recording templates are attached in Appendix F, and are also provided in Excel format.

Prior to scoring, please note the following:

- Some disciplines may find it helpful to develop sub-criteria, in order to clearly differentiate between effects. When developing sub-criteria, reasons for their inclusion should be recorded. Particular emphasis should be placed on reasoning for any sub-criteria added in addition to those used at the longlist stage. It is important that sub-criteria are developed in a robust manner so that there are no gaps in the assessment.
- Where sub-criteria are used, an overall, single criterion score is arrived at by combining the sub-criteria scores.[2]
- For all criteria/sub-criteria, measures for scoring, information sources and key assumptions should be recorded as shown in Appendix E, prior to scoring being undertaken. If multiple people have provided scoring, this should also be recorded.
- Scoring is based on the following assumptions:
    - Scores are based on the level of effects (adverse or positive) of each option for each specialist criteria.
    - One score will be provided for every criteria (or sub-criteria if these have been developed).
    - Reasons for scoring will be recorded, including if there are particular components of the option which have a significant influence on the scoring.

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[2] At the longlist stage, the briefing memo recorded the possibility of sub-criteria becoming full criteria, represented with individual scores in the overall MCA table. Following discussions at the MCA1 workshop, it has been decided not to adopt this approach.

  - The final score for each option should include standard/expected mitigation e.g. mitigation in accordance with NZTA or Council guidelines/technical papers. Bespoke mitigation and offsetting should not be considered in the final score however, the potential for further mitigation / offsetting of identified effects should be recorded. Experts are instructed to record what mitigation they have factored into their scores (and what additional mitigation might be possible), to allow for those assumptions to be tested.
    - The exception in respect of mitigation is the "fatal flaw" score, as explained below.
- All options should be scored on the 9-point (plus "fatal flaw") scale set out in Table 2 below, along with reasons for the given score. This scoring scale has been adopted partly in order to provide greater scope for differentiation between options. However, experts are instructed to score each option by applying their expertise and against the description of the scores provided below. Scoring should be carried out on an absolute rather than relative basis. In other words, experts should not seek to create an artificial distinction in scores between options.
- The scoring scale provides for a "fatal flaw" negative score. This score should be used where the expert considers that there are unacceptable adverse effects associated with the option – and that there is no reasonable way to appropriately avoid, remedy or mitigate those effects.[3] Before assigning an "F" score, experts should use their expertise to think about whether it would be possible, in the context of a resource consent application, to propose a solution that would address that effect. That includes reasonably available offsetting.
- Please provide as much information as possible in respect of "F" scores (and how those scores could be avoided). Where relevant, experts should record the type of measures they would propose in avoiding an "F" score for an option; or alternatively why they consider there is no reasonably available measure to avoid an "F" score.

[3] The "F" score can helpfully be viewed as a proxy for determining the option is "unconsentable" in respect of the relevant criterion.

Table 2: Scoring scale

Scoring	Level of effect
F	Fatally flawed - unacceptable adverse effects, that cannot reasonably be appropriately avoided, remedied or mitigated (including via offsetting).
-4	Very high / very significant adverse effects
-3	High / significant adverse effects
-2	Moderate / medium adverse effects
-1	Low / minor adverse effects
0	Neutral / no change
1	Low / minor positive effects
2	Moderate / medium positive effects
3	High / significant positive effects
4	Very high / very significant positive effects

Secondary assessment

As explained above, scores on the 9-point scale should be assigned on an absolute basis. This may create a situation where there are a number of options that receive the same score.

If that occurs, experts should provide information as to the relative merits of those options that receive the same score. Experts should use their professional judgment as to how to provide that information, and tailor the information provided to the circumstances. That should then be set out in more detail in your report on the options due on 10 July 2017.

Shortlist report

A template for the shortlist report, due on 10 July 2017, is attached in Appendix G. As set out in the template, this report should include detail on:

- A description of any sub-criteria applied;
- Assumptions applied when scoring; and
- Detailed scores and reasons for scoring.

The report should provide a level of detail which allows a layperson to pick up the report at a later stage in the project, and understand the methodology and reasoning behind the scoring given to each option.

Other matters and conclusion

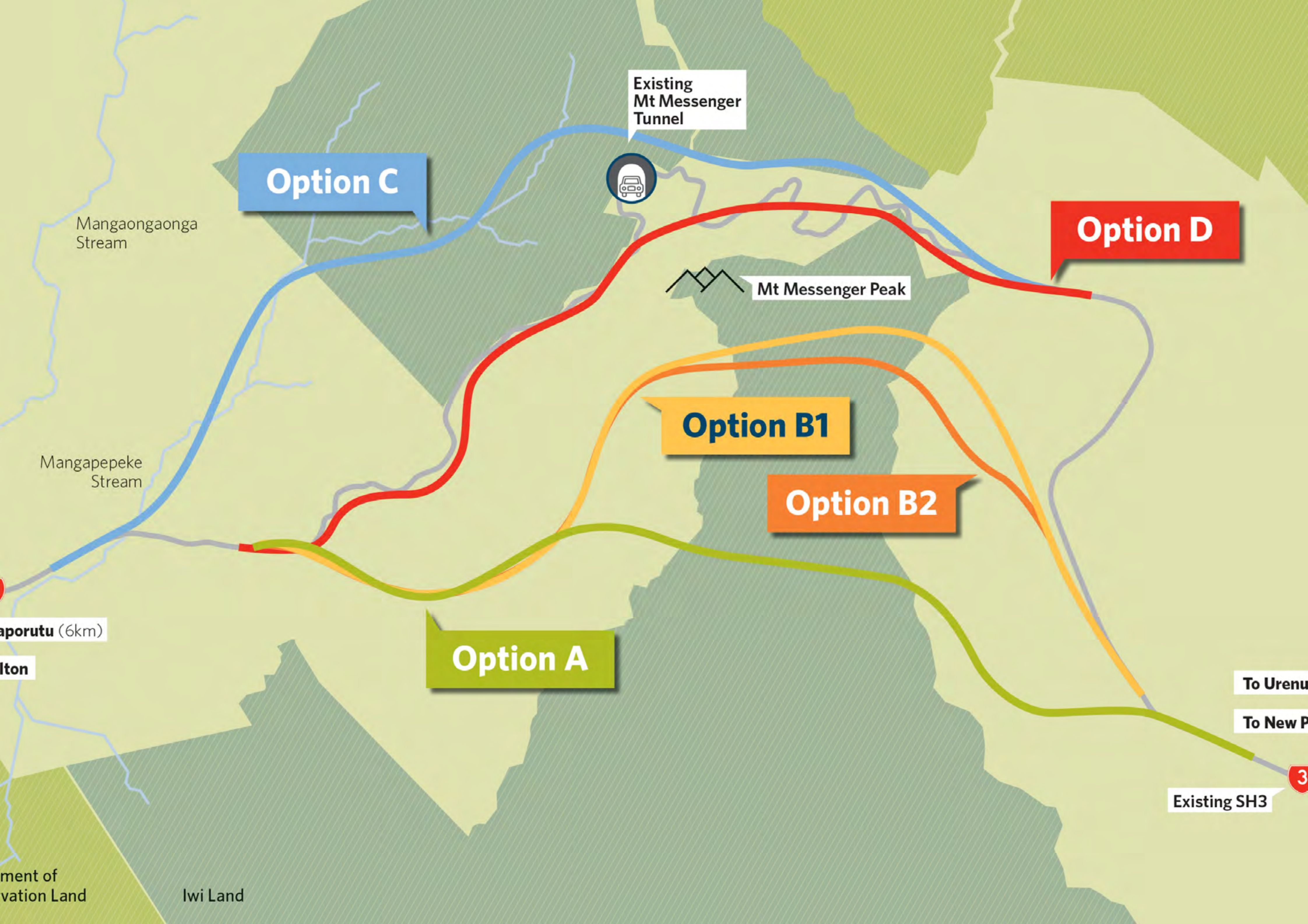
It is important that information is shared effectively between the experts, and with the project team, through this process. In particular:

- Please proactively ask any questions you have in advance of the workshop; and
- Please discuss your assessments ahead of the workshop with other experts as appropriate.

If you require any further information, please do not hesitate to contact me.

Peter Roan
Planning and Consenting Manager

Appendix A: Overall schematic of shortlisted options



Existing
Mt Messenger
Tunnel
Option C
Mangaongaonga
Stream
Option D
Mt Messenger Peak
Option B1
Mangapepeke
Stream
Option B2
aporutu (6km)
lton
Option A
To Urenu
To New P
Existing SH3
ment of
vation Land
Iwi Land

Appendix B: 3D views of options

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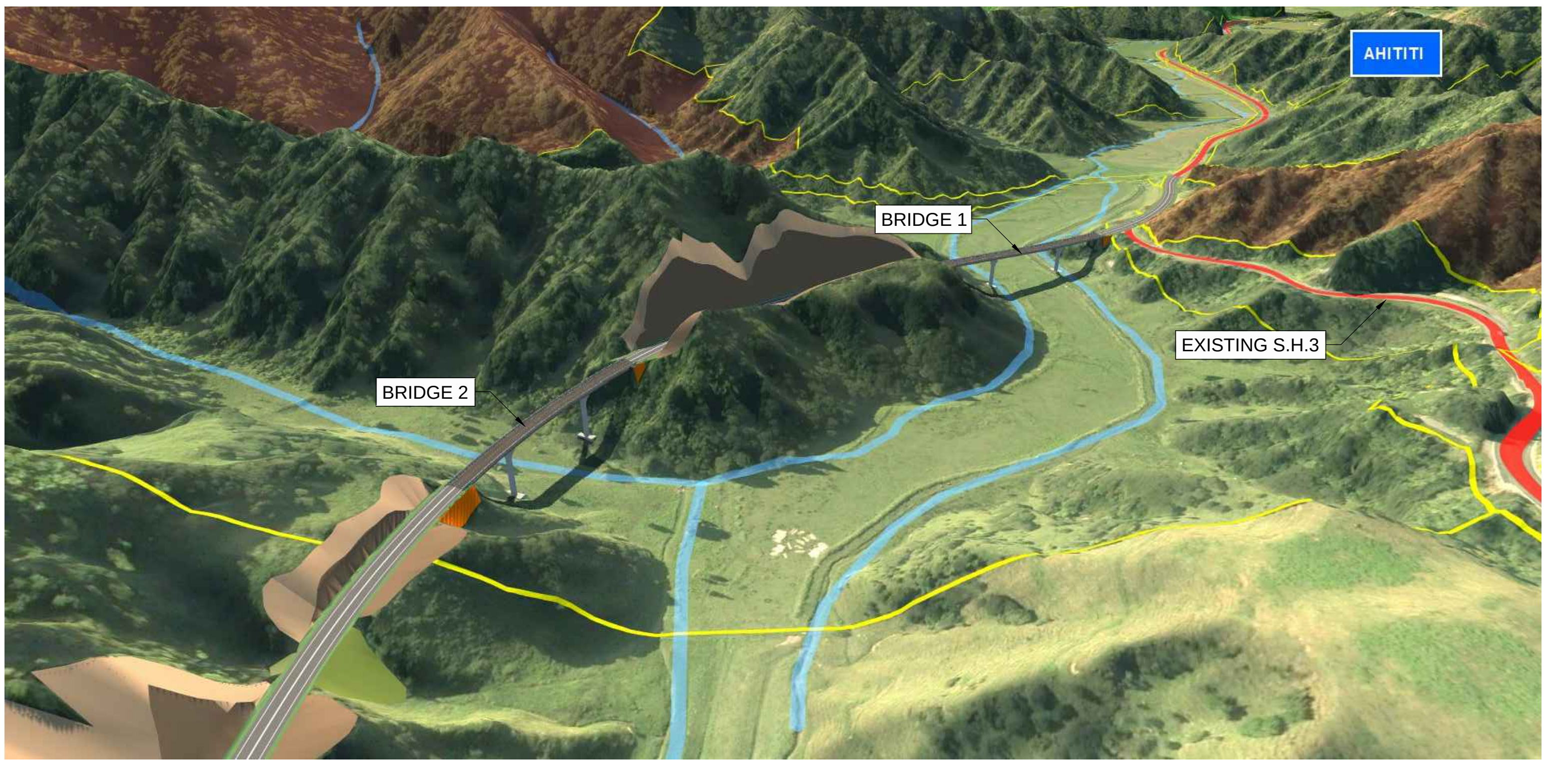

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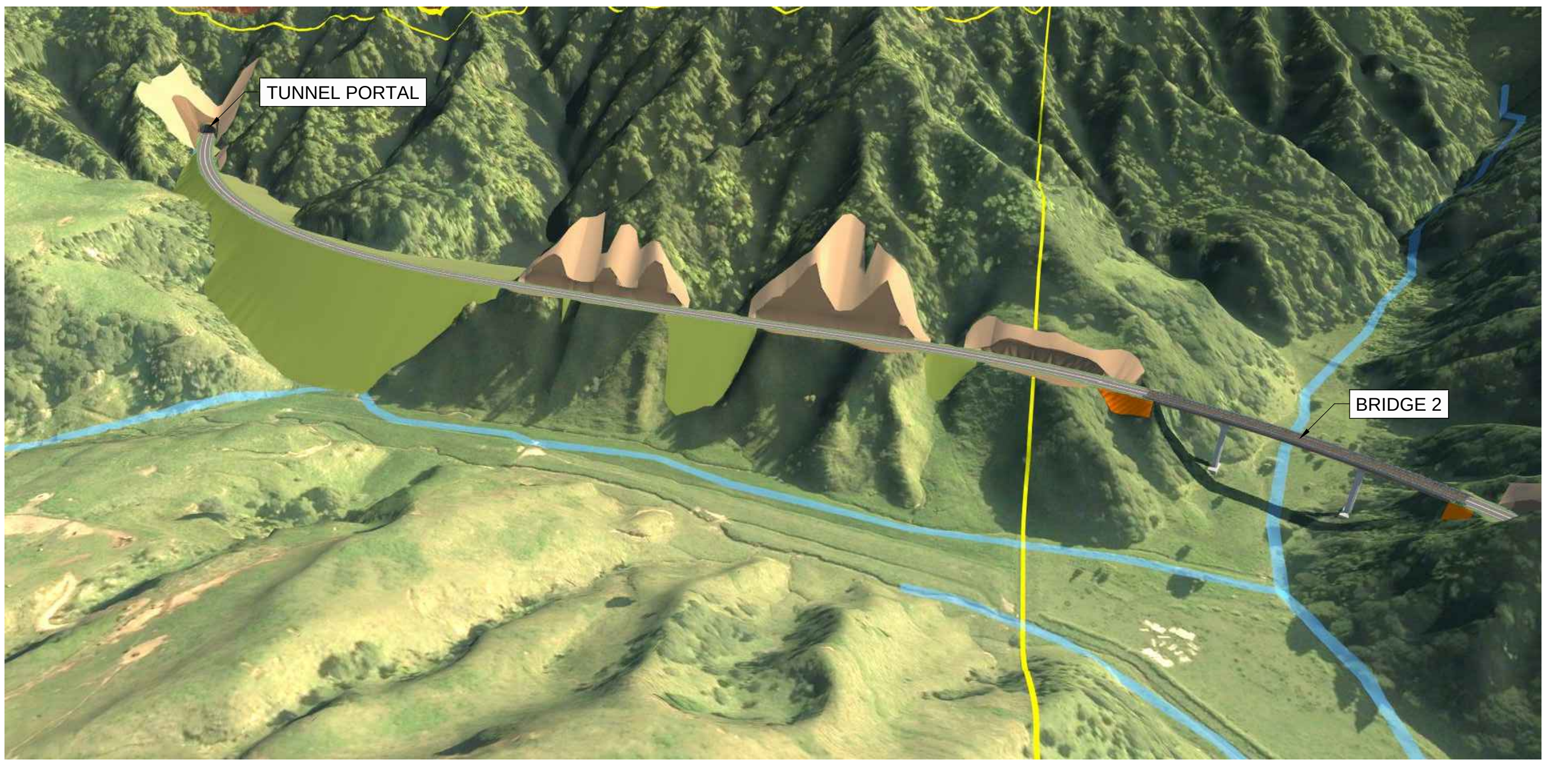

BRIDGE FROM WEST

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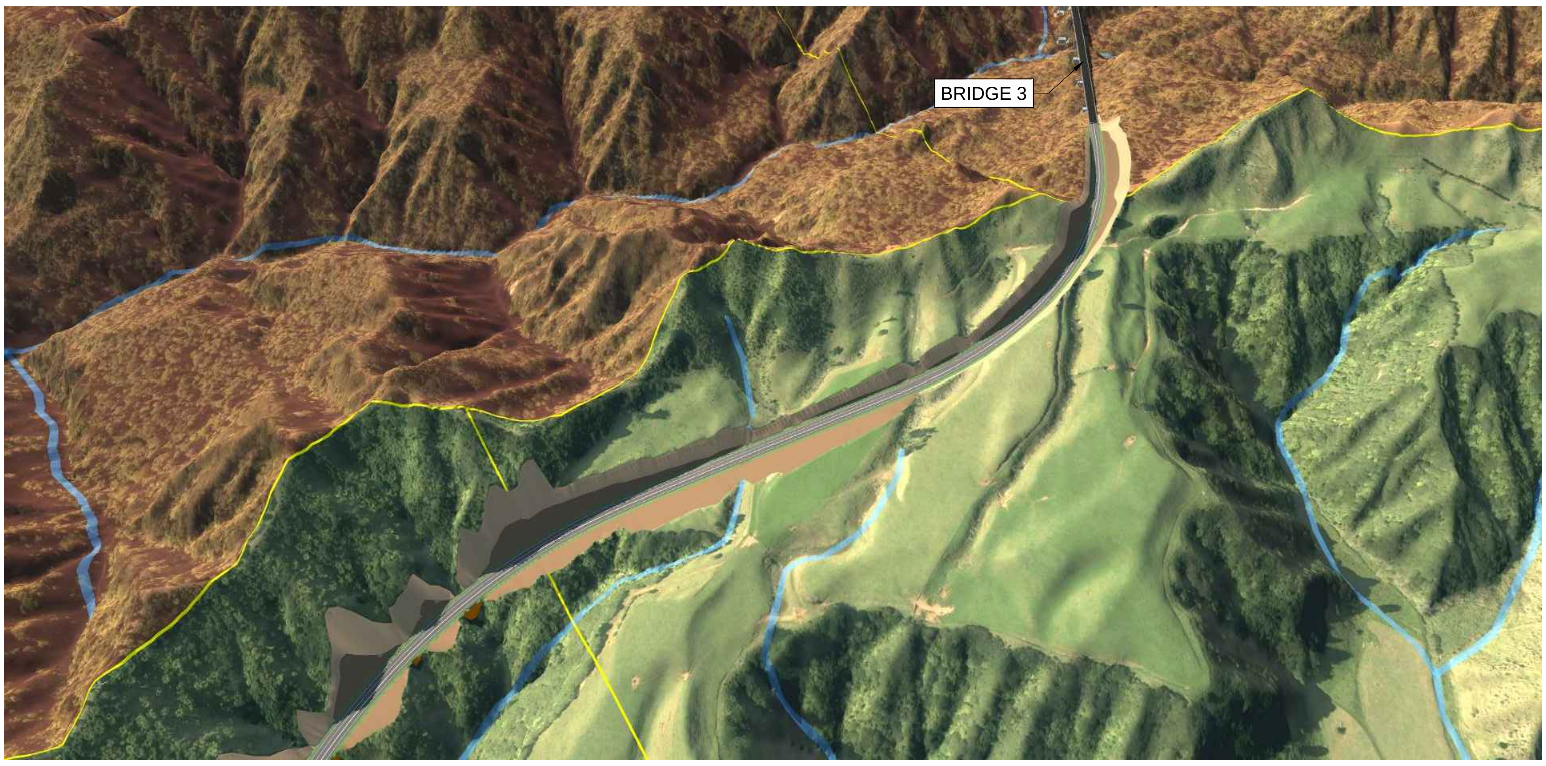
SOUTHERN APPROACH



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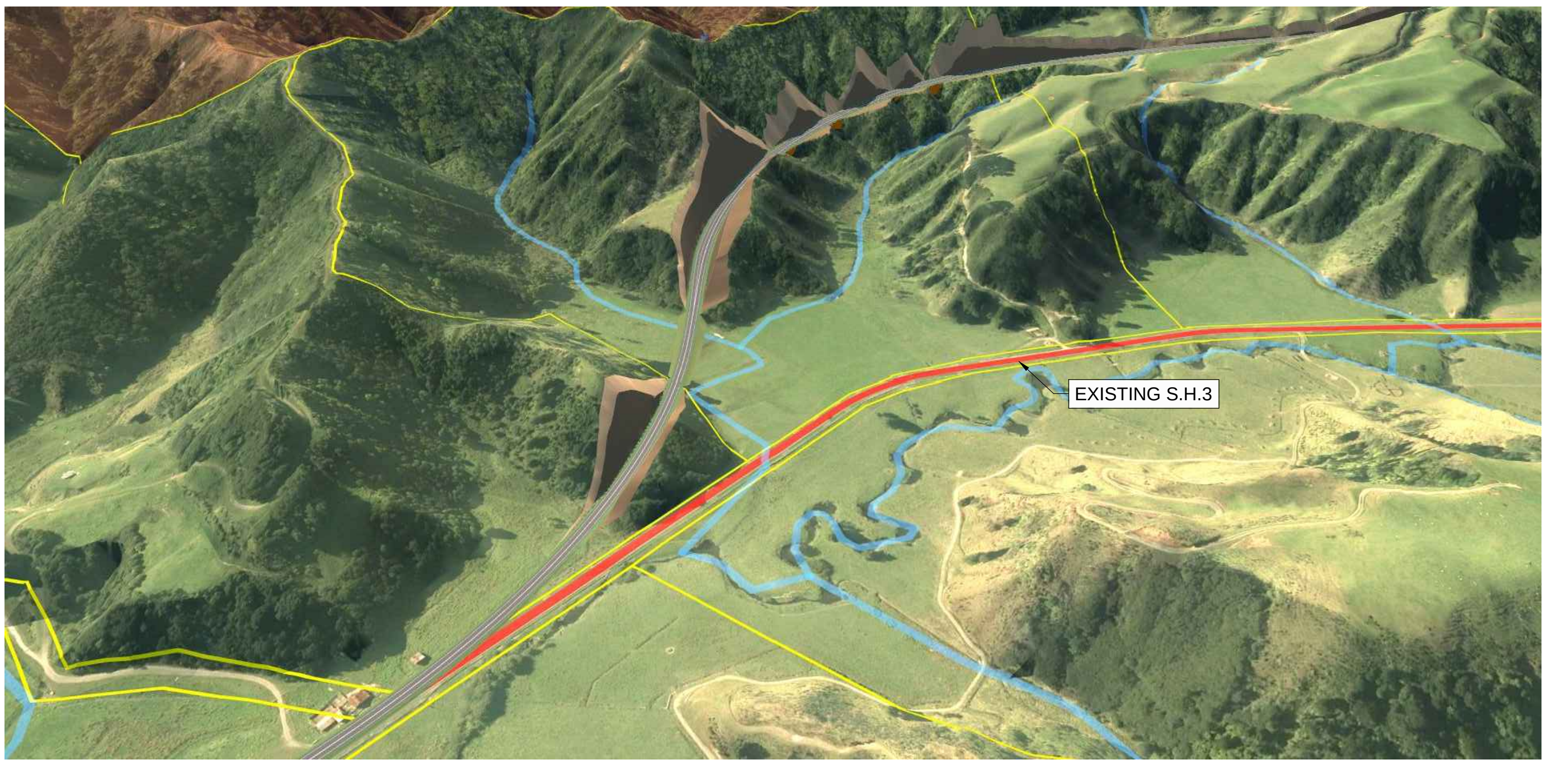

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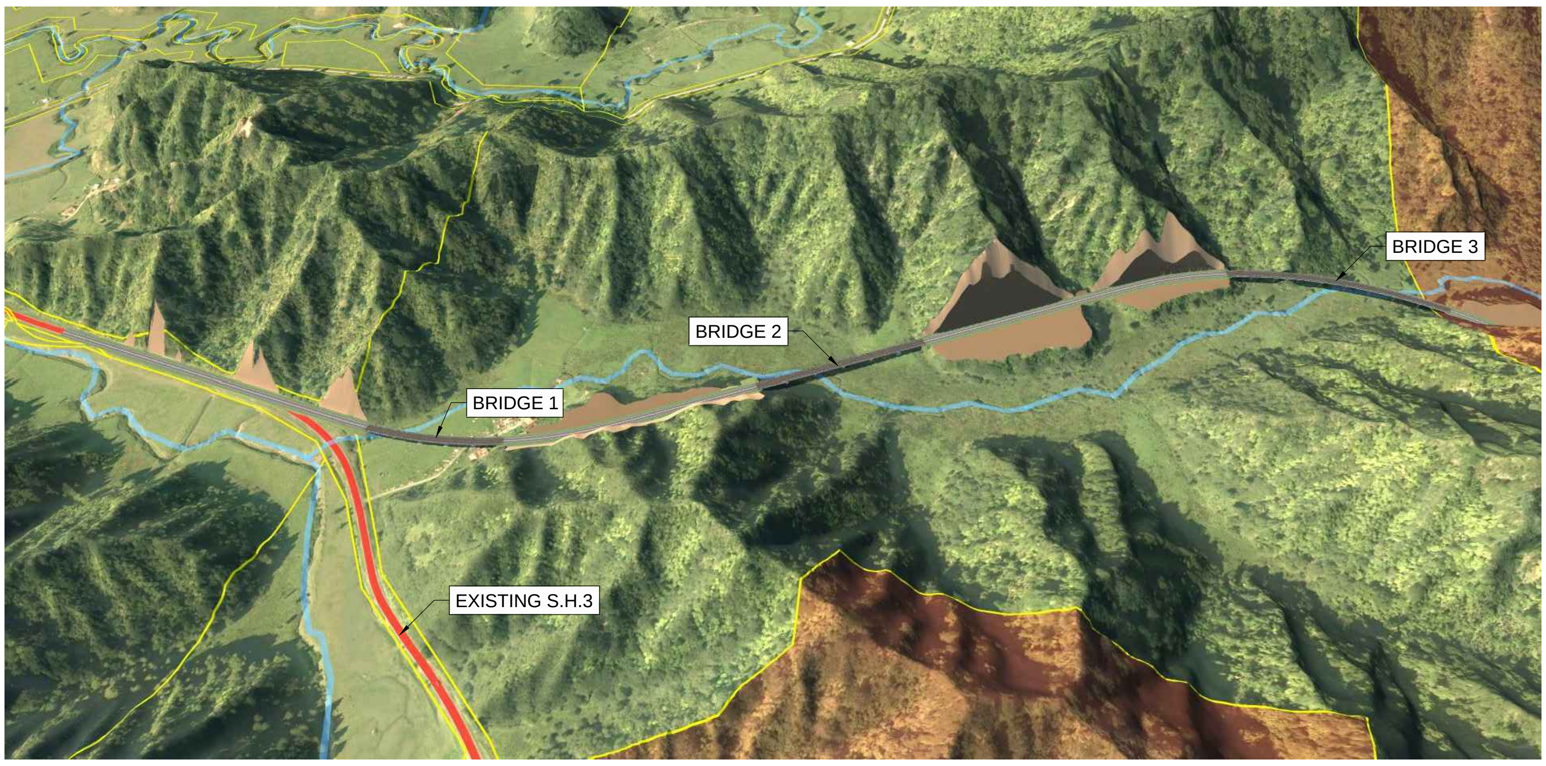

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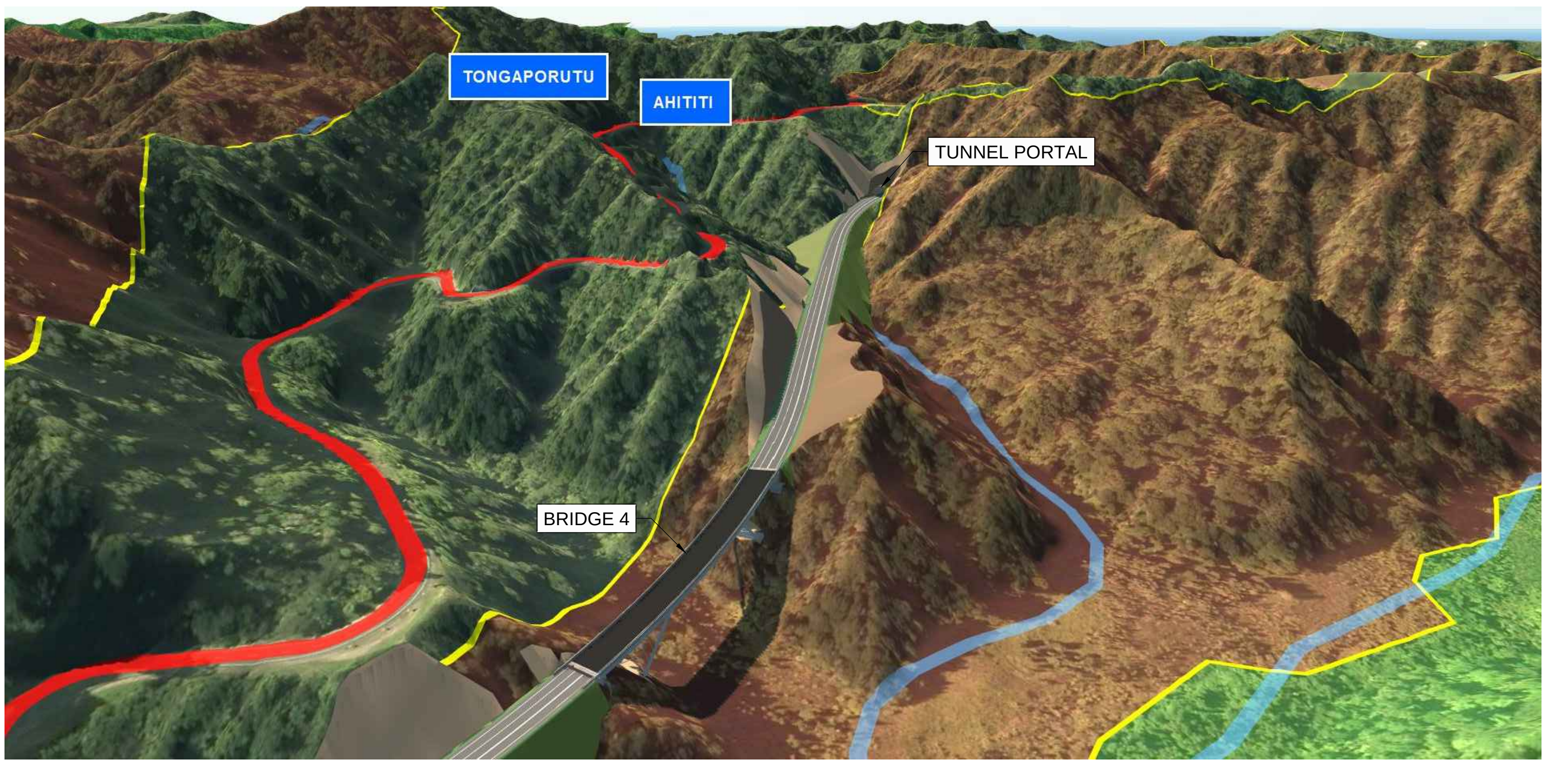

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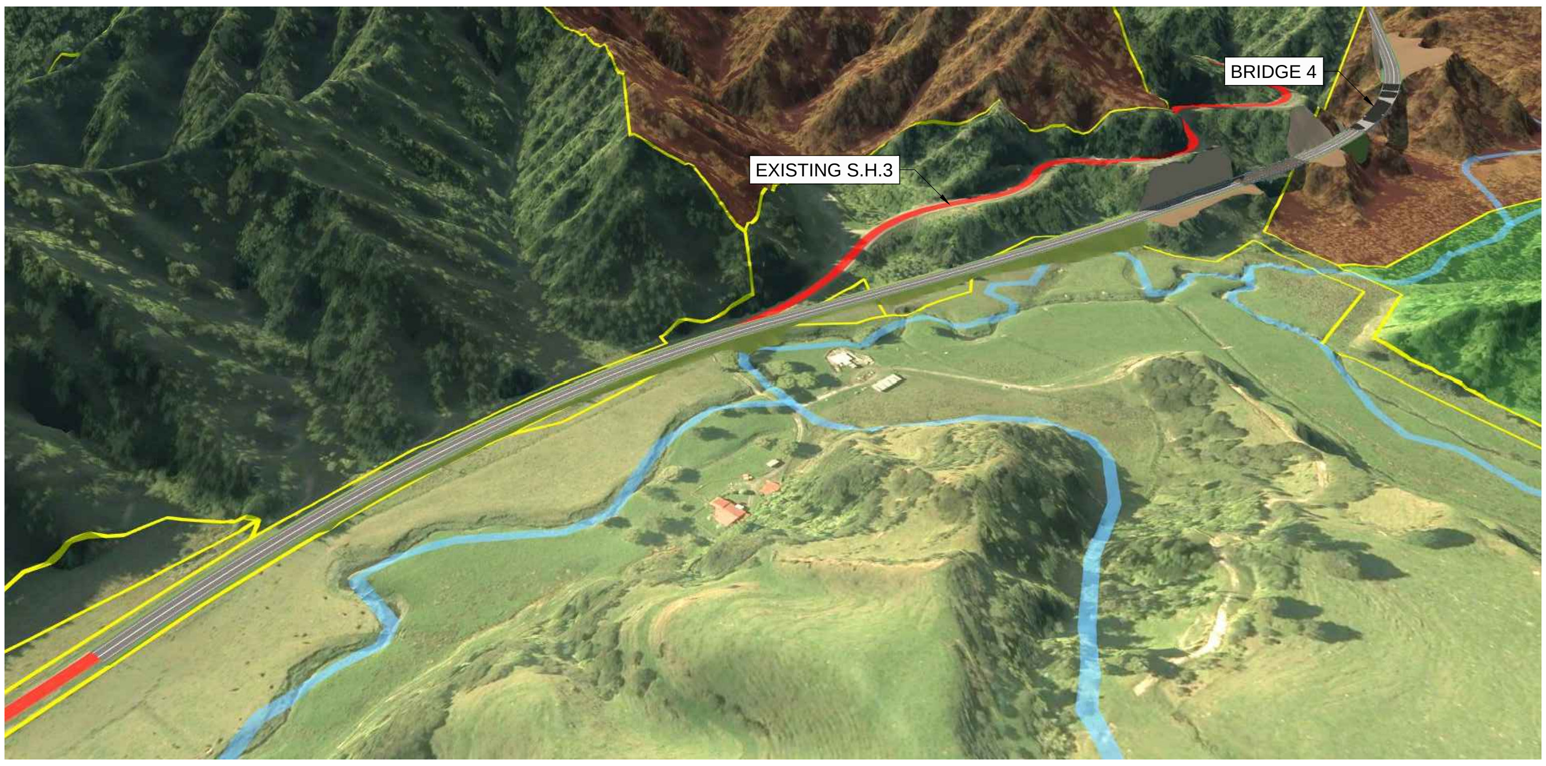

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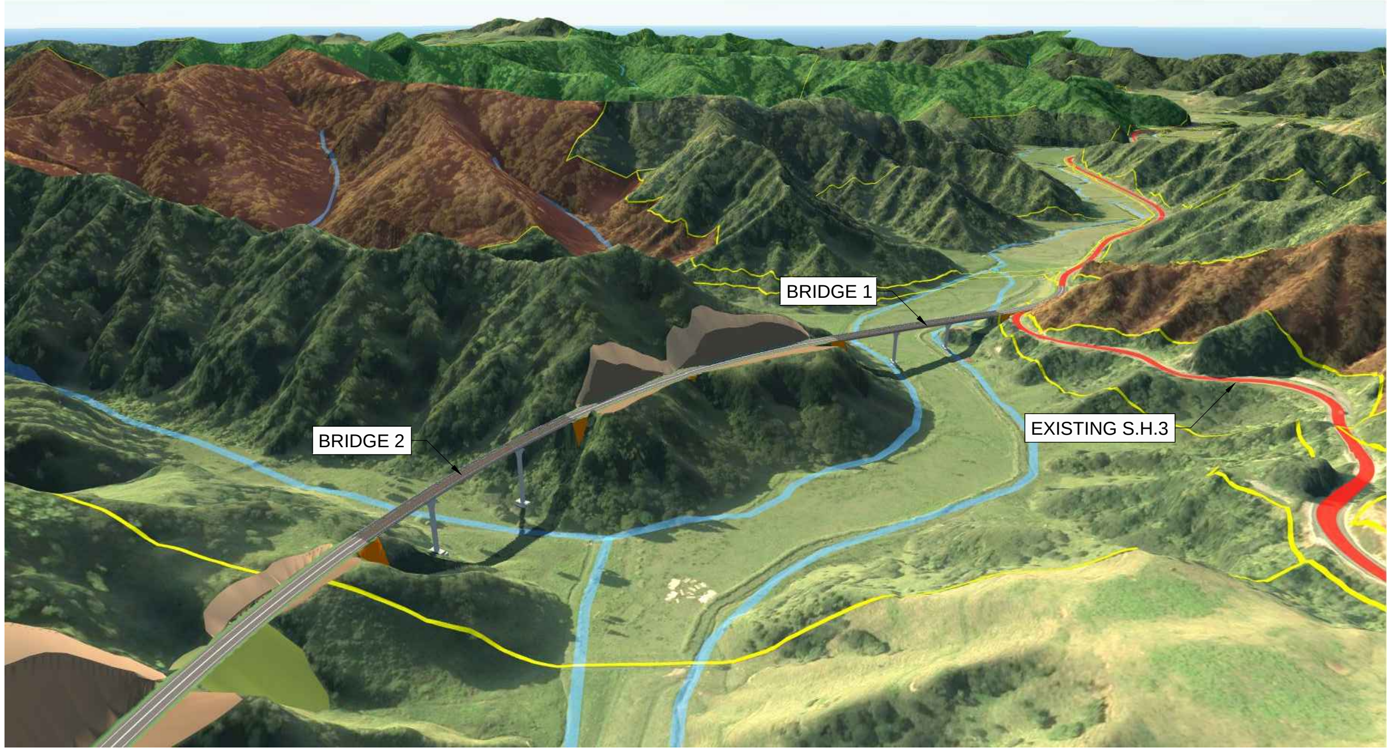

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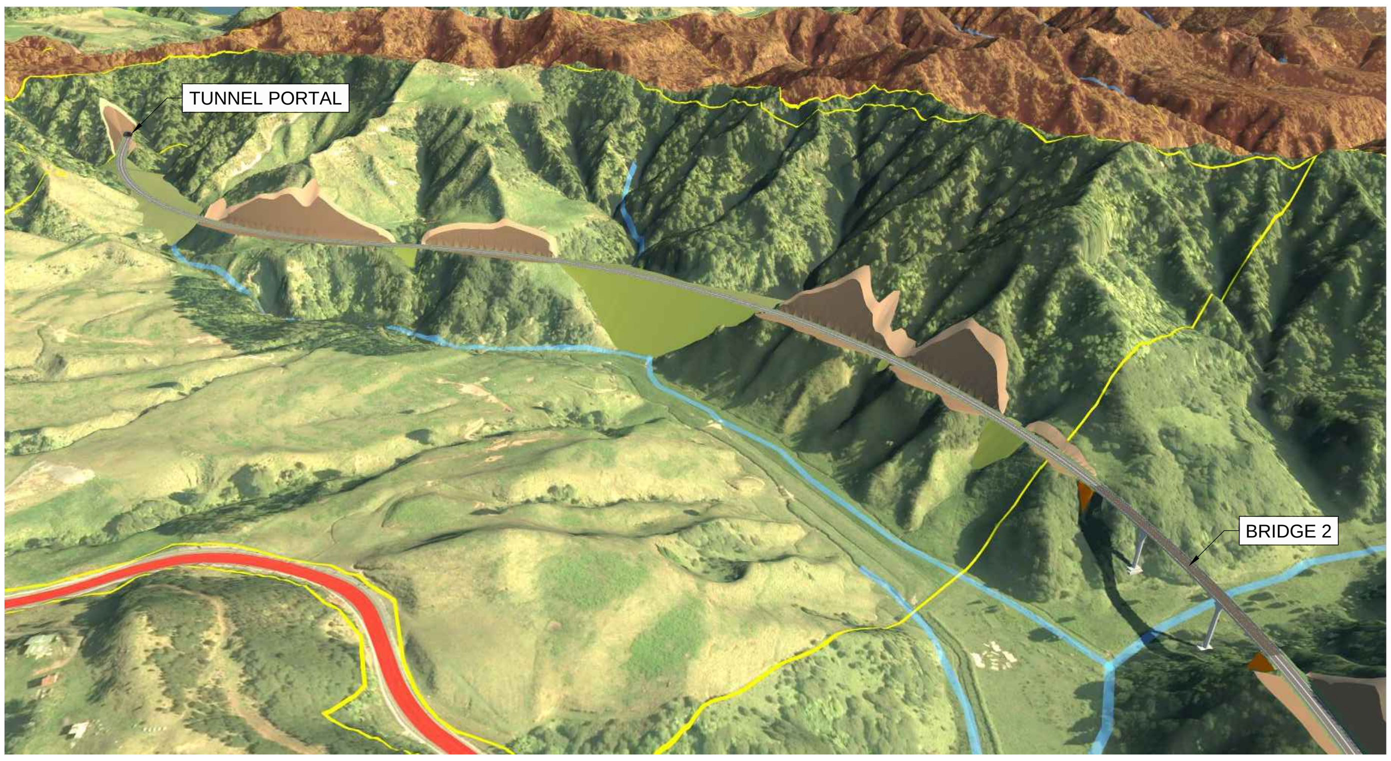

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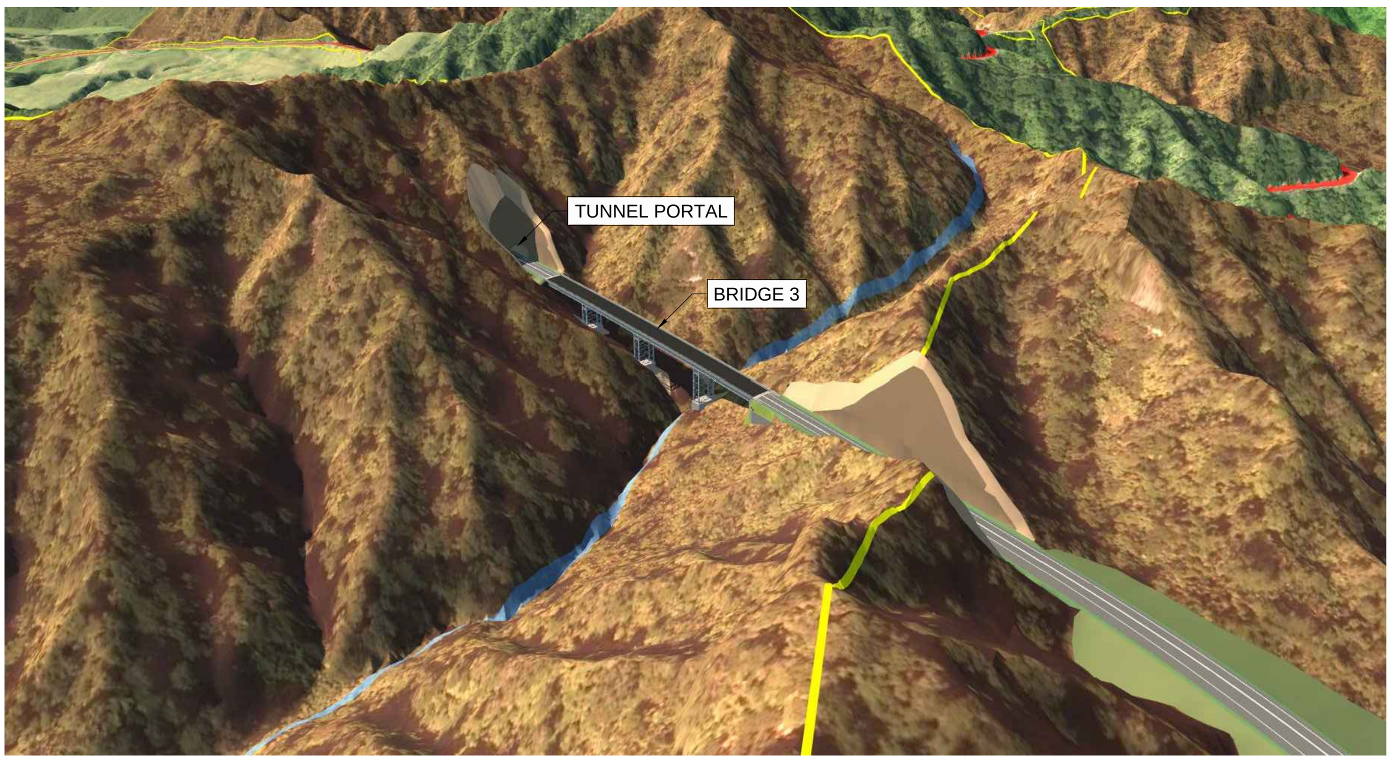

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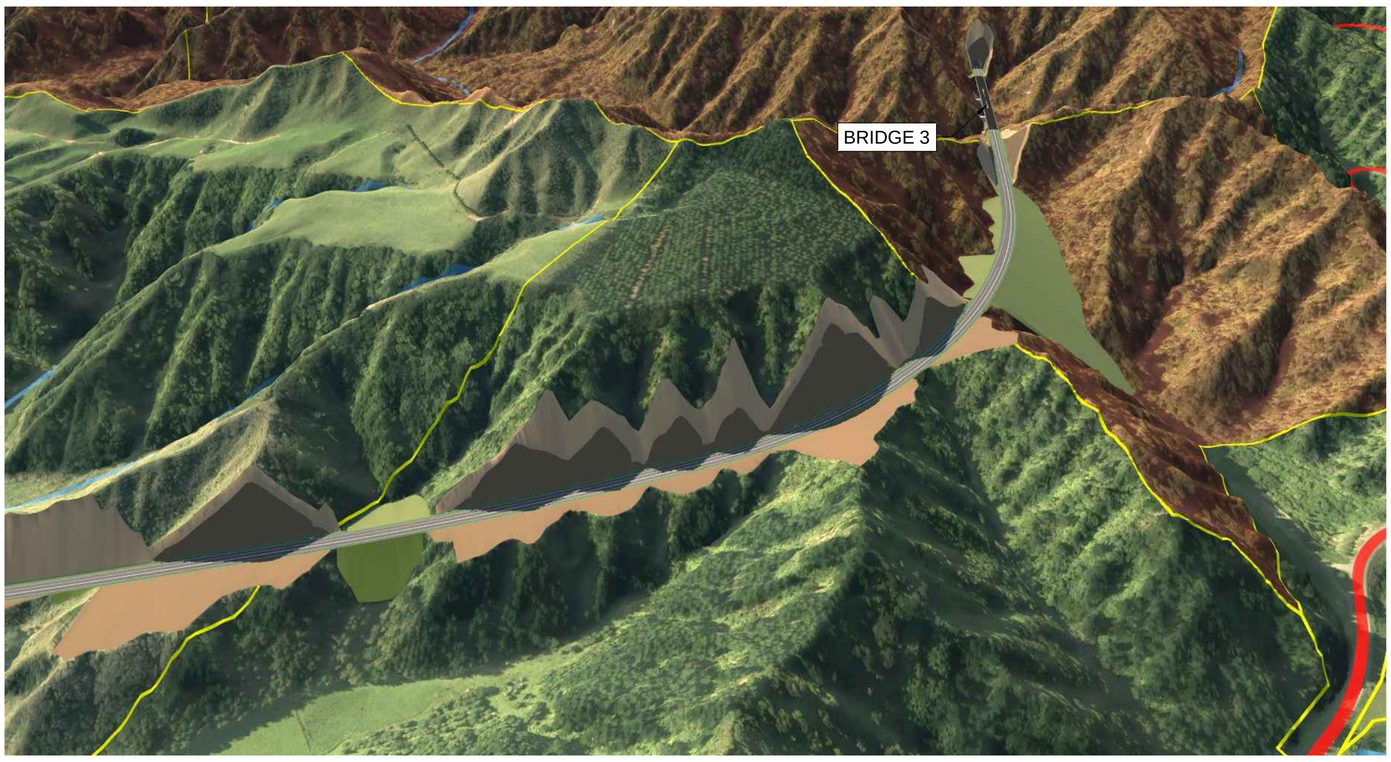

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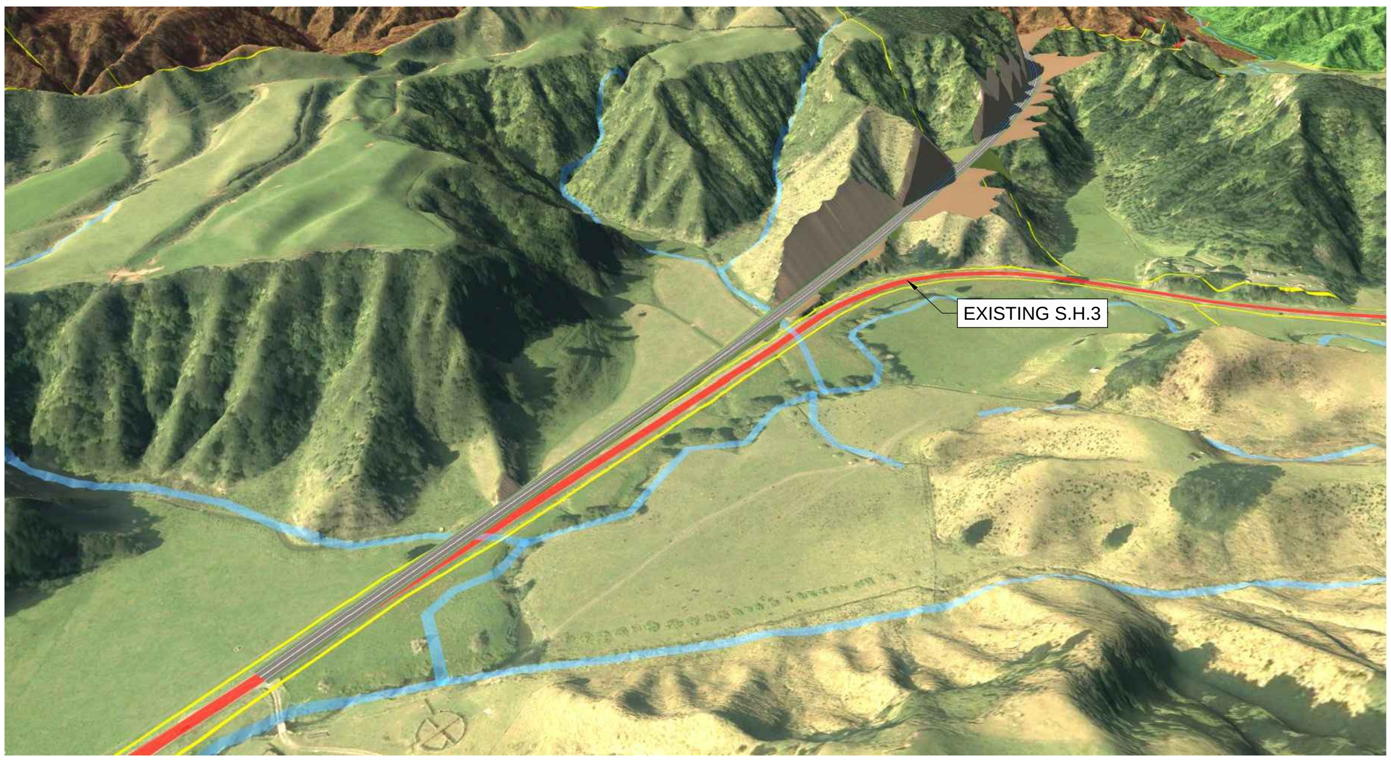

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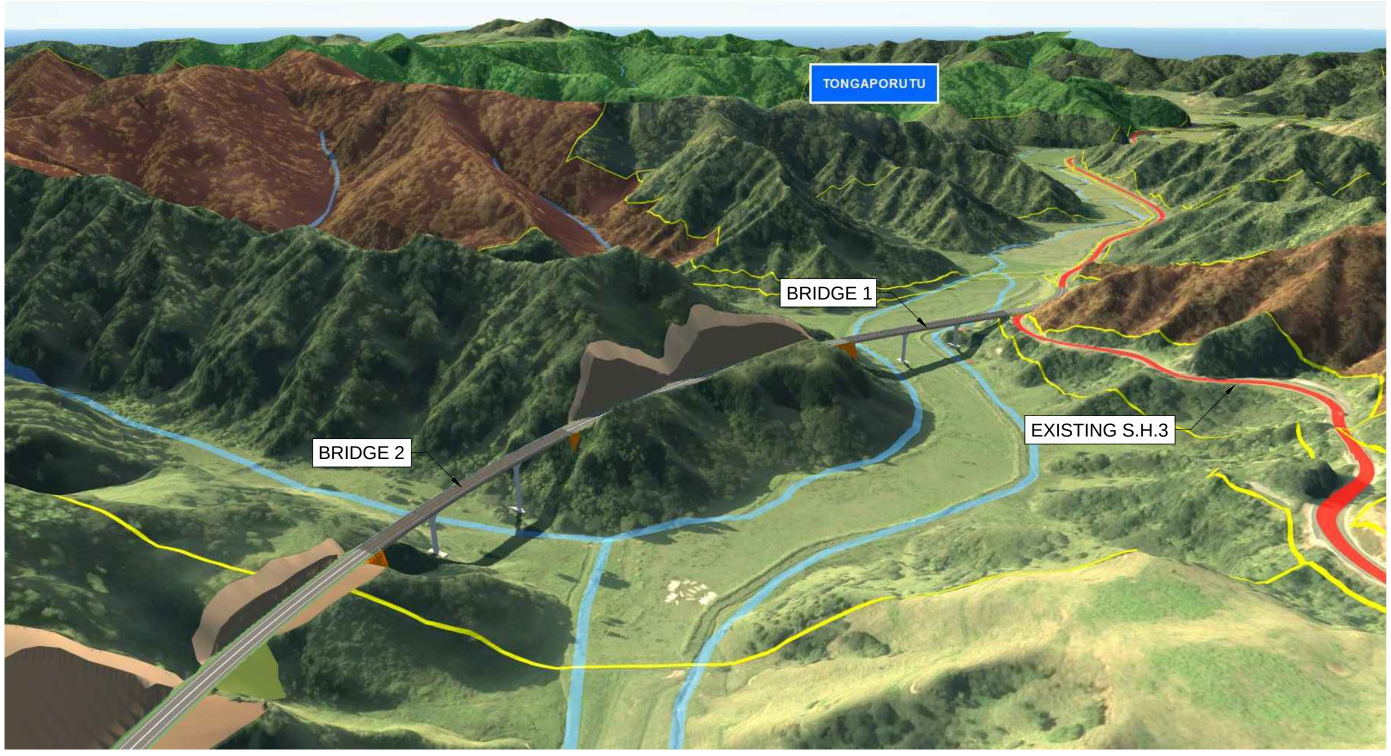

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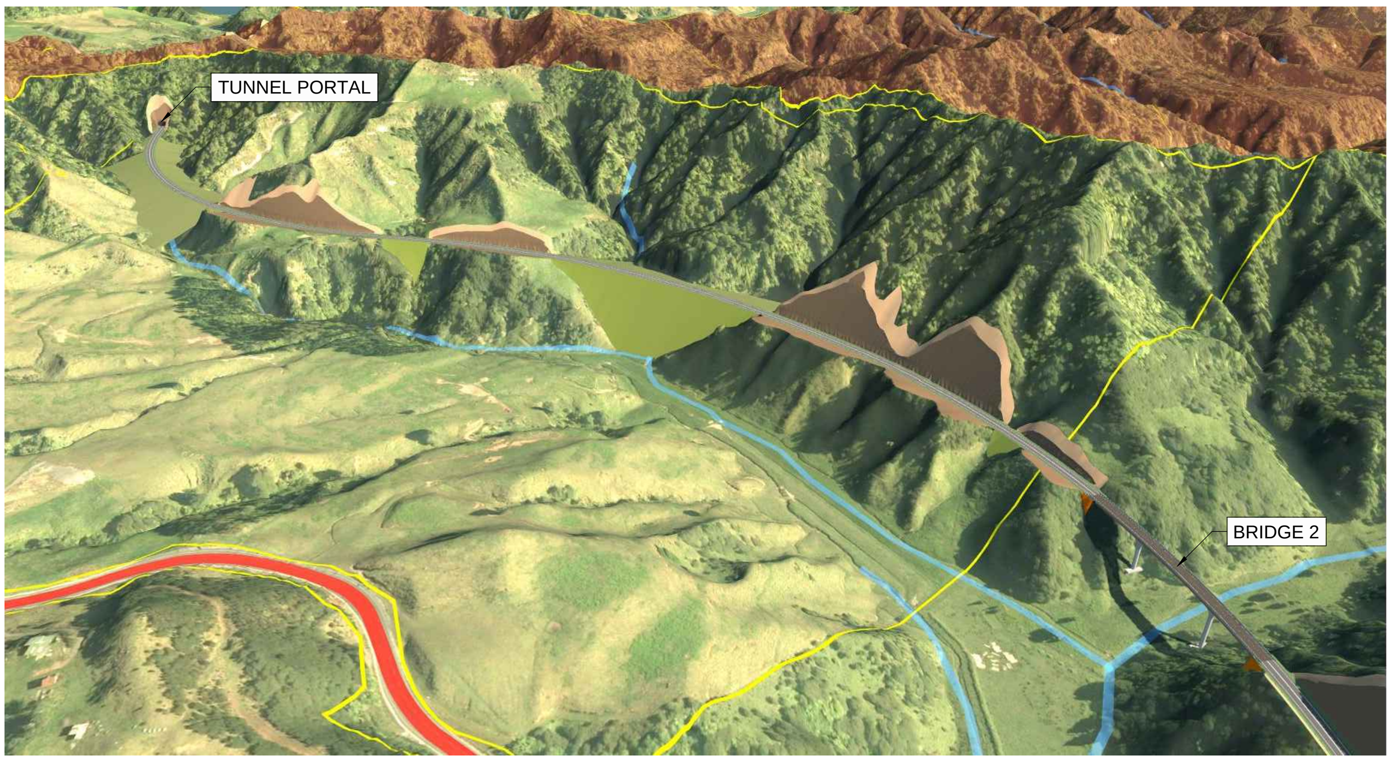

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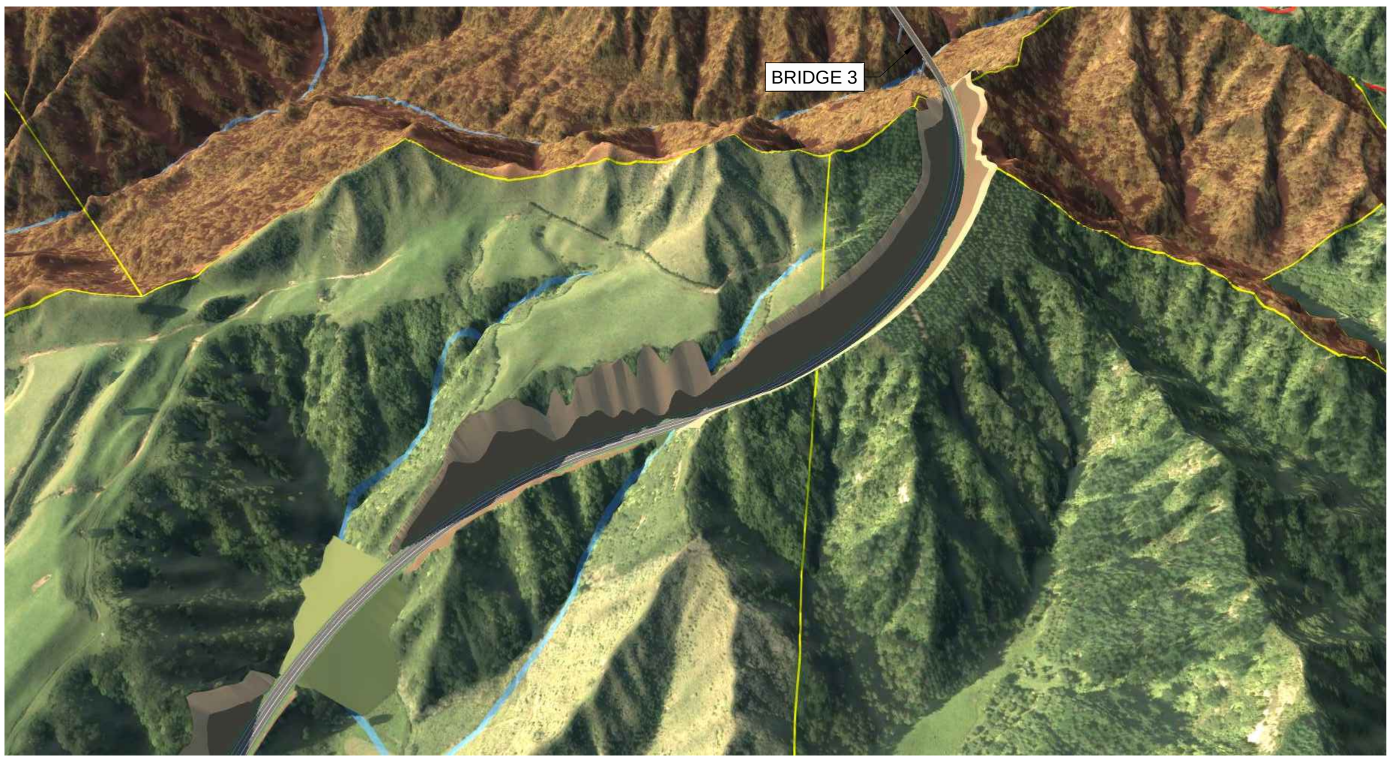

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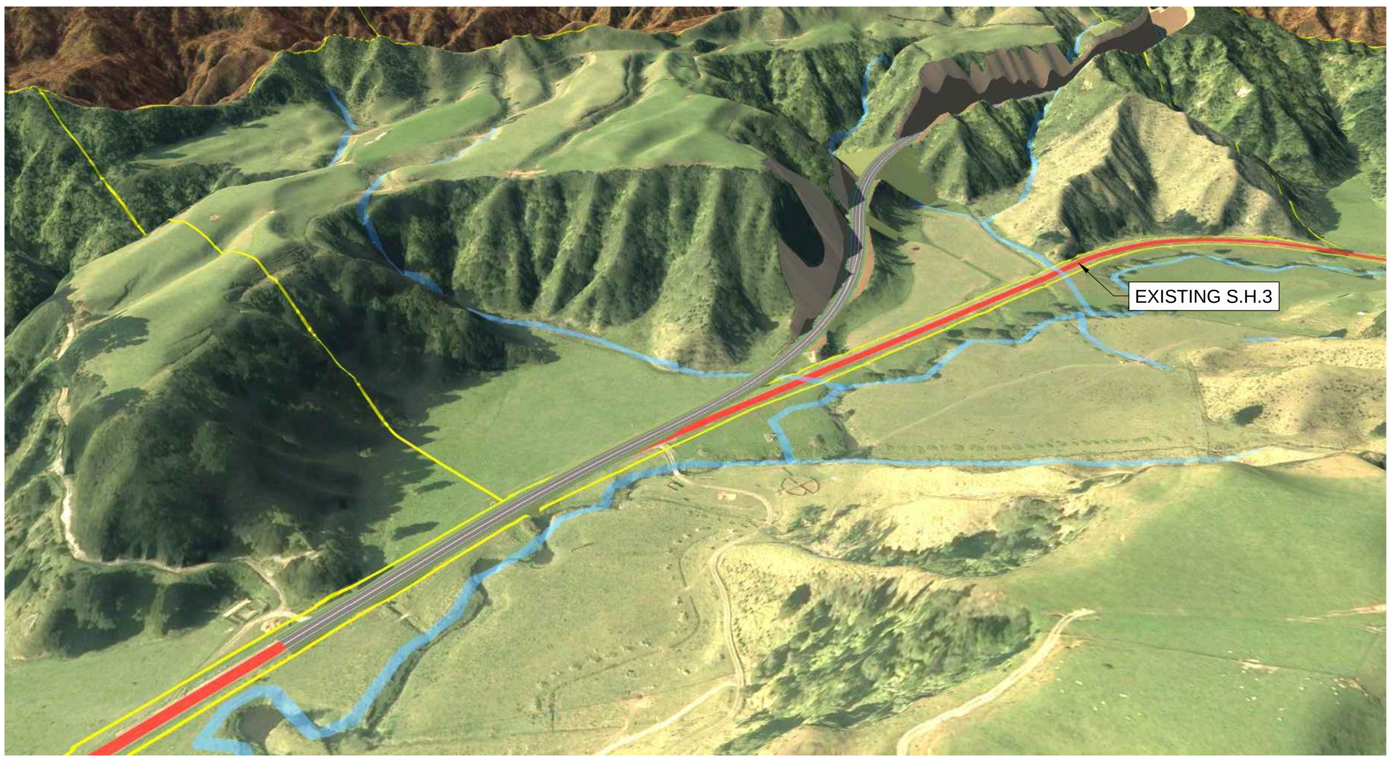

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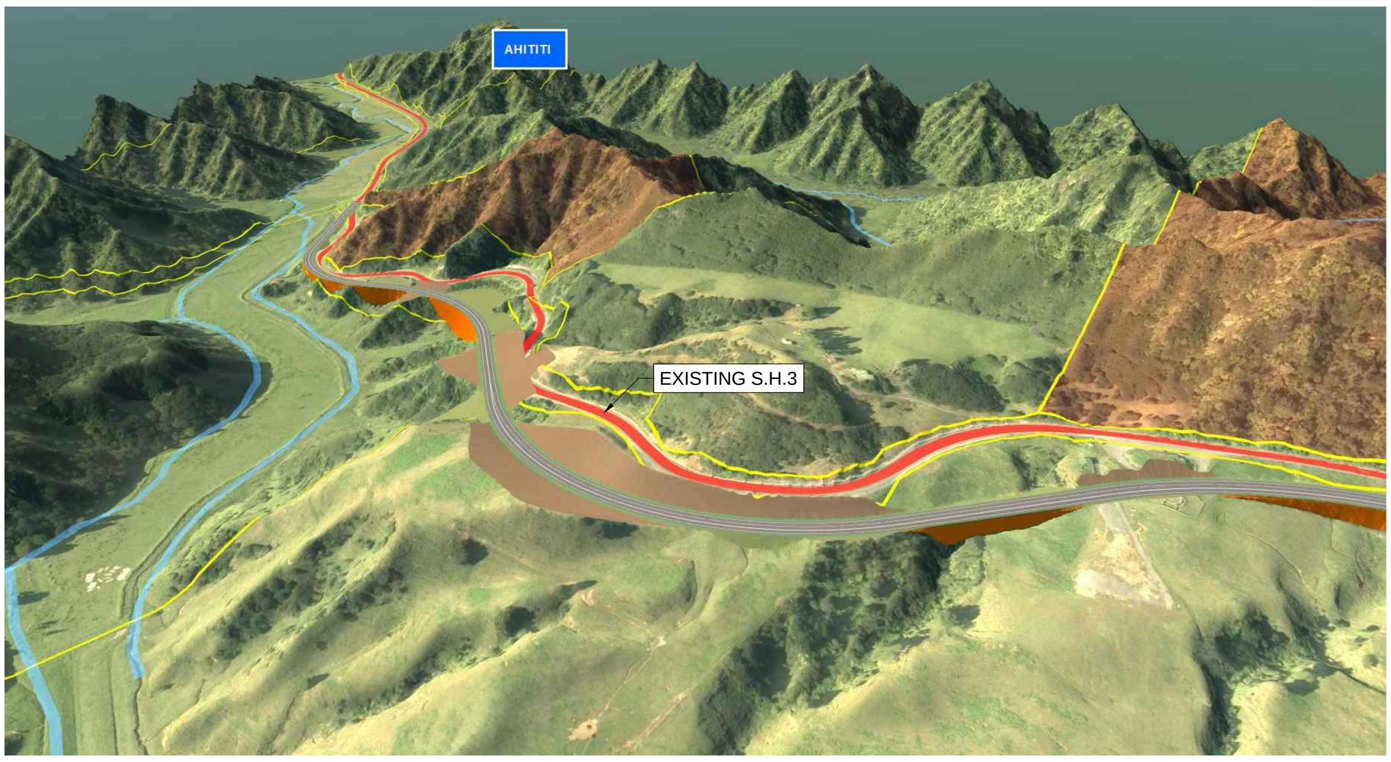

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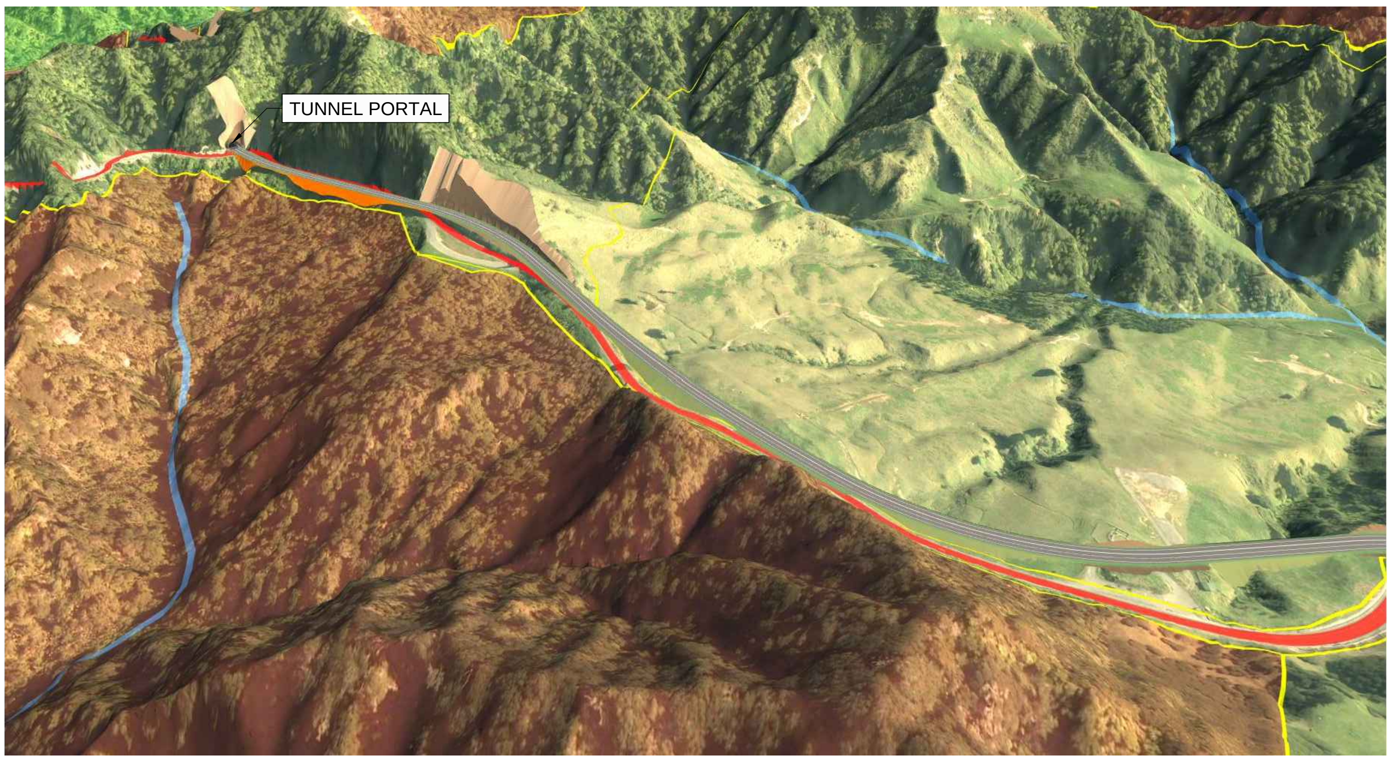

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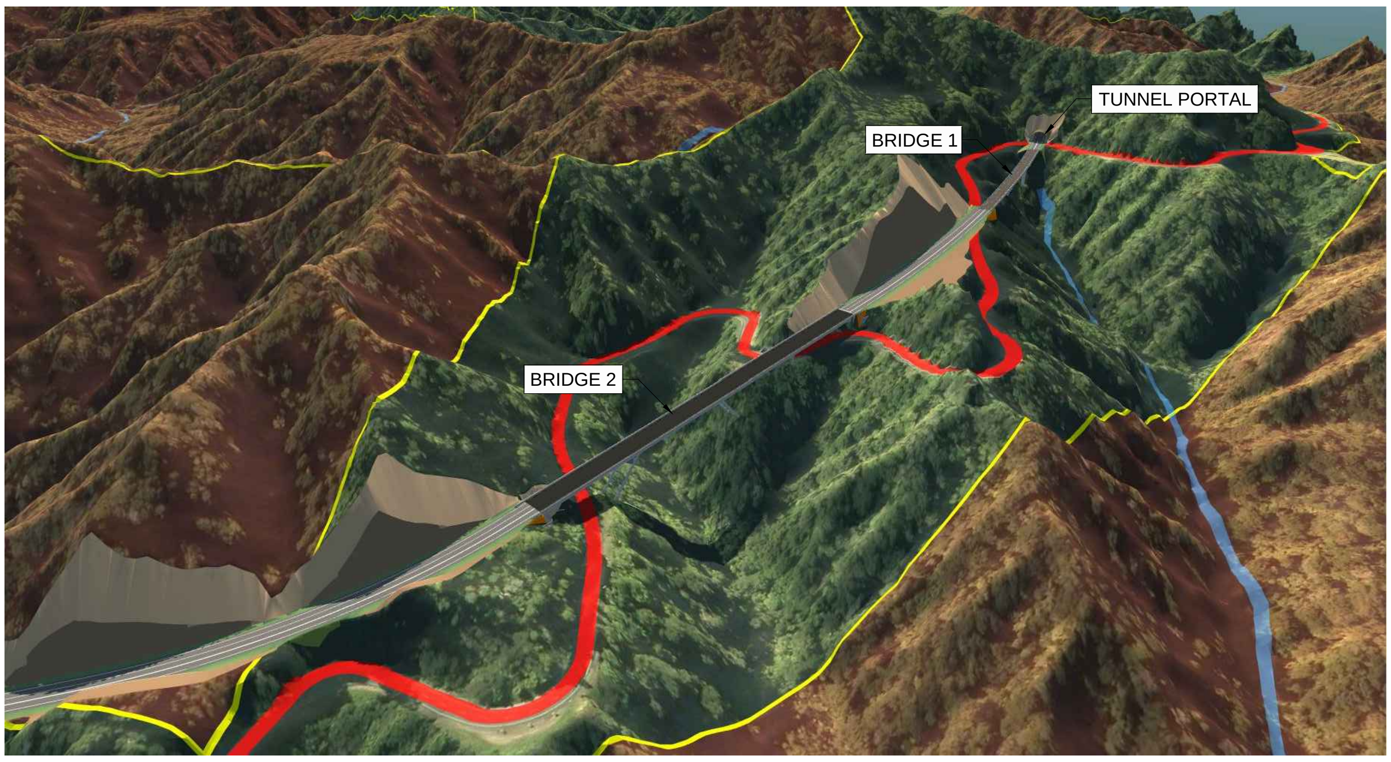

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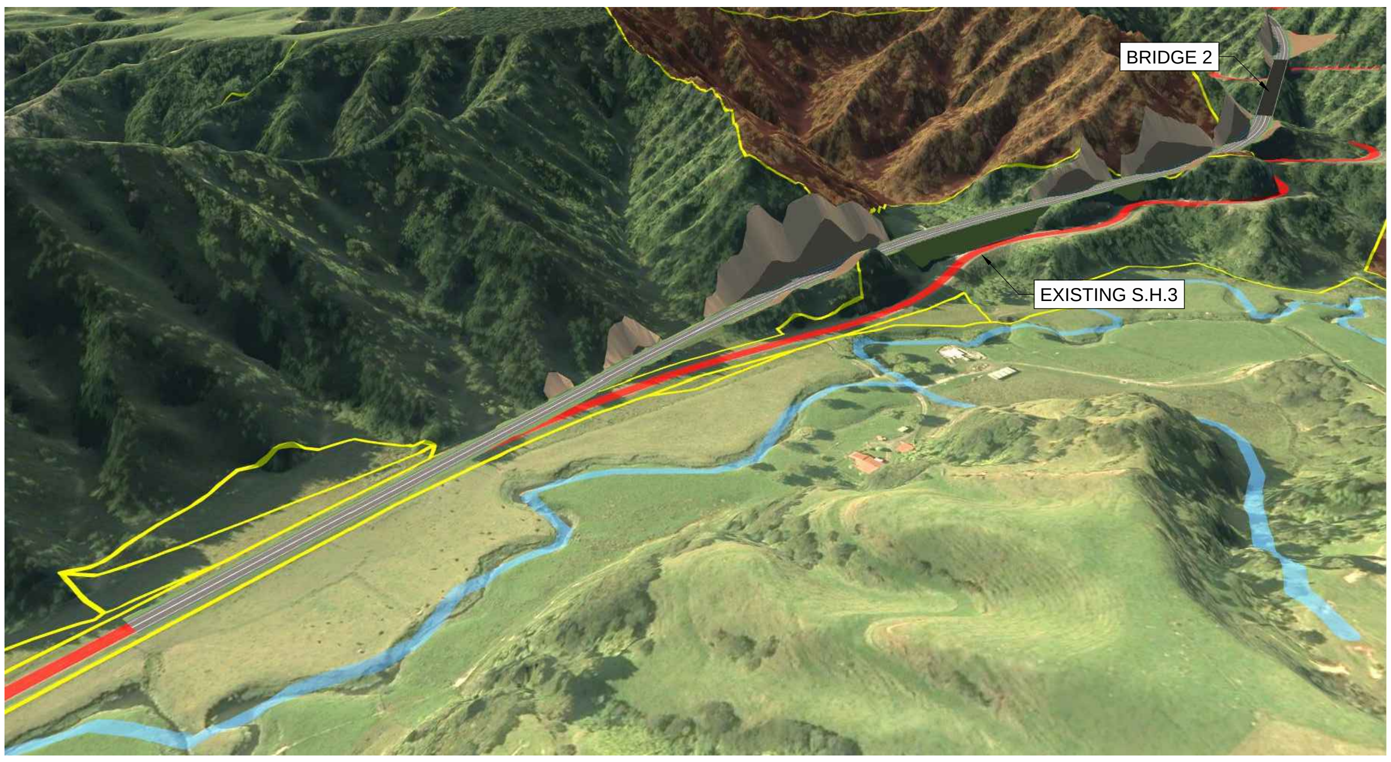

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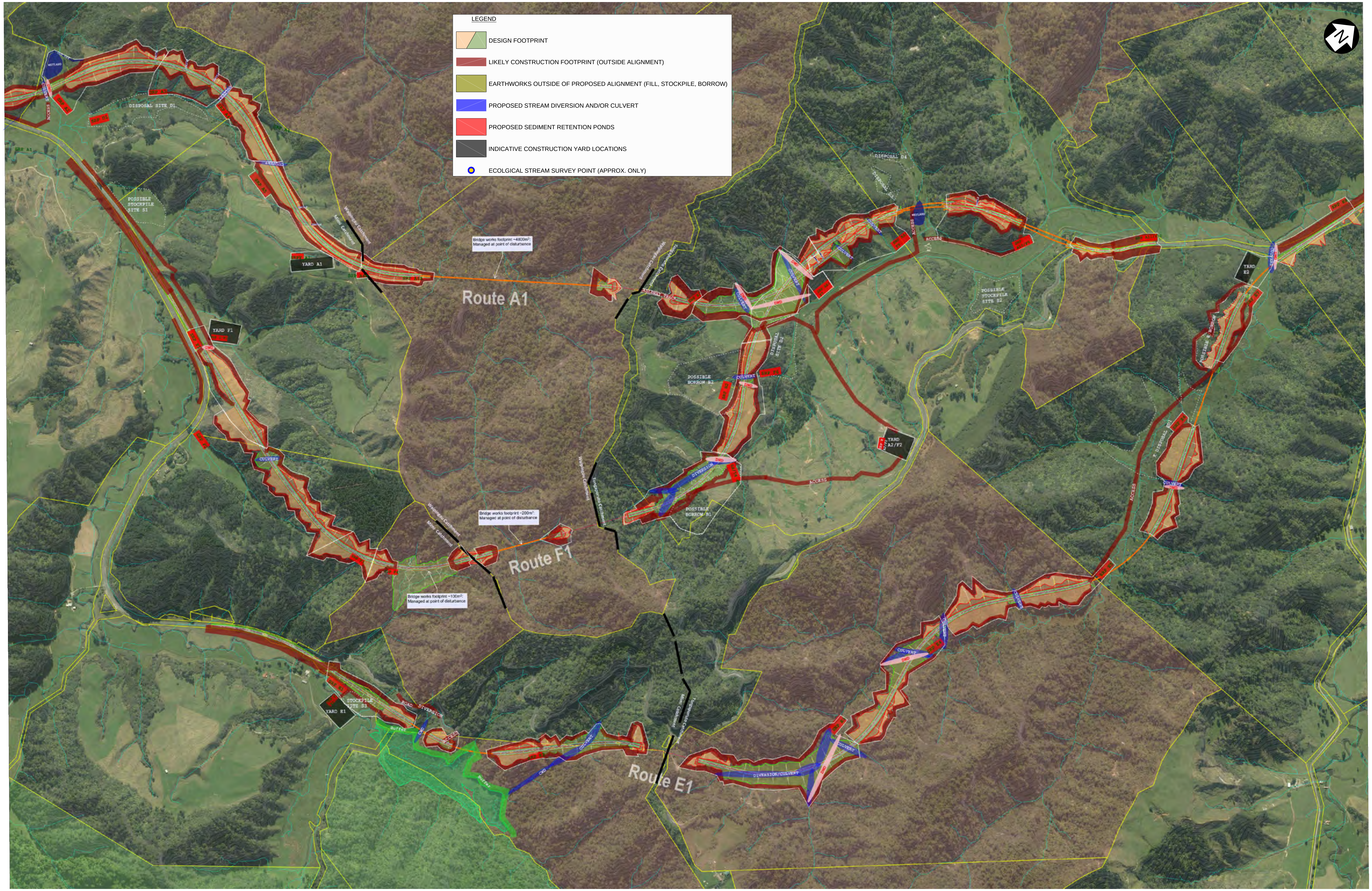
Original Size A1	This drawing is not to be used for construction purposes unless signed approved and issued For Construction		Drawing Number MMA-DES-GEM-Z7-FIG-0102 Revision A

Appendix C: Quantity summary

Corridor	Route Length	Length	Area			Grades (max)		Volumes	Ecology			Streams				Bridges									Tunnels	Pavement	Climbing Lane Notes
	Tongaporutu to Uruti (ex 21.4km)	(m)	(Plan - ha)	Cut (ha)	Fill (ha)	UP	DOWN	Total Earth Shifted (M m^3)	Native Vegetation (Ha)	Exotic Forest (Ha)	Wetland (Ha)	Culvert Length (m)	Bridge Length (m)	Effected Stream (m)	Stream Diversion (m)	Bridge 1 (m)	Bridge 2 (m)	Bridge 3 (m)	Bridge 4 (m)	Bridge 5 (m)	Length of bridge above 30m high	No. of Piers	Construction method	Construction footprint (hectre)	(m)	A (sqm)	
A	17.9	5940	25.9	20.7	5.20	7.0%	-10.0%	1.78								179	158	610			330	15	Bridge 1&2 - B, Bridge 3 - A	1.5	235	45,550	SB Not Required <8% NB Ch 3900 to 5100
E	20.4	5250	29.7	21.0	8.7	8.5%	-8.0%	2.05								180	224	270	134	54	0	23	Bridge 3 - B	2.3	230	49,790	SB Ch 2250 to 3315 NB Ch 3710 to 4600
F	19	5030	32.3	23.4	8.9	7.15%	-9.0%	2.32								207	194	192			100	8	Bridge 1&2 - B Bridge 3 - A	1.3	250	45,570	SB Not Required <8% NB Ch 3280 to 4650
P	18.8	4770	32.5	23.8	8.7	7.0%	-10.0%	2.48								215	182	234			200	10	Bridge 1&2 - B, Bridge 3 - A	1.3	220	46,010	SB Not Required <8% NB Ch 3050 to 4290
Z	20.2	4230	17.8	13.0	4.8	8.0%	10.0%	0.80								182	254	144			0	7	Bridge 1&3 - B, Bridge 2 - A	1.2	240	43,810	SB Ch 735 to 1820 NB Ch 2750 to 3900

Appendix D: Indicative disposal and borrow sites



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Rev	Revision Description	Drawn	Drawing Checked	Designed	Design Checked	Approved	Date

Tab: MMA-DES-DSM-00-FIG-0001

Scales: NOT TO SCALE

Original Size: A1

ARAHOU

DRAFT

Document Controller Check: Date:

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MT MESSENGER SH3 REALIGNMENT

INDICATIVE FOOTPRINTS OPTIONS A, E AND F FOR ECOLOGICAL SURVEYS ONLY

Approved: NOT FOR CONSTRUCTION

Status: FOR INFORMATION

Drawing Number: MMA-DES-DSM-00-FIG-0001

Revision: A

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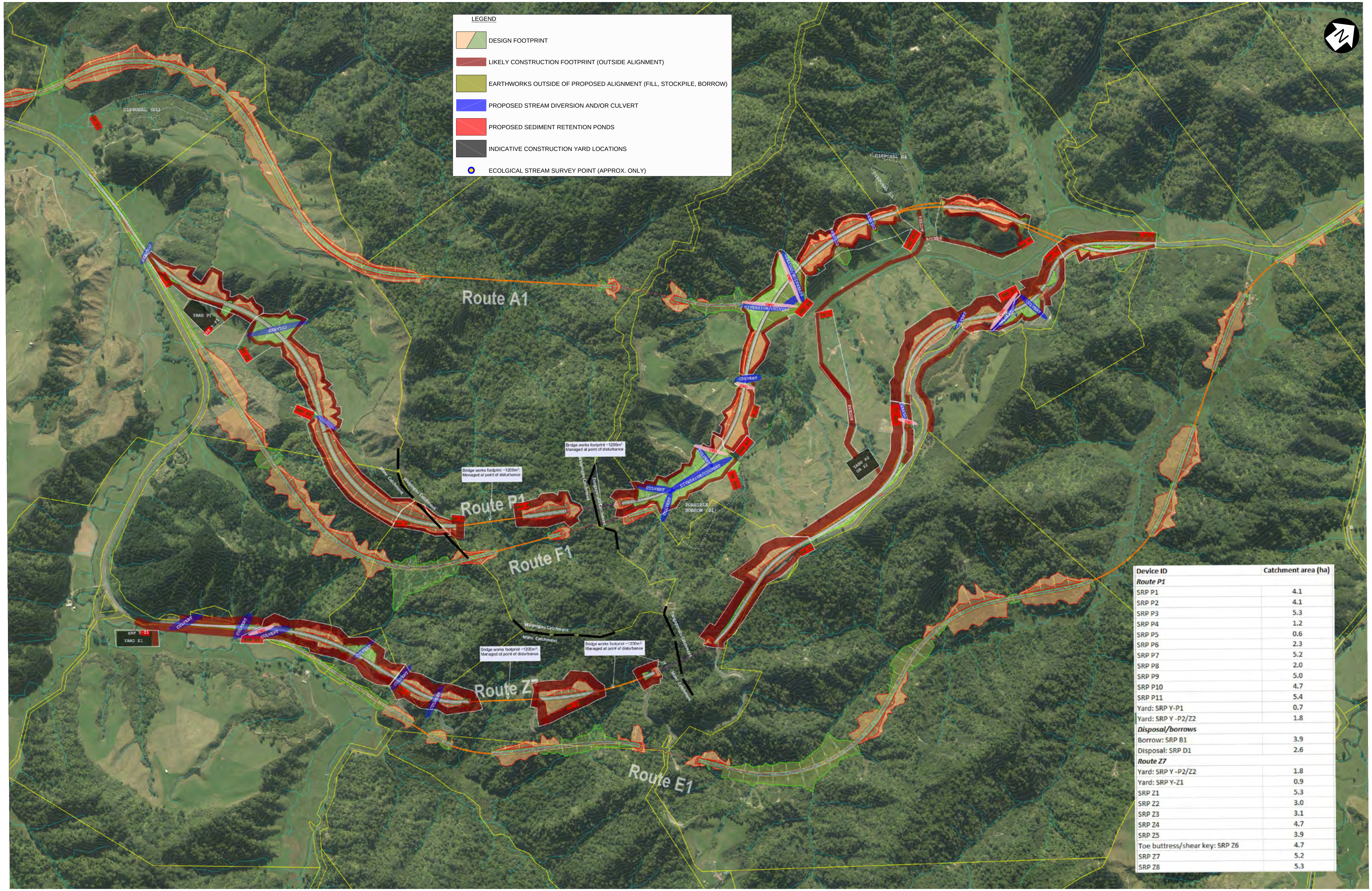

Device ID	Catchment area (ha)
Route P1	
SRP P1	4.1
SRP P2	4.1
SRP P3	5.3
SRP P4	1.2
SRP P5	0.6
SRP P6	2.3
SRP P7	5.2
SRP P8	2.0
SRP P9	5.0
SRP P10	4.7
SRP P11	5.4
Yard: SRP Y-P1	0.7
Yard: SRP Y -P2/Z2	1.8
Disposal/borrows	
Borrow: SRP B1	3.9
Disposal: SRP D1	2.6
Route Z7	
Yard: SRP Y -P2/Z2	1.8
Yard: SRP Y-Z1	0.9
SRP Z1	5.3
SRP Z2	3.0
SRP Z3	3.1
SRP Z4	4.7
SRP Z5	3.9
Toe buttress/shear key: SRP Z6	4.7
SRP Z7	5.2
SRP Z8	5.3

Rev	Revision Description	Drawn	Drawing Checked	Designed	Design Checked	Approved	Date
A	FOR INFORMATION	QDO'S		SP			

Tab: MMA-DES-DSM-00-FIG-0002

Scales: NOT TO SCALE

Original Size: A1

ARAHOU
a new pathway

DRAFT

Document Controller Check: Date:

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MT MESSENGER SH3 REALIGNMENT

INDICATIVE FOOTPRINTS OPTIONS P AND Z FOR ECOLOGICAL SURVEYS ONLY

Approved: NOT FOR CONSTRUCTION

Status: FOR INFORMATION

Drawing Number: MMA-DES-DSM-00-FIG-0002

Revision: A

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Appendix E: MCA criteria and specialists

Criteria	Sub criteria	Measures for scoring	Information Sources	Owned By
Transport	Road Safety Operational Efficiency Travel Time Operational Resilience.	As per longlist	As per longlist	Eliza Sutton
Resilience	Instability [landslides, mudflows] Earthquake [excl. ground improvements] Liquefaction and lateral spread Flooding/storm damage	As per longlist	As per longlist	Stephen Crawford
Constructability	To be developed by specialists (if necessary)	As per longlist	As per longlist	Stephane Riot / Duncan Kenderdine
Landscape and natural character	To be developed by specialist (if necessary)	As per longlist	As per longlist	Bruce McKenzie
Historic heritage	To be developed by specialist (if necessary)	To be developed by specialist	tbc	Rod Clough
Community	To be developed by specialists	To be developed by specialists	tbc	Wendy Turvey Rob Greenaway
Property	Maori Land Acquisition cost / Compensation Impact on individual properties Complexity of Acquisition	Degree of difficulty	As per longlist	Mark Spring
Ecology	· Severance of the natural environment · Removal of native vegetation · Additional sub-criteria if necessary	As per longlist	As per longlist along with additional field work	Matt Baber

Cultural heritage	Treaty settlement land Ara tupuna / pathways Kōkako Wāhi tapu Ngāhere / rakau (important bush and/or trees) Tihi maunga Awa Mauri (disruption / connection to place) Kaitiakitanga (whakama/riri/muru)	As per longlist	As per longlist	Ngāti Tama

Appendix F: MCA scoring and recording

Criteria	Sub criteria	Scored by	Option A			Option E			Option F			Option P			Option Z2		
			Score	Reason for score	Opportunities to enhance outcome	Score	Reason for score	Opportunities to enhance outcome	Score	Reason for score	Opportunities to enhance outcome	Score	Reason for score	Opportunities to enhance outcome	Score	Reason for score	Opportunities to enhance outcome
{NAME}	If relevant																
	If relevant																
	If relevant																
	If relevant																

Appendix G: Reporting template

Report Name

Report Number

Date / description

Contents

Date	Version no.	Checked by	Changes made

1. Introduction

Consistent text which will be provided to you

2. Background

- Summary of context e.g. landscape overlays, Parininihi biodiversity etc.
- Approximately ½ page except for ecologists. Ecology: approximately 1-2 pages with reference to the existing reporting.

3. Methodology

- Data/information used
- Sub-criteria and weightings (including justification)
- Scoring process including measures for scoring
- Key assumptions
- Mitigation assumptions
- What determines fatal flaws
- Approximately 1-2 pages in total

4. Scoring

See attached table. Include:

- Option number, who undertook scoring and the score
- Key reasons for score, including the standard mitigation taken into account (if required)
- Any bespoke mitigation or design opportunities

Scoring table

Scorer: {NAME}	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2
Score {Include sub-criteria if necessary}												
Key reasons for score *e.g. corridor would have significant impact on a wetland of significant value*												
Potential opportunities to enhance outcome *e.g. avoidance of the wetland could improve score*												

Scorer: {NAME}	G1	G2	H1	H2	J1	J2	K1	K2	L1	L2	Z2	Z4
Score {Include sub-criteria if necessary}												
Key reasons for score *e.g. corridor would have significant impact on a wetland of significant value*												
Potential opportunities to enhance outcome *e.g. avoidance of the wetland could improve score*												

Appendices

Appendix C: Constructability

Mt Messenger Alliance

Te Ara o Te Ata

Mt Messenger Shortlist Options Assessment (Constructability)

August 2017

Duncan Kenderdine, Stephane Riot

Contents

1 Introduction

The Mt Messenger Alliance is currently investigating alternative options for upgrading or bypassing State Highway 3 (SH3) in the vicinity of Mt Messenger, in North Taranaki. In total, five options were identified as part of the shortlisting process.

Shortlisted options were assessed via a multi-criteria analysis (MCA2) process, including presentation of the experts' assessment for each criterion at a workshop on 26 – 27 June 2017.

This report summarises the evaluation of the options under the constructability criterion; and records the scores assigned for each option under that criterion.

2 Background

The scoring for the constructability criteria was undertaken by Duncan Kenderdine (Alliance Manager) and Stephane Riot (Construction Manager), both experienced in large civil and structural infrastructure projects.

Input and feedback on the scoring was sought from:

- Ken Boam (Design Manager);
- Phil Gaby (Structures);
- Hugh Milliken (Construction Management);
- Richard Balsillie (Estimator);
- Stephen Crawford (Geotechnical Engineer);
- Sharon Parackal (Construction Water Management);
- Glenn Coppard (Design); and
- Mohammed Al-Kubaisy (Stormwater).

These specialists met prior to the MCA2 workshop to assess and discuss the five options on their constructability, based on the methodology set out below. Mr Kenderdine and Mr Riot attended the MCA2 workshop and presented their assessment. Mr Boam, Mr Gaby, Mr Crawford, Mr Coppard and Mr Al-Kubaisy were also in attendance at the MCA2 workshop.

A site visit also took place on 22nd and 23rd May, with Mr Riot, Mr Kenderdine, Mr Milliken, Mr Gaby, Mr Crawford, Mr Coppard and others to walk over parts of the proposed alignments on Options A, E, F, P and Z. The areas traversed were:

- the southern ridge of the Waipingao valley from Option A to F,
- the wetland to the south of Option E and up toward the large fill of Option E south of the tunnel,
- across the large landslide to the north of the Waipingao, to the base of the tunnel exits on Options F and P, across and up to the ridge on the northern side of the Waipingao above the Option A tunnel, down to the valley floor; and

- up the Mangapepeke Valley from SH3 to the base of the large fill to the north of the tunnel on Option E.

3 Methodology

3.1 Data / information used

The constructability assessment is based on:

- alignment information in plan and 3D simulations in a model known as 'Humphrey', which provided the basis for optimising road alignments.
- a programming comparison formed on the basis of 1million m^3 of earthworks able to be shifted in a year. The comparative programing approach was used to assess exposure of various route options to suitable weather periods, as well as total construction periods. This allows the relevant program advantages and disadvantages of routes to be compared.

This information, including new information about changes to the design of the alignments since the previous MCA1 workshop, and the site visit, was considered appropriate to inform the constructability assessment.

3.2 Subcriteria

No subcriteria were proposed on the basis that a single overall score would better reflect the constructability position.

3.3 Key assumptions and areas of interest or concern

There were a number of key assumptions and areas of interest or concern which informed the constructability scoring:

- Limited land availability, which in turn restricts the area available for access roads, construction yards and sediment and erosion control structures;
- The presence of waterways within and adjacent to the proposed alignments, and issues with constructing and managing stormwater and sediment in these areas;
- The difficulty in carrying out steep or deep cuts;
- The volume of earthworks, particularly where there were cut/fill imbalances across the site;
- Issues where routes cross or overlap with the existing SH3, which have implications on programme and the complexity of the methodology;
- The length of any tunnels, given longer tunnels are more difficult to construct; and
- The length and design of the bridges.

4 Scoring

The following table provides scores and key reasons for this scoring.

As per the instructions to all specialists, scores were assigned on an absolute rather than relative basis, applying the 9 point (including fatal flaw) scoring scale. All options present some constructability challenges, and therefore none of the options scored positively. No fatal flaw scores were assigned – this reflects the experts' view that ultimately it is technically possible to construct any of the options. However, the -4 scores assigned for Options A and Z signal that those options would be very challenging in constructability terms.

Scorers: Duncan K, Stephane R	Option A	Option E	Option F	Option P	Option Z
Score	-4	-3	-2	-2	-4
Key reasons for score	Long bridge very difficult to construct, including foundations near landslide area; difficult to programme; stormwater and sediment management critical in Waipingao Valley.	Second lowest earth moved; lots of small bridges to develop; some large cuts close to SH3; sediment control is difficult adjacent to significant wetland.	Lower volume of fill and relatively small cut/fill imbalance; smaller bridge able to be built from the abutments, sediment and erosion controls still critical in valley.	A larger cut/fill imbalance than F; a larger cut; sideling fill not ideal; smaller bridge able to be built from the abutments, but easiest to construct alongside F.	Even with design changes, still very difficult; interactions with existing SH3; access to worksite easier than others; very large retaining walls take a long time to construct.


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Appendix D: Transport

Mt Messenger Shortlist Options Assessment (Transport)

July 2017

Eliza Sutton

Contents

1 Introduction

The purpose of this memo is to set out the assessment undertaken for the Shortlist Multi Criteria Analysis (MCA) assessment of transport matters for the Mt Messenger project.

For the purposes of the assessment, four sub-criteria have been considered:

- Road Safety,
- Network Efficiency/Travel Time Savings,
- Operational Resilience,
- Effect on existing corridor during construction.

This assessment has been undertaken on the basis that any new road which is established will be developed to a higher standard than the existing route, and as such the transport effects all represent a positive outcome. However, some options have transport features which are more or less desirable, and the detail of the assessment scores reflects this. In addition, each of the assessment sub-criteria have been weighted, and it is intended that the overall score be considered based on the collective balance of all the sub-criteria.

2 Background

The NZ Transport Agency ('Agency') is progressing a series of improvements to the SH3 corridor between Mt Messenger and Awakino Gorge. This assessment focuses solely on the section of the corridor in the vicinity of Mt Messenger, between Tongaporutu and Uruti, and it expands on the earlier transport Longlist MCA process to further consider the five Shortlist options currently under consideration.1

The information considered for this MCA was provided on 20 June 2017, with an MCA workshop held on 26 and 27 June.2 The information provided and considered in this assessment included:

- MMA-PLA-OPT-MEM-494-MAC2 Briefing package 20 June 2017;
- Quantity Summary (20 June 2017).

The workshop briefing package provided detail on the five shortlisted options under consideration. These options are discussed in detail in other reports, but in summary may be described as follows:

- Option A ('Option A' for public drop in session): The most western alignment, of 5.9km length of new road with an overall reduction in the length of SH3 (between Tongaporutu and Uruti) of 3.5km. Northbound passing lane provided over length with a 10% grade.
- Option E ('Option C' for public drop in session): The most eastern alignment, of 5.3km length of new road with an overall reduction in the length of SH3 (between

[1] I also prepared a report assessing the transport effects of those longlist options.

[2] I was only in attendance at the workshop on 27 June.

Tongaporutu and Uruti) of 1km. Northbound and southbound passing lanes provided over lengths with 8 – 8.5% grades.

- Option F (‘Option B1’ for public drop in session): To the immediate west of the existing corridor alignment, of 5km length of new road with an overall reduction in the length of SH3 (between Tongaporutu and Uruti) of 2.4km. Northbound passing lane provided over length with a 9% grade.
- Option P (‘Option B2’ for public drop in session): Developed by Ngati Tama, of 4.8km length of new road with an overall reduction in the length of SH3 (between Tongaporutu and Uruti) of 2.6km. Northbound passing lane provided over length with a 10% grade.
- Option Z (‘Option D’ for public drop in session): Developed principally within the existing corridor, of 4.2km length of new road with an overall reduction in the length of SH3 (between Tongaporutu and Uruti) of 1.2km. Northbound and southbound passing lanes provided over lengths with 8 – 10% grades.

All options include a tunnel of 220m – 250m length, and most have three bridges (with the exception of Option E which has 5 bridges).

3 Methodology

The purpose of this transport criteria assessment is to consider the relevant transport outcomes of this rural state highway roading project, which is geographically isolated and situated in challenging terrain. As such, many sub-criteria typically used in assessing new roading projects are not considered directly relevant in this instance; for example it is extremely unlikely that this project will enable a modal shift away from vehicular traffic, and as such that sub-criterion is considered to be irrelevant for the purposes of this short-list assessment process.

The key sub-criteria identified in the development of this assessment are:

- Road Safety,
- Operational Efficiency/Travel Time,
- Operational Resilience,
- Effect on the existing SH3 corridor during construction.

These sub-criteria have been identified having considered transport engineering judgement and practices, as well as the author's knowledge of the project which has increased since the initial announcement of the Accelerated Regional Road Programme funds. This includes a consideration of the earlier SH3 corridor Indicative Business Case between Mt Messenger and Awakino, acknowledging that improvements to Mt Messenger are an integral part of the overall aspirations for the wider corridor. It is also noted that the Agency’s project website states *Improvements to the Mt Messenger route on State Highway 3 (SH3) are underway to* *deliver better road safety, resilience and journey experience*"[3] and these sub-criteria are considered to represent these desired outcomes.

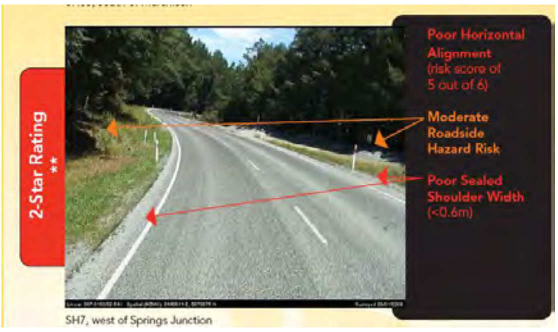
3.1 Road Safety

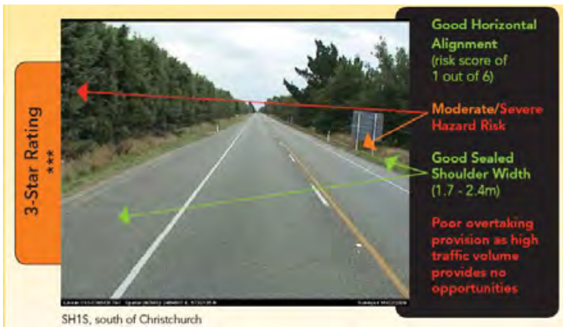
A key outcome for improvements along this section of SH3 (and the wider corridor under consideration) is to enable improved safety outcomes for the route. In the vicinity of Mt Messenger (between Tongaporutu and Uruti), for the 5-years to 2016 there were a total of 67 reported crashes, as follows:

- Fatal Crashes = one
- Serious injury Crashes = 10
- Minor Injury Crashes = 17
- Damage Only Crashes = 39

Improving safety along the corridor is a critical outcome for any improvement works, and as such a high weighting of 40% has been adopted for this sub-criterion.

SH3 is currently rated with a KiwiRap Star Rating of 3 to the north and south of Mt Messenger, with the portion of the network through the immediate vicinity rated at a lesser Star Rating 2. The Star Rating awarded to a section of road is derived from an assessment of the road's features such unsealed shoulders, or the provision of barriers. For context, the KiwiRap website provides the following examples of Star Rating 2 and 3 Roads[4]:





One of the design outcomes which has been adopted by the design team is the establishment of a Star Rating 3 road throughout the entire project area, which corresponds to a positive outcome with respect to Road Safety for all the options under consideration.

As previously described, the improvements include an overall reduction in the length of the corridor between Tongaporutu and Uruti. This length reduction corresponds to a reduction in the risk of being exposed to a crash for each customer on the corridor.

- Option A provides the greatest reduction in exposure, with a length saving of 3.5km, which is considered a high positive safety outcome.

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[3] Source: https://www.nzta.govt.nz/projects/awakino-gorge-to-mt-messenger-programme/mt-messenger/

[4] Source: http://www.kiwirap.org.nz/scoring_bands.html

- Options P and F have a comparable reduction in exposure, with a reduction in length of 2.6km and 2.4km respectively. This is considered a moderate positive safety outcome.
- Options E and Z have a least overall reduction in exposure, with a reduction of 1km and 1.2km respectively. This has been assessed as a minor positive safety outcome.

For any of the options, a higher safety rating could be awarded if the road is able to be established with a higher Star Rating. However, this would need to be considered within the context of the wider corridor rating. Improving the Star Rating of this short section would result in the standard of this section of the highway being out of context with drivers' expectations to the north and south.

3.2 Travel Time / Efficiency

The Mt Messenger site forms part of the SH3 corridor which connects New Plymouth with the wider Taranaki Region, and to the north. The length of the project site itself is remote, and carries a relatively low volume of traffic at 2,300vpd[5]. Some of the defining features of the existing transport environment include a high proportion of heavy vehicles (20% HV) through tortuous and steep terrain – up to 12% on some corners[6]. The options under consideration all include sections of the highway at steep grades, albeit an improvement on the existing arrangement with maximum grades of 10% in some options (and less in all others) and easing of the curve radii along the length.

The existing SH3 corridor between Tongaporutu and Uruti is 21.4km in length, with a 'typical' journey time of 21minutes[7]. This corresponds to an existing operating speed of 61km/hr over this length of the network. Across Mt Messenger itself, this average operating speed drops to 55km/hr.

Unlike urban scenarios, where congestion due to a high volume of vehicles reduces the network efficiency, in the context of Mt Messenger the steep grades and high proportion of heavy vehicles results in reduced efficiency and increased travel times when vehicles are caught behind slower moving (heavy) vehicles, with limited passing opportunities.

Because of the inter- relationship between these issues, travel time and operational efficiency have for this short-list assessment been combined into one sub-criterion (when for the long-list they were two separate sub-criteria). A combined weighting of 20% has been adopted (noting each were weighted 10% for the long-list assessment).

Within the earlier assessment, it was identified from the Austroad guidelines that grades from 6% can have an adverse effect on the speeds of heavy vehicles (up and downhill). The Design Philosophy adopted for the short-list of options under consideration is to provide climbing lanes where grades are in excess of 8%, resulting in those options with grades of

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5 Pg 40, Mt Messenger Stock Effluent Disposal Site 2015 AADT https://www.nzta.govt.nz/assets/resources/state-highway-traffic-volumes/docs/2011-2015-AADT-Booklet2.pdf

6 Source: Glenn Coppard, MMA Geometric Design Lead

7 Source: Google Maps

6–7.9% continuing to experience reduced operating speeds due to the presence of the slower heavy vehicles. Based on the Austroads guidance, uphill speeds of heavy vehicles can be 'significantly' slower and 'minimally' affected for downhill grades (for straight roads).

Options A, F and P each provide northbound passing lanes only, and have southbound grades of between 6 – 7.9% where no passing lanes are provided. As a result, Options E and Z represent the preferred outcome with respect to the opportunity to pass these slower vehicles. I consider the provision of northbound only passing lanes for routes A, F, and P to represent a minor benefit; while the provision of passing lanes in both directions for routes E and Z to represent a moderate benefit.

The travel speeds of light and heavy vehicles across Mt Messenger has been determined based on a first principles approach of the grades across the length of the improvements. With an assumed average travel speed of 100km/hr (for LV) and 80km/hr (HV) for the remainder of the existing route between Tongaporutu and Uruti, the travel time savings for this section of the corridor has been assessed. I consider the 179 second saving for Option Z represents a minor benefit, while the travel time savings in excess of over 200 seconds for all other options represents a moderate benefit.

In assigning scores under this sub-criterion, I have assessed the benefits of each route both in terms of the provisions of passing lanes, and travel time savings based on route length and travel speed. I have then awarded an overall score to each option, as follows:

Assessment Criteria	A	E	F	P	Z
Passing Lanes	1	2	1	1	2
Travel Time Savings	290sec (+2)	204sec (+2)	247sec (+2)	238sec (+2)	179sec (+1)
Score	3	4	3	3	3

Taken together, I consider the provision of passing lanes plus the travel time savings (based on expected travel speed plus shorter distance of the route options) represent a significant benefit under this sub-criteria for Options A, F, P, and Z; and a very significant benefit for Option E.

Improvements to the scores for Options A, F and P could be awarded if southbound passing lanes were provided.

3.3 Operational Resilience

'Operational Resilience' for the purposes of this assessment has been considered to be the ability of the route to recover from planned and unplanned foreseeable events (such as minor debris slips onto the road, crashes, planned maintenance). It does not consider the ability of the network to recover after major events – that lifeline assessment has been undertaken by others as part of this MCA process.

The existing route has suffered a number of long-term closures over recent years, including multiple road closures of more than 4 hours[8]. Those closures have occurred as a result of heavy vehicles losing control, as well as slips at Mt Messenger. The effect of closures is significant, with the alternative route between New Plymouth and Waikato being the much longer route of SH3 or SH3A (travelling south of New Plymouth), and then SH43/SH4 between Stratford and Te Mapara. This alternative route is approximately 250km (between the intersections of SH3/SH3A in the south and SH3/SH4 in the north), excluding any turn-around distance. There is anecdotal evidence that during closures, truck drivers will choose to stop and wait for the road to re-open, rather than take the longer journey resulting in adverse outcomes for the regional economy. As such, a sub-criteria weighting of 30% has been adopted to reflect the potential for significant adverse effects as a result of the road closures, and the significant benefits of avoiding road closures.

It is considered that all options under consideration will represent a high positive (+3) transport outcome when compared to the existing environment; the options are designed to a higher standard than existing, resulting in less likelihood of (particularly) unplanned events, and greater opportunity to re-open the road quickly. In addition, discussions with the relevant specialist[9] in the Alliance as part of the earlier long-list assessment have confirmed that less routine maintenance would be expected for the tunnels and bridges associated with the options under consideration at this stage, when compared to the earthworks-only options which were earlier discounted.

3.4 Effect on Existing Corridor during Construction

The effect of construction on the existing corridor was not explicitly considered as a criterion during the earlier long-list assessment process, as at that time the construction methodology was in the very early stages of development, particularly around the on-line options. The criterion has been added for this short-list selection process to consider the construction effects given a comparably greater level of clarity is now available in this regard.

The effect of the construction of the Bypass on the existing SH3 corridor is considered an adverse effect of the project. However, that effect will only be temporary, and is to be expected for all major roading projects. Given the temporary nature of the works (being a very short period within the overall life of the asset), this has been weighted at 10%.

For all of the options, with the exception of Option Z, the effects on the existing corridor will be limited to the northern and southern tie-ins which has been scored as a minor adverse effect (-1). For Option Z, in addition to the northern and southern tie-ins, there are a number of locations where the new road crosses the existing route – in many instances, the new road will be required to be constructed above or below the existing level, however there will be one additional period where the traffic on the existing road will need to travel

[8] Source: TREIS

[9] Source: Stephen Crawford, MMA Geotechnical Lead

through an active worksite. For this reason, Option Z has been assessed as having a moderate adverse effect (-2) for this sub-criteria.

4 Scoring

The assessment process adopted has considered four separate sub-criteria, three of which have been identified as enabling the key transportation outcomes to be realised. Weightings have been adopted to reflect the relative importance of each sub-criteria based on the currently understood package of works. The overall score for each option has been reached by rounding the weighted sum totals of the scores to the nearest whole number.

Overall, Option A represents the preferred transport outcome and based on the assessment approach adopted, it has been identified as having 'High Positive' effects (following a rounding up to 3 from a sum score of 2.6). All other options have been assessed as having 'Moderate/Medium Positive' transport effects. When considering the raw scores, there is a slight preference for Options F and P (ranked second equal).

The following table show the sub-criteria scoring (with weightings).

Sub-criteria	Weighting	A	E	F	P	Z
Road Safety	40%	3	1	2	2	1
Travel Time/Efficiency	20%	3	4	3	3	3
Operational Resilience	30%	3	3	3	3	3
Effects on Existing Corridor	10%	-1	-1	-1	-1	-2
Raw Score		2.6	2	2.2	2.2	1.7
Final Score		3	2	2	2	2


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Appendix E: Resilience

Mt Messenger Alliance

Te Ara o Te Ata

Multi-criteria analysis: Resilience shortlist review

July 2017

Stephen Crawford

Contents

1 Introduction

The Mt Messenger Alliance is currently investigating alternative options for upgrading or bypassing State Highway 3 (SH3) in the vicinity of Mt Messenger, in North Taranaki. In total, five shortlisted options have been identified.

Shortlisted options were assessed via a multi-criteria analysis (MCA) process which scored ten criteria: transport, resilience, constructability, landscape, historic heritage, community, property, terrestrial ecology, water environment and cultural heritage. Criteria were scored by specialists prior to presenting at a collaborative workshop on 26-27 June 2017.This report details the evaluation and scoring of the resilience criteria.

2 Background

This Multi Criteria Assessment No. 2 (MCA2) resilience review of the five shortlisted corridor/route options follows on from MCA1, which covered the initial twenty four corridor/route options. These reviews were undertaken by Stephen Crawford (SC), Geotechnical Design Lead for the Mt Messenger Alliance (MMA). SC is a professional geotechnical engineer with 35 years' experience in geotechnical and civil engineering, including many NZTA/Transit NZ projects as well as international experience in Australia, SE Asia, the Middle East and UK. SC's experience covers the various stages of large civil infrastructure projects from concept and scheme through design to technical supervision during construction.

The review of resilience for stormwater drainage and flooding was undertaken for MCA2 by Mohammed Al-Kubaisy (MAK), who is a professional civil engineer with over 5 years' experience, specialising in stormwater management, including NZTA projects such as Wellington's Transmission Gully and Auckland's Southern Corridor Improvements and Northern Corridor Improvements. MAK's design work was reviewed by Warren Bird a Principal Environmental Engineer with more than 30 years' experience in infrastructure and roading.

This MCA2 resilience review considers the geotechnical, earthquake and civil engineering aspects of the operation of the built routes (i.e. after design and construction is complete). This review excludes the transport and traffic engineering aspects, undertaken by Eliza Sutton, Transport Lead for the Alliance. This resilience review forms part of the broader Multi-Criteria Assessment of the five shortlisted corridor/route options for the Mt Messenger Tunnel Bypass Project.

Prior to MCA1, SC undertook site visits including driving the existing SH3 route and walking to the top of Mt Messenger with other design and environmental staff. With the project Engineering Geologist, Bernard Hegan (BH), SC also undertook engineering geological mapping along the existing SH3/Mt Messenger route, and observed the performance of existing slopes, cut batters, fills and retaining walls. BH also walked up corridor/route E with Duncan Kenderdine (DK), Mt Messenger Alliance Project Manager, from the Pascoes' house onto the Ngati Tama land in the valley to the east of the existing SH3. BH has also undertaken preliminary mapping of the large landslide feature, which extends for several hundred metres north of the existing Mt Messenger tunnel, and west of SH3. While BH has not had direct involvement with the resilience review scoring, SC has worked closely with him on investigations and design/route option development.

Since MCA1 and prior to MCA2, SC undertook a 2-day field walkover of parts of the five routes, which are readily accessible by foot. This involved walking accessible parts of Routes A, F, E and Z, excluding the Wai Pingao catchment. This walkover included the active (upper/southern) part of the large landslide. SC also walked through the swamp matai area immediately downslope and downstream of Routes E and Z and the existing Mt Messenger section of SH3.

Conceptual design for hydrology and drainage was initially undertaken for all MCA1 corridors and route options as a high level/scoping exercise, with inputs by Jack McConachie (Hydrology & Drainage Design Lead), Glenn Coppard (Geometrics & Roading Design Lead) and Phil Gaby (Structural Design Lead). This work was supplemented by preliminary design assessment of catchments and associated culvert requirements for the proposed five MCA2 route/ corridor options by Mohammed Al-Kubaisy (Drainage Designer).

The output from this early/'high level' design work and the subsequent, more focussed drainage preliminary design was assessed as part of this MCA2 resilience review for drainage aspects.

3 Methodology

3.1 Data/information used

Data and information relied on for this assessment includes:

- MMA corridor/route options design information including alignment plans and 3-D computer simulation ("Humphrey") of these alignments overlaid on LiDAR survey of the steep Mt Messenger terrain. This includes the 3-D output for the MCA2 assessment for Routes A, E, F, P and Z, which now includes the structural options (extended viaduct on Route A, and tunnel options on each route) It also includes realigned routes that 'hug' the valley edges (routes A, F, P and E) rather than extend along the centre of valleys, and many of the structures along route Z are replaced by reinforced fills
- Preliminary Geotechnical Appraisal report for Mt Messenger PST Investigation [Beca, 2001, ref. 8501106/20] prepared for Transit NZ on route feasibility and geotechnical aspects.
- Opus route option drawings, 2016 for MC10, MC20/23, MC70/71 route options, ex Opus 2016 SH3/Route Options/Feasibility report. These drawings identified areas of landslide risk (from GNS "QMaps"), likely areas of liquefaction, watercourses, property boundaries and Ngati Tama and DoC land.

- Drainage scoping/high level design output (spreadsheet, 4 May 2017) on culvert locations, lengths, sizes and stream diversions, prepared by MMA hydrology team in conjunction with geometrics and roading.
- Preliminary drainage design for the five MCA2 routes/corridors comprising routes A, E, F, P and Z, output summary dated June 2017.
- MMA Quantities summary for high level design output (spreadsheet, 9 May 2017) on corridor/route options information including route information (lengths, areas, grades, etc.), cut and fill volumes/balance, stream/culvert data, bridge information (lengths, heights, piers, construction type & footprint, tunnels (lengths) and wall type and lengths.
- Resilience data record (TREIS - Traffic Road Event Information System) for SH3/Mt Messenger route disruption over past 5 years for the existing SH3 route. This system records SH3 closures/delays greater than 2hrs. Only one slip occurred (in Oct. 2013) during this period at Mt Messenger, immediately north of the existing tunnel. However, no particular details of the event are recorded, other than a delay duration of 8.75 hrs. [TREIS record received from Eliza Sutton (Opus), 17 March 2017]. This is not a long delay time and suggests a slip of a relatively minor nature.
- Personal communications by SC with NZTA NOC (Network Outcomes Contract) maintenance contractor for SH3 (Downer, Dave Nicholl on 12 March 2017). Their maintenance history indicates only very limited/infrequent maintenance has been required for drainage, slip and rockfall issues along the Mt Messenger section of the SH3 route in recent years.
- Site visit observations by SC and discussions between SC and BH.

3.2 Sub-criteria and weightings

Resilience is the ability to recover from an adverse event, and is influenced by design that mitigates the effects of adverse (natural) events. For the post-construction condition/permanent works, four sub-criteria were selected for assessing corridor/route resilience for each option – three geotechnically related and one for culvert/drainage issues. These generally were the same criteria as used in MCA1 and the reasoning for their selection is given in this MCA2 report.

These are outlined as follows:

- Instability (potential for landslides, rockfall, mudflows, road overslips and underslips).
- Earthquake induced instability, excluding liquefaction. Includes potential for earthquake induced landslides, rockfall, mudflows, road overslips and underslips.
- Liquefaction & lateral spread of fills on soft liquefiable ground, nominally valley floor alluvium.
- Drainage/culverts (potential for blockage in bush catchments and issues related to post-event remediation, culvert length, overland flow, and flooding).

3.3 Scoring process including measures for scoring

The scoring was the same as the broader MCA1 process, i.e. scores were given between +4 and -4 (with a fatal flaw option) as follows:

Scoring	Level of effect
F	Fatal flaw
-4	Very high adverse effects
-3	High adverse effects
-2	Moderate / medium adverse effects
-1	Low / minor adverse effects
0	Neutral / no change
+1	Low / minor positive effects
+2	Moderate / medium positive effects
+3	High positive effects
+4	Very high positive effects

The scoring process was to compare each of the five MCA2 corridor/routes with zero ratings for the existing Mt Messenger section of SH3, i.e. the various sub-criteria were assessed either as a (positive score) improvement in resilience for the existing SH3 route or a (negative score) reduction in service or resilience. One score was given for each sub-criteria for each MCA2 route option.

No weightings were imposed on the sub-criteria for resilience. This is because the three geotechnical sub-criteria were assessed as having equal influence on resilience, and one criteria for drainage/storms/flooding has relative influence to these three sub-criteria for the route options.

The overall score was assessed using expert judgement based on the importance of the sub-criteria for each option, noting that resilience is about the 'break in the chain' and a (high) positive score should not necessarily offset a (low) negative score.

No fatal flaws were given for the sub-criteria for any of the corridor/route options. A fatal flaw is seen as a major disruption to the SH3 route, requiring many months, if not years to resolve, e.g. an event severely damaging a major bridge, tunnel or structural wall such that it (and the route) could no longer function or are severely impaired. This would result in major diversions of traffic to alternative routes which are very distant.

Further information on scoring is set out in the scoring section below.

3.4 Key assumptions

Design would address the potential for fatal flaws mentioned above, making the probability of such major events/damage very low indeed. This is consistent with the principles of the NZTA Bridge Manual 3rd Edn (V3.2).

This is a high level review, based on very limited to no (geotechnical and hydrological) data, and there is a great deal of uncertainty. However, the degree of uncertainty applies to all routes, probably in equal measure. This MCA2 scoring tool was considered suitable for assessing all routes. Some assumptions include:

- Past History, based on the TREIS (SH3 operations) record for the past 5 years and site observations:
    - Operational disruption history is largely traffic related, not typically landslip, rockfall, flooding or culvert blockage. The lack of landslip, landslide or flooding delays in the past 5 years' TREIS record suggests these types of events are infrequent or do not significantly affect the overall performance of this Mt Messenger section of SH3.
    - There are several steep to very steep high natural and formed rock batters. Based on site observation and reported (low, infrequent) maintenance by the NOC contractor, rockfall from these batters is localised, not common and results only in limited volumes and sizes of debris.
- For the natural and cut landforms, it is likely that few major geotechnical events that cause significant damage (e.g. major landslides or earthquake-induced instability) will occur over the design life of the design (100 years), based on the apparent history of the good performance of these landforms.
- Landslides – QMap indicates two landslide features but only one affects some of the proposed options – this is limited to one large landslide north of the existing tunnel[1]. The project area appears to have generally performed well under earthquake loading over Recent (geological) time (i.e. less than 10,000 years). It was assumed this is a feature triggered by a very large earthquake. Such an earthquake (with a return period of greater than 10,000 years) is likely to have been well above normal design conditions (typically 1000 years for embankments and cuts or 2500 years for bridges and tunnels).
- Tunnels are generally particularly resilient to earthquakes – this is evident locally by the very good condition of the unlined Mt Messenger tunnels and several other unlined tunnels within the Tertiary siltstone/sandstone formations across Taranaki. Traffic issues within tunnels (with respect to resilience) are not part of this review, rather part of the transport resilience review.
- Earthfills are typically very resilient to earthquake and intense rainfall in adequately drained catchments. Exceptions to this can include if culverts block (refer to the 4th sub-criteria), or if embankments are underlain by deep soft sediments, which have

[1] (See comments on the southern abutment of the route A large viaduct in *mitigation assumptions* in the following section).

not been strengthened. It was assumed the (normal) design practice is sufficient for such earthfills not to feature in this review.

- For liquefaction and lateral spread of fills near streams or a free face, deep liquefiable deposits are expected to exist within valley alluvium. Significant ground improvements (e.g. stone columns to more than 20m depth) are proposed to address this expected vulnerability, unless other robust measures are proposed, e.g. buttress fill to support the free face/nearby stream. Routes primarily above valleys floors rate better for liquefaction and lateral spread. Limited data on measured liquefaction potential is available at the time of this review.
- The existing route has liquefaction/lateral spread issues next to the stream in the southern part of the route as do other nearby new options. Some route options avoid these liquefaction-prone areas and so are marked with a positive score.
- Flooding/storm damage – Surface flooding and failure of cross culverts, resulting in damming or overtopping of the road are the primary considerations when assessing road resilience for flooding and storm damage. The existing road and proposed bypass routes generally have steep gradients through Mt. Messenger and therefore little to no risk of surface flooding with exception of the southern and northern extents where the road passes through the flatter, flood prone valley floors adjacent to the Mimi River and the Mangapepeke Stream.
- Given that the existing route is low-lying and flood prone at the northern and southern extents, any tie-in into the existing route will also be flood-prone. For this reason, we believe that none of the routes proposed will worsen the existing situation and thus do not consider surface flooding from streams/rivers further in this assessment. The predominant consideration assessed when scoring resilience of the routes is therefore performance of culverts.
- The proposed routes have been scored against existing SH3, considered as the baseline. From a desktop review the existing road appears to have been constructed into the side of Mount Messenger, rarely crossing depressions within the topography and thus requiring little to no cross culverts.
- Given the densely bush-clad catchments and seismic activity within the region, the performance of culverts is assessed against the risk of blockage and earthquake damage potentially displacing culvert joints. We note that debris build-up is common & maintenance and regular inspection is unlikely, given the poor visibility from the road and typical difficult access.
- Culvert inlets will be designed with a secondary scruffy dome inlet should the primary inlet block due to debris build-up.
- It is proposed to found the culverts into the side of the valley and out of the original stream/alluvium, i.e. in good ground, to minimise potential displacements.
- The criteria for assessment of culvert performance has been determined to be diameter, indicative of upstream flows and therefore importance. Length and depth, indicative of the extent and difficulty of repair should the culvert fail. Please refer to the following table for resilience scoring for the individual route scores and comments.

3.5 Mitigation assumptions

In general, design will address the potential for fatal flaws so that the probability of their occurrence is very low. These design approaches will either prevent fatal flaws occurring or mitigate the effects so that the post-event effects are controllable and repairable in a suitable timeframe.

Of particular note for MCA2 though was the discovery during site walkovers, and subsequent topographical and geomorphological/landform assessment, of the landslide conditions near the southern abutment of the large bridge on the route A corridor. While this has been scored at -3 for static stability and earthquake stability, it came close to scoring -4. It was assumed that specific design would be required for this structure to accommodate lateral and vertical movements associated with landslide movements, should they occur during the life of the structure.

4 Scoring

The scoring is summarised in the attached table. This table includes:

- The corridor/route option number (e.g. routes A1 and A2 in corridor A – the "1" in A1 denotes a structural option (bridge & tunnel); and the "2" denotes an earthworks option (large, high cuts and deep valley fills).
- The score for each sub-criteria and the assessed overall score. Note this is an overall judged score (as explained in the assessment table later in this report), rather than a simple averaging of the four sub-criteria scores).
- Key reasons are provided for each score, including the standard mitigation taken into account (if required).

Key themes are presented below for scoring and future design mitigation or opportunities. The scoring of route options was based on the designs as 'presented on the page', and did not include mitigation or design opportunities. However, these mitigations/opportunities are listed in these sections for future work, many of which were addressed before MCA2. They are reported here as part of the record of design development.

4.1 Key themes for sub-criteria scoring:

Instability:

i. Assess height of cuts along route and look at potential for instability, rockfall, slabbing within rockmass, noting that the current design allows for rock drapes on batters with adverse geological defects, bedding and joints. Also, the current design contains a 3m wide rockfall debris buffer zone at the toe of the cut batters.

ii. Assess potential for soil slope instability above cuts, noting that there is no bench at the interface between the upper soil cut batter and the underlying rock batter. There is, however, more engineering control on many of these soils batters with the introduction of slope reinforcement (e.g. grouted soil nails, or durable plastic geogrids in fill areas) along with subsoil drainage where required.

iii. Take into account the length of the route, in broad terms, the longer the route the more exposure it has to instability. This applies more to corridors J, K and L for MCA1. However, for MCA2 all routes are similar in length and so this aspect does not really affect the scoring for MCA2.

Earthquake (generally similar to (i) to (iii) above):

iv. Assess height of cuts along route and look at potential for instability, rockfall, slabbing within rockmass, noting that the current design allows for rock drapes on batters above 20m height and those with adverse geological defects, bedding and joints. Also, the current design contains a 3m wide rockfall debris buffer zone/topsoil cushioned swale at the toe of the cut batters.

v. Assess potential for soil slope instability above cuts, noting that there is no bench at the interface between the upper soil cut batter and the underlying rock batter.

vi. Take into account the length of the route, in broad terms, as the longer the route the more exposure it has to instability. (See note iii above).

Liquefaction & Lateral Spread:

vii. Assess the length of route that is exposed to potential liquefaction of valley floor alluvium and compare with the length of existing route vulnerable to liquefaction.

Flooding, Storm Damage, Culvert blockage:

viii. Assess the length of route that is vulnerable to flooding and compare with the length of existing route vulnerable to flooding.

ix. Consider impact of long culverts in particular.

5 Mitigation & design opportunities

5.1 Key themes for mitigation or design opportunities - Geotechnical sub-criteria:

5.1.1 Information gathering:

1. Undertake more geotechnical investigations at key points on routes - tunnels, bridges, deep cuts and fills.
2. Cone penetrometer tests (CPTs) in valleys to obtain soil type, permeability, strength and liquefaction potential profiles. Some of this has been done since MCA1, but much more is needed for detailed design.
3. Investigate the depth of soil (colluvium/slope-wash and residual/weathered-in-place). A small amount of this has been done since MCA1, but much more is needed for detailed design.
4. Undertake strength testing of rock samples from boreholes to obtain strength profiles/deformation properties with depth. A small amount of this has been done since MCA1, but much more is needed for detailed design.

5. Assess the quality, grading, strength and permeability of local Mt Messenger Formation sandstone, with a view for its use as drainage layers in deep fills (to avoid the need for importing expensive drainage materials from distant quarries. A visual assessment of this has been achieved during the 2-day field walkover post MCA1, and this material was found to be marginal. More detailed work is required to confirm the use of site-won sandstone to minimise the import of granular materials from distant sites/quarries.
6. Undertake more engineering geological/geomorphological mapping across the site, particularly in landslide areas. And undertake critical geotechnical boreholes to assess the landslide failure model, mechanism and triggers (rainfall? earthquake?) – the landslide appears to be a complex 3-D model, with the upper area just north of the existing tunnel being significantly more active than the northern end of the valley where there are fewer signs of gross movement and also much higher relief in terrain. Some work has been achieved on this between MCA1 and MCA2 but more detailed information is required to understand the large landslide north of the existing tunnel and in the area around the route A viaduct.

5.1.2 Design mitigation:

7. Shift geometric alignments where possible from valley floors to the valley side slopes, to 'hug' rock cuts –most relevant to the Pascoe (east)/Ngati Tama (east) valley (affects route E), and the north valley (affects corridors A, F & P), and Anglesey/south valley (affects all routes except Z). This has largely been achieved for the MCA2 route options but more design refinement will likely produce better design.
8. Steepen soil cuts from 2H: 1V (25°) to say 1H: 2V (65°), by using soil nail reinforcement with containment mesh. This mitigates geometric designs where soil cut batters 'chase' the existing slope up for significant distances but cut depths are quite shallow. Some of this has been done since MCA1, but more opportunities are available during for detailed design.
9. Steepen fill batters using reinforced earth or mechanically stabilised earth (MSE) technology to steepen fill batters and reduce fill footprints in bush environments or sites with difficult access. This has been achieved in many parts of the MCA2 routes, but more opportunities are available as part of the detailed design process.
10. Consider toe buttress fill approach for main landslide in the north valley to 'lock in' the large landslide against future movement. This is a simple, robust approach, which involves large scale earthworks in an area which has already been highly modified by farming practices. This could potentially eliminate the tied back structural retaining walls that secure the Corridor Z options. It may also open the opportunities for more direct northern sections of routes to traverse the landslide itself. This opportunity has been considered prior to MCA2, and is still available for refining during the detailed design process.

5.2 Key themes for mitigation or design opportunities - Drainage sub-criteria:

5.2.1 Information gathering:

11. Obtain more hydrological data and/or weather records off locals. Farmers in particular often keep daily rainfall records for their farming practice – Some farmer's records have been obtained since MCA1.
12. Obtain RAMM data (if available) for culverts on existing SH3 Mt Messenger section.

5.2.2 Design mitigation:

13. Undertake more site specific assessment of each culvert site, especially for earthworks options – some limited work has been undertaken on this but more can be achieved during the detailed design process.
14. Reduce fill heights (by refinement of vertical geometric design) – this will reduce culvert lengths, and ease maintenance requirements for debris removal from culverts, thereby improving route resilience. Work on this since MCA1 has been achieved and further refinement of design will likely achieve more.
15. Oversize the culverts for blockage and provide secondary inlets.
16. Backfill upper gully streams where upstream catchments are highly modified or degraded and disposal of surplus cut material is necessary and provide raised culverts to reduce culvert length and achieve shallow cover.

6 Results Summary: Resilience

Key outcomes from MCA1 scoring:

(Refer to the following table for detailed scoring)

The key outcomes from the MCA2 scoring for resilience are:

A. All corridor/route options were compared with the existing SH3 Mt Messenger section for resilience.

B. There are no strongly preferred options under this resilience assessment. Route A is strongly not preferred with a score of -3.
   Routes F and P score (+2) moderately well for resilience – otherwise the scores were +1 (Routes E and Z). In other words, these options have a moderate improvement in resilience over the existing SH3. The overall +2 scores relate to improvements in the potential for instability being controlled by good geotechnical investigation and understanding of engineering geological and geotechnical engineering site conditions and the application of current, more advanced engineering design practice.

C. Generally, in highly valued bush areas, structural options scored favourably in MCA1, and only structural options were considered in MCA2.

Of minor note is:

- The stormwater -2 score for Route E relates to potentially poor stormwater controls/culvert blockage for large embankments with long or deep culverts. These often have upstream catchments in bush areas where there is a high potential for development of debris mats and culvert inlet obstruction during storm events. The bush environments next to large fill embankments also make inspection and maintenance more difficult, and so less likely.
- Three of the corridors/routes (E, P and Z) scored '0' for the neutral liquefaction/ lateral spread comparison with the existing SH3 route immediately after a strong (design) earthquake event.

Appendices

Appendix A: Scoring table

Appendix A: Scoring table

Scorers: S Crawford M Al Kubaisy	Option A	Option E	Option F	Option P	Option Z
Score For each sub-criteria Overall:	Instability: -3 Earthquake: -3 Liquefaction: +1 Flooding: -1 Overall: -3	Instability: +2 Earthquake: +2 Liquefaction: 0 Flooding: -2 Overall: +1	Instability: +2 Earthquake: +2 Liquefaction: +1 Flooding: -1 Overall: +2	Instability: +2 Earthquake: +2 Liquefaction: +1 Flooding: -1 Overall: +2	Instability: +1 Earthquake: +1 Liquefaction: 0 Flooding: 0 Overall: +1
Key reasons for score	Moderately high, steep rock cuts; Route A largely avoids Northern Landslide area. Southern abutment of long viaduct is located on additional landslide (score -3 but close to -4). Very low potential for landslips or rockfall causing road closure. shorter length of route subject to liquefaction/ lateral spread of fill embankments. Minor reduction in resilience for stormwater/ hydrology in main valleys and minor improvement for flooding potential at south end of route. 7 culverts, only two culverts of which are at depths greater than 15m and 30m with lengths greater than 70m and 150m respectively; serving moderate catchments. Overall – a *significant reduction in resilience* compared to the existing SH3, mainly due to the risk of landslide at the south abutment of the long viaduct.	Route E in east valley in sandstone. Moderately high, steep rock cuts; minor cuts in lower east valley. New design hugs east valley sides. Avoids Northern Landslide area. Low potential for landslip, rockfall causing road closure. Significant reduction from MCA1 of route subject to liquefaction/lateral spread of fill embankments. Similar to existing route risk now. Upstream catchment in bush –slightly to moderately prone to debris mat/culvert blockage. Moderate improvement in stormwater/hydrology in main valleys and moderate improvement at north & south ends of route; but significant re-routing of streams. 9 culverts, 4 of which are at depths greater than 15m, 20m *(2No.)* and 40m with lengths greater than 40m, 100m *(2No.)* and 150m respectively; culverts serving large catchments. Overall – a *minor improvement in resilienc*e compared to the existing SH3, mainly due to increased resilience to instability and earthquake resilience, offset by poor drainage resilience and neutral liquefaction/lateral spread effect for the designed E1 route.	Moderately high, steep rock cuts. Route F avoids landslide headscarp. Low potential for landslip, rockfall causing road closure. Shorter length of route subject to liquefaction/ lateral spread of fill embankments. Bridges replace fills Minor reduction in resilience for stormwater/ hydrology in main valleys and very minor improvement for flooding potential at south end of route. 7 culverts, 4 of which are at depths greater than 15m and 30m *(3No.)* with lengths greater than 100m, 140m *(2No.)* and 160m respectively; flows conveyed are moderate and there is a minor increase in upstream catchments in bush and associated potential for debris build-up at inlet. Overall – a *moderate improvement in resilience* compared to the existing SH3, mainly due to the moderate increase in resilience to instability; liquefaction and stormwater control sub- criteria offset each other for the designed route F.	Moderately high, steep rock cuts. Route P avoids landslide headscarp. Very low potential for landslip, rockfall causing road closure. Shorter length of route subject to liquefaction/ lateral spread of fill embankments. Bridges replace fills Minor reduction in resilience for stormwater/ hydrology in main valleys and very minor improvement at south ends of route. 7 culverts, 4 of which are at depths greater than 15m, 20m *(2No.)* and 30m with lengths greater than 120m, 140m *(2No.)* and 150m respectively; flows conveyed are moderate and there is a minor increase in upstream catchments in bush and associated potential for debris build-up at inlet. Overall – a *moderate improvement in resilience* compared to the existing SH3, mainly due to the moderate increase in resilience to instability; liquefaction and stormwater control sub- criteria offset each other for the designed route P.	Moderately high to high, steep rock cuts. Traverses landslide headscarp area for about 1km. Low to moderate potential for landslide movement causing prolonged road closure. However, significant designed retaining structures are proposed to isolate new Z route from landslide. Moderate to significant improvement in resilience for and earthquake instability. Similar length of route subject to liquefaction/ lateral spread of fill embankments. Similar drainage resilience to the existing SH3/Mt Messenger section. Only has 4 culverts, 3 of which are shallow and only one at a depth of 15m and a length of 50m. Conveying moderate flows. Overall – a *minor (to moderate) improvement in resilience* compared to the existing SH3, mainly due to a moderate increase in resilience to earthquake instability and neutral resilience for liquefaction for the Z route.

Scorers: S Crawford M Al Kubaisy	Option A	Option E	Option F	Option P	Option Z
Potential opportunity to enhance outcome	*[Refer to report Section 5 for explanation of codes 1-14]*	*[Refer to report Section 5 for explanation of codes 1-14]*	*[Refer to report Section 5 for explanation of codes 1-14]*	*[Refer to report Section 5 for explanation of codes 1-14]*	*[Refer to report Section 5 for explanation of codes 1-14]*
Information gathering:					
Geotechnical	1 to 6	1 to 6	1 to 6	1 to 6	1 to 6
Stormwater	11, 12	11, 12	11, 12	11, 12	11, 12
Design Mitigation:					
Geotechnical	7 to 10	7 to 9	7 to 10	7 to 10	7 to 10
Stormwater	13 to 16	13 to 16	13 to 16	13 to 16	13 to 16

Appendix F: Landscape

Te Ara o Te Ata – Mt Messenger bypass Project Multi-criteria analysis: Landscape summary report

14 July 2017

Bruce McKenzie/Sarah Poff

Contents

1 Introduction

This MCA2 summary report sets out key landscape matters for consideration for the Mount Messenger By-Pass project (the project) and likely key issues for five ‘shortlist’ route options. These five options have been derived from the previous longlist of 24 options that were the subject of evaluation through the MCA1 process.

These shortlist options have been evaluated for the purposes of identifying further key landscape issues to inform the ongoing Multi-Criteria Analysis (MCA) process so the 5 shortlist options can be refined to a preferred route option.

This report follows on from the MCA1 Landscape Report and refers to the general landscape description and landscape character evaluation which is included in the MCA1 report. For brevity, this baseline landscape evaluation material (MCA1 Report Sections 2-4) is not repeated in the front-end of this MCA2 report (and is instead reproduced in Appendix 1). However, this previous work does form the consistent basis for shortlist evaluation for the shortlist options.

The purpose of this report therefore is to inform the MCA2 preferred route selection process including:

- Highlighting landscape matters relevant to considering each option.
- Identifying further measures that might be taken to refine the options and to address potential adverse effects.
- Providing an indicative ‘landscape’ score for each route option.

2 Summary

The project represents significant challenges in landscape terms. The SH3 corridor north and south of Mt Messenger follows relatively simple, open rural valleys. These lowland landscapes are separated by very steep, topographically complex bush hill country, some of which is of high ecological and cultural landscape value. Negotiating this hill country while avoiding and mitigating adverse landscape effects presents one of the most significant challenges of a project of this type.

In considering the 5 route options to address this challenge it is important to appreciate the broader landscape context of the project area as well as the more immediate landscape setting of the existing SH3 corridor. Of particular importance is the landscape continuum from the coast through to inland hill country of the Mt Messenger Forest. This is particularly relevant to the Waipingao catchment to the west of the Mt Messenger summit. This catchment is of unique and high ecological, cultural landscape and landscape value and includes a regionally significant landscape notation. The Waipingao valley's landscape value as a near pristine wilderness environment is in part derived from the undisturbed, natural landscape continuum from the coast up to Mt Messenger. This landscape connectivity extends further eastwards inland into extensive areas of the Department of Conservation estate further adding to its value in the broader landscape context.

Route Options A, F and P traverse the Waipingao catchment and present the greatest challenges in landscape terms. These options are particularly problematic for landform modifications, as they sit high in the landscape and run 'across' the complex coastal hill terrain rather than 'with' the landscape.

Route Option F presents a particular challenge with a large engineered fill area within a steep otherwise natural hill slope. A further challenge is the proximity of Options F and P to the Mt Messenger summit and landform. These options also directly affect the extensive area of Regional Landscape Significance.

Route Options E and Z remain low in the landscape, working 'with' the landscape and the valley system, avoiding the ridgelines and the extensive area of Regional Landscape Significance. However, Route Option E and Z also present landscape issues with particular regard to landform modifications (structures, cuts and fills in valley floors in particular). Route Z within the existing SH3 corridor represents the least extensive landscape effects, including because work would generally take place within or in close proximity to the existing roadway environment.

3 Route options evaluation

3.1 Mitigation Considered

In evaluating route options 'standard' mitigation has been assumed. This is interpreted as addressing key design considerations (see Appendix 1) in the context of standard NZTA specifications and matters including those addressed in the NZTA Landscape Design Guidelines, NZTA P39 Standard specification for highway landscape treatments and NZTA Bridging the Gap Urban Design Guidelines.

While the project offers the opportunity for significant and positive landscape restoration and landscape management outcomes, such outcomes have not been considered as part of each route evaluation. This is because these outcomes will require further detailed work and collaboration with landowners and other specialists to determine their feasibility.

Since MCA1, further work has been undertaken in determining mitigation measures in regard to options and it is understood that this work will be applied in regard to a preferred option once selected. It is expected that this wider mitigation work will be integrated with the route specific landscape treatments for the preferred option to develop a whole-of-landscape design and landscape management plan.

3.2 Overall Judgement and Sub- Criteria:

The following section sets out the evaluation and scoring of each route option. The landscape "sub-criteria" that have been applied to evaluate each route support the contextual landscape sub-unit evaluation of landscape quality and highway absorption capability applied above. These 'sub-criteria' have not been scored separately, but have been considered as guidance in developing an overall judgement of likely effects of each route.

i. Effects on Landscape quality:

- Natural landscape attributes (Biophysical values such as the natural science values of landform, vegetation, waterways)
- Extent of Human (modified) landscape attributes

ii. Effects on Perceptual landscape attributes including:

- Legibility (expressiveness)
- Coherence & distinctiveness
- Memorability

iii. Effects on Shared and Recognised Values

- Values that tangata whenua and others might associate with the landscape

iv. Effects in relation to Landscape capacity to absorb highway development:

- Attributes sensitive to change (Likely modification to natural landforms, waterways or vegetation)
- Visibility (Likely prominence, including the ability to fit a road to the contours, potential screening by vegetation or topography)
- Scenic Amenity effects (pleasantness and aesthetic fit with surroundings)
- Context and character (Likely extent of change to existing character – taking into account the landscape's complexity and existing degree of modification)

Each option has been scored using the scoring scale listed below.

Table 1: Scoring scale

Scoring	Level of effect
F	Fatally flawed - unacceptable adverse effects, that cannot reasonably be appropriately avoided, remedied or mitigated (including via offsetting).
-4	Very high / very significant adverse effects
-3	High / significant adverse effects
-2	Moderate / medium adverse effects
-1	Low / minor adverse effects
0	Neutral / no change
1	Low / minor positive effects
2	Moderate / medium positive effects
3	High / significant positive effects
4	Very high / very significant positive effects

4 Route Options Evaluation

4.1 Score Summary

Score Summary Table

-4	-3	-2	-1	0	+1	+2	+3	+4
Option F	Options A & P	N/A	Options E & Z	N/A	N/A	N/A	N/A	N/A

4.2 Route Option Landscape Evaluation Summary

The findings of each route evaluation are summarised below. As with MCA1 the score that has been assigned for each option represents an overall professional judgement in respect of the level of effects of that option, in terms of landscape effects.

Although improvements have been discussed at a high level, only standard mitigation has been assumed for the purposes of scoring the options.

4.2.1 Option A: Score -3

As with MCA1 the key landscape issues for Option A relate to the alignment traversing a near pristine, visually well-defined and contained landscape of high ecological and cultural landscape value (the Waipingao Valley). This landscape is currently a **Regionally Significant Landscape** (Operative District Plan) and may be considered an Outstanding Natural Landscape through the Draft District Plan review. *This valley in particular clearly demonstrates landscape attributes that meet generally accepted Outstanding Natural Landscape criteria.*

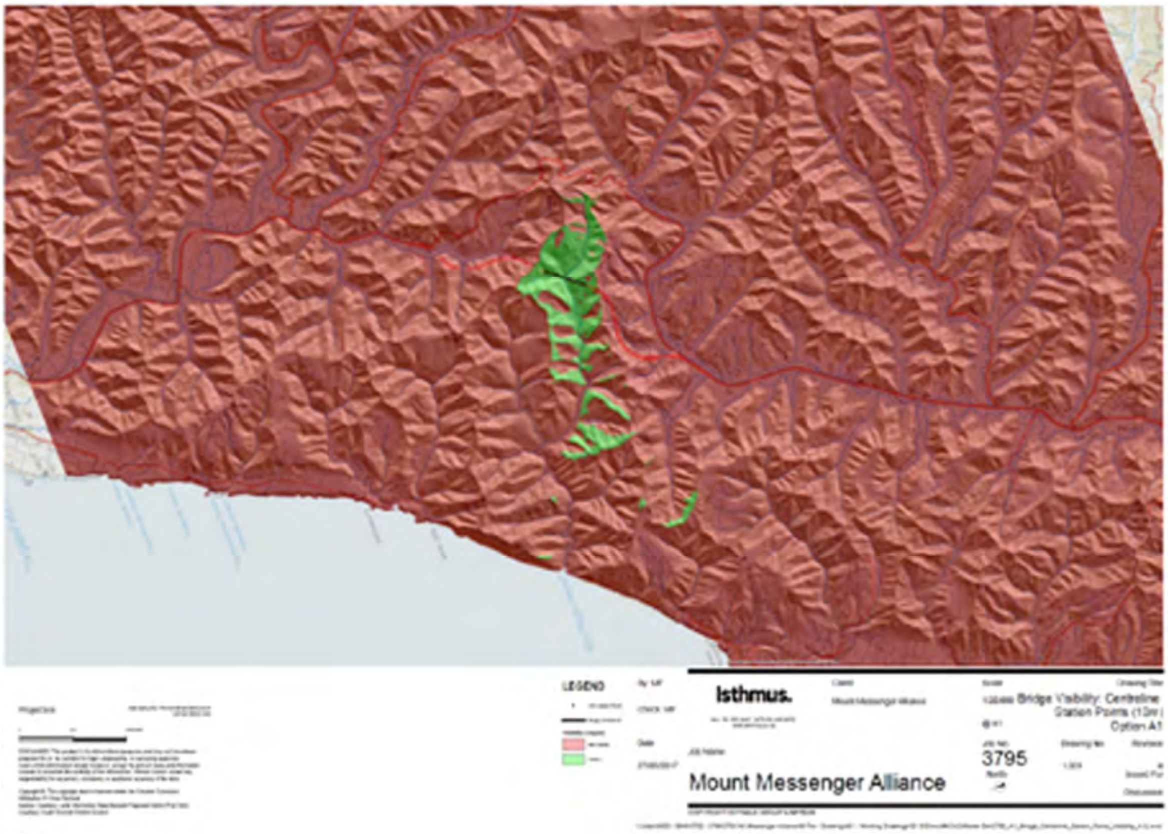
While the Waipingao valley has a low capacity to absorb the type of landscape change proposed the more modified rural valleys to the north and south are of a lesser landscape quality and are more able to accommodate landscape change.

Further design work has been undertaken since MCA1 with the alignment redesign taking a more sympathetic approach to integrating the highway into the landscape. This approach has also been driven by geotechnical issues and the need to avoid soft alluvial valley floor areas. In the south this is reflected in an alignment that better reflects the underlying landform and is more sympathetic to the landform alignment of the south facing spurs of the Anglesea property.

In the north this approach is less sympathetic with large areas of fill to the immediate north of the northern tunnel portal and a series of cross spur cuts mid-way up the hillslopes which frame the wider northern rural valley. These fill areas would require further design consideration to be integrated into the immediate landform context. The use of bridge structures further down the valley represents a design response that better retains the natural landform.

The structure crossing of the Waipingao has been lengthened in comparison to MCA1 (option A1). As noted previously structural crossing options could be developed further as a cultural recognition "gateway" to reflect / address cultural landscape values and associations (as part of a cultural recognition plan as suggested in the CVA).[1] The option therefore potentially introduces a sequence of built elements as a quality scenic driver experience. However, this would still be **a significant built structure in a near pristine, remote and undisturbed natural landscape.** Very careful detailed design consideration would be required regarding the introduction of significant built structures into this natural landscape. That is introducing built infrastructure qualities into a unique valley environment of high natural landscape character and value.

Further theoretical visibility analysis has also been undertaken for this option (see the figure below). This analysis suggests that a 620m long bridge could be visible from the majority of the immediate upper Waipingao catchment. This suggests that the introduction of built infrastructure within this upper valley could potentially have a significant effect on the valley's otherwise predominantly natural qualities.



[1] Though this has not been assumed for the purposes of scoring.

In this regard route A still represents **a very high and significant landscape risk because of the inherent high natural landscape and natural character values of the Waipingao Valley, and the Regionally Significant Landscape notation**, which are assumed to reflect high ecological and cultural landscape values. These values not only relate to the immediate option A corridor but also the wider natural character value of the landscape continuum that extends from Mt Messenger to the coast and the Parininihi Marine Reserve. <u>That is the adverse landscape effects would not only effect the immediate option A corridor but also the landscape value of the Waipingao catchment as a whole.</u>

Overall, Option A scores a -3 (high / significant adverse effects). This compares to the -4 score for A1 and F score for A2 assigned at MCA1. In summary, Option A scores better than those MCA1 options because:

- The revised route alignment from the southern approach works 'with' the land form more than the previous options which ran across the landform. This new alignment reduces the scale of landform modification and visibility.

The following images illustrate the potential landscape effects of Option A.

<u>NOTE:</u> These photo-simulation images have been developed using the raw geometrics model as an indication of general 'bulk and location' of option alignments. These views are elevated contextual landscape views and are not representative of on the ground viewpoints. They are not fully rendered images of a final expected outcome and they do not show the option footprint during the construction period. These images have been produced solely for the purpose of providing a better understanding of options in their landscape context over and above the existing 3D geometrics and earthworks modelling that has been applied by the design team.

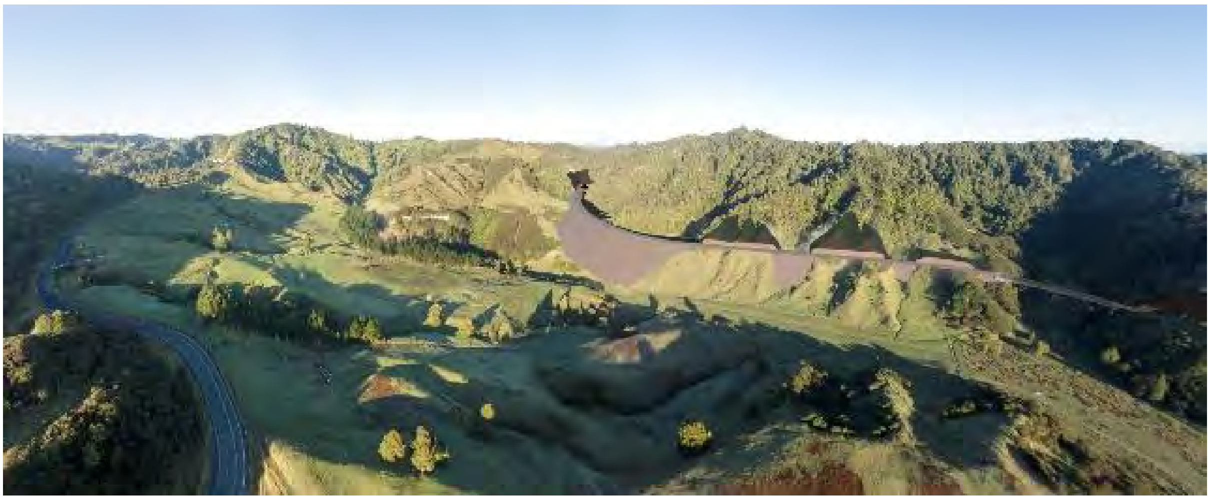


Figure 1: Aerial contextual view looking south over the existing SH3 corridor towards the northern Option A portal. This image shows the contrasting potential landscape effects of large areas of structural fill (light brown) compared with structures (bridge – right of frame)

Figure 2: elevated contextual landscape view of the Option A southern approach looking to the north east. This is an improved alignment in comparison to MCA1 A options illustrating an improved highway and landform alignment.

Figure 3: elevated contextual view of Option A southern approach looking south west. This image illustrates a generally cohesive orientation between highway and landform resulting in a relatively visually recessive highway section that keeps low in the landscape.

Figure 4: Option A also includes a cut in the southern Waipingao ridge. This image has been a useful guide in determining the likely landform effects of such a cut in the context of the wider southern ridge continuum.

Figure 5: Seen from a more southerly perspective this image shows the same southern cut in the context of the wider hill country and ridgeline continuum. The oblique angle between the highway and natural ridgeline in combination with the cut location in a natural saddle helps to integrate highway and landform.

Figure 6: Option A includes a proposed 620m structure – the image above has been used to help understand the visual effects and shows a 'baseline' steel structure design. As discussed above this structure will introduce a significant built element into an otherwise undeveloped near pristine valley landscape. This image is also a useful guide to help understand the visual effects of possible bridge structural elements. In this image the use of steel lattice piers reduces the visual effect of vertical structures while the use of steel 'I beams' emphasises the visual depth of the bridges horizontal elements.

4.2.2 Option E: Score -1

As with MCA1 this alignment option, in the first instance, avoids one of the most sensitive landscape sub-units of the project area (the Waipingao). This alignment also therefore avoids the Regionally Significant Landscape area.

Option E is a direct 'valley to valley' option (landscape sub-units 3 to 6) that crosses only one ridgeline minimising potential for landform disturbance and enhancing the legibility of an alignment that responds to the existing character of SH3. That is, SH3 to the immediate north and south can be characterised as a lowland valley road corridor which 'keeps low in the landscape'.

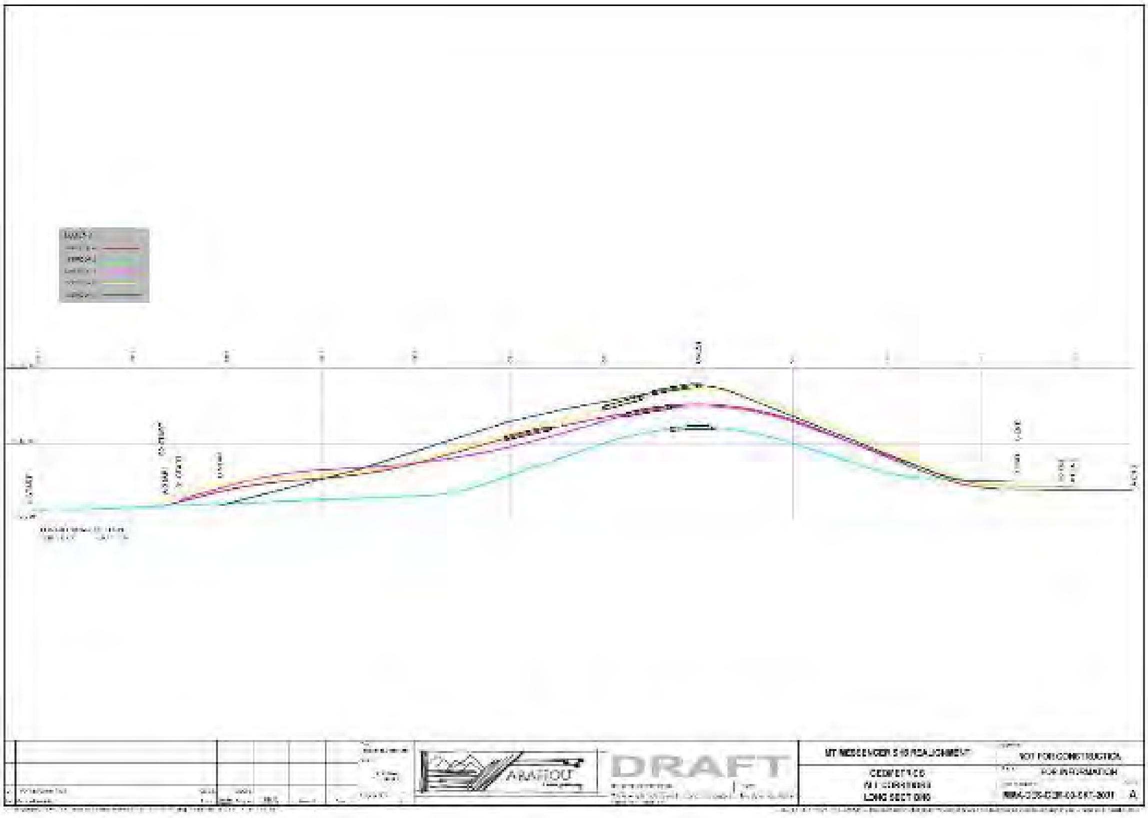


Figure 7: long section geometrics drawing showing Option E (in blue) as the alignment which is consistently the lowest in its vertical alignment by comparison to the other 4 options.

This option also represents a positive potential outcome for a scenic landscape route particularly working up into the visually contained and defined Mangapepeke Valley. Option E introduces potential for a “scenic bush” experience with built infrastructure contrasting with, but complementary to, bush gully landscape (assuming standard mitigation measures to integrate the roadway). This valley alignment is consistent with the wider character of SH3 as a lowland / valley route as noted above. However, this may also potentially result in significant landform (fill) modification of the valley floor and therefore natural drainage patterns. Sensitive stream and valley crossings are recommended (and assumed for the purpose of scoring).

Figure 8: This image illustrates Option E looking north from the east of Parininihi / Mt Messenger. This image helps in understanding the spatial relationship between a valley alignment option and the surrounding dominant hill country landscape. This recessive lowland alignment maintains the landscape integrity of Mt Messenger and represents a legible and cohesive roadway through otherwise complex hill terrain.

The upper Mangapepeke valley is a steep, visually well contained spur and gully system that has a moderate degree of capacity to absorb the type of landform modification proposed. However, Option E shows a pattern of fill that dominates the natural incised character of the upper valley and existing natural stream corridor. This could be mitigated by the consideration of short span bridging options to preserve the natural stream alignment. Modified fill slopes could then be designed to blend with the underlying and dominant natural landform rather than the fill appearing as a predominantly engineered landform. This design principle of reflecting underlying landform would need to be balanced with any additional vegetation clearance that could result from changing fill slope batters. This has been assumed as “standard” mitigation for the scoring for this option.

Similarly fixing the E corridor alignment to the eastern side of the northern Mangapepeke valley (thereby reducing the number of stream crossings) may also improve the landscape integration of this corridor (this has not been assumed for the purposes of scoring)

The southern entry near the Mimi River confluence has been improved since MCA 1 and avoids a sensitive wetland environment. Within the Mimi Valley system two bridges and a fill area characterise the option for the upper gullies that then drain to the Kahikatea wetland to the south. The two bridges are a positive design outcome that responds to the natural character of the gullies which immediately address the Kahikatea wetland. It is recommended that a further short span bridge is considered for the existing fill area south of the southern tunnel portal to preserve the natural landform and drainage characteristics of this gully (this additional structure has not been considered as part of the scoring for this option).

Overall, Option E scores a -1 (minor adverse effects). This compares to the -2 score for E1 and -3 score for E2 assigned at MCA1. In summary, Option E scores better than those MCA1 options because:

- The revised route alignment from the northern approach with the addition of engineered structures has reduced the number of engineered landforms required within the Mangapepeke catchment.
- The revised alignment of the route from the southern approach has less impact on the kahikatea swamp. The addition of engineered structures has reduced the number of engineered landforms in the upper Mimi catchment.

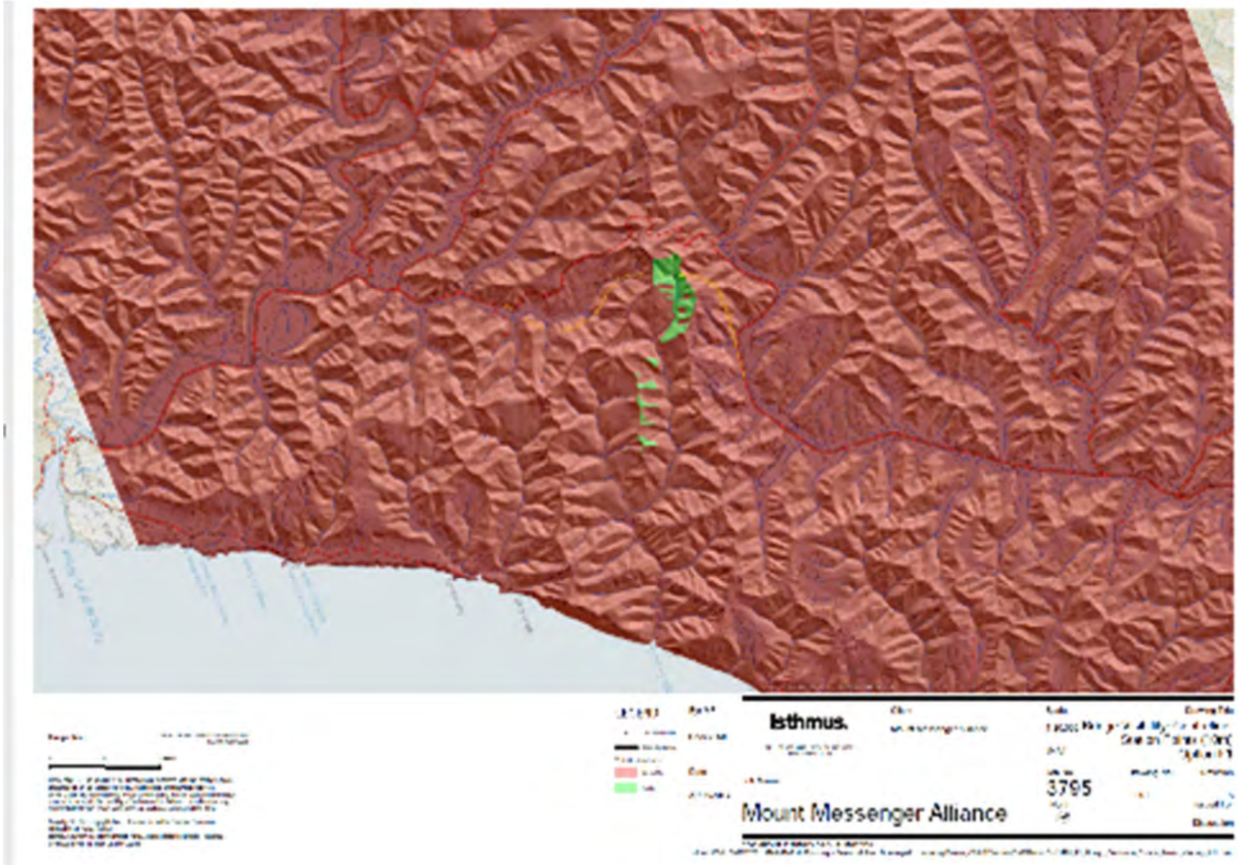
Figure 9: this contextual landscape image shows the Option E tunnel and the continuous ridge / landscape connection from the distant coast in the background, Mt Messenger in the mid-ground and the foreground hill country landscape. Left of frame shows the option alignment to the north of (avoiding) the Mimi Valley Kahikatea wetland.

4.2.3 Option F: Score -4

4.21 The MCA F option represents a hybrid between MCA1 F1 and F2. In this regard the F option has not resolved key landform modifications discussed at MCA1. Option F for MCA2 shows the removal of the structures (MCA1 F1) for the southern hill slopes. This in particular results in a very large engineered fill within a steep otherwise natural hill slope area. It is understood that this hill slope area also includes some of the best examples of individual remnant forest trees and is therefore of high natural landscape value. This fill in combination with a large cut in the southern Waipingao ridge represents a significant and adverse landscape effect.

While this option limits crossing of the Waipingao valley to the upper catchment, it still requires land within the Regionally Significant Landscape area, (though to a lesser degree than Option A). It is also more proximate to Parininihi / Mt Messenger which is a key landscape feature of the project area. This option therefore introduces significant landform modification as well as built infrastructure into some of the most sensitive landscapes of the project area – albeit for a reduced distance in comparison to Option A.

The Option F bridge is also theoretically less visible that the 620m Option A bridge. Nevertheless inter-visibility terrain analysis suggests that the Option F bridge could be visible from the majority of the immediate upper Waipingao catchment (see below).



The southern and northern approaches are generally predominated by modified landcover (pasture / scrub and forestry). The northern approach results in landform modification along the western extent of the northern rural valley. This rock cut alignment 'hangs' midway up the hillslope landform cutting across the natural pattern of spurs and gullies in order to avoid soft valley floor alluvial soils. This (Option F) rock cut approach lacks the cohesion of Option E (for example) which in contrast is more contained within a relatively tight valley landform and, as a result works across the underlying landform. Option F does however include bridging options for the lower northern valley which represent positive landscape outcomes.

Figure 10: Option F northern approach – This approach results in landform modification along the western rural valley slopes with an alignment that cuts across the natural spur and gully pattern. This includes a large area of gully fill (mid-frame).

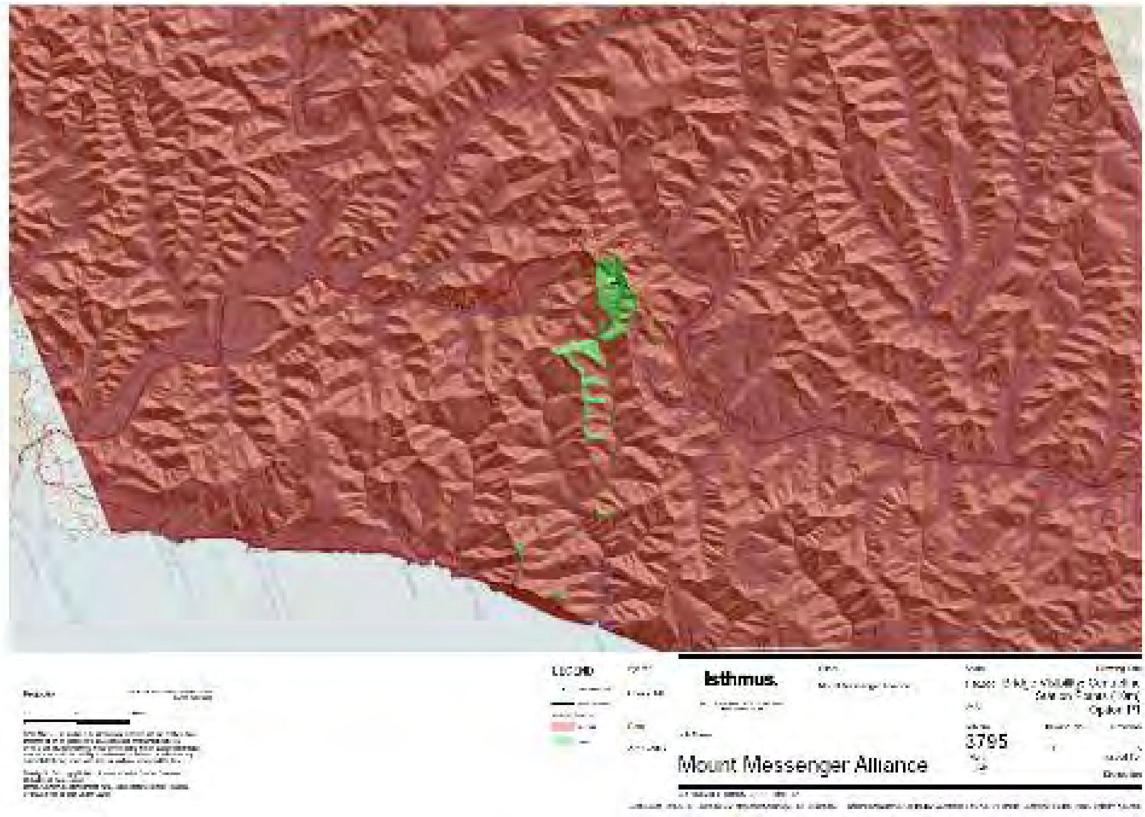
As discussed above the southern approach includes a significant ridgeline cut in proximity to Parininihi / Mt Messenger as well as a large engineered fill slope. This is further exacerbated by relatively high sidling cuts across the southern slope faces which are proposed to be 'daylighted' on the downslope side. This southern alignment section lacks a degree of coherence between underlying landform and road geometry which in combination with the ridge cut and slope fill result in significant adverse landscape effects.

Overall, the fact that Option F is a "hybrid" of the two MCA1 F route options is reflected in the score assigned. Option F scores -4, which is better than the fatal flaw score that Option F2 received at the MCA1 stage, the same as the -4 score Option F1 received.

4.2.4 Option P: Score - 3

Option P is a new corridor option which has not been previously evaluated. This option represents similar adverse landscape effects to Option F by crossing the upper Waipingao in proximity to Parininihi / Mt Messenger.

Similar to Option F theoretical inter-visibility analysis suggests that the proposed Option P bridge will predominate the otherwise natural character of the upper Waipingao Valley (see below).



In addition, Option P also represents a significant cut to the southern Waipaingo Ridgeline. While this cut avoids Ngati Tama landholdings in the south it results in a pronounced landform modification (for example in comparison to Option F) as it cuts obliquely across the southern ridge landform. This deep cut continues southward resulting in a steep ‘cut corridor’ which continues southward towards the Mimi valley. The southern tie in also represents an area of valley fill near the existing SH3. Unlike Option F however there is no significant engineered fill within the southern slope areas of high ecological value.

To the north, Option P represents similar landscape effects to Option F where the northern approach results in landform modification along the western extent of the northern rural valley. As with Option F this rock cut alignment ‘hangs’ midway up the hillslope landform cutting across the natural pattern of spurs and gullies in order to avoid soft valley floor alluvial soils. Option P does however include bridging options for the lower northern valley which represent positive landscape outcomes.

Like Option A, Option P also scores -3 (high / significant adverse effects).

4.2.5 Option Z: Score - 1

Option Z is an ‘on line’ option located primarily within the existing cadastral road corridor. As reported for MCA1, the immediate SH3 road corridor is a modified highway environment characterised by more open valley rural character to the north and the south. The existing Parininihi / Mt Messenger hill crossing is a unique section of road predominated by the very steep surrounding topography and a predominance of indigenous vegetation. This natural bush character extends to the immediate roadside where previous engineered cuts have been colonised by a diverse range of native plants. These colonised papa faces have a natural appearance which visually blends with both the exiting naturally steep terrain and bush as well as partly revealing the papa landscape 'foundation'.

The driver experience through this section is one of a highly scenic journey along a route complementary to the terrain as the road winds its way up and across the bush hill landscape. The route also includes a unique short tunnel section cut directly into the hillside which also provides a unique reveal of the underlying strata character of the papa formation.

The MCA2 Z option echoes the existing alignment and includes a series of two principal structures that 'step' across south facing spurs, bridging steep gullies in the south. This southern section of the proposed alignment generally responds to the underlying landform pattern, but does introduce a series of built 'viaduct' type structures as a significant pattern of built development in an otherwise natural environment. The option also introduces a series of large cuts in the south that truncate the secondary south facing spurs to accommodate the spur 'step' before entering a tunnel portal on the south side of Mount Messenger.

It is noted that at the MCA2 workshop the Option Z tunnel itself received a F (Fatal Flaw) from Ngati Tama in relation to the proximity of the tunnel to Parininihi / Mt Messenger, reflecting in part consideration of wider shared and recognised values of Mt Messenger as a landscape feature. It was previously noted that the proposed tunnel option for the Mount Messenger summit is a positive landscape outcome and the portals have a logical fit with the existing terrain and would further enhance the driver experience of a scenic bush journey of considerable interest. This is in contrast to the Ngati Tama perspective. However, this perspective is recognised in this respect.

This further consideration of tunnelling 'through' Parininihi / Mt Messenger should be considered in the context of the cuts that also characterise the Option Z western roadside to the immediate north of Mount Messenger (although these do not significantly impact on the landform integrity of summit itself). To the north the option generally follows the existing alignment along a largely modified pasture / bush near ridge edge.

In general Option Z is consistent with the character of the existing roadway in the north. However, it does introduce a series of significant structures traversing the southern spur slopes. These structures will afford a similar scenic bush experience to the existing alignment; however this route will also result in large cut faces in the south. The proposed tunnel option for the Mount Messenger summit is a positive landscape outcome and the portals have a logical fit with the existing terrain and would further enhance the driver experience of a scenic bush journey of considerable interest. Considering the above this option is scored -1 representing a low adverse landscape effect overall.

Overall, Option Z scores a -1 (minor adverse effects). This is a better score than was assigned to the two 'on line' options for MCA1 (-2 for Z3 and -3 for Z4). In summary, Option Z scores better than those MCA1 options because:

- The revised alignment of the route from the southern approach has less impact on the kahikatea swamp. The addition of engineered structures has reduced the number of engineered landforms proposed in the upper catchment of the Mimi River.

Appendices

Appendix A: The Parininihi Landscape

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In the context of this report the Parininihi landscape refers to the wider project area as described below.

Location

The project area that has been considered for MCA1 includes the steep to very steep bush hill country from the coastal terraces south of the Tongaporutu River; south to the pastoral flats of the Mimi Valley; west to the coast and the Parininihi Cliffs and; east to the Mangaonga Road Corridor and the (DoC) Mount Messenger Forest (see Figure 1 below).

Fig.1 The location of the wider project area and existing SH3 corridor characterised by sparsely populated steep bush hill country and lowland pastoral valleys. (NZ Topo 50)

This area is sparsely populated and is dominated by steep bush with pockets of pastoral rural land in lowland areas as well as pasture on some limited upper spur areas. Strong ridgeline patterns predominate lowland landscape views from the existing SH3 corridor which generally follows the valleys (apart from the existing upland Mt Messenger SH3 alignment. Extensive areas of very steep bush hill country within the Mt Messenger Forest (including DoC areas) characterise the inland landscape context in the east. The Taranaki coast (including the Parininihi Cliffs and Marine Reserve) characterises the coastal hill and terrace country in the west.

Landscape Context of the Project Area

In general terms, the project area traverses a landscape that is predominantly characterised by steep bush hill country. This includes a pattern of fragmented areas of ecologically significant bush as well as areas of high value but unprotected bush. Of particular relevance to the project is the potential for landscape connectivity that may be able to be achieved to address current landscape and habitat fragmentation between large areas of bush and marginal pasture land in the northwest with the existing conservation estate in the southeast.

There are also recognised cultural landscape values associated with this landscape pattern with Ngāti Tama landholdings and land management programs extending from the Parininihi Marine Reserve to landholdings east of the existing SH3 corridor. Parininihi is of cultural, spiritual, historical, and traditional importance to Ngāti Tama. These associative landscape values (cultural values) and Natural Science Values help to inform the wider understanding of Landscape value including shared, recognised and community associations with the project area (see Figure 2 below).

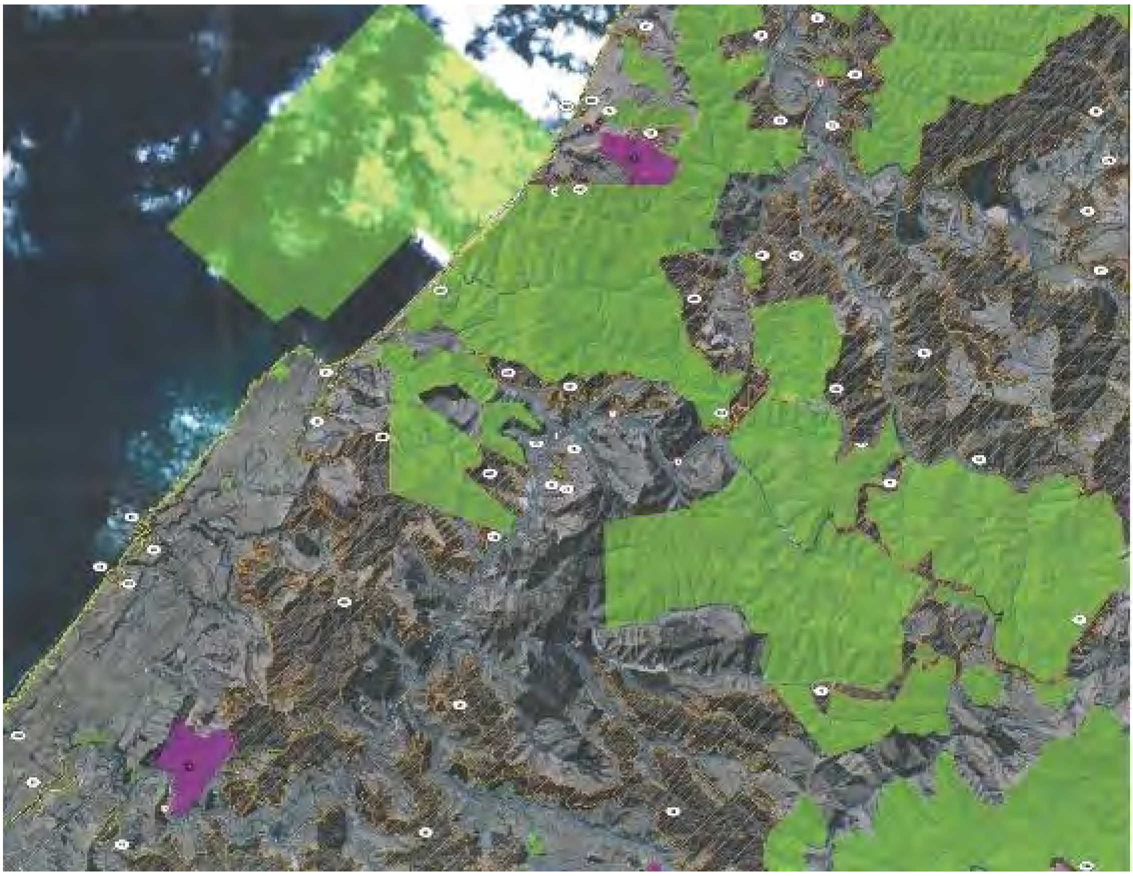

Figure 2: The Wider Landscape Pattern of Bush Hill Country- SNAs and Wildlands. Protected Natural Areas in green and Proposed Significant Natural Areas hatched (Source Opus background reports)

Figures 3 to 6 below show a series of maps of key landscape attributes that characterise the project area. These attributes are shown on a topographic base map and include landcover, landform, hydrology, significance, and cultural significance and ownership.

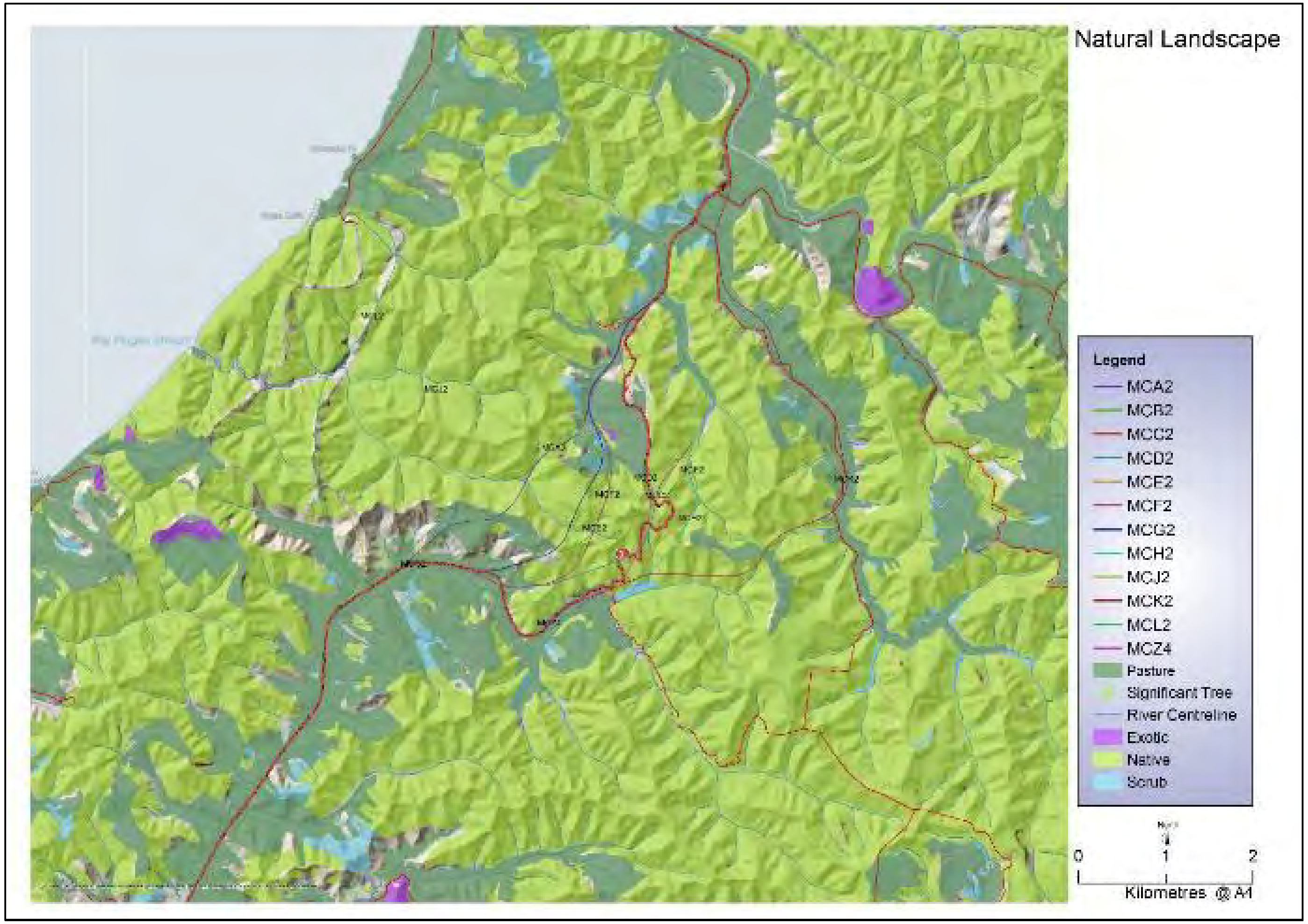

Figure 3: Landcover: Including the extensive pattern of indigenous landcover across the project area with a predominance of bush on steeper hill country and pasture in valley floors, mid to upper spur areas and limited areas of coastal terrace in the north. The existing SH3 corridor follows pastoral valley floors before crossing the Mt Messenger bush hill county.

Figure 4 Landform: Illustrating a very strong pattern of steep hill country defined by two principal valley systems (Tongaporutu in the north and Mimi in the south) as well as a complex pattern of very steep (over 25 degrees) hill county ridges and gullies.

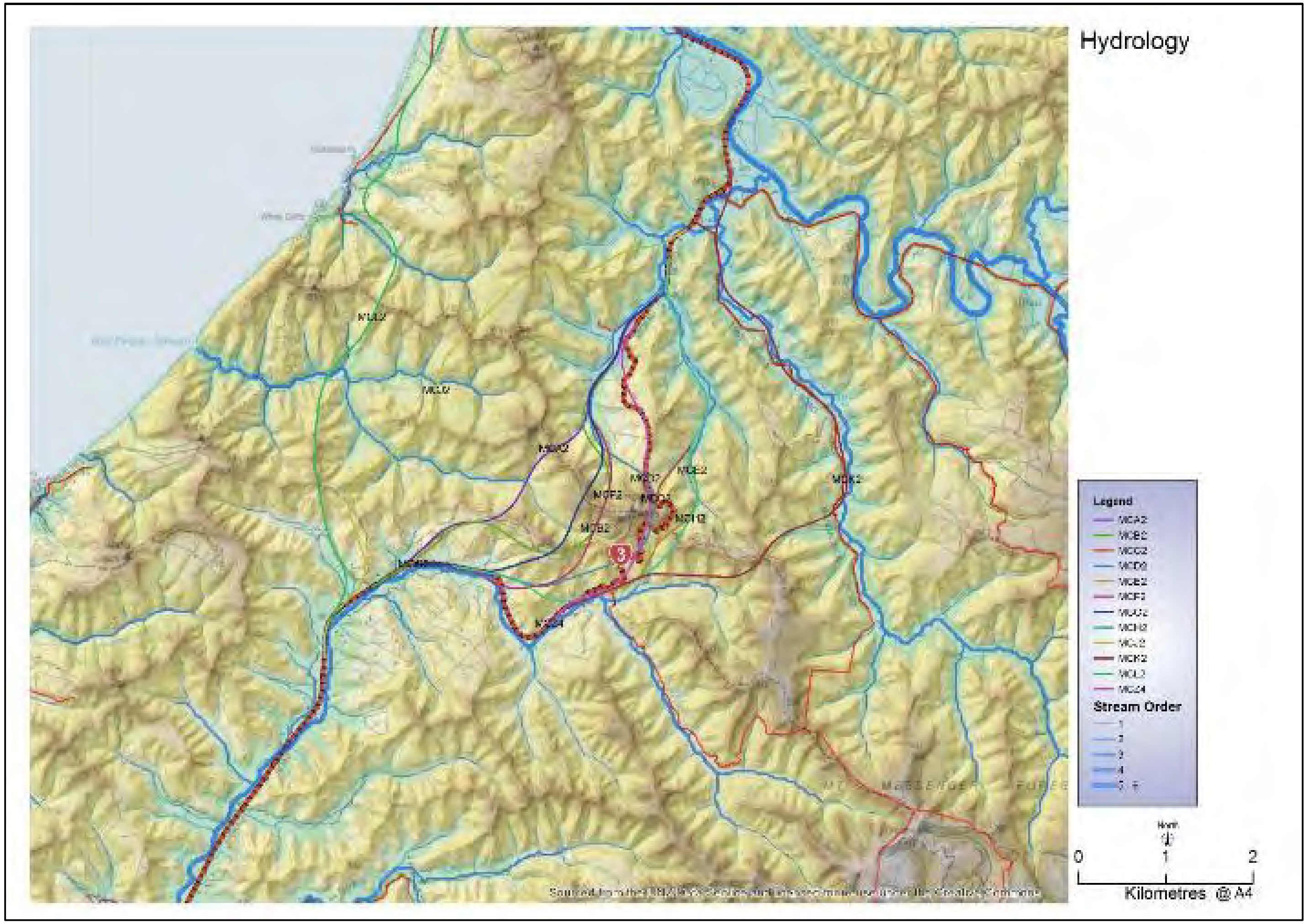

Figure 5: Hydrology: This strong natural landscape pattern is also reflected in the complex ridgeline patterns of the wider Parininihi landscape and the natural valley drainage patterns of the three principal catchments of the project area; Tongaporutu in the north; the Mimi in the south; and the Waipingao Catchment which extends from the Mt Messenger summit to the Parininihi Cliffs and coast in the west.

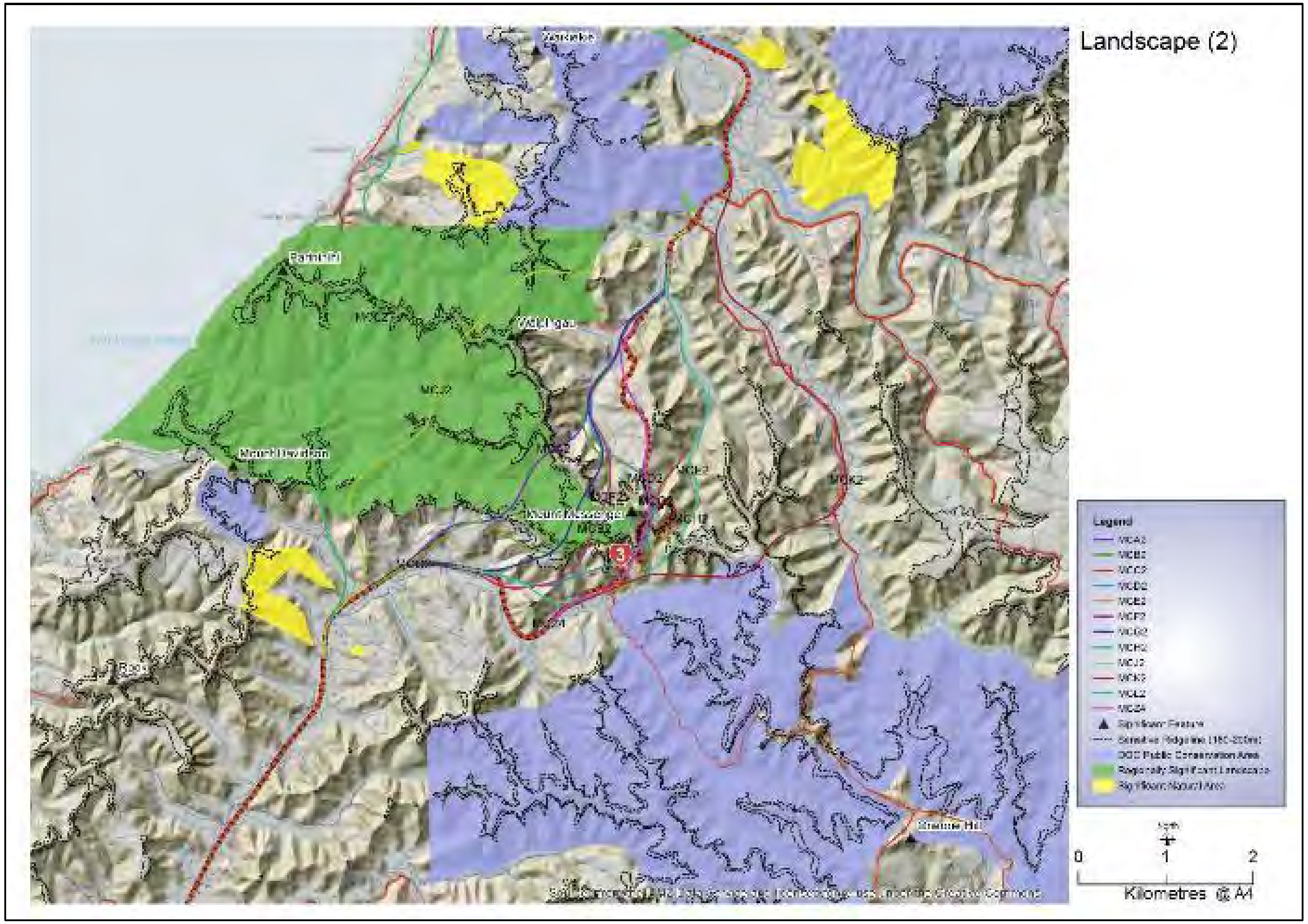

Figure 6 Significance: The Waipingao catchment in particular is part of a wider area that has been identified as a Regionally Significant Landscape in the New Plymouth District Plan. The project area also includes extensive areas of DoC conservation estate – particularly in the east.

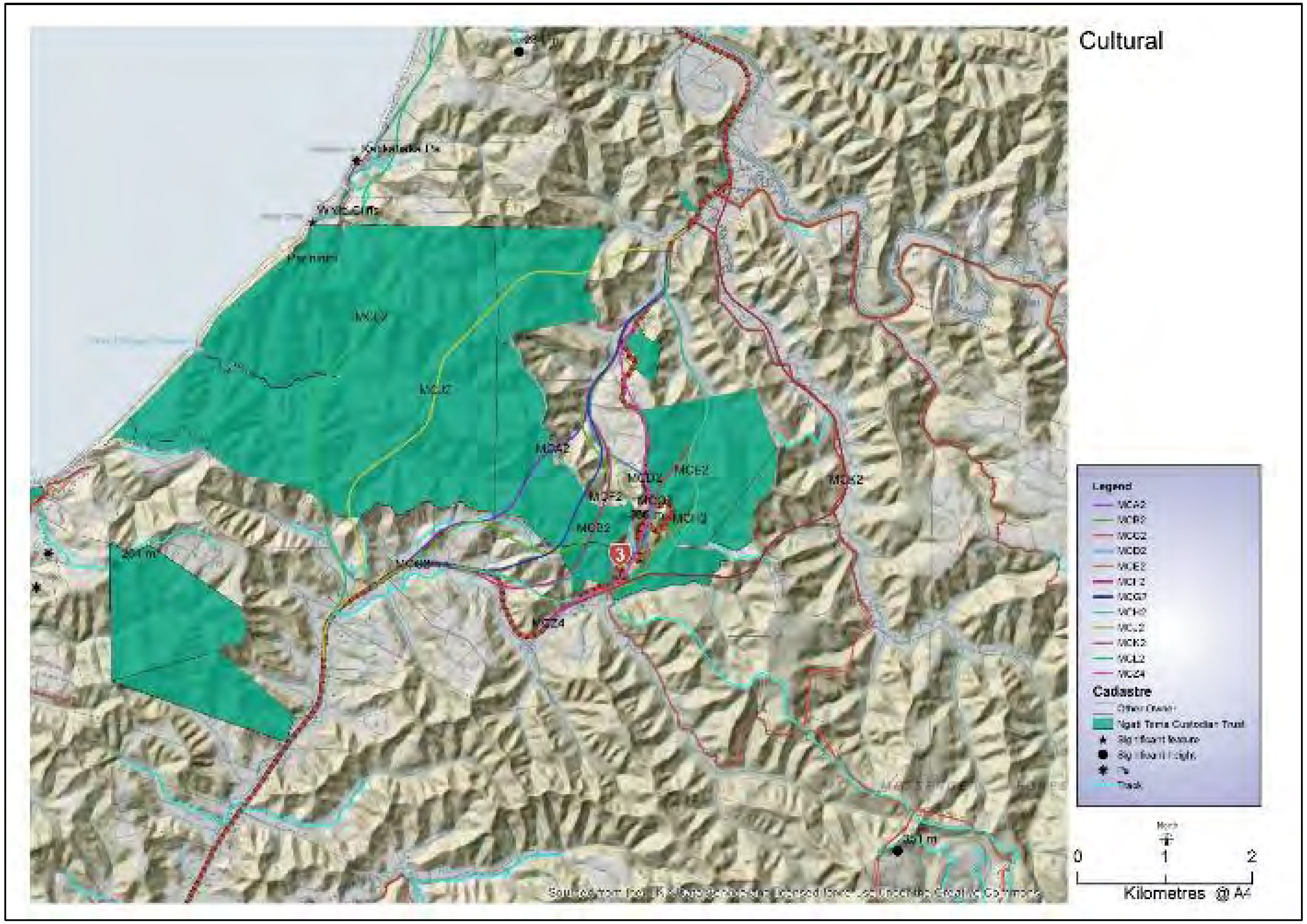

Figure 7 Cultural Significance and Land ownership: As discussed above the project area is also characterised by significant Ngāti Tama landholdings. This includes the Parininihi Protection Project area to the west of Mt Messenger

This mapping illustrates the relative complexity of the project area landscape which is predominantly characterised by natural landscape elements and patterns in proximity to the inland conservation estate of the Mt Messenger Forest. This land includes extensive areas of Ngāti Tama land. These natural landscape elements and patterns also reflect high ecological values, particularly for large contiguous areas of indigenous vegetation -characterising the project area as a predominantly natural landscape.

As noted above, the project area also includes extensive landholdings by Ngāti Tama. This land represents an area of high cultural significance. Ecological Values within the project area are discussed in the MCA1 Ecology Report. Cultural Landscape Associations are discussed in brief in the following section and are informed in this report by the Cultural Values Assessment in relation to the SH3 Mount Messenger Project, (Atkins Holm Majurey Ltd March 2017.)

Recognising these cultural landscape associations informs a more inclusive and holistic understanding of particular landscape attributes (such as specific places of value or particular physical landscape connections) in the context of wider shared and recognised landscape associations and values.

Cultural Landscape Associations

The Project area is set within an important cultural landscape. Ngāti Tama are acknowledged as mana whenua and the project potentially traverses Ngāti Tama treaty settlement lands. "There is significant historical, cultural and spiritual value attached to this land given its role in redressing the past breaches by the Crown of its treaty obligations and the role and value of this land in restoring the cultural and spiritual wellbeing of Ngāti Tama" (Cultural Values Assessment in relation to the SH3 Mount Messenger Project, Atkins Holm Majurey Ltd March 2017).

Inland bush areas are of particular importance to Ngāti Tama where "...The associations with the inland bush area played an important role in the customary practices of Ngāti Tama, along with the many streams, ridgelines and peaks of this area, and continue to do so today…." (op cit, p.10 para 41).

This is also reflected in important landscape connections between coastal and inland areas including coastal pa and inland tracks and peaks. In particular, the importance of ridgeline walking tracks between the coast and the Mount Messenger peak. These pathways have cultural significance to Ngāti Tama as the source of Mauri. Important waterways which flow to the coast and Parininihi Cliffs are also of major cultural significance to Ngāti Tama Cultural Values Assessment in relation to the SH3 Mount Messenger Project. (Atkins Holm Majurey Ltd March 2017.)

Of particular note is the alignment of the natural landscape and ridgeline landscape connections which generally run in a northwest to south east direction. The SH3 corridor and most new alignment options traverse this pattern in a north-south direction.

Cultural and Ecological Landscape Value: The Parininihi Protection Project

The project area includes the Parininihi Protection Project area which is located west of Mt Messenger within the Waipingao catchment and western coastal hills. This is an iwi led ecological restoration project on the Parininihi Block which was started in 2006 with pest control and monitoring. This work builds on the previous management of the block for conservation purposes. This Parininihi Protection Project relates to the wider landscape values associated with this part of the project area and informs the shared, recognised and community landscape values associated with this land as well as natural landscape (bio-physical) landscape values.

Te Tiaki Te Mauri o Parininihi Trust has been established to manage the conservation project area. The Parininihi Protection Project includes land of high ecological value identified as a Key Native Ecosystem by the Taranaki Regional Council. The Department of Conservation ranks Parininihi as a priority site in Taranaki (Tiaki Te Mauri O Parininihi Trust). The area includes numerous protected native species including Kiwi, Karearea, kereru and pekapeka (bat) as well as high value indigenous vegetation communities. The Waipingao catchment and Parininihi coastline extends to the Parininihi Marine Reserve which includes the Pariokariwa Reef which ranks highly internationally (op cit, p.17 para 65).

The Te Tiaki Te Mauri o Parininihi Trust has recently released Kokako into the Waipingao Catchment as part of a long-term project. This project is both of ecological and cultural significance. A long-term goal of the trust is to establish a viable breeding population of Kokako that can be reintroduced throughout Taranaki. It is understood that this programme is predicated on the established high ecological values of the Waipingao Catchment as a unique, near pristine managed natural landscape.

The Parininihi Project is recognised as a significant conservation project both regionally and nationally. (op cit, p.16 para 64) In this regard, the natural science and natural landscape values of the Parininihi Protection Area are particularly high and generally well recognised (for example http://www.radionz.co.nz/news/national/331805/bypass-casts-shadow-over-kokako-release). This is reinforced by the very strong cultural associations and ongoing land management by Ngāti Tama and the wider community. The combination of these high ecological and cultural landscape values reinforces the high natural landscape values of the site (also recognised as an area of Regionally Significant Landscape) and the high natural character values of the Waipingao Stream, Parininihi Coast and Marine Reserve as an area of contiguous high natural character value from Mount Messenger to the Pariokariwa Reef.

Desktop Landscape Character Unit Classification and Ranking

For evaluation purposes the project area can be categorised into ten landscape character sub-units. This baseline evaluation is undertaken for the whole of the project area to identify landscape areas in a manner useful for comparing 'joined-up' routes that cross several sub-units that may demonstrate differences in landscape quality and capacity to accommodate landscape change. The evaluation is based on preliminary site investigations and high-level desktop analysis using existing mapped resources (NZtopo, Google Earth and Imagery, Site survey and 3D Model).

The purpose of this classification is therefore to broadly identify areas of landscape quality in general terms and the capability of the landscape to accommodate or 'absorb' the type of landscape change anticipated by a highway project. This is a general assessment of 'highway absorption capability'.

Landscape quality was assessed taking into account the following matters:

- Biophysical values such as the natural science values of landform, vegetation, waterways.
- Perceptual values such as aesthetic quality, legibility, distinctiveness and memorability.
- Shared and recognised associative factors particularly values that tangata whenua and others might associate with a landscape.

The **highway absorption capability** is an appraisal of the likely degree of effects that would result from a highway of the type proposed taking into account such matters as:

- Likely modification to natural landforms, waterways or vegetation.
- Likely prominence, including density of dwellings, proximity to settlements, the ability to fit a road to the contours, potential screening by vegetation or topography.
- Likely extent of change to existing character – taking into account the landscape's complexity and existing degree of modification.

Figure 8 Ten Indicative Landscape Character Sub-units across the project area.

The above Sub-units are relatively defined landscape sub units. These areas demonstrate subtle as well as distinct differences in landscape characteristics. These areas reflect differences of each areas capacity to accommodate landscape change in regard to the construction and operation of a new highway. These characteristics, overall landscape quality, and landscape capacity, are summarised as follows:

1. Mimi Rural Valley:
    - Moderate to steep pastoral hill country in the south.
    - Pastoral rural hill country character predominates
    - Includes existing SH3 corridor
    - Overall modified rural landscape
    - Features Mimi River system (meander) and valley
    - *Low quality / High capacity to accommodate landscape change*
2. Upper Mimi Bush Valley
    - Very Steep Bush Hill country (includes DoC estate)
    - Complex stream systems
    - Sensitive Wetland / stream system (Mimi System and confluence)
    - Includes existing SH3 corridor in the Northwest.
    - Modified lowland valley
    - SH3 roadway south of Mt Messenger
    - *High quality / Moderate to Low capacity for landscape change*
3. Mimi Rural Hills (sub units a / b / c)
    - Steep south facing spurs and scarps.
    - Strong and defined landforms patterns
    - Visually prominent from SH3 northbound approach in the south
    - Modified farmland remote open rural character
    - Fragmented bush
    - Frames existing corridor in the north
    - *Low quality / Moderate capacity to accommodate landscape change*
4. Parininihi Coastal
    - Steep coastal hill country
    - Prominent Coastal Features (Cliffs)
    - High natural character and cultural landscape values (coastal, bush, stream areas)
    - Unmodified near pristine natural environment – high natural character
    - High known ecological values
    - *Very High quality / Very Low capacity for landscape change*
5. Waipingao Bush Valley System
    - Contained highly natural remote unmodified bush valley
    - Strong, prominent ridgeline patterns in the north
    - Less well defined but still prominent ridge system in the south
    - Very high ecological values (bush and streams and ongoing pest management area)
    - High cultural landscape values (includes Parininihi Summit – Mt Messenger)
    - Unmodified – high natural landscape values overall
    - *High quality / Low to capacity for landscape change*

6. Northern Rural Valley
    - Relatively open rolling valley landform
    - Pastoral open rural character
    - Mixed landuse activities and landcover
    - Framed by less modified and more natural steeper north facing slopes
    - *Moderate to Low quality / Moderate to high capacity to accommodate landscape change*
7. Mangapepeke Bush Valley
    - Well defined and visually contained bush valley
    - Moderate ecological values
    - Partially modified (grazed in the north) with an unmanaged 'scruffy' rural character partially the valley floor
    - Assumed cultural landscape values associated with landownership
    - *Moderate quality / Moderate capacity to accommodate landscape change*
8. Mangaongaonga Valley
    - Relatively defined partially enclosed bush valley
    - Includes and existing rural road (Mangaongaonga Road corridor)
    - Pastured and modified valley floor throughout
    - Steep to very steep bush hill slopes particularly in upper valley areas
    - *Low to moderate quality / High to moderate capacity to accommodate landscape change*
9. Waioiotawa Bush Hills
    - Steep bush hill country
    - Dissected and strong landform and streams
    - Includes lowland pastured flats near existing SH3 corridor
    - *Moderate to high quality / Moderate to low capacity to accommodate landscape change*
10. Northern Coastal Hills
    - Partially includes coastal terrace areas
    - Likely moderate natural character values
    - Steep dissected Coastal hills and streams
    - Mixed landuse activities and landcover
    - Moderately high natural character
    - *Moderate to high quality / Moderate to low capacity to accommodate landscape change*

The following table ranks landscape sub units in regard to landscape quality from lowest to highest (left to right on the table).

Landscape unit ranking: Landscape quality									
1	3	6	8	7	9	2	10	5	4

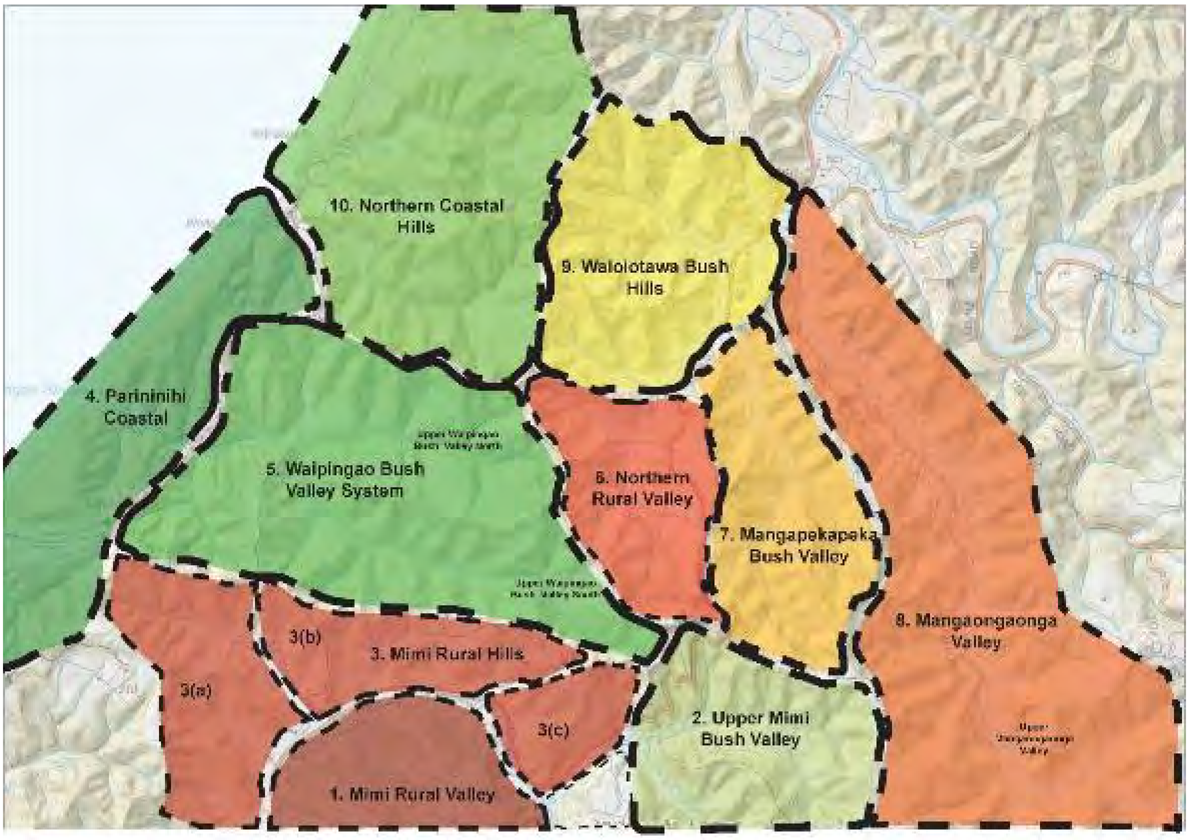

Figure 9 Sub-unit character landscape quality

The following table ranks landscape sub units in regard to highway absorption capability from least capacity to most capacity (left to right on the table).

Landscape unit ranking: Highway Absorption Capability									
4	5	10	2	9	7	3	6	8	1

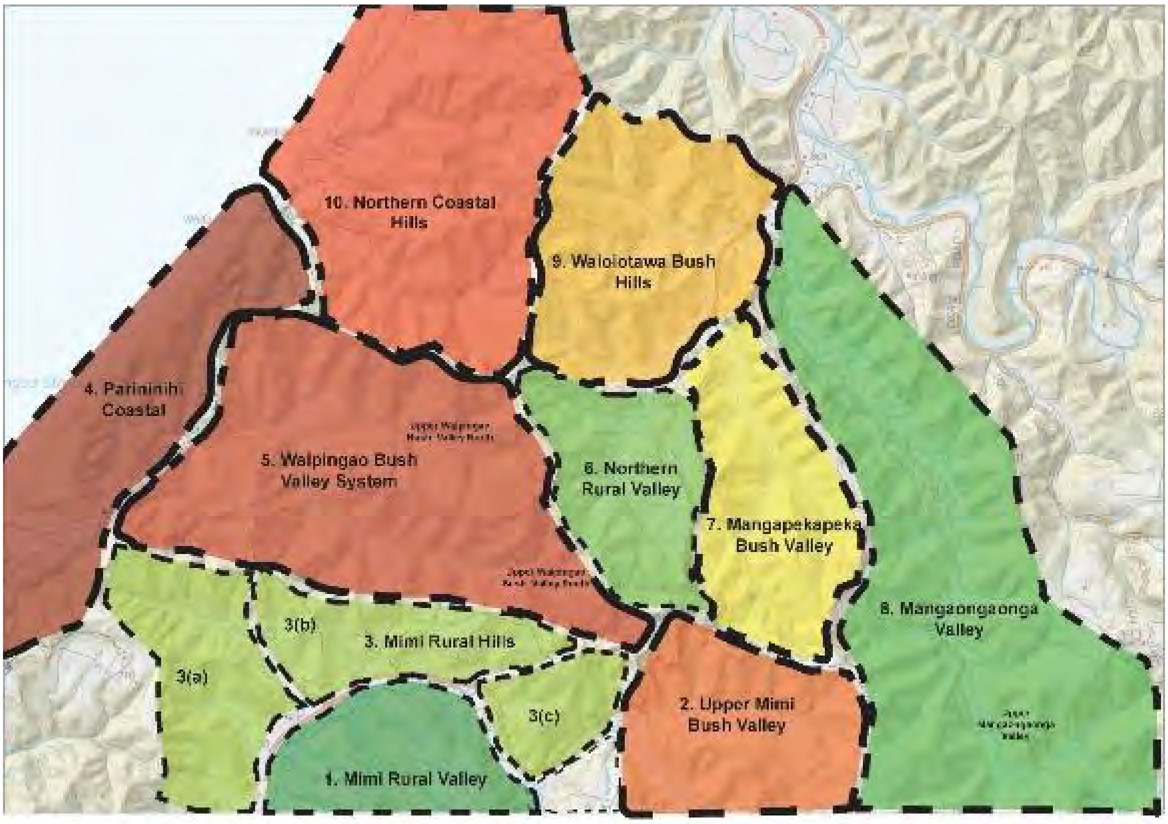

Figure 10: Sub-unit character landscape highway absorption capacity

Notable landscape features

The following noteworthy natural features are also included within the broader project area:

- **The Parininihi Cliffs (Fig.11).** Well-recognised and prominent coastal features listed as a regionally significant landscape (NPDP). These cliffs have significant cultural value, as well as ecological and natural character value.

Figure 11 Parininihi Cliffs: Ngāti Tama- Photo credit. High Natural Character and Landscape Values

- **The Parininihi Summit (Mount Messenger)** A prominent and recognisable landform feature with associated strong contiguous ridgeline patterns that are visible from the SH3 corridor. This landform and associated ridges are also recognised as having significant cultural landscape value.
- **The Waipingao Catchment (Fig. 12)** This area is part of the Parininihi Protection Project which has been managed for over 30 years. It is an area recognised as having very high ecological and cultural values. This catchment is also listed as a regionally significant landscape. The Waipingao catchment drains into the **Parininihi Marine Reserve** which is of high ecological significance and high natural character value including the Pariokariwa offshore reef featuring and rare sponge communities. "*Marine biologist Chris Battershill (a renowned expert on marine sponges) rates Pariokariwa Reef as one of the top sponge spots in the world. Many of these fantastic "undersea gardens" remain unexplored and may yield further scientific discoveries*" (DoC, Parininihi Marine Reserve Brochure). In this regard, the Waipingao Catchment represents a particularly sensitive natural environment from ridge (Mt Messenger) to reef.

Figure 12 The Mouth of the Waipingao Stream and valley extending east to Parininihi (Mt Messenger) & Parininihi Cliffs: Ngāti Tama- Photo credit. Regionally Significant Landscape.

The Landscape of the Existing SH3 Corridor

The existing SH3 corridor follows the Mimi River valley in the south before turning eastwards at the south facing toe slopes and spurs of the west east running ridgeline that defines the defines the southern catchment boundary of the Waipingao. These slopes are characterised by regenerating bush on the steeper scarps and pasture on the more moderate spur flanks. (See Fig. 13 below)

Figure 13 Aerial view looking north across the upper pastoral slopes (Angelsea Farm) to the south of the Waipingao catchment towards Mt Messenger. (Landscape Sub Unit 3b)

A prominent conical landform with exotic forestry marks the southern SH3 hill climb towards Parininihi / Mount Messenger with the existing highway winding up to the summit and saddle and rest area. A short tunnel characterises the highway north of a rest area at the catchment saddle between the Mangapepeke Stream and the Mimi Valley. This tunnel is cut directly into the slope face revealing the underlying papa strata. Roadside cuts through this area are generally well vegetated demonstrating a diversity of successional plant communities creating a highly naturalised roadside character.

Fig. 14 Aerial view looking northwest towards Mt Messenger with the existing SH3 alignment winding around Mt Messenger in the context of the wider steep bush hill country and limited pastoral farmland.

The northern existing alignment area is characterised by a more open and rolling pastured valley characterised by the disturbed landslide landform, dissected sub-catchment valleys and drained valley floor. This Valley is defined by the strong ridgelines of the northern Waipingao catchment and Mt Messenger summit. Landcover on these northern slopes is generally more mixed including areas of pasture, regenerating bush and exotic forestry.

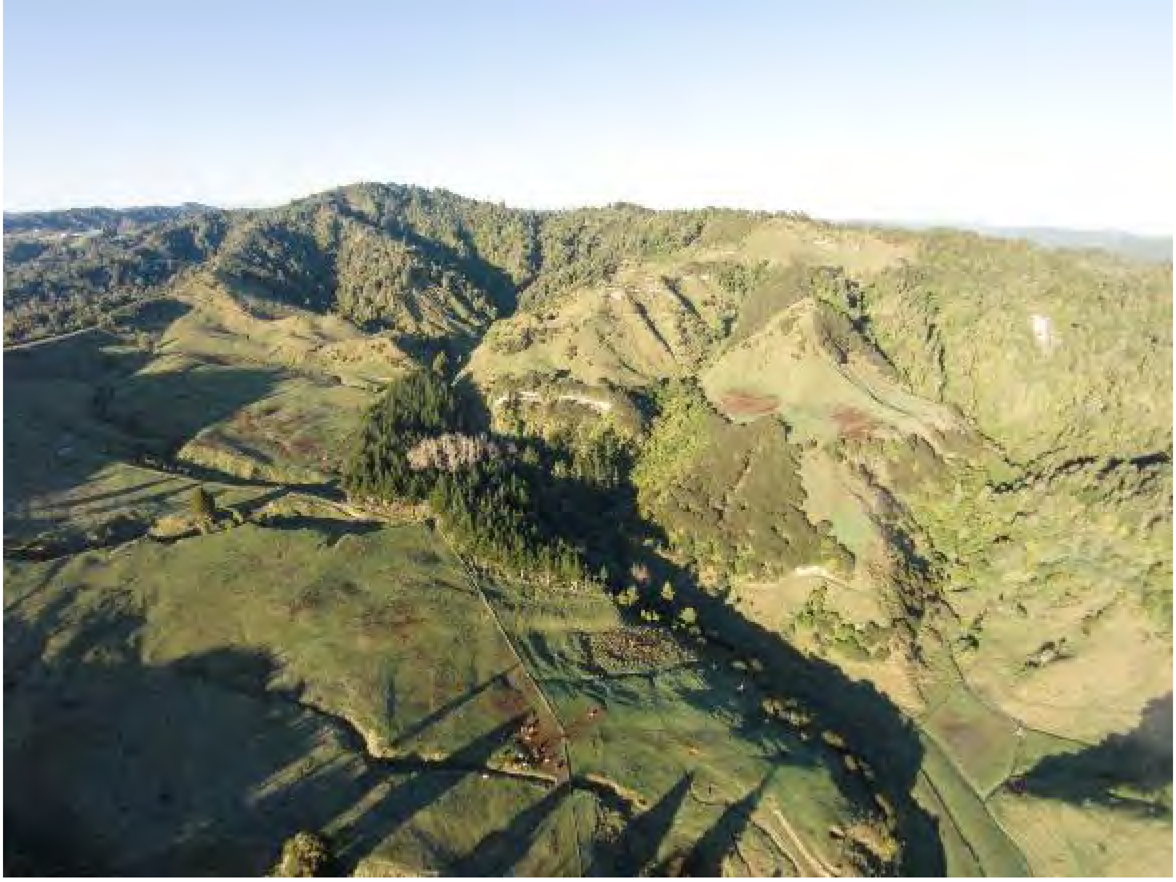

Fig. 15 Aerial view looking south towards Mt Messenger with the existing SH3 alignment right of frame, steep dissected sub-catchment gullies and mixed landcover. (landscape Sub Unit 6)

Settlement within the project area is sparse and determined predominantly by the access afforded by SH3. There are a small number of dwellings at Ahititi at the intersection of Moaku Road (SH3) and Okau Road and a pattern of sparse and occasional dwellings along the road corridor itself.

The New Plymouth District Landscape Assessment.

The New Plymouth District Landscape Assessment (LA4 - June 1995) identifies a number of landscape units across New Plymouth District. The project area is predominantly within Landscape Unit 4: Eastern Hill County – Bush.

This landscape unit is described as being predominantly remote bush covered hill country with strong underlying landform

i. Steep ridges rising to 400m

ii. Peaked and angular landform

iii. Clearly defined stream gullies

iv. Mature and regenerating native vegetation

v. An enclosed landscape quality form strong landform and solid bush cover

vi. Skyline landform backdrops which frame lower valley views

This broad scale district wide assessment identified cuts in the hillsides and cliffs for roads for SH3 through the Mount Messenger Area as an adverse element. The Landscape unit is also identified as being sensitive to change (overall sensitivity rating 5 out of 7) and is recommended as a Regionally Significant Landscape. Elements that make the unit sensitive are listed as

i. Extensive and homogenous bush landcover

ii. Lack of development / activities

iii. Strong ridged landform is listed as heightening sensitivity

The unit is listed as having a viewing audience limited to SH3 users. Key qualities that contribute to the assessment of regional significance (and therefore – protection) are

iv. Remoteness

v. Large undisturbed areas of bush

vi. Strong landforms with bush cover forming backdrops

The New Plymouth District Plan: Regionally Significant Landscape.

The project area includes land mapped as Regionally Significant Landscapes in the Operative District Plan. This includes extensive hill country areas to the west of Mt Messenger and the Waipingao Catchment. This area is less extensive than the District wide Landscape Unit 4 mapped in the 1995 district wide landscape assessment.

The description and values of this area focus mostly on the Parininihi Cliffs and coast. *"White Cliffs form a dramatic sea/land interface with sandstone cliffs backed by bush covered hills. The distinctive pattern of this landscape is due to its simplicity, bush and white cliffs with the occasional plateau of pasture. White Cliffs is a distinctive remote feature that appears to rise out of the sea."* P.91

The Draft District Plan (2016) notes Parininihi as an Outstanding Natural Landscape. However, no mapping is provided with this draft to define the spatial extent.

Landscape input to route selection seeks to find an alignment that has a fit with the landscape, and minimises the potential adverse effects that inevitably arise with new infrastructure such as a highway. In the context of this project such input relates predominantly to natural rather than human elements (given the generally sparsely populated and remote qualities of the project area).

The following matters are relevant in achieving a good fit that is consistent with or complementary to the character of the area and is generally coherent with its setting:

Landscape Matters

- Following the pattern or 'grain' of the landscape: following an alignment that best fits into the existing topography recognising that the existing SH3 corridor mostly follows either coastal terrace landforms or lowland valleys.

Figure 16 Elevation model showing the grain of the landscape looking from the south to the north – a strong east west landform pattern. Note: the existing SH3 corridor in the south following the valley floor. The purpose of the project is to traverse this strong east – west pattern in the context of a north south road corridor.

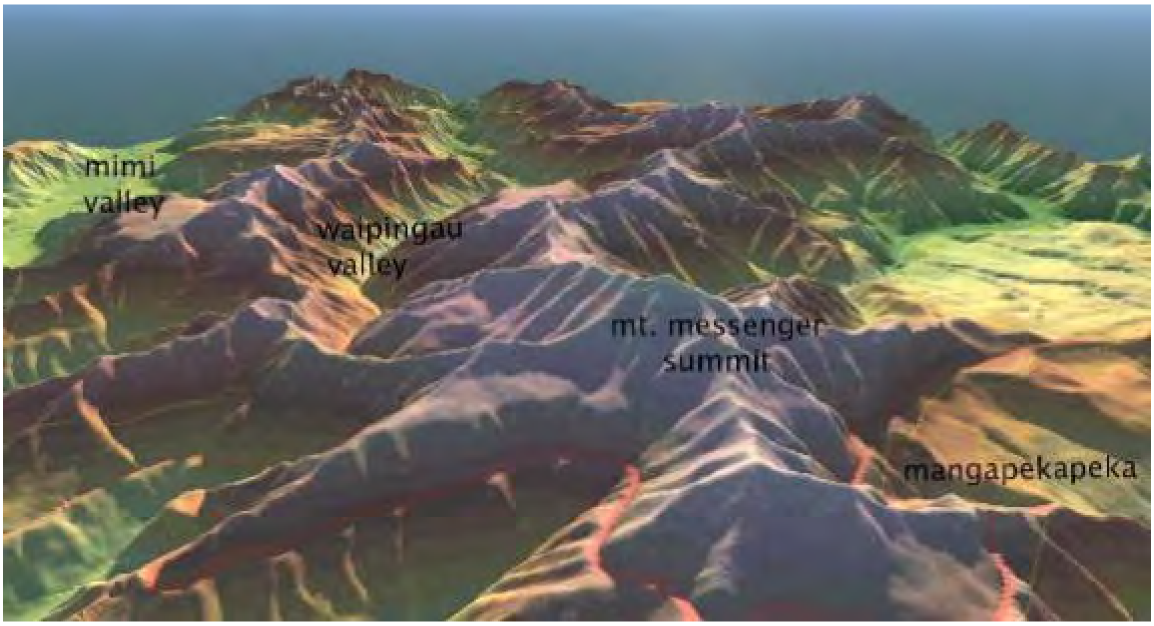

Figure 17 Elevation model showing the grain of the landscape looking from the east and Mt Messenger summit westwards down the Waipingao Valley defined by two "parallel" ridgelines

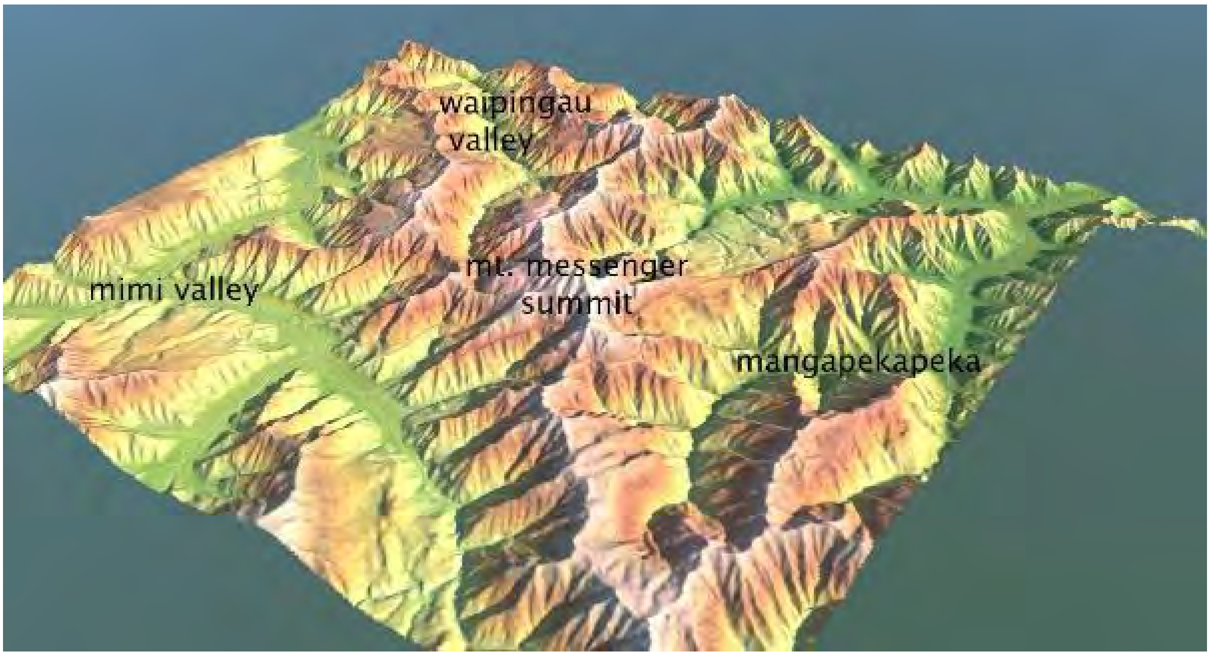

Figure 18: Elevation model showing the grain of the landscape looking from the east to the west. Note the ridgeline pattern west of Mt Messenger with two ridges and the ridge pattern to the east of Mt Messenger with one main ridge between the Mangapepeke Valley and the Mimi Valley.

- Avoiding modification of **significant natural features** such as remnant stands of bush, waterbodies and distinctive landforms: In this case modification of Mt Messenger; prominent ridgelines; extensive areas of high ecological value bush and wetlands; Coastal Hills and other coastal features; and selecting appropriate crossing points for valleys and streams
- Avoiding areas of **natural habitat value** where possible: Recognising ecological sensitivities (Significant Tress, Fresh Water Habitats, Native Species Habitat Kokako release site - / bats / lizards etc) to preserves as much native ecology and vegetation as possible
- **Recognising Cultural Landscape values:** acknowledging and recognising known cultural landscape associations, land ownership, land management and other traditional and spiritual values and key concepts such as Mauri.
- Spatial and **visual relationships with surrounding natural features** and elements including terrain and topography: considering the scenic and landscape experience of the road user including movement through the route and key views and viewshafts to landscape features and scenic protection.

Design Considerations: Landscape

The following design matters will also contribute to landscape outcomes and are reflected in route evaluations. This means careful consideration of existing Landscape Character and integration with the existing bush hill country and rural landscape.

Key considerations include:

- **Sympathetic earthworks, and landform modification** and the appropriate reflection of underlying natural land forms – for example integrating cuts with existing natural slope profiles, and a preference for structures (bridges and tunnels) over large scale extensive landform modification.
- **Construction methodologies** that also avoid and minimise landscape disturbance
- Enhancement, protection and **management of natural vegetation patterns** for improved landscape connectivity and strengthening wider character of remote bush hill country as well as enhanced landscape ecological function.
- Enhancement, protection and **management of natural drainage patterns** and integrated stormwater management for improved water quality on a catchment-wide basis including the use of structures for stream and gully crossings where possible
- Reinforce the existing patterns of the underlying landscape. For instance, retain natural features such as stream courses, ridgelines, major landforms and escarpments, and reinforce human patterns such as rural settlement patterns.
- Reflect and **enhance the natural character of streams** and existing wetlands design should minimise effects on both the biophysical and visual aspects of natural character at streams and wetlands. General principles include:
  - a Cross rivers and streams at right angles where practical
  - b **Bridge significant streams and gullies** in preference to culverts. Where culverts are used they should be designed to be 'fish friendly', for instance by allowing a naturalistic stream bed to form within the culverts.
  - c **Re-instate or restore riparian vegetation** upstream and downstream of crossings. Such vegetation can off-set any biophysical effects of the bridge or culvert on the stream, and soften the appearance of embankments and culverts
  - d **Avoid any significant wetland areas.** Potential locations where this would apply include the Mimi wetland
- Carefully consider the **aesthetic design of key built elements** such as bridges and tunnels in the context of an overall predominantly natural landscape characterised by expansive and remote areas of bush hill country. Simple, clean and elegant structures and forms that are complementary to the overall dominant natural landscape character are recommend which "**let the landscape speak**" rather than bespoke or feature built elements. Avoid visual clutter of built elements and any highway furniture or ancillary structures.
- Consider **cultural expression** and cultural recognition measures in design including aesthetic treatments and overall design concepts and cultural narrative in the design of built structures. This includes opportunities for cultural landscape interpretation

of mana whenua where appropriate and wider community legacy outcomes. A ***Cultural Recognition Plan*** is suggested in the CVA report and this is supported in terms of design opportunities across the project area.

Appendix G: Historic heritage

Mt Messenger: MCA2 Shortlist Historic Heritage Evaluation

Prepared for MMA

July 2017

By

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Contents

INTRODUCTION

Project Background

The purpose of this memo is to outline the evaluation of heritage/archaeological values undertaken for the Multicriteria Analysis (MCA2) for the shortlisted options of the Mt Messenger Upgrade/Bypass Project.

This follows a Longlist MCA1 evaluation carried out earlier in 2017, from which the shortlist of 5 options was generated.

For MCA1, the heritage assessment (which focussed on archaeology) was prepared by Peter Roan, an expert planner. Mr Roan assigned scores based on the analysis in the Opus Report (Mt Messenger MCA Specialist Report: Archaeology-July 2016),[1] which was prepared for the purposes of the previous MCA process carried out in 2016 I have reviewed Mr Roan's MCA1 report and consider the conclusions it reaches were reasonable, in light of the Opus Report. I was subsequent to the MCA1 workshop, to provide the heritage / archaeology assessment for MCA2.[2]

As there were no known archaeological effects on any of the shortlisted options, the primary criterion applied was the potential for impacting on unrecorded archaeological remains along the shortlisted options.

The scoring also took into account feedback received during the MCA2 workshop on 26th June.

Methodology

The methodology employed for this MCA2 assessment and report used the same information sources as those outlined in the Opus Report and included review of:

- The New Plymouth District Council and the Taranaki Regional Council maps and district plan schedules.
- The New Zealand Heritage List.
- The New Zealand Archaeological Association (NZAA) digital database 'ArchSite';
- Local histories;
- Published books, reports, and newspaper articles;
- Historic aerial photographs, maps and survey plans; and
- Unpublished archaeological reports.

Additional historic plans (LINZ) were also reviewed and satellite imagery of each route was viewed to obtain a better understanding of the terrain and archaeological potential.

I have not addressed all the material listed above in detail in this report (and note the Opus Report includes a summary of what the material records). However, later in this report I comment briefly on key information found in early maps and plans.

---

[1] Written by Emily Cunliffe (Archaeologist, Opus) and reviewed by Sheelagh Conran (Principal Archaeologist, Opus).

[2] This report (and the heritage criterion for MCA2) focusses solely on archaeology.

Evaluation Criteria

The archaeological criteria used for evaluation of each of the options essentially falls into two components:

1. Effects on recorded archaeological remains (significance of site etc)
2. Potential of any route to impact on unrecorded archaeological remains

Statutory risks as opposed to actual effects were also given consideration in scoring. As the one recorded archaeological site recorded in the general project area (Q18/74 – Maukuku Pa, see Figure 1) has been avoided by the proposed shortlist options, there are no known effects on archaeological sites. Statutory risk would therefore relate to the potential discovery of an archaeological site of sufficient significance to risk a consent or authority (Heritage NZ) application being declined.

For example, the Opus report identifies the potential of remains relating to early pre-1900 farming in the Mangaongaonga Valley at the northern end of Option E (referred to in the context of the 2016 MCA option 0) and consequently scores two of the 2016 options in that vicinity more negatively than other options. However, should any remains of pre-1900 farming be located along the route they are unlikely to be of such significance as to create a risk to consenting,[3] and are therefore not considered to be more negative from a statutory risk perspective than any other route option.

As there are no known effects on recorded archaeology in terms of any of the MCA2 options, and no distinction is made between the route options from a statutory risk perspective, only the second evaluation criterion (archaeological potential) was influential in evaluation of each option.

The evaluation of the archaeological potential was based on a coarse locational analysis, influenced by the proximity of each route option to the coast or access to the coast, water and other resources (bush, swamps, alluvial soils …), topography and recorded archaeological sites. The location of Maukuku Pa, for instance, on a relatively flat spur overlooking the Mimi river valley, gives an indication of the type of location that favoured Maori settlement in these inland locations. Steep bush country was generally considered unsuitable for settlement but would have provided a source of raw materials (plants, fibres, birds etc) to the Maori community.

From an archaeological perspective, the risks of encountering archaeology relating to pre-1900 farming along Option E do not appear to be significantly higher than the risk of encountering other pre-1900 remains along any of the other route options.[4] Overall the risks are considered to be low in all options. In terms of the scoring scale we have been instructed to apply (see Table 1 below), I have accordingly scored all route options as -1.

[3] Either in terms of the designation that will be sought under the Resource Management Act 1991, or in terms of the need to obtain an archaeological authority under the Heritage New Zealand Pouhere Taonga Act 2014

[4] As discussed below, in my view there is only a low possibility that there are any farming related archaeological remains at the northern end of Option E.

Table 1 - Scoring Scale

Scoring	Level of effect
F	Fatally flawed - unacceptable adverse effects, that cannot reasonably be appropriately avoided, remedied or mitigated (including via offsetting).
-4	Very high / very significant adverse effects
-3	High / significant adverse effects
-2	Moderate / medium adverse effects
-1	Low / minor adverse effects
0	Neutral / no change
1	Low / minor positive effects
2	Moderate / medium positive effects
3	High / significant positive effects
4	Very high / very significant positive effects

HISTORICAL SURVEY

Information from Early Maps and Plans

Several historic plans were of value as they provided information related to subdivision of the land around the late 19th to early 20th century and relevant information relating to the environment at the time. Two plans in particular (SO 864 and SO 25/13A) identified the location of a pa (Maukuku) and related cultivations, 'old clearing' ('Nga oko oko') indicative of earlier Maori occupation and use of the land.

Several farms noted in the northern end of Option E (Mangaongaonga Valley) c.1902 (SO 1038) were considered suggestive of possible earlier remains relating to pre-1900 European settlement (Opus report), but there are no indications of any buildings on these plans so the possibility of effects on early farming remains is considered to be low.

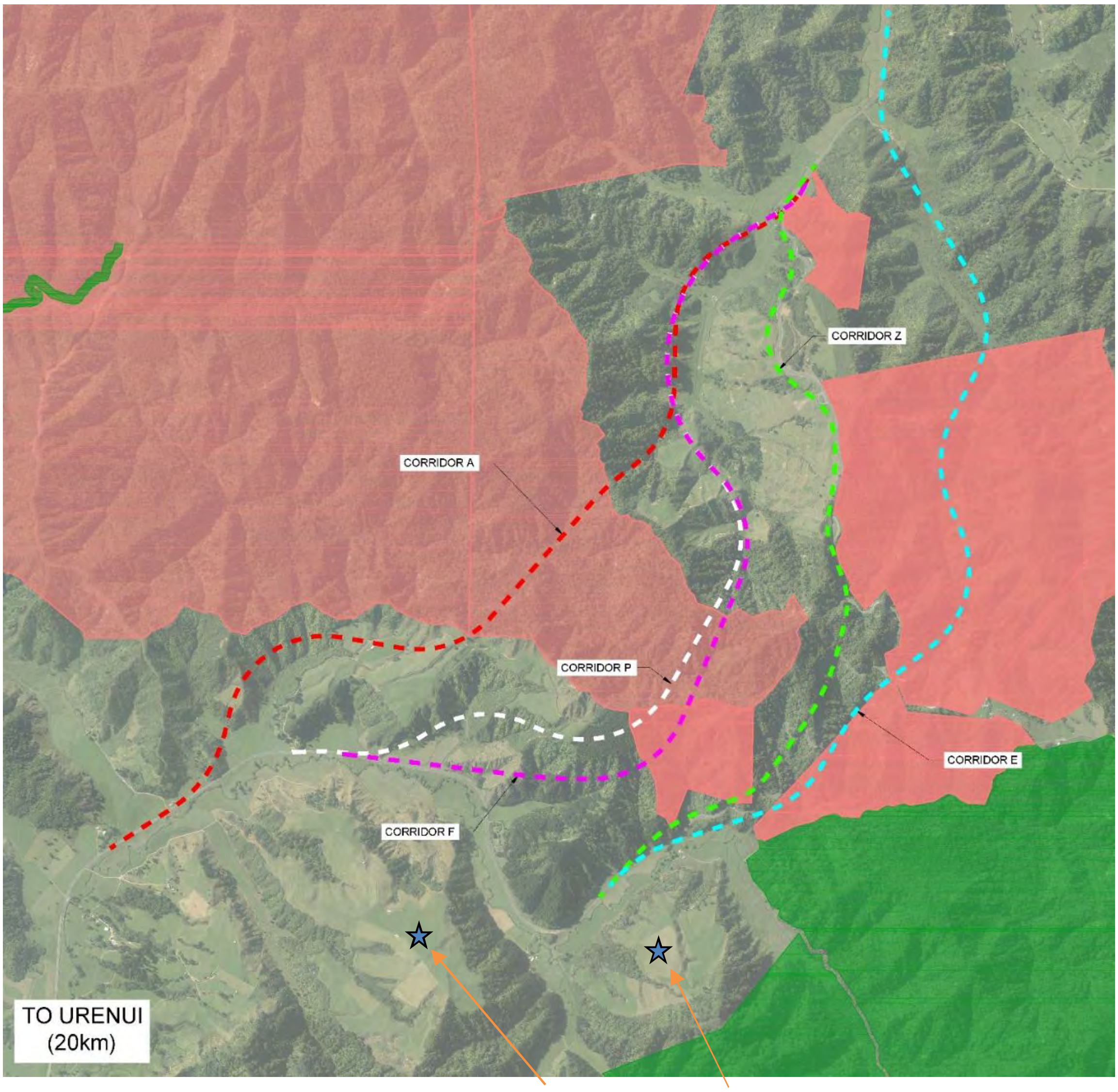

Figure 1. Options and recorded heritage sites Maukuku and Nga oko oko

Discussion and Conclusions

Summary of Results

The scoring represents a high-level analysis largely based on desktop review and only limited ground survey. Detailed ground survey will be required for the preferred option.

There are no effects on the known or recorded historic heritage/archaeological sites in the general vicinity – Maukuku Pa and the 'old clearing' 'Nga oko oko' observed on historic plans (Figure 1). Consequently, the scoring reflects my professional opinion of the potential risks of encountering unrecorded archaeology, based on a broad locational analysis of topography, available resources and proximity to known sites.

The scoring of options is presented on the appended table. Each option scores -1, which is low to minor adverse effects.

At the southern end, all routes are in proximity to the recorded pa or old clearings which are indicative of Maori settlement in the Mimi valley system. All routes at the northern end are in river valleys leading into the Tongaporutu Valley and at the lower reaches of the valley where the river meets the coast there are numerous sites relating to earlier Maori occupation. Combined with the nature of Maori settlement patterns – a broad territory or rohe, usually coastal in orientation but with access to numerous inland resources (mara) – all route options suggest that there is some potential to encounter settlement remains.

Of relevance to Option E, the presence of historic farms in the Mangaongaonga Valley, possibly predating 1900, is not considered to raise the potential of discovering archaeology, or certainly not significant archaeology. The statutory risks in this respect are considered to be low.

It is assumed that, given the low potential for effects on historic heritage, in the event of discovery of archaeological remains during future survey or construction of the preferred option, appropriate mitigation could be achieved through detailed recording under an authority from Heritage New Zealand.

Conclusions

1. There is generally a lower risk of impacting on archaeology away from the coast, particularly in heavily dissected terrain.
2. There is increased risk bordering river valleys which give access to the hinterland and its resources (alluvial soil, birds, fibres etc) (e.g. Mimi Stream valley, Tongaporutu)
3. There is very little to differentiate options on the basis of historic heritage / archaeology
4. Significant recorded archaeology (Maukuku Pa) has been avoided
5. There are mitigation opportunities to investigate any archaeology identified/exposed to provide a greater understanding of early settlement in the inland areas.

6. Overall, there is a low potential risk of encountering archaeology and a low statutory risk for all MCA2 options.[5]

[5] I have noted in the scoring table (Table 2) a low-moderate risk of encountering archaeology at the northern end of Route E. This does not lead to an overall change to the -1 score for that option.

Criteria	Scored by	Option A		Option E		Option F		Option P		Option Z	
		Score	Reason for score	Score	Reason for score	Score	Reason for score	Score	Reason for score	Score	Reason for score
Historic Heritage	RC	-1	While not affected, recorded archaeology (Maukuku Pa) and other observations in general vicinity of southern end are indicative of some archaeological potential. Potential also at northern end with easy access to Tongaporutu where there are numerous recorded sites. Similar alluvial valley environment to Mimi Stream valley, Mokau Rd	-1	Some recorded archaeology at southern end, but not effected. No recorded archaeology but potential at northern end considered low-moderate as route borders river valley (Mangaongaonga Valley). Presence of historic farms possibly predating 1900 does not raise the likelihood of archaeological effects. Similar environment to Mimi Stream valley, Mokau Rd	-1	Recorded archaeology (Maukuku Pa) and other observations in general vicinity of southern end are indicative of some archaeological potential. Potential also at northern end with easy access to the coast and numerous sites recorded at Tongaporutu. Alluvial valleys similar environment to Mimi Stream valley, Mokau Rd	-1	Recorded archaeology (Maukuku Pa) and other observations in general vicinity of southern end are indicative of some archaeological potential. Potential also at northern end, Alluvial valleys similar environment to Mimi Stream valley, Mokau Rd	-1	Recorded archaeology (Maukuku Pa) and other observations in general vicinity of southern end are indicative of some archaeological potential. Potential also at northern end, Alluvial valleys similar environment to Mimi Stream valley, Mokau Rd

Table 2. Historic Heritage Scores Table

Appendix H: Community

Mt Messenger Alliance

Te Ara o Te Ata

Multi-criteria analysis: Community shortlist report

August 2017

Wendy Turvey / Stephanie Brown / Rob Greenaway / Shaun King

Contents

1 Introduction

The purpose of this memo is to set out the assessment undertaken for the Shortlist Multi Criteria Analysis (MCA) assessment of “community” matters for the Mt Messenger Bypass project.

For the purposes of the assessment ‘Community’ comprises of three sub areas:

- Social
- Recreation
- Noise.

2 Background

The NZ Transport Agency (‘Agency’) is progressing a series of improvements to the SH3 corridor between Mt Messenger and Awakino Gorge. This assessment focuses solely on the section of the corridor in the vicinity of Mt Messenger, between Tongaporutu and Uruti.

This assessment expands on the earlier Longlist MCA process, to further consider the five Shortlist options currently under consideration. At the longlist stage, the community assessment was carried out by Peter Roan as a high-level planning assessment of potential effects on recreational values and potential effects on social values, namely ‘way of life’:

- Recreational values (severance of public walking tracks or hunting blocks, and changes to access including vehicular access to recreational opportunities).
- ‘Way of life’ / social values (the potential impacts on the use of land affected by the proposed options).

At this shortlist assessment stage, the community assessment is comprised of separate assessments undertaken by a social impact expert (Wendy Turvey), a recreation effects expert (Rob Greenaway), and a noise expert (Shaun King).[1] This report draws together these assessments, explaining how the three experts have assessed and scored each option, and then arrived at an overall community score for each of the five shortlisted options.

Consideration was given to specifically incorporating an economic effects assessment into this community assessment. However, following discussions between the three community experts, the MCA expert (Peter Roan), and the project's consultant economist (Mike Copeland), no specific economics assessment has been included because:

- economic benefits that would flow from an improved road connection are captured, at least to some extent, in the transport assessment;

[1] Shaun King's colleague Tiffany Lester attended the MCA2 workshop in Shaun's place, and provided the initial noise scores at the workshop. Those scores were subsequently reviewed and updated by Shaun.

- wider economic benefits not captured in the transport assessment are likely to be common to all the options (ie, they will flow from having an improved road connection rather than being option specific).

However, discussions between Mr Copeland and the three community experts have helped inform the assessments carried out (particularly the social assessment).

The background to the three individual components of the community assessment is set out below. That is followed by an explanation of the methodology applied, and of the scoring process and the scores applied in this assessment.

2.1 Social

Social impact assessment (SIA) is the most accepted and recognised framework used in New Zealand and internationally to manage social impacts.

The International Association for Impact Assessment defines social impact assessment as:

'…the processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions' (International Association for Impact Assessment, 2003)

State highway projects create positive and negative social impacts. Specifically, a social impact is a change that is experienced in either a perceptual (cognitive) or a corporeal (physical) sense at any level associated with a planned intervention, for example an individual, an economic unit (eg family/household), social group (circle of friends), a workplace (a company or government agency) or by community/society generally. These different levels are affected in different ways by an impact or impact-causing action[2].

At an options assessment stage, from a social perspective, it is necessary to:

- Define who the community(s) of interest are
- Work with other technical assessors to understand the social impacts caused by environmental impacts
- Use information gathered as part of the community and stakeholder engagement process.

From a SIA perspective for this project the 'Community of Interest' is made up of three levels, being:

1. Those in the immediate area of the project
2. Those that use SH3
3. At a wider inter-regional level recognising that people and goods move in and out of the district and region via SH3

2.2 Recreation

Recreation can be defined broadly to include personal and emotional benefits gained from being in or passing through natural areas whether at work or leisure. Recreation includes tourism (i.e. recreation carried out by visitors to a region, and specifically those spending at least one night away from home).

In this case, to avoid overlap with the landscape assessment, recreation is defined to include only active use of public recreation settings which are provided specifically for recreation and which could be directly affected by the route options. This excludes recreational use of SH3 for, for example, driving for recreation (that is, the recreation assessment does not

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2 NZ Transport Agency (2016) Social Impact Guide

include a review of the different scenic values of driving through each route option). All roading options have similar effects on the experience of driving the larger expanse of SH3.

Similarly, effects on recreation settings accessed via SH3 to the north or south of the proposed roading redevelopment are also not considered – such as improved access to recreation opportunities in Tongaporutu or Mokau for residents of New Plymouth. These are considered broadly equal for all options.

Use of private land for recreation is also not considered in this assessment. Potential effects on landowners are personal and cannot be generalised, and includes farmers enjoying working on their land and the use of Ngati Tama land by its owners, or by others who access the Ngati Tama land by permission (noting that there are no tourism options currently available on Ngati Tama land beyond the easements for walking). The use by Ngati Tama of their land is covered in their MCA assessment. Effects on other private landowners are considered in the property MCA assessment.

The recreation settings considered in this recreation assessment are shown in Figure 1 in Appendix 2 and include the Mt Messenger Track and Kiwi Road Track. Figure 2 in Appendix 1 shows the relevant walking easements on Ngati Tama land. There is also a small stopping area at the summit of the Mt Messenger road (on road reserve) with a picnic table, free-range chickens, rubbish bin, and fencing to reduce the potential for fly tipping over the steep adjacent banks (only partly successfully). This stopping area does not service any recreation routes and is more a relief-site for drivers negotiating the road, and would only be replaced for road safety purposes. That is, its provision is not determined by recreation demand.

In summary, the potential effects on recreation of the roading options are considered for:

- walking track access to Paraninihi / Mount Messenger from SH3 and along the Mt Messenger Track to Waipingau;
- walking access to the Kiwi Road Track which leads from SH3 to the Mt Messenger Conservation Area.

Potential effects include:

- loss of, or changes to, access to recreation settings,
- changes to the ability to enjoy a recreation setting considering, for example, noise and route visibility,
- direct effects on recreation assets (such as tracks and huts),
- loss of recreation lands,
- severance of contiguous areas of recreation land,
- direct effects on recreation destinations.

2.3 Noise

Noise effects have been assessed using change in noise level at the affected receivers. This is done by comparing the existing ambient noise level to the ambient noise level with the project's noise included. It has been assumed that the ambient noise level near the existing SH3 is dominated by traffic noise. Further away from SH3 it has been assumed that the ambient noise level is low, which is typical of sparsely populated rural areas.

Table 1 presents the subjective reaction and the impact for various changes in noise level.

Table 1:Change in noise level

Change in Noise Level (dBA)	Subjective Reaction	Impact
1 - 2	Imperceptible change	Negligible
3 - 4	Just perceptible change	Slight
5 - 8	Appreciable change	Noticeable
9 - 11	Doubling of loudness	Substantial

3 Methodology

3.1 Assumptions

The following assumptions have been made:

- Noise – that NZS 6806:2010 Acoustics – Road traffic noise – New and altered road is the only applicable standard and would be adopted on this project. It is assumed that compliance with the standard would be achieved and mitigation would be developed if necessary to achieve compliance.
- Any mitigation applied is 'standard' for a project of this type. No bespoke mitigation was used as part of the scoring process. Standard mitigation measures include things like: maintaining access to walking tracks,
- Effects on property owners (eg. changes in access, business impacts) is not included in the 'Community' assessment, as these impacts are covered in the 'Property' criteria.
- No change in traffic volumes from the do-nothing scenario and between options.
- Exiting SH3:
    - Not presumed that it will be maintained as road
    - Cycling is through the new route
    - Where new road severs existing public walking track, a new connection (or direction) is provided.

3.2 Social

During the options stage of a project an assessment of the options is limited to the information/data available at the time. This compares to an assessment of a preferred option where the design and information available is more extensive.

At the time of assessing the options the social data and information available was limited to views expressed by attendees at the Drop In sessions, a review of the community facilities in the area, the April 2017 Consultation on Options report, and a review of relevant documentation such as the 2012 Venture Taranaki report etc. The full SIA will include an assessment of a targeted survey and a series of face-to-face meetings.

Using the International Association for Impact Assessment (IAIA) framework[3], combined with the requirements of the Transport Agency[4], the following framework has typically been

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[3] www.iaia.org/

[4] NZTA PSF/13 Standard, PSG/13 guidelines and Social Impact Guide

established for assessing the potential social and community effects that may result from a transportation project:

1. Way of Life
   - Impacts on accessibility, connectivity, patterns of living and mobility
   - Changes to ways of walking & cycling and changes to public transport
2. Wellbeing
   - Changes to wellbeing
   - Safety
3. Environment and Amenity
   - Noise, dust, visual changes
4. Community
   - Impacts on people's property and neighbourhoods
   - Impacts on educational facilities
   - Impacts on community areas and sites
   - Impacts on community plans and aspirations
   - Impacts on and accessibility to commercial areas

However, in this case due to the nature of the 'Community of Interest' it was necessary to re-examine the criteria to ensure they are suitable for this project and to avoid double-counting with other specialist areas.

The 'standard criteria' (way of life, wellbeing, environment and amenity and community) are considered as appropriate but require an 'overlay' given there is a broader community of interest than that which would normally apply (including in particular all those who use this section of State highway 3).

The following broader overlaying sub-criteria have been adopted for the social assessment:

Sub-Criteria	Sub-Criteria description
S1	Localised effects
S2	Difference the project would make to daily life
S3	Opportunity to lever off changes in access

3.3 Recreation

The method for recreation is based on considering the likely effects of each option on the recreation values and opportunities in the study area.

There are no data available to indicate absolute levels of recreational use of the Mount Messenger and Kiwi Road Tracks. Department of Conservation advice indicates use is low in both cases (low 100s per year), with the Kiwi Road track providing access for pig hunting in the Mount Messenger Conservation Area to the east. Roadside access off SH3 is especially poor for the Mt Messenger Track, with it intersecting SH3 directly onto the road and with no adjacent parking area. There is a pull-over area at the start of the Kiwi Road Track with parking for two to three vehicles. Both routes are promoted via the Department of Conservation's online recreation information for Taranaki.

The Mt Messenger Track is cleared infrequently by the Department of Conservation, largely to retain its function for pest trapping access. The standard of the track surface is poor and while legible it is virtually a tramping route (the lowest standard for a back-country track) with many precipitous drops to the north. The Kiwi Road Track at its western end is more legible and may have a relatively high level of use near SH3 before users branch off into the bush for pig hunting. Neither track is of a standard for road users to casually access without tramping boots and a good level of fitness.

The Mt Messenger Track links with the Whitecliffs Walkway which runs from Gilbert Road in the south to Waikoroa Road in the north, and to the coast via Waipingau Stream (see the easements marked A and B in Figure 2 Appendix 2). This is the most popular recreation setting near Paraninihi / Mt Messenger, but its use is also low due to low-tide-only access along the beach and the closure of track access north of the walking easement. The latter has been a long-running problem, but if resolved is unlikely to have much – if any – effect on use of the Mt Messenger Track (particularly if the latter is not upgraded, and there is no proposal to do so).

The Mt Messenger Track between SH3 and Waipingau is within sight and hearing of SH3 for almost all that distance. At Mt Messenger, vehicles and trucks are clearly audible from the road north and south of the existing road tunnel; and from Paraninihi / Mt Messenger to Waipingau, the sound of trucks on SH3 north of the tunnel are very easily heard even at Waipingau. Views from the Track are most frequently gained to the north over rural farmland, and is adjacent to pasture for some long sections. Views to the south over the Ngati Tama block are almost entirely obscured by adjacent bush.

All roading options, apart from E, would retain the status quo in terms of the visibility and audibility of a major road in the valley to the north of the Mt Messenger Track; with options A, P and F removing road noise from the valley east of Mt Messenger and south of the summit. Route E would reduce visibility and noise from SH3 from almost all of the Mt Messenger Track (see Photos 1 to 4 in Appendix 2), and would retain the existing road noise at the start of the Kiwi Road Track. Routes A, P and F would pass under the Mt Messenger Track via tunnels through the ridgeline. Access for both tracks could be formed under bridges for both routes Z and E. New parking and track access for both routes would need to be provided for all options, logically in a combined setting (these are base assumptions for all options).

None of the options bisect large areas of public land, and the footprint of each on public land (road reserve only) is minor, with option Z having a very similar effect to the status quo for recreation.

All options include proposed improvements to the ability to cycle on the new road, but as improvements do not extend north and south of the development area this is not considered a significant benefit, and, regardless, is equal for each option.

3.4 Noise

Data on the proposed options was limited, therefore no noise modelling or sound level predictions were undertaken. The assessment was undertaken at a high level, which was considered appropriate for this stage of the project, and the nature of the noise environment (relatively few potential receivers within close proximity of the route options).

NZS 6806:2010 only applies to Protected Premises and Facilities (PPFs). PPFs are defined as;

- Buildings used for residential activities
- Marae
- Spaces within buildings used for overnight patient medical care
- Teaching areas and sleeping rooms in educational facilities

In a rural area, NZS 6806:2010 only considers PPFs within 200m of the proposed road alignment. This is considered acceptable because traffic noise levels at distances greater than 200m are generally negligible. A map showing the assessed PPFs, within 200m of any of the five options being considered (and / or the existing road) is included in Appendix 3.

Each PPF is marked in blue, and numbered. The PPFs were determined using google maps and from discussions with the team.[5]

The road moving away from a receiver (by comparison to the existing road) will result in a reduction in noise level and the road moving closer to a receiver will result in an increase in noise level. Also acoustic shielding of the road, such as where the local topography blocks line of sight, will provide a noticeable reduction in noise level.

The acoustic consultant determined the likely change in traffic noise level at a high level using the change in distance and any shielding that may or may not be present. This is a broadly accurate way of characterising the impact of distance and shielding on noise levels, and therefore capturing the likely effects of each option on the potential noise receivers within the project area.

An overall assessment of the noise effects of each option was then carried out, taking into account the likely effect each option would have on each receiver in the project area. Due to the large distances between each option and the nearest receivers, it is unlikely that any noise mitigation will be required to enable compliance with NZS 6806:2010 for any of the options.

4 Scoring

Scoring was undertaken by Wendy Turvey (social), Rob Greenway (recreation) and Tiffany Lester (noise) during a joint Community workshop on 26th June 2017. The social, recreation and noise sub-criteria were each scored separately.

An overall score for each option was reached by consensus among the three experts. Rather than simply take an average of the three sub-criteria scores, the experts agreed an overall score based on their combined professional judgment as to the collective balance of all the sub-criteria scores.

Following the workshop the noise scores were reviewed, and the scores for options A, F and P were revised, by Shaun King – the revised scores are included in Table 2.[6] Shaun's revised noise scores, and the rationale for those revised scores, were then considered by the three experts. It was agreed that the revisions to the noise scores should not change the overall scores assigned at the workshop for Option A, F or P. It was agreed that on balance, those three options (as with with Option E) would bring combined 'community' effects of a minor positive nature, particularly when considered at a broader / regional level rather than solely focussing on localised matters.

[5] While not necessarily identifying the location of the PPFs with precise accuracy, this identification method is considered appropriate for this high level assessment of the noise effects of the five options.

[6] The noise scores assigned by Tiffany Lester at the workshop were: Options A, E, F, and P scored 1; Option Z scored 0. Shaun considered the noise scores for options A, F and P should be improved, reflecting his opinion that the anticipated changes in the noise environment for PPFs along those routes amounted to moderate (for A) and high (for F and P) positive effects, respectively. See the explanation in the table that follows.

Table 2:Sub-criteria scores and final scores for Community for each option

	A	E	F	P	Z
Social	1	1	1	1	0
Recreation	0	1	0	0	0
Noise	2	1	3	3	0
Final score	1	1	1	1	0

The explanation to accompany the scores is as follows. More detail in respect of the scoring for the social component of the assessment is provided in Appendix 1 (this includes the scores for the sub-criteria applied for the social component):

Social	None of the options will result in adverse effects as they will all improve the current situation with respect to safety, mobility, connectivity, cycling and community aspirations. Option Z7 is different from the other options - any localised effects are considered to be insignificant and there is limited opportunity to lever of change in access given the option follows the current route. Any overall improvement is therefore so minor as to be effectively neutral – resulting in no real change to the existing situation. Options A1, E1, F1 and P1 all have benefits – but overall, these benefits will be minor as outlined in Appendix 1. The benefits that would flow from these options are very similar, and any of the subtle changes between options do not warrant a difference in score. For these reasons they have been scored the same.
Recreation	Options A, P, F and Z gained a zero score due to the small scale of effects (in terms of change from the status quo), if any, and the low use of the recreation settings. Option E gained a positive score for effects on recreation due to its increased distance from Paninihi / Mount Messenger and the Mount Messenger Track. Option E removes roading noise effects from the Track from Paninihi / Mount Messenger north. Because SH3 road noise is a constant on the existing track, this is considered a benefit. There would be little change from the status quo to road proximity for the Kiwi Road Track for option E. Options A, P and F would remove road noise from the start of the Kiwi Road Track, but existing road noise affects only a very short part of this route. Options A, F and P remove a road intersection with the Mt Messenger Track (with their ridgeline tunnels). These options introduce a road into an undeveloped valley (private Ngati Tama land) which is only occasionally and only ever partly visible from parts of the Mt Messenger Track, but remove a road from another valley. There is some balance achieved, but road noise would still remain obvious from the Track as it does currently. The tracks are low use, relatively undeveloped and local resources.

	The roads are all at the start of the Messenger Track and so do not intersect the middle and more remote sections (using the term 'remote' carefully, since the area is not remote on a national scale – it remains a gateway setting between SH3 and Waipingau). Option Z is similar to the status quo and requires the same mitigations for track access as for the other options. Option E has the greatest separation from the Mt Messenger Track and Paraninihi / Mount Messenger, and retains the status quo for effects on the Kiwi Road Track.
Noise	Option A substantially decreases traffic noise at 4 receivers (B, C, D and E) and moderately increases traffic noise at 1 receiver (A) out of a total of 5 PPFs along the route (receiver F is not relevant). Overall, this would have a medium positive effect in noise terms. Option E substantially reduces traffic noise at one receiver (D) and slightly to noticeably increases traffic noise at one receiver (F) out of a total of 3 PPFs along the route (receivers A, B and C are not relevant). Overall, this would be a minor positive effect in noise terms. Option F substantially decreases traffic noise at 4 receivers (B, C, D and E) out of a total of 4 PPFs along the route (receivers A and F are not relevant). Overall, this would have a high positive effect in noise terms. Option P substantially decreases traffic noise at 4 receivers (B, C, D and E) and slightly increases traffic noise at 1 receiver (A) out of a total of 5 PPFs along the route (receiver F is not relevant). Overall, this would have a high positive effect in noise terms. Option Z may have small increases or decreases (less than 3 decibels) in noise level due to slightly altered road alignment. Overall, however, it is expected that these differences would broadly balance out, meaning option Z would be neutral in noise terms.

Appendices

Appendix A: Social sub-criteria explanations and scoring

Appendix A: Social sub-criteria explanations and scoring

	Way of life Impacts on accessibility, connectivity, patterns of living and mobility Changes to ways of walking & cycling and changes to public transport	Wellbeing Changes to wellbeing Safety	Community Impacts on people's property and neighbourhoods; educational facilities; community areas and sites; community plans and aspirations; and on accessibility to commercial areas
A E F P	*Localised effects* Requires access along existing SH to be maintained or property purchased. Existing SH not considered suitable for walking or cycling but new route will be safer for cyclists. *Difference to daily life* More resilient and easier to drive route may make access to employment easier. Improves connectivity north and south along SH and therefore potential improvement in mobility and people's connection to the wider region and outside the region (includes eg. access to health services like Waikato Hospital). Improved and more resilient route could improve perception of the route with those currently reluctant to drive the SH feeling more comfortable. SCORE: 1	*Localised effects* Safer route means less potential for those living along the route to have to deal with impacts of local accidents. Localised safety benefits for the school bus particularly if pull off areas become safer and visibility and sight distances are improved. Anxiety for property owners on what will happen until preferred Option is selected (very short term until decision made). Wellbeing likely to be affected through anxiety about the nature and duration of construction effects (short term). *Difference to daily life* New SH standards provides significant safety benefits. Improved health for truck drivers (ie. potential for reduced stress).	*Localised effects* Positive effect on properties adjacent to current SH through improved amenity as SH moved. New SH route impacts on a rural community/landowners where there is currently no road. For those that farm along the existing SH will make it easier to eg. move stock given the absence of SH traffic. *Opportunity to lever off changes* Improved connectivity could lead to savings for businesses (freight costs, fuel savings, driver hours, time critical goods – dependable schedules) due to more resilient route, increased limits on type/size of what can be transported. Opportunity to lever off any conservation areas created/improved conservation values. Good infrastructure supports business.

	Way of life Impacts on accessibility, connectivity, patterns of living and mobility Changes to ways of walking & cycling and changes to public transport	Wellbeing Changes to wellbeing Safety	Community Impacts on people's property and neighbourhoods; educational facilities; community areas and sites; community plans and aspirations; and on accessibility to commercial areas
A E F P		*Opportunity to lever off changes* Opportunity to improve stopping areas, radio/cell coverage, toilets, rubbish SCORE: 1	Increased use of local facilities such as the Uruti community hall for economic development initiatives (art shows, coffees etc) SCORE: 1
Z	*Localised effects* Requires access along existing SH to be maintained or property purchased. Requirement for new SH standards may place constraints on existing property accesses. *Difference to daily life* More resilient and easier to drive route may make access to employment easier. Improves connectivity north and south along SH and therefore potential improvement in mobility and people's connection to the wider region and outside the region (includes eg. access to health services like Waikato Hospital). Improved and more resilient route could improve perception of the route with those currently reluctant to drive the SH feeling more comfortable.	*Localised effects* New SH standards provides significant safety benefits. Localised safety benefits for the school bus particularly if pull off areas become safer and visibility and sight distances are improved. Anxiety for property owners on what will happen until preferred Option is selected (very short term until decision made). Wellbeing likely to be affected through anxiety about the nature and duration of construction effects (short term but long construction timetable). *Difference to daily life* New SH standards provides significant safety benefits.	*Localised effects* No improvement to local amenity as road upgraded in existing location. For those than farm along the existing SH may make it harder to eg. move stock speed environment will be higher. Increased speed environment may create perception of being less safe in the vicinity of the schools along the route. *Opportunity to lever off changes* Improved connectivity could lead to savings for businesses (freight costs, fuel savings, driver hours, time critical goods – dependable schedules) due to more resilient route, increased limits on type/size of what can be transported.

	Way of life Impacts on accessibility, connectivity, patterns of living and mobility Changes to ways of walking & cycling and changes to public transport	**Wellbeing** Changes to wellbeing Safety	**Community** Impacts on people's property and neighbourhoods; educational facilities; community areas and sites; community plans and aspirations; and on accessibility to commercial areas
Z	Possible perception that as uses current alignment there is no improvement for users. SCORE: 0	Improved health for truck drivers (ie. potential for reduced stress). *Opportunity to lever off changes* Opportunity to improve stopping areas, radio/cell coverage, toilets, rubbish SCORE: 0	Good infrastructure supports business. SCORE: 0

Appendix I: Property

SH3 Mount Messenger Bypass

MCA Shortlist Assessment (Property)

MMA-ENV-OPT-RPT-671

11 July 2017

Contents

1. Introduction

The Mt Messenger Alliance is currently investigating alternative options for upgrading or bypassing State Highway 3 (SH3) in the vicinity of Mt Messenger, in North Taranaki.

In total, 5 alternative options have been identified as part of the shortlisting process. Shortlisted options were assessed via a multi-criteria analysis (MCA) process which scored nine criteria: transport, resilience, constructability, landscape, historic heritage, community, property, ecology and cultural heritage. Criteria were scored by specialists prior to presenting at a collaborative workshop on 26-27 June 2017.

This report details the evaluation and scoring of the property criteria.

2. Background

On behalf of the Transport Agency we (Mark Spring, Principal Property Manager and Louise Jones, Senior Property Manager) have provided input on property related information as part of the MCA on the Mount Messenger Bypass corridor options. Previous assessments were carried out for the initial MCA in September 2016 and the longlist MCA in May 2017 (both on similar alignments).

We have undertaken an assessment of the property effects of each individual option to improve SH3 in the vicinity of Mt Messenger. There are a total of five corridor options, and each option has some property acquisition requirement.

The following section outlines the methodology adopted in our assessment, together with the specific considerations for each of these sub-criteria.

3. Methodology

We are not aware of any specific methodology that guides the ‘property’ input to an MCA process.

In developing our methodology/approach, we have been mindful of the following:

- Public Works Act 1981 and associated case law
- Te Ture Whenua Māori Act 1993
- Reserves Act 1977
- Ngati Tama Claims Settlement Act 2003
- Conservation Act 1987
- Land Information New Zealand (LINZ) Standards & Guidelines for the acquisition of land under the Public Works Act 1981
- New Plymouth Operative District Plan

Whilst we are familiar with the general locality, and with some specific areas, we have not carried out a full inspection of the alignments. Our assessment has been based on a 'desktop' approach involving a review of the relevant plans and property interests using both project provided data and online property software (e.g. eMap, Quickmap, Property Guru, Google Earth, 'Humphrey' etc.).

3.1 Sub-criteria

The following table outlines the criteria and the key considerations adopted in assigning a score for each sub-criteria:

Criteria	Key Considerations
Maori Land	- Maori Reservation. - Treaty Settlement. - Maori Freehold. - General Freehold Land with Ahu Whenua Trust.
Acquisition cost / Compensation	- The amount and quality of land taken. - Type and value of improvements affected. - Injurious affection ('IJ') to be considered (not around quantum but significance).
Impact on individual properties	- Impact on large parcels as opposed to compensation payable (reinstatement of farm tracks, water supply etc.). - Amount of take relative to property size. - Severance. - Structures vs Earthworks.
Complexity of acquisition	- Number of owners affected. - Impact on individual properties in terms of the location of the alignment. - Land tenure. - Ownership structure (e.g. single owner, company etc.) & location of owners (e.g. New Plymouth, Australia etc.). - Other interests in land (e.g. leases, registered easements, forestry rights, QE II Trusts etc.). - Legislative land interests that may necessitate additional negotiations / discussions with third parties (e.g. Reserves Act 1977, Conservation Act 1987 etc.). - Property right required (e.g. tunnel / strata vs 'traditional' footprint). - Known opposition to project.

Sub-criteria & Key Considerations

The 4 sub-criteria that we have adopted, together with the key considerations associated with each of them, are briefly discussed below:

1. *Maori land*

   This sub-criterion reflects the added complexity and time involved in acquiring Maori owned land compared to non-Maori owned land. It is not designed to reflect any particular spiritual or cultural significance that the land may hold, which is considered as part of a separate MCA assessment.

   Maori owned land includes Maori Reservation or Maori Freehold land (as defined under Te Ture Whenua Maori Act 1993), land that has been returned to iwi as part of a Treaty Settlement, or general freehold land that is administered by an Ahu Whenua Trust.

   The acquisition process for Maori land typically takes significantly longer than it does for non-Maori land. There are a number of reasons for this:

   - The ownership can be quite fragmented (there can be hundreds of owners in some cases), and the owners may be widely spread across the country (or even overseas in some cases).
   - Not all successions may have been recorded, meaning that that ownership records are not up to date.
   - As a result of the above points, it can initially take some time to determine who is mandated to negotiate on behalf of the owners.
   - A number of hui may need to be held to provide the mandate to enter into negotiations in the first instance, and then approve any subsequent agreement.
   - Maori Land Court approval may be needed for any alienation ratified by iwi.

   In addition, current legislation and case law mean that Maori Reservation land is inalienable. The impact of this is that the Crown is unable to acquire this land, either compulsorily or by negotiation.

2. *Acquisition cost / Compensation*

   This sub-criterion reflects the relative property acquisition cost (or compensation payable) for each corridor. This includes:

   - The amount and quality of land taken (e.g. steep hill vs river flats).
   - The type and value of improvements affected (e.g. is it a 60 year old woolshed or 5 year old dwelling that will need to be removed?).
   - Whether there will be any severed land that will also need to be acquired.
   - Whether there will be any significant injurious affection ('IJ') to the balance of the property (e.g. new corridor passes within 50m of dwelling on balance land vs new corridor bisects vacant block of land).

Unfortunately, the design is not sufficiently advanced at this stage to be able to determine the final land requirement with absolute certainty (both quantum and alignment). As a result, this means that the assessment can only be made at a relatively high level.

In addition, the amount and location of any land needed for temporary occupation on each property during construction is also unknown at this stage, as is any requirement for sites for disposal of excess fill. Accordingly, these have not been considered as part of our assessment.[1]

3. *Impact on individual properties*

This sub-criterion reflects what the impact that the land requirement will have on individual properties. This includes:

- The impact on large properties vs compensation payable (e.g. is it possible / practicable to reinstate farming operations post land take?).
- The amount of land taken relative to property size (e.g. 1 ha from 2 ha property vs 1 ha from 100 ha property).
- Will part of the property be severed from the balance and will access be possible post construction?
- Will the works involve structures (e.g. a bridge or tunnel) or earthworks (e.g. what impact will this have on ongoing operation of the property?).

4. *Complexity of acquisition*

This sub-criterion reflects how complex the acquisition of the necessary property rights will be for each corridor. This includes:

- How many landowners are involved (e.g. are there 5 or 50?).
- The location of the land requirement (e.g. is it a strip of land along the front of the property or does it bisect the middle of the property).
- The ownership structure (e.g. individual vs company) and their location (e.g. live locally vs Australia).
- Whether negotiation will be needed with any third parties (e.g. holder of easement registered on title of land required for the Project).
- Whether we require a ‘traditional’ property right (e.g. a corridor of land at grade) or a strata interest (e.g. for a tunnel or bridge).

[1] Potential indicative sites were identified as part of the briefing material for this shortlist assessment. However, due to the preliminary nature of this information, it was agreed that we should not presume the use of the sites indicated in that material, and should not otherwise consider / seek to assess temporary occupation and / or fill disposal sites for the purpose of the shortlist MCA assessment.

Weighting

The weighting that we have applied to the adopted ratings (raw score) reflects our view as to the relative importance of each sub-criterion in relation to this particular project.

There is an argument that each of the sub-criterion is of equal importance. However, as discussed above, the acquisition process for Maori land typically takes a lot longer than non-Maori land. This would not necessarily be an issue if there was a 3-4 year property acquisition window prior to construction commencing on the project. However, the Transport Agency's process means that the period available for property acquisition (i.e. from final confirmation of alignment to construction start date) is now typically 2 years, or even less in some cases.

Therefore, from a property acquisition perspective, 'Maori land' criteria has more impact than the other 3 criteria on this project and this is reflected in its weighting of 30%.

The 'Impact on individual properties' and 'Complexity of acquisition' sub-criteria have slightly more impact from a property acquisition perspective on this project than the 'Acquisition cost / Compensation' sub-criterion. This main reason for this is the land contour involved for this project. It is generally steep hill country, and means the impact on individual properties is likely to be greater than if it were easy to rolling contour. This will also serve to make some acquisitions more complex than would otherwise be the case. That is the reason these 2 criteria have been given a weighting of 25%.

3.2 Rating Criteria

Rating	Description
4	Very high positive effects
3	High positive effects
2	Moderate / medium positive effects
1	Low / minor positive effects
0	Neutral / no change
-1	Low / minor adverse effects
-2	Moderate / medium adverse effects
-3	High adverse effects
-4	Very high adverse effects
F	Fatal flaw

For the purposes of assessing the property effects of the routes, it is acknowledged that making no changes to the existing SH3 corridor in this location would be scored '0' to reflect this as the base/existing case.

3.3 Assumptions

Whilst it is possible to mitigate the impact that a project has on an individual property to the extent that the impact becomes neutral or even positive (i.e. by way of betterment), this is quite rare. In the vast majority of roading projects the impact on individual properties is negative from a property perspective, and the overall impact across the project is invariably negative to some degree.

In certain locations allowances were made when assessing impacts on property with regards to potential significant cuts, including the possible requirement for soil nails / rock anchors to stabilise some batter slopes. This was estimated on a conservative / worst case basis as no final engineering advice was to hand when this assessment was undertaken.

It is likely that all corridors will require some degree of temporary occupation during the construction process (e.gs haul roads, lay down / storage areas etc.), and this will result in additional land disturbance. However, the extent and duration is unknown at this stage and therefore it is not included in this assessment.

It is also likely that, given the extent of earthworks proposed, some land will be permanently required for soil disposal. However, the extent is unknown at this stage and therefore it is not included in this assessment.

We understand that the wetlands shown on the indicative footprint plans are an operational requirement to treat storm water runoff from the highway. However, we have advised that the locations of the wetlands are not fixed so can, within reason, be moved if necessary.

This report assumes that a significant area of existing road reserve adjoining the Ngati Tama Custodian Trustee Limited (NTCTL) land at Mt Messenger is potentially available to be used in exchange with NTCTL.

Not all titles and encumbrances have been searched at this stage with only high level analysis of property effects completed.

No allowance has been made for any land that may be needed for mitigation planting to meet potential resource consent requirements.[2]

Options A, F & P: We have assumed that the existing state highway will remain open (as a local road), at least in part, to provide access to the Scott, Gordon, Thompson, Beard & NTCTL properties, together with the second (southern) dwelling on the Pascoe property.[3]

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[2] We understand it is likely land would be required for mitigation planting for all of the options being considered at the shortlist stage. On that basis, it is likely that the associated property requirements will need to be considered at the detailed design stage, once a route is selected.

[3] Following discussion at the MCA2 workshop, the agreed common assumption is that the part of the existing roadway necessary to provide access to these properties will remain open. However, it is also an agreed assumption that the existing roadway will not remain open in complete north – south form. In other words, the assumption is that there

Option E: We have assumed that the existing state highway will remain open (as a local road), at least in part, and provide access to the Beard property near the summit of Mt Messenger. We have also assumed that access to the Thompson property will remain, although it would likely need to be relocated to the south. In addition, we have assumed east-west access will be available beneath the three bridge structures on the Pascoe property to ensure normal farming operations can continue.[4]

Option Z: This will result in removal of the current legal / physical access to the Beard property, and means that full purchase of this property would be required[5]. It will also remove the current physical access to the NTCTL property to the east of the state highway, but we have assumed alternative access will be able to be provided further to the north. We have also assumed that access will be retained to the Thompson property and the second (southern) dwelling on the Pascoe property.

3.4 Maori Land

All options impact to a greater or lesser degree on land owned by the NTCTL. This land was transferred to NTCTL in early 2000s as part of a Crown settlement with the Iwi group. The land is not Maori Freehold land, but is held in a number of freehold titles.

However, the NTCTL land is subject to Conservation Covenants pursuant to Section 77 Reserves Act 1977 and Section 27 Conservation Act 1987. These are administered by a management group comprising representatives of Department of Conservation (DoC) & Ngati Tama.

There is considerable risk to the Transport Agency and the Crown in acquiring this land from NTCTL, given that it has only recently been transferred to these owners as part of a Treaty settlement. Whilst compulsory acquisition is an option that is technically available to the Crown, it is unlikely to be seen as a pragmatic path to take in any negotiations.

The likely lack of a compulsory land acquisition process from NTCTL is a potential fatal flaw for this Project. It will require extremely careful management to reach a negotiated outcome with NTCTL that meets the objectives of all parties involved.

Note that part of the NTCTL land is also subject to a right (in gross) for the purposes of a walkway pursuant to the New Zealand Walkways Act 1990. This has the potential to further complicate the use of NTCTL land as it is possible that additional interests may need be acquired from, or surrendered by, the Walking Access Commission.

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will be a "gap" in the middle of the existing state highway 3 alignment through the project area, meaning it will not be available as an alternative north – south route once the realigned section of the highway is open.

[4] The discussion in the above footnote applies here, also.

[5] The proposed tunnel near the top of Mt Messenger will sever the existing state highway for all practical purposes. The existing road will be immediately adjacent to the tunnel entry to both the northern and southern ends, and means it will not be safe for vehicles to access onto the new state highway at this point. The steep topography and broken nature of the surrounding land means that it will not be practical to provide alternative access to the Beard property.

4. Scoring

General

All scoring was undertaken by Mark Spring and Louise Jones.

The following table on page 12 details the ratings assessed for the individual sub-criteria on each of the corridors under consideration.

Summary of rating for each criteria

It is very uncommon for a project to have positive effects from a property perspective, aside from the situation where betterment arises (e.g. project results in legal access being provided to a property which was previously landlocked). At best it is neutral / no change (i.e. where the project can be constructed within the existing road corridor and no additional land is required), but most projects will have adverse effects from a property perspective.

The following headings briefly explain the outcomes of the scoring for each sub-criterion, the key reasons why certain options were most favoured, and the key reasons why some were least favoured:

1. *Maori land*

All five options affect Ngati Tama Treaty Settlement land. As noted in section 3.4 this is a potential fatal flaw, so these corridors were given a rating of -4 (very high adverse effects).[6] Although the amount of Ngati Tama land required differed for each corridor, the same rating was adopted for all corridors as it was the fact that this land is required and not the amount of land involved that is critical.

The only opportunity to enhance the outcome would be to realign option Z so that it avoids the Ngati Tama land altogether.[7] This is not practicable for any of the other options as, unlike option Z, they all bisect the Ngati Tama land to varying degrees.

2. *Acquisition cost / Compensation*

Option Z has the smallest land requirement of all the corridors. Although full purchase of the Beard property is likely, it still has the lowest overall land compensation and level of injurious effect. Accordingly it was given a -1 rating (low /minor adverse effects).

The other 4 options were all given a -2 rating (moderate / medium adverse effects). Option A will result in significant land compensation and injurious effect to the Anglesey property plus a possible severance purchase. It has a similar land requirement and likely

[6] A -4 score recognises the significance of the effect. Assigning a -4 score for all options recognises the possibility of, and need for, a negotiated outcome with Ngati Tama for the acquisition of the necessary Ngati Tama land.

[7] However, such a realignment has not been presumed for the purposes of scoring.

compensation in relation to the Pascoe property to options F and P. However, it has the lowest land requirement and likely compensation in relation to the Washer property to options F and P.

Option E will result in slightly higher compensation overall than option A. It severs the Ngati Tama land, but with earthworks rather than a bridge structure. It will also result in significant land compensation and injurious effect to the Pascoe property, including removal or demolition of the main dwelling.

Option P will result in slightly lower compensation overall than option A. Whilst the land compensation and injurious effect to the Washer property will be higher than for option A, this will be more than outweighed by the lower land compensation and injurious effect to the Anglesey property.

Option F will have the second lowest compensation cost overall. The land compensation and injurious effect to the Anglesey property is significantly lower than option P, and this slightly outweighs the higher land compensation and injurious effect to the Gordon property.

Whilst the acquisition cost / compensation will differ for each of these four corridors, the difference was not considered to be sufficiently material to alter the rating to either -1 or -3.[8]

The only opportunity to enhance the outcome would be to design option Z so that some degree of legal and physical access was retained for the Beard property.[9]

3. *Impact on individual properties*

Option Z had the least impact on individual properties of all the corridors. The land required was to the boundary with the existing highway, with minor / negligible severance. Whilst the existing access to the Ngati Tama land to the east of the state highway will be severed, it has been assumed that alternative access can be provided further to the north. Accordingly, this option was given a -1 rating (low / minor adverse effects).

The other 4 options were all given a -2 rating (moderate / medium adverse effects). Option P will have a lower impact than the other three options, but only marginally lower. However, although the impact on individual properties will differ each of these four corridors, the difference was not considered to be sufficiently material to alter the rating to either -1 or -3.

The only opportunity to enhance the outcome would be to design option Z so that some degree of legal and physical access was retained for the Beard property.[10]

[8] Noting that we were instructed to assign scores on an absolute rather than relative basis.
[9] This has not been assumed for the purposes of scoring.
[10] Again, this has not been assumed for scoring purposes.

4. *Complexity of acquisition*

All five options were given a -2 rating (moderate / medium adverse effects). All required land from Ngati Tama, and involved 5-6 land owners. In addition, the Ngati Tama land is subject to the Reserves Act 1977 (eastern option only), Walkways Act 1990 and Conservation Act 1987, meaning there are potentially 1-2 other parties to negotiate with for necessary property rights (e.g. Walking Access Commission & DoC).

Option Z will have a lower complexity of acquisition than the other four options, but only marginally lower. However, although the complexity will differ for each of these five options, the difference was not considered to be sufficiently material to alter the rating to either -1 or -3 for any of the options.

Raw / Weighted Score & Judged Score

The rating assessed for the individual sub-criteria were totalled to give the Raw Score for each corridor, with the weighted ratings similarly totalled to give the Weighted score for each corridor.

The MCA Rating Criteria (detailed in section 3.2) uses whole numbers ranging from -4 to 4. In order to align with these criteria, the Weighted Score for each corridor was then rounded to the nearest whole number to give the Judged Score for that corridor.

Preferred options

Option Z was the preferred corridor with a Judged score of -2 (Weighted score -2.15). This is a result of the better scores it received in the acquisition cost / compensation and impact on individual properties sub-criteria.

Options A, E, F & P all received a Judged score of -3 (all with a Weighted score of -2.60).

Scoring table

Criteria	Sub criteria	Weighting	Option A			
			Raw Score	Weighted Score	Reason for score	Opportunities to enhance outcome
Property	Maori Land	30%	-4	-1.20	Requires land from Ngati Tama (Treaty Settlement land) to northern & southern end	
	Acquisition Cost / Compensation	20%	-2	-0.40	Significant land compensation & injurious effect ('IJ') for Anglesey, plus possible severance purchase. Long bridge structure results in very modest land requirement from Ngati Tama relative to property size. Lowest land requirement & compensation for Washer of 3 western options. Similar land requirement & compensation for Pascoe to other western options.	
	Impact on individual Properties	25%	-2	-0.50	Significant severance to Anglesey, with major earthworks in relatively close proximity to new dwelling. Wetland to treat stormwater also required (currently shown to western corner). Most significant severance of Ngati Tama land. Lower land requirement from Washer than Options F & P.	
	Complexity of acquisition	25%	-2	-0.50	6 landowners. Ngati Tama land subject to Walkways Act 1990, Reserves Act 1977 and Conservation Act 1987. Potentially 2 other parties to negotiate with for necessary property rights (e.g. Walking Access Commission & DoC).	
Raw/Weighted Score			-10	-2.60		
Judged Score			-3			

Sub criteria	Option E			
	Score	Weighted Score	Reason for score	Opportunities to enhance outcome
Maori Land	-4	-1.20	Requires land from Ngati Tama (Treaty Settlement land)	
Acquisition Cost / Compensation	-2	-0.40	Slightly higher than Option A. Severs Ngati Tama land, but earthworks rather than structures. Significant land compensation & IJ for Pascoe land, with dwelling to be removed / demolished.	
Impact on individual Properties	-2	-0.50	Similar impact to Option A. Significant impact on Ngati Tama property (severance) to east of SH. Significant impact on Pascoe property - severance & 3 bridge structures. Also dwelling to be removed & wetland to Ngati Tama boundary. Wetland on Thompson property to SH boundary.	
Complexity of acquisition	-2	-0.50	5 landowners. Assume access still available to Beard property from the north. Ngati Tama land subject to Walkways Act 1990, Reserves Act 1977 and Conservation Act 1987. Potentially 2 other parties to negotiate with for necessary property rights (e.g. Walking Access Commission & DoC).	
Raw/Weighted Score	-10	-2.60		
Judged Score	-3			

Sub criteria	Option F			
	Score	Weighted Score	Reason for score	Opportunities to enhance outcome
Maori Land	-4	-1.20	Requires land from Ngati Tama (Treaty Settlement land) to northern & southern end.	
Acquisition Cost / Compensation	-2	-0.40	Slightly lower than Option P. Significantly less land compensation & IJ for Anglesey - which slightly outweighs higher land compensation for Gordon.	
Impact on individual Properties	-2	-0.50	Slight greater impact overall than Option P. Less impact on Anglesey property but greater impact on Gordon & Ngati Tama main block. Significant cuts to Anglesey & Gordon properties. Wetland to corner of Anglesey property (adjacent Gordon boundary). Significant severance to rear of Washer property. Pine plantation to rear of Gordon property severed from balance.	
Complexity of acquisition	-2	-0.50	6 landowners. Ngati Tama land subject to Walkways Act 1990, Reserves Act 1977 and Conservation Act 1987. Potentially 2 other parties to negotiate with for necessary property rights (e.g. Walking Access Commission & DoC).	
Raw/Weighted Score	-10	-2.60		
Judged Score	-3			

Sub criteria	Option P			
	Score	Weighted Score	Reason for score	Opportunities to enhance outcome
Maori Land	-4	-1.20	Requires land from Ngati Tama (Treaty Settlement land) to northern & southern end.	
Acquisition Cost / Compensation	-2	-0.40	Slightly lower than Option A. Less land compensation and IJ for Angelsey, but greater land compensation and IJ for Washer.	
Impact on individual Properties	-2	-0.50	Slighty less impact than Option A. Lower impact on Anglesey & main Ngati Tama block, but more impact on Washer. Wetland to Anglesey property. Pine plantation to rear of Gordon property bisected. Significant severance to rear of Washer property.	
Complexity of acquisition	-2	-0.50	5 landowners. Ngati Tama land subject to Walkways Act 1990, Reserves Act 1977 and Conservation Act 1987. Potentially 2 other parties to negotiate with for necessary property rights (e.g. Walking Access Commission & DoC).	
Raw/Weighted Score	-10	-2.60		
Judged Score	-3			

Sub criteria	Option Z			
	Score	Weighted Score	Reason for score	Opportunities to enhance outcome
Maori Land	-4	-1.20	Requires land from Ngati Tama (Treaty Settlement land) to southern end.	Realign to avoid Ngati Tama land altogether.
Acquisition Cost / Compensation	-1	-0.20	Lowest of all options. Full purchase of Beard property likely, but land compensation for other land owners significantly lower than Option F.	Provide access to Beard property.
Impact on individual Properties	-1	-0.25	Lowest of all options. Assumes access to Beard property no longer be possible with proposed tunnel locations, so full purchase likely. Current access to Ngati Tama land to east of SH will no longer be available, but assume alternative access provided further to the north. Assumes access will be retained for Thompson property & Pascoe's second dwelling. Relatively minimal impact on other affected landowners. Wetland on Thompson property on paper road to northern end of Pascoe property.	Provide access to Beard property.
Complexity of acquisition	-2	-0.50	6 landowners. Ngati Tama land subject to Walkways Act 1990, Reserves Act 1977 and Conservation Act 1987. Potentially 2 other parties to negotiate with for necessary property rights (e.g. Walking Access Commission & DoC).	
Raw/Weighted Score	-8	-2.15		
Judged Score	-2			

Appendix J: Terrestrial ecology

Mt Messenger Alliance

Te Ara o Te Ata

Mt Messenger bypass Project Multi-criteria analysis: Terrestrial ecology shortlist evaluation

03 August 2017

Contents

1 Introduction

The New Zealand Transport Agency (Transport Agency) is undertaking investigations into improvements to the Mount Messenger section of SH3, the key transport link between Taranaki and the Waikato regions. The MCA 2 workshop was held on 26th – 27th June 2017, with Alliance experts in engineering, construction and environmental specialist disciplines providing inputs to score options for selected criteria. 5 corridor options were evaluated. This included options crossing Ngāti Tama land to the east and west of the existing SH3 land corridor, plus options that remained largely within the SH3 corridor (see Figure 1).

Options were scored for criteria which included: transport, resilience, constructability, landscape and natural character, historic heritage, community, property acquisition, cultural and ecology. In previous MCA 1 workshop the scores relating to terrestrial ecology and aquatic ecology/water quality were combined into a single score for 'Ecology'. However, the MCA 1 process highlighted that different routes tended to have different levels of impacts on the terrestrial and aquatic environment. Thus, in assessing the short list of five route options for the MCA 2 workshop, terrestrial ecology and the aquatic environment was scored as separate criteria. This report describes the methods and process for assessing and scoring the potential impact of five different corridor options on the terrestrial ecology values as determined by the projects terrestrial ecology specialists.

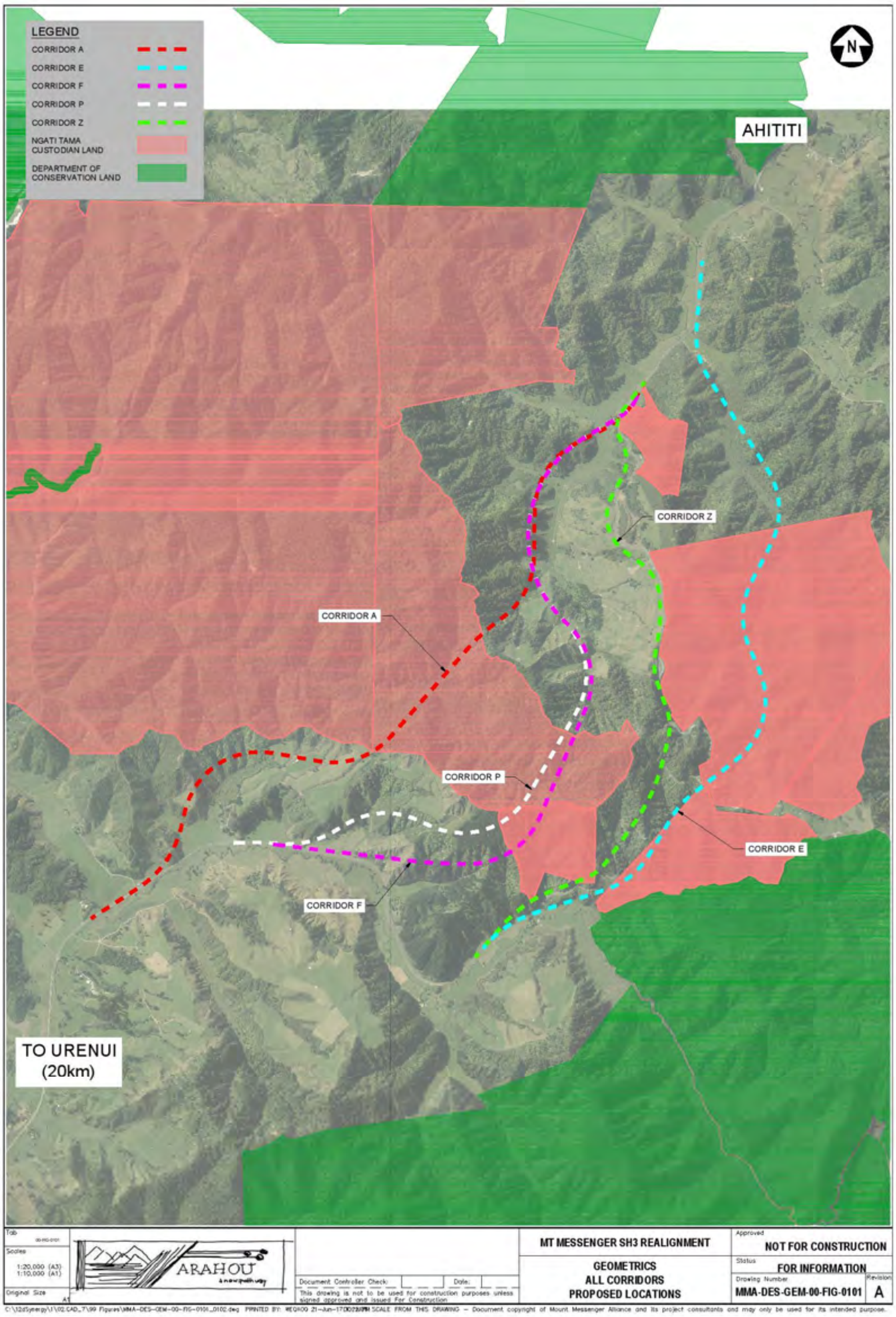

Figure 1 Mt. Messenger section of SH3 and the 5 corridor options assessed during MCA 2 workshop

2 Terrestrial Ecology Overview

Mount Messenger is situated in the North Taranaki Ecological District[1], an area comprised of eroded and dissected landforms of marine derived sandstone sediments, much of which is still covered in indigenous forest. Warm, humid summers and mild, wet winters create conditions suitable for dense broadleaved dominant forest with an abundance of lianes and epiphytic plants over mostly hill country land, and kahikatea, pukatea and swamp maire forest and associated wetlands in valley floor areas.

The Parininihi Reserve, previously known as "Whitecliffs Conservation Area" is located west of the existing SH3 corridor and is a large tract of mainly primary forest centred on the Wai Pingao Stream. This area is classified as "Rimu tawa forest" within the New Zealand Forest Service class map (NZFSMS6). The Reserve encompasses a rare continuous forest sequence through coastal, semi-coastal and lowland bioclimatic zones. As such, the area is regarded as being ecologically significant, and is described as "the best example of primary coastal hardwood-podocarp forest on the west coast of the North Island" by eminent forest ecologist John Nicholls, whose forest assessment is summarised in Bayfield et al. 1991.

Ecological management of the Reserve was started in the early 1990s by the Department of Conservation, and involved possum and goat pest control activities. Since being returned to Ngāti Tama in 2003, management of these pests has continued, and control of rodents, mustelids and feral cats has also occurred. Consequently, the area is now healthy and ecologically functioning with vulnerable browse-sensitive plants regenerating.

The dominant forest to the east of the existing SH3 corridor would have originally been very similar to the western part of the Parininihi Reserve, however it has not had consistent pest control. Consequently, the ecological condition of this area is poorer, with fewer palatable canopy trees remaining, such as thin-barked totara and northern rata. Within the Mangapepeke Stream catchment, vegetation communities are more modified and have been affected by stock grazing, fire and logging. Of greatest ecological significance in this area is the hydrologically intact swamp forest and non-forest wetland areas in the valley floor of the northern Mimi River catchment. The valley floor sequence within the northern tributary of the Mimi River represents a full range of swamp forest, scrub and non-forest wetland communities.

There are a significant number of large, emergent trees in the Project area, with rimu and miro being most common, as well as large northern rata and thin-barked totara which support a diverse range of epiphytes. These large, old trees play a significant ecological role in the forest ecosystem and provide important habitat for wildlife (e.g. roosting and nesting sites for bats and birds), and act as a source of pollinators for the rest of the ecosystem. They also provide food sources for a wide range of birds, lizards, geckos and invertebrates. For example, northern rata provides a large seasonal nectar source for nectar feeding birds and wildlife, whilst podocarp trees such as miro and rimu provide a seasonal fruit source.

[1] http://www.doc.govt.nz/Documents/science-and-technical/Ecoregions1.pdf

Large flowering and fruit producing trees are likely to be functionally important for seed dispersal and the breeding life cycles of birds such as tui, bellbird and kereru.

The North Island brown kiwi (*Apteryx mantelli*) is also present in the Project area and is listed as Nationally Vulnerable. Three other bird species listed as At Risk or Naturally Uncommon which may be present in the area are black shag (*Phalacrocorax aristotelis*), long-tailed cuckoo (*Urodynamis taitensis*) and pipit (*Anthus novaeseelandiae*). The wetland area to the east of the existing SH3 corridor, offers high quality habitat suitable for wetland birds including fernbird and spotless crake. Ngāti Tama have also recently reintroduced kokako (*Callaeas wilsoni*) into the Parininihi Reserve. Five kokako pairs and two individuals were translocated from Tiritiri Matangi Island and released to a central area of the Parininihi Reserve on May 28th 2017. A further four pairs were released on 2nd July 2017.

The North Island long-tailed bat (*Chalinolobus tuberculatus*) is a Nationally Vulnerable species and is present in the Project area. Central lesser short-tailed bats (*Mystacina tuberculate rhyacobi*), listed as At Risk - Declining are dependent on large tracts of old growth native forest and the Project area overlaps with the known national distribution of this sub-species of lesser short-tailed bat. Therefore, it is anticipated that this species may also be present in the area.

The mature forest habitat in the project area and particularly the large number of epiphyte plants present (most commonly *Astelia* spp.) provide habitat for a number of different lizard species. Arboreal or semi-arboreal species such as goldstripe gecko, elegant gecko, Pacific gecko, and striped skink favour epiphyte habitat as a food source and for refuge and reproduction. The trunks and loose bark of canopy trees are used by most of the above species, and particularly common gecko, for refuge. Forest geckos are often found on trunks and larger branches of trees in mature forest. Groundcover plants such as young tree ferns, fallen epiphytes, flax and sedges provide habitat for striped skink and goldstripe gecko. Woody debris and leaf litter on the forest floor provide refuge for copper and ornate skink.

Herpetofauna records show that the goldstripe gecko (At Risk – Relict), striped skink (At Risk – Declining), copper skink (Not Threatened), forest gecko (At Risk – Declining) and Hochstetter's frog (At Risk – Declining) have all been found in recent years within a 50km radius of the project area. The presence of Duvaucel's gecko (At Risk – Relict), found within less than 50 km from the Project area in 1984, indicates there is a possibility that this species may also be found within the main forest area.

As with many parts of New Zealand, there is a paucity of entomological knowledge of the Mount Messenger area. In addition, the taxonomic knowledge of New Zealand terrestrial invertebrates is very uneven across major invertebrate groups. 179 invertebrate taxa have been recorded at Mount Messenger and no known nationally threatened species are currently known in the area. However, the invertebrate fauna that has been found in the area is 'typical' of communities inhabiting primary forests of the southern portion of the North Island. The forest habitat available to invertebrates is considered to be of high quality, with deep leaf litter layers, an abundance of dead wood and numerous potential plant hosts.

Plant communities are diverse with a range of ground cover plants, varied understorey layer and a mixed emergent tree layer.

3 Methodology

3.1 Terrestrial ecology team

Due to the potential for significant adverse ecological effects associated with this project, it was considered appropriate for a team of experienced ecologists and taxonomic specialists to undertake scoring and participate in the MCA 2 workshop scoring process. The workshop process involved lengthy and detailed discussions between the ecology team members; and with the design team. The terrestrial ecology team that contributed directly to the MCA 2 scoring process included:

- Matt Baber — Ecology Team Leader
- Liz Deakin[2] — Lead Terrestrial Ecologist
- Nick Singers — Ecosystem Specialist
- Roger MacGibbon — Ecological Mitigation Specialist

3.2 Data/information used

Our understanding of the ecological characteristics and values within the general area stems from site visits, a review of available information and data, and field surveys and associated reports that have been specifically commissioned as part of this Project. Commissioned reports include:

- Singers, N. 2017. Mt Messenger Bypass Investigation: Botanical Investigation and Assessment of Effects. Report prepared for Opus International Consultants Ltd, Hamilton NZ by Nicholas Singers (Ecological Consultants);
- Battersby, P. and Chapman, S. 2017. Mt Messenger Bypass Investigation: Bat Baseline Survey and Preliminary Assessment of Effects. Opus International Consultants;
- Nichol, R. 2017 My Messenger Bypass Investigation: Bird Baseline Survey and Preliminary Assessment of Effects. Opus International Consultants;
- Battersby, P. and Chapman, S. 2017. Mt Messenger Bypass Investigation: Lizard and Frog Baseline Survey and Preliminary Assessment of Effects. Opus International Consultants;
- Watts, C 2017. Invertebrate taxa known from Mt Messenger, Taranaki and the potential impact of the proposed realignment of SH3. Report prepared for Opus by Landcare Research; and
- Chapman, S. 2017 Mt Messenger Bat Assessment Update for MCA2 Memo. Ecology New Zealand.

[2] Liz Deakin did not attend the MCA2 workshop due to constraints with the number of people but Liz has extensive field experience in the project footprint and has contributed to all ecology reports to date – as such her involved was considered to be essential to ensuring that we undertook a robust and informed MCA2 process

3.3 Terrestrial survey work undertaken post MCA 1 workshop

Further understanding of the terrestrial ecological characteristics and values within the areas of the shortlisted route options was gained through additional detailed survey work undertaken after the MCA 1 longlist workshop was held in May 2017. This work entailed:

- more comprehensive vegetation survey and mapping work that included additional RECCE plots and deployment of drones to capture high resolution imagery;
- Mapping of 'significant' remnant trees; and
- Further bat habitat investigations.

3.4 Options Scoring – Terrestrial Ecology Sub-criteria and Weightings

Four sub-criteria were used to assess the potential for terrestrial ecology effects associated with each option and the corresponding assignment of an ecological effects score. Collectively, these sub-criteria comprise what were considered to be the key terrestrial ecology effects associated with each option. The sub-criteria were subjectively weighted based on consensus by Project ecologists. The four sub-criteria along with their weighting include:

1. **Vegetation/habitat type loss (50%)**
2. **Number of significant trees (5%)**
3. **Threatened species (15%)**
4. **Severance (30%)**

These sub-criteria and weightings used in this MCA 2 process differed from those used in the MCA 1 process with the MCA 1 sub-criteria comprising only habitat loss (wetlands, indigenous forest and stream habitat loss) and severance, with a 50:50 weighting. The change in sub-criteria reflects the fact that:

- More comprehensive data was available (particularly for vegetation type and significant tree loss) to make better informed decisions on ecological effects; and
- The remaining short-list options all have significantly lower severance-related effects because all short-list options include structures in the form of tunnels and bridges. Consequently the weighting or relative effects of severance has been reduced (i.e. from 50% to 30%).

3.4.1 Sub-criteria 1 - Vegetation/habitat loss (weighting 50%)

Vegetation loss was given the heaviest weighting (50%), which reflects the significant of vegetation and associated habitat loss in the overall picture of ecological effects (generally, and for this project in particular).

A spatial map of terrestrial and wetland vegetation types was produced from field surveys and drone imagery analysis covering the five road options and areas between these (Appendix A, Figure 1). For each option, the amount of habitat loss for each vegetation type was determined by superimposing the project footprint of each option onto the vegetation map. Appendix A, Table 1 gives the loss (ha) for each vegetation type with respect to each road option.

While the amount of vegetation loss per se is a major consideration for assessing ecological impact, it is also important to understand and assess the significance of each vegetation type as part of the scoring process. To this end, we applied a similar process to that used by John Leathwick for ranking ecosystems (for conservation management) for several regional councils including Taranaki Regional Council. The approach factored in the following parameters: rarity, current state (based on degree of human modification), and condition based on structure and composition (focused only on vegetation).

Within the Vegetation loss subcriteria, vegetation type was weighted to to ensure that options that resulted in the highest loss of the most significant vegetation received the highest effects scores (Appendix A, Table 2).

3.4.1.1 Rarity

Habitat or ecosystem rarity was based on values generated by John Leathwick[3] for the Taranaki Region in the biodiversity prioritisation process and derived by comparing the potential ecosystem layer and current indigenous vegetation cover based on Land Cover Database 4 (LCDB4). Three ecosystem types are present at Mt Messenger for which regional rarity values are available, specifically:

- WF8: Kahikatea, pukatea swamp forest (approximately 2.5% of the original area of this type of forest is remaining in the region);
- WF13: Tawa, kohekohe, rewarewa hinau forest (approximately 16.9% remaining in the region); and
- WF14: Kamahi, tawa, podocarp, hard beech (approximately 91.4% remaining in the region).

Cliff ecosystems are also present within the alignment, however because they are not mapped well in either the potential ecosystem layer or LCDB4, an assessment of habitat rarity has not been made. Cliff ecosystems however are mostly intact and were estimated at 90% remaining in the region.

A potential ecosystem type was allocated to all mapped vegetation community units. In the model these figures were converted to a proportion, and the inverse score was used to weight ecosystems which are rarer higher than those for which a larger proportion remains (* 1 minus proportion of remaining).

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[3] J. R. Leathwick. (2016). Biodiversity Rankings for the Taranaki Region. Unpublished report for the Taranaki Regional Council.

3.4.1.2 Current state (or intrinsic value)

Current state estimates the change in vegetation structure and composition from direct human modification such as logging, land clearance and burning. Vegetation community types were given scores from 1 (theoretical pristine state) to 0.05 (highly modified vegetation). Areas which have had no logging, burning or land clearance activities were given scores of 0.95. Conversely, highly modified secondary vegetation such as manuka scrub which has developed following land clearance was given a score of 0.25. Higher scores were also given for more advanced successional stages.

3.4.1.3 Habitat condition

Habitat condition assessed three structural and compositional ecosystem components: canopy condition to assess the impact of possums, understory condition to assess the impact of ungulates here including feral goats, pigs and cattle, and weed dominance. This measure recognises the biodiversity gains which management of pressures accrues, such as controlling possums and ungulates to low or very low levels.

Canopy and understory condition scores ranged from 1 – 0.5. Scores of 1 were only given to areas where the structural and compositional integrity was intact (c.f. the potential) without any pressure affecting these components. As an example, a 1 for understory condition was given to areas where a high abundance and diversity of palatable plants occurred, such as hen and chicken fern, king fern, large leaved coprosma shrubs, hangehange and native daphne, which become uncommon even with a low level of ungulates. Conversely, a score of 0.5 was given to areas where complete loss of these species, and additionally also moderately palatable species, has occurred, and where the understory was sparse and composed of unpalatable species, such as crown fern, silver fern, hook grass and bush rice grass.

Weed dominance was scored from 1 – 0.05, and was assessed entirely on the percent cover of introduced species. As weed abundance is generally low throughout most of the area this score had limited influence with scores of 1 – 0.95. The main exception to this was in the Mangapepeke Valley, where African clubmoss is abundant growing on the forest floor in browsed and open forest, scoring 0.85.Current state together with habitat condition are essentially analogous to “representativeness”. These three components (habitat rarity, current state and habitat condition) were then multiplied together to provide a single score of habitat condition.

3.4.1.4 The Model

The formula used to assess ecological value is:

[X = Habitat rarity (as 1 – proportion of remaining) * current state * condition.

For display purposes (in Figure 1, Appendix A) these scores have been multiplied by 100 to provide percentage values (recorded in the Figure as an ecological score, between 0 and 100, with the higher scores reflecting greater significance).

3.4.2 Sub-criteria 2 - Significant trees (weighting 5%)

Significant trees were given the lowest weighting of the sub-criteria (5%), In part this is because significant trees are partially addressed in the positive weighting assigned to more significant vegetation (which typically includes more mature indigenous vegetation). Furthermore, we consider significant trees to be of lower importance than direct effects on nationally 'Threatened' or 'At Risk' species values and the effects of ecological severance.

Significant trees were determined as having the following attributes: being large (typically emergent) trees or being relatively uncommon abundance and having significant habitat value for other flora and fauna such as providing important flowering or fruiting resources; cavities for roost and nests; and hosts for epiphytic plants. Eleven tree species were determined as being significant and included; hinau, kahikatea, miro, narrow-leaved maire, northern rata, pukatea and kahikatea, rimu, thin-barked totara and white maire.

The number of significant trees that could potentially be lost for each option was determined by measuring the location of each significant tree (using a handheld GPS or orthorectified drone imagery) and superimposing the tree layer on the Project footprint for each option (see Appendix A, Table 3).

3.4.3 Sub-criteria 3 – Threatened species (weighting 15%)

Threatened species were given the second lowest weighting of the sub-criteria (15%). We consider direct effects on Threatened species populations to be of lower importance than direct effects on vegetation (which supports Threatened species) and on ecological severance, which can compromise the viability of indigenous biodiversity (including Threatened species).

Accurate information on the composition and relative abundance of threatened species was generally lacking for each option, although we did have some information (e.g. we knew the location of several 'At Risk' plant species and the location of the kokako release). In large part, this lack of information was because we had not yet undertaken comprehensive seasonal surveys as these are done in spring/summer/early autumn when fauna are more conspicuous.

Given the lack of information, our assigned relative scores for Threatened species effects were largely based on the knowledge that threatened fauna values (particularly relative abundance or population size) would be higher in areas subject to the control of predatory mammals (e.g. mustelids, possums, feral cats and rats). Areas that were in close proximity to pest control locations would also be expected to have higher values for Threatened fauna (than areas that were a long way from pest control locations; this is known as the 'halo' effect).

3.4.4 Sub-criteria 4 – Severance (weighting 30%)

Severance was given the second highest weighting of the sub-criteria (30%). Direct vegetation loss constituted a greater ecological effect than severance associated with each of the MCA2 short-list options because, unlike MCA1, the MCA2 options included structures (tunnels and bridges). As such, the relative effect of severance was lower than it was for MCA1 options where habitat loss and severance were given equal weightings because some options excluded structures (i.e. included only cut and fill).

The degree of severance effects (or alternatively habitat contiguity) on habitats associated with each option was scored for each option and based on the relationship between the magnitude of severance (scale) and the significance of severance (effect) (Appendix A. Table 4).

The magnitude of severance was measured as the inverse of the total length of bridge and tunnel on the understanding that structures provided complete or near complete habitat contiguity, while cut and fill sections of each option resulted in complete or partial severance depending on the taxonomic unit being assessed. For example, for lizards or kokako, cut and fill was assumed to result in complete severance whereas for most forest birds e.g. tui, cut and fill was not expected to result in habitat severance as tui readily fly over highways. We also considered the magnitude of severance based on the lineal meterage of tunnels and bridges > 30m in height (this height ensured no large trees would need to be felled and bats could readily fly under the bridge).

The significance of a severance effect was influenced by the magnitude of severance and the sensitivity and ecological value of the affected biodiversity. For example, severance of habitat that is part of an ecologically significant ecosystem sequence, and includes kokako, has a greater effect than habitat severance that isn’t part of an ecologically significant ecosystem and doesn’t support kokako.

3.5 Overall scoring System

All five options were scored on the 9-point (plus "fatal flaw") scale (see Table 1 below).[4]

The scoring assumed anticipated effects after standard terrestrial mitigation approaches were developed and implemented.[5] These standard mitigation measures included but were not limited to:

- Salvaging and relocation of threatened species (e.g. lizards) along with short term pest control and habitat enhancement at relocation sites.
- Habitat creation or enhancement in the form of native terrestrial, wetland, and riparian indigenous revegetation and deployment of felled logs into these mitigation sites.
- Protection measures to minimise effects, e.g. kiwi fences or bat roost tree felling protocol.

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[4] The scoring scale provided for a "fatal flaw" (F) negative score. This score was to be used where it was considered there would be unacceptable adverse effects associated with the option and that there is no reasonable way to appropriately or adequately avoid, remedy, mitigate or off-set those effects. In other words, with respect to assigning an "F" score, experts were to use their expertise to think about whether it would be reasonably possible, in the context of a resource consent application, to propose a solution that would address that effect.

[5] For this short list assessment option, all of the options received either a -3 or a – 4 score with standard mitigation – offset mitigation was not required to avoid an F score for any option.

- Adaptive monitoring programmes to identify effects and implement appropriate management responses as required, e.g. inspection monitoring of revegetation mitigation sites.

Table 1. 9 Point Scoring System used for options scoring

Scoring	Level of effect
F	Fatal flaw
-4	Very high adverse effects
-3	High adverse effects
-2	Moderate / medium adverse effects
-1	Low / minor adverse effects
0	Neutral / no change
1	Low / minor positive effects
2	Moderate / medium positive effects
3	High positive effects
4	Very high positive effects

3.6 Terrestrial ecology scoring process

Prior to the MCA 2 workshop, and in common with the other experts, the ecology team members reviewed route option figures and generic representations of earthworks and structures maps. They also reviewed the table that summarised the quantities information in respect of each option, including length, area, grades, cut and fill, stream works, bridges, tunnels, retaining walls and pavement area. This table included information provided by ecologists to assist with options assessments and included measurements of vegetation loss (and value of vegetation based on the analysis of ecological values process outlined in section 3.4), and measurements of tunnel and bridge length (as an indicator of the habitat contiguity/severance). See Appendix A, Tables 2 & 3.

At the commencement of the MCA 2 workshop, the design team used the 3D model ('Humphrey') to present a more in-depth examination of option footprints. The construction experts also provided description and discussion on constructability, construction techniques and also construction related impacts in addition to the option footprint.

While consideration of factual material, both in terms of ecology and the design specifications of the options, was an important part of the scoring process, professional judgement was also employed in determining weightings and scores for each sub-criteria.

Through the scoring process there was considerable discussion to align our understanding of habitat significance within the footprint of each option. The intention was to help ensure that options affecting the largest amount of habitat deemed to be of the greatest ecological significance received appropriately high scorings for ecological effects. Specifically, this included options with a higher magnitude of effects on:

- Rare vegetation types that were relatively unmodified by humans and were in good condition through management of introduced mammalian predators and browsers, e.g. Miro-Rewarewa-Kamahi forest which is located on ridges in the Parininihi Reserve. This is a vegetation type of regional and national significance in large part due to the presence of remnant rata and Halls totara trees that are more than several hundred years old and that are now rare or absent in other unmanaged forests due to the effects of mammalian browsers.
- Significant trees, specifically options that resulted in the loss or potential loss of relict emergent and/or relatively rare canopy trees.
- Threatened species, specifically options that were likely to have effects on nationally 'Threatened' or 'At Risk' fauna such as the kokako, kiwi, king fern and kohurangi.
- Ecological connectivity or conversely the severance of ecosystem sequences and dispersal/colonisation potential of indigenous biodiversity as a result of each alignment option.

The scoring process was as follows:

- Following the design and construction team presentations the ecologists met separately during the afternoon of 26th June 2017 to confirm their scoring. The meeting was also attended by representatives from Ngāti Tama, the design / project team, and the Department of Conservation.
- At the start of the meeting each of the experts outlined their approach to scoring. The scores for the criteria were then recorded from each expert for each option. During the process of recording each discussed their reasons for giving the score and where there were differences between scores, the reasons were debated.
- Overall scoring was carried out on an absolute, rather than relative, basis, though scoring within each criteria was undertaken on a relative basis with respect to each option.
- An overall consensus score for each option was provided following discussion amongst the specialists.
- Reasons for scoring were recorded, including if there are particular components of the option which have a significant influence on the scoring.
- The scoring process had the potential to create a situation where a number of options received the same score. If that occurred, experts were to provide information as to the relative merits of those options. Experts were to use their professional judgment as to how to provide that information, and tailor the information provided to the circumstances.

- Having discussed and tabulated all the scores there was then a process of reviewing the scores to determine an overall rating for the option and weighting of sub-criteria. This final process was undertaken at a separate workshop in Hamilton on Friday 7 July. In addition to the aforementioned terrestrial ecologists, John Turner was available and involved in this process in his capacity as the Project ecology peer reviewer.

4 Terrestrial ecology scores

Table 2 below sets out the consensus ecology criteria score for each option (assuming standard mitigation practices are applied). Table 3 outlines the reasons for scoring, including if there are particular components of the option which have a significant influence on the scoring.

4.1 Scoring the sub-criteria vs the overall scores

As explained earlier, scores were assigned under four sub-criteria. The sub-criteria scores are relative. The scores assigned for the sub-criteria are relative to the other options.

Relative vegetation loss scores and relative tree loss scores are based on quantitative information derived from survey work (Appendix A, Table 2 and 3). For example, the relative score for Option A (1.0) and the relative score for Option F (3.0), correspond to the fact that the vegetation score for Option F was approximately 3x higher than the vegetation score for Option A (Appendix A, Table 2).

Relative scores for threatened species and severance are based on professional opinion only. For example, for the Threatened species sub-criteria, the option A relative score of 2.0 and the Option F scores of 1 reflects the opinion by Project ecologists that effects on Threatened species values associated with Option A are approximately double the effects of Option E on Threatened species.

The combined sub-criteria scores were then added together, applying the respective weightings for each sub-criterion (for example, 50% weighting for vegetation loss). This provides an overall relative score for each option, and a ranking of the overall effects of each option relative to each other.

An overall score for each option was then assigned. These scores were assigned on a relative, rather than absolute basis. These overall absolute scores were assigned bearing in mind the rationale for the sub-criteria scores, and the weightings for each sub-criterion. The overall scores represent the experts' consensus on the level of effects of each option, taking into account standard mitigation.

So, while Option E is considered the 'best' option in terms of overall effects, the experts' view is that Option E would have a high / significant effect on terrestrial ecological values (after standard mitigation).

Table 2 Consensus Ecology Score ordered by option number

Corridor	Sub-criteria and weightings				Outcome		
	Relative vegetation loss scores 50% weighting	Relative significant tree loss scores 5% weighting	Relative threatened species loss scores 15% weighting	Relative severance effects scores 30% weighting	Weighted effects scores (lower score = lower effect	Option ranking	Absolute score with standard mitigation
A	1.0	1.0	2.0	3.0	1.75	4	-3
E	1.5	2.0	1.0	1.0	1.30	1	-3
F	3.0	1.5	1.5	1.5	2.25	5	-4
P	2.0	1.0	1.5	1.5	1.73	3	-3
Z	2.0	1.5	1.0	1.0	1.53	2	-3

Opportunities to reduce the impact of the routes and enhance environmental outcomes (not taken into account in the scores above) include:

- Reducing the extent of enabling works, particularly at northern and southern end of the routes.
- Limiting vegetation disturbance through design refinement and careful enabling works management under the guidance of an onsite ecologist.

Further reduction of the footprint in the Waipingao catchment by using a V-pier bridge structure where practical.

Table 3: Overall scoring for Terrestrial ecology sub-criteria, (Vegetation, Significant trees, Threatened species and Severance). Scores of -3 = High adverse effects, and -4 = Very high adverse effects. The scoring assumes standard mitigation only is applied.

Option (Score)	Reasons
A (-3)	Route Option A had the lowest level of effects on vegetation and was relatively low in terms of significant tree loss because the habitat loss footprint was small and the proportion and amount of vegetation that was affected was generally not as significant as on other routes. Conversely, effects on threatened species were considered the highest of the options because the area has been subject to pest control for approximately 20 years and population sizes of nationally 'Threatened' or 'At Risk' species were likely to be relatively high compared to areas not subject to pest control. Severance effects were considered the highest of all the options because any severance in this location would disrupt the coastal-inland ecosystem sequence from the coastal marine environment to the inland lowland forest of which the Waipingao catchment is one of the most (if not the most) intact ecological sequences in the North Island. Moreover, the presence of structures in this location may compromise kokako dispersal, particularly due to noise effects. In conclusion, we consider this option to have significant adverse ecological effects on ecological values after standard mitigation measures have been implemented because standard mitigation will not adequately address the loss of irreplaceable significant vegetation and trees, and severance effects on the ecosystem sequence and populations of nationally 'Threatened' or 'At Risk' species, which resulted in a -3 score. In relative terms this option received the second worst score reflecting the fact that the potential effects of severance on ecological sequencing and threatened species (particularly the kokako) were considered a significant issue.

Option (Score)	Reasons
E (-3)	Route Option E had the second lowest effect on vegetation loss because the vegetation that was affected was generally not as significant as on other routes. This option did score worst for effects on significant trees though. Specifically, the vegetation within the E option footprint was of relatively low quality compared to other route options (mostly due to the effects of introduced mammalian browsers), however, the footprint included a higher number of significant trees. Effects on threatened species were considered relatively low because most of the vegetation within the footprint has not been subject to pest control and populations of nationally 'Threatened' or 'At Risk species were likely to be low and in decline. Severance effects were considered relatively low because the coastal-inland ecosystem sequence in this location has already been disrupted and following road construction the continuity of habitat would remain largely intact because structures are proposed within the most significant vegetation. In conclusion, we consider this option to have significant adverse ecological effects on ecological values after standard mitigation measures have been implemented because standard mitigation will not adequately address the loss of irreplaceable significant vegetation and trees and impacts on populations of nationally 'Threatened' or 'At Risk' species, which resulted in a -3 score. In relative terms this option received the best score reflecting the fact that this option had the lowest overall ecological effect, largely because much of the affected vegetation was in poor condition due to the impacts of introduced mammalian pests and because several issues were low relative to other options.
F (-4)	Route Option F had the highest effects on vegetation loss because the habitat loss footprint was large and the proportion and amount of vegetation that was affected was generally more significant than along other routes. Effects on significant trees were moderate compared to other routes. Effects on threatened species were considered high because like A and P, the area has been subject to pest control for approximately 20 years and populations of nationally 'Threatened' or 'At Risk' species were likely to be relatively high compared to areas not subject to pest control.

Option (Score)	Reasons
	Severance effects were also high but not as high as A, because any severance in this location would not be as disruptive on ecosystem sequence from the coastal marine environment to inland lowland forest. Moreover, the presence of structures in this location is likely to have lower effects on kokako than A because this option is further away from the kokako release site than A. In conclusion, we consider this option to have very significant adverse ecological effects on ecological values after standard mitigation measures have been implemented because standard mitigation will not adequately address the loss of irreplaceable significant vegetation and trees, and ecological sequences and populations of nationally 'Threatened' or 'At Risk' species, which resulted in a -4 score. This option has the most severe ecological impact of the options assessed, mostly because of the extent of effects on highly significant vegetation.
P (-3)	Route Option P scored second worst (equal with Option Z) for vegetation loss because the habitat loss footprint was large and the proportion and amount of vegetation that was affected was more significant than two other routes. Effects on significant trees was the lowest (equal with Option A) compared to other routes. Effects on threatened species were considered high because like A and P, the area has been subject to pest control for approximately 20 years and populations of nationally 'Threatened' or 'At Risk' species were likely to be relatively high compared to areas not subject to pest control.

Option (Score)	Reasons
	Severance effects were also fairly high because any severance in this location would disrupt the ecosystem sequence from the coastal marine environment to inland lowland forest, although not to the extent that A would. Moreover, the presence of structures in this location is likely to have lower effects on kokako than A because this option is further away from the kokako release site than A. In conclusion, we consider this option to have significant adverse ecological effects on ecological values after standard mitigation measures have been implemented because standard mitigation will not adequately address the loss of irreplaceable significant vegetation and trees, and ecological sequences and populations of nationally 'Threatened' or 'At Risk' species, which resulted in a -3 score. In relative terms this option received the 3rd best score reflecting the fact that this option had relatively moderate effects on vegetation loss, threatened species values and severance.
Z (-3)	Route Option Z had the second worst (equal with Option P) effects on vegetation loss mainly because the proportion and amount of vegetation that was affected was more significant than most other routes. Effects on significant trees were the second highest (equal with Opton F) compared to other routes. Effects on threatened species were considered to be lowest equal with Option E because these footprints were not subject to control of predators as is the case for A, P and F.

Option (Score)	Reasons
	Severance effects were also relatively low because habitat continuity in this location has already been disrupted by the existing SH1 and any severance in this location would not disrupt the ecosystem sequence from the coastal marine environment to inland lowland forest. Moreover, the presence of structures in this location is likely to have lower effects on kokako than A because this option is further away from the kokako release site than A and is along the existing SH1 corridor. In conclusion, we consider this option to have significant adverse ecological effects on ecological values after standard mitigation measures have been implemented because standard mitigation will not adequately address the loss of irreplaceable significant vegetation and trees and populations of nationally 'Threatened' or 'At Risk' species, which resulted in a -3 score. In relative terms this option received the 2nd best score reflecting the fact that vegetation loss and severance issues were relatively low. This option did not receive the best score because some of the vegetation was in excellent condition due to the near absence of browsing by introduced mammals.

5 Conclusions

The potential effects of the routes on terrestrial ecology were assessed based on the ecological effects relating to four criteria: vegetation loss, significant trees loss, threatened species loss and habitat severance effects. Routes E, Z, P and A were all considered to have significant adverse ecological effects (-3) after standard mitigation measures were applied. However, in relative terms Route E was considered to have the least impact on terrestrial ecology due to having relatively low effects on significant vegetation, severance and threatened species.

Conversely, Route F was considered to have very significant adverse effects (-4) and this was predominately attributed to the relative high proportion and amount of very significant vegetation that would be impacted.

Standard mitigation approaches are considered inadequate for adequately addressing effects on all of the route options. For instance native revegetation will not adequately address adverse effects because native revegetation will take decades to replace no matter how much native revegetation is undertaken. Loss of relict trees will take hundreds of years to replace. Given the inadequacies of standard mitigation measures for all of the route options, careful consideration of suitable offset mitigation is required.

Appendices

Appendix A: Option Footprint Calculations (Terrestrial Ecology)

Appendix A: Option Footprint Calculations (Terrestrial Ecology)

Table 1. Quantities of vegetation loss by type for each route option

Vegetation community	Route A (ha loss)	Route P (ha loss)	Route F (ha loss)	Route Z (ha loss)	Route E (ha loss)
Dry cliff	0.041	0.012	X	X	0.289
Hard beech forest	0.115	0.010	0.000	X	1.270
Manuka scrub	3.559	3.911	1.358	0.967	0.066
Manuka treefern rewarewa forest	1.398	1.989	1.799	X	2.477
Manuka treefern scrub	X	2.005	0.295	0.371	1.521
Secondary broadleaved forest	0.243	0.187	0.175	X	0.000
Tawa rewarewa kamahi forest	0.098	0.000	0.000	X	X
Wet cliff	0.040	X	X	X	X
Pukatea treefern treeland	X	X	X	X	0.404
Rushland sedgeland mosaic	X	X	X	X	0.021
Total (<20% Ecological value)	**5.494**	**8.114**	**3.628**	**1.338**	**6.049**
Manuka treefern scrub	2.178	0.148	X	X	X
Secondary broadleaved forest	0.196	0.074	0.061	0.615	0.201
Tawa nikau treefern forest	X	0.150	1.917	X	9.258
Manuka succession	X	X	X	X	0.007
Pukatea nikau forest	X	X	X	X	0.729
Total (>20 and <40% Ecological value)	**2.374**	**0.372**	**1.978**	**0.615**	**10.194**
Kohekohe tawa nikau forest	0.909	X	X	X	X
Tawa rewarewa kamahi forest	1.530	1.960	1.459	0.166	2.376
Pukatea nikau forest		X	X	0.178	
Miro rewarewa kamahi forest		X	X	X	0.395
Total (>40 and <60% Ecological value)	2.439	1.960	1.459	**0.343**	**2.770**
Manuka succession	0.101	0.006	X	X	X
Pukatea puriri nikau forest	0.145	X	X	X	X
Tawa rewarewa kamahi forest	0.513	2.093	3.203	2.787	0.772
Miro rewarewa kamahi forest	X	0.173	0.239	0.220	X

Vegetation community	Route A (ha loss)	Route P (ha loss)	Route F (ha loss)	Route Z (ha loss)	Route E (ha loss)
Pukatea nikau forest	X	0.073	X	X	X
Rewarewa nikau forest	X	X	0.227	X	X
Kahikatea swamp maire swamp forest	X	X	X	X	0.101
Total (>60 and <80% Ecological value)	0.759	2.345	3.670	3.007	0.872

Table 2. Weighted Vegetation effects scores for each option

Route	Ha loss < 20 score	Weight	Weighted score < 20	Ha loss 20-40 score	Weight	Weighted score 20-40	Ha loss 40-60 score	Weight	Weighted score 20-40	Ha loss > 60 score	Weight	Weighted value score > 60 (ha)	Total weighted vegetation score	Vegetation loss subcriteria weighted scores
A	5.49	1	5.49	2.37	4	9.50	2.44	16	39.02	0.76	64	49	103	1.0
E	6.05	1	6.05	10.19	4	40.76	2.77	16	44.32	0.87	64	56	147	1.5
F	3.68	1	3.68	1.98	4	7.92	1.46	16	23.36	3.67	64	235	270	3.0
P	8.11	1	8.11	0.37	4	1.48	1.96	16	31.36	2.35	64	150	191	2.0
Z	1.33	1	1.33	0.61	4	2.44	0.34	16	5.44	3	64	192	201	2.0

Table 3. Significant trees and threatened plants on MCA2 routes

		Significance value			
Route	Species	Moderate	High	Very high	Total
A	Rimu	2		1	
A	Pukatea	4			
A	Kohurangi		1		
A	King fern		1		
	Total	**6**	**2**	**1**	**9**
P	Northern rata			1	
P	Rimu		1		
P	Miro	3	1		
P	Hinau	1			
P	White maire	1			
	Total	**5**	**2**	**1**	**8**
F	Rimu		3		
F	Northern rata			1	
F	Thin barked totara			3	
F	Miro			8	
	Total	**0**	**3**	**12**	**15**
Z	Rimu		3		
Z	King fern		9		
	Total	**0**	**12**	**0**	**12**
E	Rimu		6		
E	Hinau		2		
E	Northern rata			2	
E	Thin barked totara			6	
E	Miro		6		
	Total	**0**	**14**	**8**	**22**

Figure 1. Ecological value/condition of vegetation at Mt Messenger

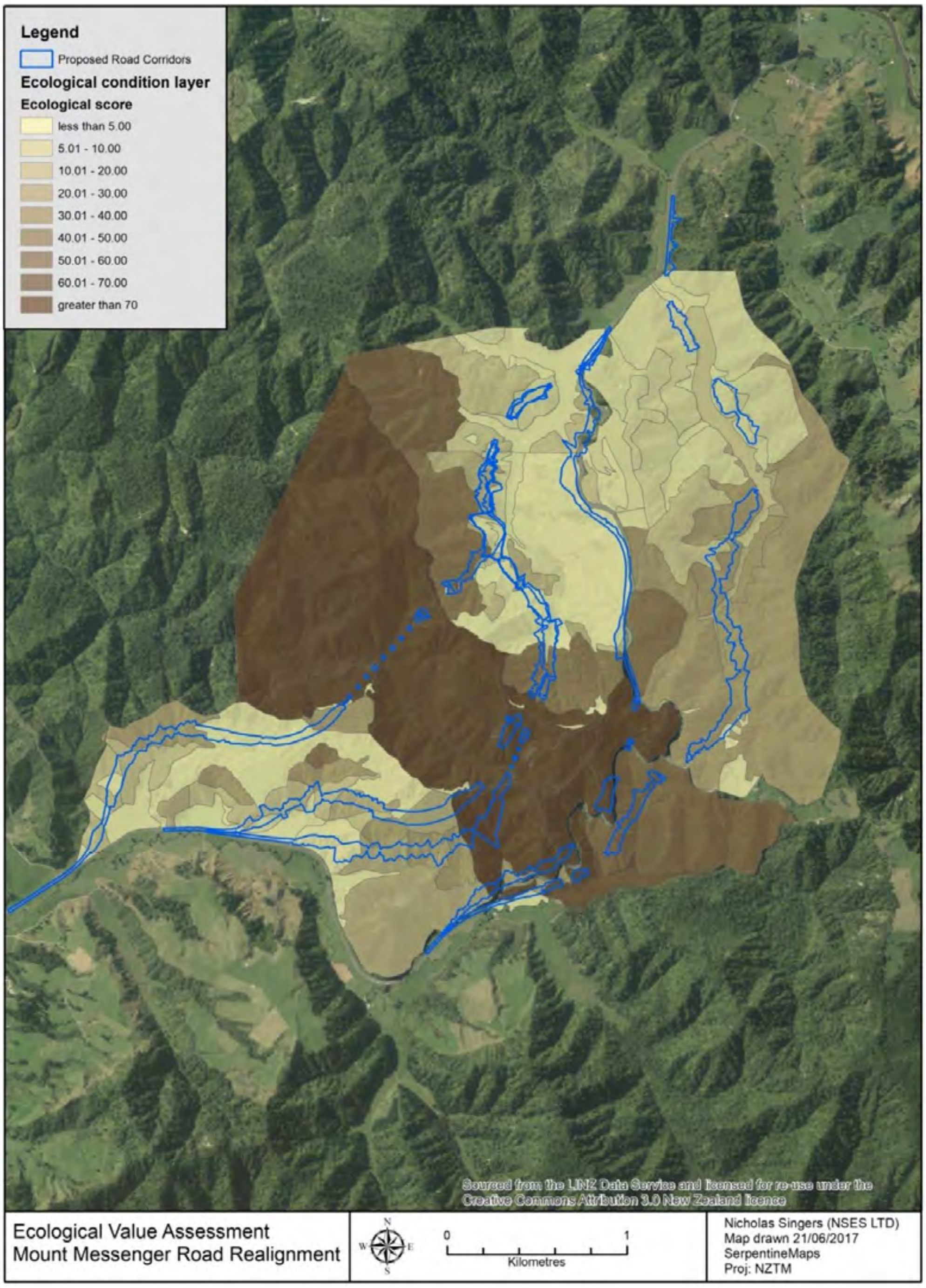

Table 4. Option footprint native vegetation value, loss and significant trees

	(m)	(Plan - ha)	Ecological value score < 20 (ha)	Eological value score 20-40 (ha)	Ecological value score 40-60 (ha)	Ecological value score > 60 (ha)	Total native vegetation loss (ha)	Significant trees	Construction footprint (ha)	Total Bridge	Length of bridge above 30m high	(m)
A	5940	25.9	5.49	2.37	2.44	0.76	**11.06**	**9**	1.5	947	330	235
E	5250	29.7	6.05	10.19	2.77	0.87	**19.88**	**42**	2.3	862	0	230
F	5030	32.3	3.68	1.98	1.46	3.67	**10.79**	**15**	1.3	593	100	250
P	4770	32.5	8.11	0.37	1.96	2.35	**12.79**	**8**	1.3	631	200	220
Z	4230	17.8	1.33	0.61	0.34	3	**5.28**	**12**	1.2	580	0	240

Appendix K: Water environment

Mt Messenger bypass Project Multi-criteria analysis: Water environment shortlist evaluation

31 July 2017

Graeme Ridley and Keith Hamill

Contents

1 Introduction

The New Zealand Transport Agency (Transport Agency) is undertaking investigations into improvements to the Mount Messenger section of SH3, the key transport link between Taranaki and the Waikato regions. The MCA 2 workshop was held on 26th – 27th June 2017, with Alliance experts in engineering, construction and environmental specialist disciplines providing inputs to score options for selected criteria. A short list of five corridor options were evaluated. This included options crossing Ngāti Tama land to the east and west of the existing SH3 land corridor, plus options that remained largely within the SH3 corridor (see Figure 1).

Options were scored for criteria which included: transport, resilience, constructability, landscape and natural character, historic heritage, community, property acquisition, cultural, terrestrial ecology and the aquatic environment.

This report provides describes the methods and process for assessing the potential impact of five different corridor options on the aquatic environment. The aquatic environment covers both aquatic ecology and water quality – primarily in the form of potential sediment yields from earthwork activities.

In the previous MCA 1 workshop the scores relating to terrestrial ecology and aquatic ecology/water qualify were combined into a single score for 'Ecology'. In doing so, some loss of differentiation between different route options occurred because the different routes tended to have different levels of impacts on the terrestrial and aquatic environment. Thus, in assessing the short list of five route options for the MCA 2 workshop terrestrial ecology and the aquatic environment were scored as a separate criterion.

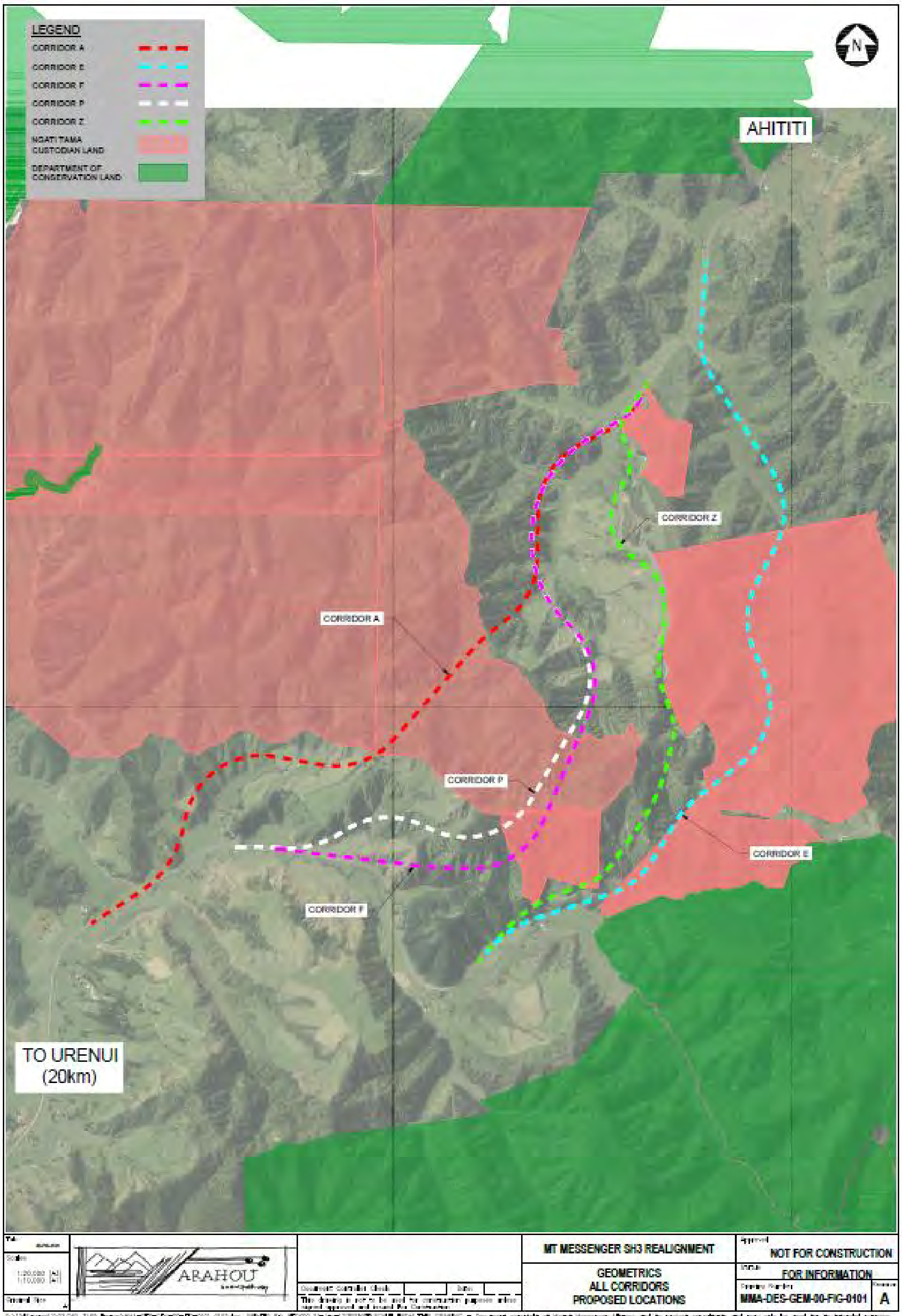

Figure 1.1: Mt. Messenger section of SH3 and the 5 corridor options assessed during the MCA2 workshop

2 Environment

Mount Messenger is situated in the North Taranaki Ecological District[1], an area comprised of eroded and dissected landforms of marine derived sandstone sediments, much of which is still covered in indigenous forest. Warm, humid summers and mild, wet winters create conditions suitable for dense broadleaf dominant forest with an abundance of lianes and epiphytic plants over mostly hill country land, and kahikatea, pukatea and swamp maire forest and associated wetlands in valley floor areas.

The area consists of high quality habitat for indigenous flora and fauna. A description of the flora, fauna and management history is provided in the Terrestrial Ecology MCA 2 report.

Many of the waterways in the Mount Messenger – Parininihi area provide high quality habitat for freshwater species. Waterways draining north to the Mangapepeke Stream, west to the Waipingao Stream and headwater tributaries draining to the Mimi River on the south side of Mount Messenger all present significant ecological values.

The lower section of the Mangapepeke Stream tributary is a small low gradient stream and has a predominantly pasture catchment. The aquatic macroinvertebrate community indicates good water quality and there is a good diversity of fish present. Species include adult inanga, longfin eel koura/crayfish and redfin bully (all classified as At Risk – Declining), whilst common bully and paratya shrimp (Not Threatened) are also present. Streams in the upper sections of the Mangapepeke tributary are small and shallow, which largely run through pasture and have degraded habitat. The main tributaries have catchments dominated by indigenous forest and macroinvertebrate communities are indicative of excellent water quality/habitat.

The Waipingao Stream has a pristine catchment of indigenous forest from its headwaters to the sea and contains a high diversity and abundance of aquatic habitat and excellent water quality. Longfin eels, banded kokopu and koura/crayfish are known to be present in the stream. The Parininihi Marine Reserve is situated near the mouth of the Waipingao Stream and supports large populations of rock lobster and several rare sponges.

The Mimi River flows south west to enter the coast between Waiiti and Urenui. Native forest dominates most of the headwaters upstream of Mt Messenger. There is a kahikatea, pukatea swamp forest downstream of some tributaries potentially affected by Route E. This is kakikatea forest has high ecological value because it is hydrologically intact and only a very small percent of the original area remains in the region. It offers high quality habitat suitable for wetland birds including fernbird and spotless crake.

Most of the headwaters of the Mimi River affected by the alignment of routes A, F, P and Z are very small and have seasonally intermittent flow. On farmland, cattle access has degraded many, although in steeper gullies where cattle are excluded regenerating kanuka forest covers the stream. The forested sections have moderate to high habitat values and good to excellent water

[1] http://www.doc.govt.nz/Documents/science-and-technical/Ecoregions1.pdf

quality. Longfin eel, giant kokopu, banded kokopu, redfin bully, and koura are known to be present in the Mimi Stream.

3 Background to Construction Water Management

To assist with the MCA process it is important to recognise the principles of construction water management (as set out below in Section 4.3) and from these determine if there are any specific aspects of the routes that are in conflict with the principles that apply. To assist with understanding these principles, and achievement of them, the erosion and sedimentation process needs to be understood as follows.

From an erosion and sediment control perspective it is important to recognise that erosion occurs when the surface of the land is worn away (eroded) by the action of water, wind, ice or geomorphological processes. Through the erosion process, soil particles are dislodged, generally by rainfall and surface water flow. As rain falls, water droplets concentrate and form small flows. As this flow moves down a slope, the combined energy of the rain droplets and the concentration of flows has the potential to dislodge soil particles from the surface of the land.

Sedimentation occurs when these soil particles are deposited. The amount of sediment generated depends on the erodibility of the soil, the energy created by the intensity of the rain event, the site conditions (for example the slope and the slope length) and the area of bare earth or unstabilised ground open to rainfall. For the Mt Messenger Project options, a significant influence on sediment generation is slope angle. There are steep slopes through the majority of the route options with these steeper slopes having a proportional increase in sediment generation. The presence of these steep slopes, in most soil types, creates a significant challenge in terms implementing measures aimed at reducing erosion.

While all MCA 2 routes are subject to steep terrain and these slopes have a risk of some failure, this is not an issue for the installation and use of the erosion and sediment control measures implemented. All measures installed will be subject to geotechnical considerations to minimise potential of failure. Any wider slope failure that results will be managed on site with associated clean-up and engineering works as necessary. There is assessed to be no route which provides for a higher risk of failure of erosion and sediment control devices than any other.

Erosion control is based on the practical prevention of sediment generation in the first instance. If erosion control measures and practices are effective then sediment generation will be minimised and the primary reliance on the sediment control measures is reduced. Erosion control forms a key component of any chosen option.

Sediment control refers to management of the sediment after it has been generated. It is inevitable that some sediment will be generated through land disturbance activities even with best practice erosion control measures in place. Sediment control measures are designed to capture this sediment and to minimise any resultant sediment-laden discharges to waterways. A primary sediment control measure that will be utilised are sediment retention ponds.

Rather than primarily relying on sediment control measures, reducing erosion will have the direct effect of reducing sediment generation and therefore less sediment laden runoff will need to be intercepted, treated and discharged from the sediment control measures. Erosion control practices are a key measure in reducing sediment yields from the site, in particular progressive stabilisation.

In addition to structural practices, which include physical measures such as sediment retention ponds, a series of non-structural practices will be used that focus on various site management practices, such as staging of construction works and providing an appropriate level of resourcing for environmental management and monitoring. The primary aim of non-structural practises are to minimise the potential for erosion. A secondary aim is to monitor effectiveness of erosion and sediment control measures to allow adaptive management to be applied.

With the above in mind, the erosion and sediment control measures will be designed to minimise the extent of soil erosion and manage any resultant sediment yield. Erosion control will be the highest priority however sediment control will also be a critical feature.

Prior to any land-disturbing activities occurring, erosion and sediment control measures will be installed to minimise potential adverse effects by achieving industry best practice. The *NZTA Erosion and Sediment Control Guidelines for State Highway Infrastructure, Construction Stormwater Management* (dated September 2014) (NZTA Guideline) have been considered in the design of the erosion and sediment control measures and is considered the default guideline. “Best Practice” will however apply throughout to reflect site conditions.

While the focus during construction remains on erosion and sediment control the associated assessment is considered through a wider construction water management (CWM) assessment and includes other construction related activities including concrete management. The final assessment for consent lodgement will be based on this CWM concept. A CWM Plan will be prepared for the preferred route, to support the resource consent application.

Detailed site and/or activity specific erosion and sediment control plans will be required and will need to be in accordance with the general principles of the CWM plan. These will provide the ability for the various parties to have further input into the methodologies implemented to ensure enhanced outcomes and the opportunity for other non-structural measures and innovative practices to be implemented.

Following installation of the erosion and sediment controls, ongoing site monitoring will occur to ensure that the construction water management measures have been installed correctly, and are functioning effectively throughout the duration of the works. This is referred to as an adaptive monitoring programme. During construction, a variety of measures will be used to manage construction activities and ensure that construction is being undertaken in a way that avoids, remedies or mitigates potential adverse effects on the environment. These measures will include specific erosion and sediment control measures, environmental monitoring and environmental auditing.

4 Methodology

4.1 Aquatic environment team

A team of experts contributed to the scoring the potential effect of the route options on the Aquatic Environment. The scores were discussed in the MCA 2 workshop with the terrestrial ecology team members and the design team but the scores were decided by the aquatic environment specialists. The Aquatic Environment team included:

- Keith Hamill Freshwater ecology and water quality
- Josh Markham Freshwater peer review
- Graeme Ridley Erosion and sediment control
- Sharon Parackal Erosion and sediment control

Keith Hamill and Graeme Ridley are the lead experts, and had final responsibility for assigning scores.

4.2 Information used and process to date

Our understanding of the aquatic ecological characteristics and values within the general area stems from a review of available information, maps and aerial photograph of the route footprint (including enabling works), summary information of lengths of streams impacted, numerous site visits and ecological field surveys. The risk of sedimentation was primarily based on a desk top assessment (described below).

The majority of streams affected by Routes A, F and P had previously been assessed in February 2017 and the results reported in Hamill (2017). Additional field work was undertaken in early June 2017 to provide information to assess the five possible route options identified following the MCA 1 workshop. The fieldwork focused on assessing the ecological value of streams affected by route E and the southern end of routes A, F, P and Z.

The fieldwork followed the methods described in Hamill (2017). In particular stream habitat and ecological function was assessed using the Clapcott (2015) protocol and the Stream Ecological Valuation (SEV) method according to Storey et al. (2011). Stream habitat was assessed at eight sites on Route E plus three tributaries to the Mimi Stream impacted variously by Routes A, F and P. In addition, the SEV was applied to six of the sites on Route E; this included assessing habitat values, sampling for aquatic macroinvertebrates and sampling for fish using either fine mesh fyke nets or the backpack electric fishing method. The location of sites surveyed in February and June 2017 are show Appendix A and Figure 4.1.

For the erosion and sediment control aspects the assessment to date is based on the best available information at this time and provides a conceptual approach to the erosion and sediment control measures that will be utilised on site.

Key aspects and assumptions within this sediment yield assessment are as follows:

- Plans reviewed to inform this report are based on information available as of 16th June 2017.

- No site visit was undertaken as part of the overall assessment. This will occur for the consent lodgement phase once a final route has been selected.
- Discussions on the 5 routes has occurred with the construction team, ecology, geotechnical advice and planning.
- The plans and assessment are broad scale concept only and have been developed based on knowledge of the options and an indicative view on potential options, issues and opportunities.
- Estimates of the volumes have been previously provided within the MCA2 process and these has been used. The basis for the assessment relied on information available to date, previous experience with these types of projects and an assessment of the 5 routes against the principles as specified in this report.
- Appendix D provides the conceptual erosion and sediment control plans for the 5 route options.
- Specific construction methodology is not yet determined at the time of writing this report and this will influence the erosion and sediment control measures utilised.

While the principles for construction water management are outlined above, the specific design of all measures needs to be determined as part of the consent lodgement phase. This design is to be based on best practice with best practice generally representing the NZTA Guideline. It needs to be acknowledged that due to the steep slopes within the site (for all routes) that some of this design will need to be adapted to reflect the conditions. As an example, clean water diversions (whereby all cleanwater will be diverted away from the earthworks locations) will be difficult to achieve at a design capacity and alternatives will need to be considered on a case by case basis.

Figure 4.1: Overview of stream survey points and route options for SH3 Mt Messenger. The north side is the top image and the south side is the bottom image.

4.3 Aquatic Environment Sub-Criteria

The potential impact of each route option on the aquatic environment was assessed based on two sub-criteria:

1. Habitat loss
2. Potential Sediment Yield from Project Route Alignment

The habitat loss sub-criteria was based on the SEV method and integrated potential effects on instream habitat, riparian habitat, hydrology, biogeochemistry, and biodiversity including fish, aquatic macroinvertebrates, and plants and vegetation. The sedimentation criteria was based on the risk of exacerbated stream erosion caused from the change in land use and the uncontrolled or controlled stormwater runoff, and the uncontrolled discharge of sediment laden water from the construction footprint either frequently as part of construction works or as part of a catastrophic event such as landslides.

A number of other potential effects of the routes on aquatic ecology were considered but not included as criteria for scoring route options because they provided little ability to distinguish the effects of one route from another. This included potential effects of routes on severance of fish passage. The use of bridges in the design had reduced the potential effects of severance from all route options and it was assumed that standard fish passage mitigation measures would ensure suitable fish passage was maintained through all culverts. This could be more challenging in long lengths of culvert, but all route options were similar in this respect except Route Z which had least impact on streams.

Consideration was also given to the potential direct effects on pristine stream habitat in the Waipingao catchment and the Kahikatea swamp forest downstream of site E6. The use of bridges, routing stormwater away from sensitive catchments, and modification to the route alignments compared to the options considered in the MCA 1 workshop resulted in the direct effects of the routes on aquatic habitat in sensitive catchments being largely avoided. However, potential effects of erosion and sedimentation were still considered as part of the sedimentation criteria.

Another potential effect of routes crossing the Waipingao catchment is the increased risk of rubbish and weed invasion into the catchment as a result of fly tipping. Fly tipping has resulted in rubbish and exotic weeds in tributaries with headwaters extending to the rest area at the top of the current Mt Messenger road. It would be a concern if a new route over the Waipingao valley resulted in the same practice because it is currently in a largely pristine condition. However it was assumed that this risk could be avoided through detailed design of the road, bridges and stormwater system.

4.4 Habitat Loss Criteria

The potential impact of routes on stream habitat loss was assessed using a single score that integrated stream length impacted, stream width, current habitat quality and the magnitude of impact (e.g. permanent piping is worse than a diversion or temporary piping that will be removed after the construction period). It accounted for effects of piping, diversions and temporary impacts from enabling works.

For each route option, the length of stream impacted by the permanent footprint and enabling works was measured using the route overlaid on aerial photographs and a stream layer derived from a Digital Terrain Model (DTM). Stream lengths were further subdivided to allow an SEV score and average stream width to be assigned to each section of affected stream.

A modified Ecological Compensation Ratio (ECR) was calculated for sites where the SEV survey method was used. The ECR was modified to use the current SEV score rather than the potential SEV score for any particular site (called ECRc). This provided a better rating of impact for the purpose of comparing route options, but it is not intended to replace the standard ECR method used for the purpose of calculating lengths of stream required for compensating effects of habitat loss (see Hamill 2017, Storey et al. 2011).

In calculating the ECR, a lower after impact SEV was used for piped steams (i.e. SEVi-I of 0.23) compared to streams that will be diverted or temporarily impacted by enabling works. It was assumed that diversions would be improved to only a moderate habitat quality (i.e. SEVi-I of 0.6). For the purpose of calculating an ECR it was assumed that restoration work at a hypothetical compensation site would improve it by 0.25 SEV point (calculations are shown in Table 1 in Appendix B).

A Habitat Impact Score was calculated for each stream section by multiplying the modified ECR (ECRc) by the stream area (m^2) affected by the works. These were summed to provide an overall Habitat Impact Score for each route (see Table 2 in Appendix B). The use of stream area impacted rather than just stream length is consistent with the SEV approach and puts more weighting on larger streams (Storey et al. 2011) that have greater potential habitat value. If an SEV survey had not been undertaken on a particular section of stream impacted by a route, then an ECRc was assigned based on scores from nearby sections of stream with similar habitat. Stream lengths impacted and habitat loss scores calculated for each route are shown in Appendix A.

4.5 Sediment Yield Criteria

To assist with determination of sediment yield for each route alignment a series of construction water management principles have been developed for the MCA 2 process and these will be amended as necessary throughout the process leading to lodgement. These are outlined below and form the basis of the MCA 2 analysis.

In addition, as specified above, the key objectives and principles we wish to achieve need to be assessed so we can determine if there are any specific aspects of the routes that conflict with the principles that apply. The objectives and principles are as follows:

Overall Objective

All construction works will be undertaken in accordance with the best methods and practice available at the time of construction to:

- minimise the volume and area of the proposed earthworks required for the Project through the project design matching expected soil types and geology;
- maximise the effectiveness of erosion and sediment control measures associated with earthworks by minimising potential for sediment generation and sediment yield; and
- take all reasonable steps to avoid adverse effects on freshwater and marine water environments within or beyond the works boundary, with particular regard to reducing opportunities for the works to generate sediment.

<u>Key Principles for all Construction Works</u>

1 Construction water management measures will, where practicable, be undertaken and implemented with a hierarchy and priority order as follows:
   - Avoidance of effects, including from sediment discharge, will continue as a first priority.
   - Erosion control will be provided for in all circumstances by minimising sediment generation through a range of structural (physical measures) and non-structural (methodologies and construction sequencing) erosion control measures.
   - Sediment control will be considered for all sediment laden discharges with Sediment Retention Ponds considered as the most viable and effective sediment control solution. Sediment Retention Ponds will be rationalised within the Project to ensure they are fully utilised, centralised and effective and do not create unnecessary earthworks in themselves.

2 The construction water management measures will be illustrated through an erosion and sediment control plan. All erosion and sediment controls will, where practicable, meet the minimum criteria of the NZTA Guidelines and will also incorporate innovative ideas and procedures to match the local challenges.

3 The development of site-specific erosion and sediment control plans, in accordance with the direction and principles of the erosion and sediment control plan, will allow for future innovation, flexibility and practicality of approach to erosion and sediment control to ensure the ability to adapt appropriately to changing conditions.

4 Progressive and rapid stabilisation, both temporary and permanent, of disturbed areas using mulch, aggregate and geotextiles will be on-going. Stabilisation will apply particularly with respect to stockpiles, pre load locations, concentrated flow paths and short batter establishment. Stabilisation will need to be appropriate to the soil surface geology with the intent of achieving an 80% vegetative cover or non-erodible surface over the entire exposed area of earthworked areas. Stabilisation is designed for both erosion control and dust minimisation.

5 All Sediment Retention Ponds and Decanting Earth Bunds, if utilised, will be fitted with floating decants with a mechanism to control (or cease) outflow during dewatering pumping activities to these structures if required. This mechanism could take the form of a manual decant pulley system or plug. Pumping will be such that pump volumes will only be to the

same level as that able to be fully captured within the retention structure and discharged out the designed decant structure.

6 Streamworks will be undertaken in a manner that recognises the higher risk of this activity, from a sediment generation and discharge perspective, and the sensitivity of the receiving environments. At all practical times these activities, and any associated works with these streams will be undertaken in a “dry” environment. This will be based upon diversion of flows around the area of works or undertaking construction “off – line”. Consideration will also be given to downstream water users, fish spawning and fish migration periods (if relevant), during which time instream works will be restricted and carefully managed.

7 Water quality monitoring, both qualitative and quantitative will occur as part of the Project implementation as a way of assessing the effectiveness of the treatment and allowing for improvements / modifications and continuous improvement as the Project works continue. Qualitative monitoring may include visual surveys of the downstream environment. Quantitative monitoring may include sampling and testing of pond discharges for turbidity, clarity and/or total suspended solids to assess against water quality parameters.

The sediment yield criteria risk was assessed for the proposed earthworks. This can sometimes be undertaken utilising Universal Soil Loss Equations (USLE) which is a calculation based on a range of factors and associated inputs including area of earthworks, rainfall, soil types, slope angle and length, erosion and sediment practices employed and efficiency of the specific controls utilised.

While USLE provides an estimated annual sediment yield for a particular area of earthworks, its primary purpose is in the identification of “hot spots” (higher sediment yield locations) and also for the purpose of comparative assessment. For works and MCA 2 assessment we have undertaken a broad scale USLE with a range of assumptions for this comparative purpose. This allows a direct comparison between the 5 routes on the likely magnitude and differences between sediment yields and will assist with the MCA 2 process.

The USLEs are presented in Appendix C of this memorandum.

Table 4.1 below illustrates a comparative analysis of sediment yields within the catchments and the various route options and as detailed above should not be used as an absolute sediment yield calculation. It is based on assumptions made at this stage of the process which will need to be verified and confirmed through the final route assessment process prior to lodgement. The USLE calculations have been based on all earthworks required to complete the various routes, including possible disposal, borrow and temporary stockpiling sites but excludes associated access tracks.

Table 4.1: Sub Catchment and Route Sediment Yield Analysis

Route	Mimi Catchment % of Total Route Yield (Tonnes)	Tongaporutu Catchment % of Total Route Yield (Tonnes)	Waipingao Catchment % of Total Route Yield (Tonnes)	Total Sediment Yield Tonnes
A1	13 (400)	83 (2500)	4 (100)	3000
F1	25 (900)	64 (2300)	11 (400)	3600
E1	12 (250)	88 (1800)	0	2050
P	13 (380)	75 (2200)	12 (320)	2900
Z	17 (250)	83 (1250)	0	1500

Table 4.2 presents the same USLE information but allows a comparative assessment between the various route options and ranks the routes from a sediment yield perspective.

Table 4.2: Route and Sub Catchment Comparative Ranking - Sediment Yield (1 – Highest Potential Yield / 5 – Lowest Potential Yield)

Route	Mimi Catchment Ranking (Tonnes)	Tongaporutu Catchment Ranking (Tonnes)	Waipingao Catchment Ranking (Tonnes)	Total Sediment Yield Ranking (Tonnes)	Overall Route Ranking
A1	2 (400)	1 (2500)	3 (100)	3000	2
F1	1 (900)	2 (2300)	1 (400)	3600	1
E1	4 (250)	4 (1800)	0	2050	4
P	3 (380)	3 (2200)	2 (320)	2900	3
Z	4 (250)	5 (1250)	0	1500	5

This USLE process is <u>not for the purpose of an AEE or for assessing effects</u> but does enable some assessment to occur of specific locations within the alignments if required. This report does not specifically address “Route E and Z Wetland”, however this can be further analysed with respect to sediment yields if required.

Appendix A of this report provides the MCA2 scoring assessment for each route based on the overall erosion and sediment control approach that can be applied and predominantly on the potential sediment yield calculated.

Particular attention was given to the potential effects on areas with high ecological values, in particular the Waipingao catchment and the Kahikatea swamp forest downstream of site E6. These sites were considered particularly sensitive to sedimentation because they are currently in pristine condition. Any accelerated sedimentation to the Waipingao catchment could also potentially impact on the Parininihi Marine Reserve. Every route had a risk of increasing the erosion or sediment load to one of these sensitive areas.

4.6 Overall scoring system

For each route option, the Habitat sub-criteria and the Sedimentation sub-criteria were scored independently on the 9 point MCA 2 scale (from +4 to -4 plus an option for a fatal flaw; Table 4.3). The scoring scale provided for a "fatal flaw" (F) negative score. [2]

The scoring system was intended to be 'absolute' rather than scoring route options relative to each other. This often resulted in routes having the same overall score. In these situations some explanation has been provided of the relative merits of different routes by using the information used to derive the scores.

An overall score for the Aquatic Environment was derived for each route by averaging the scores of each sub-criteria using a 60:40 weighting for sub-criteria of Habitat and Sedimentation respectively. The weighting was based on professional judgement of the experts and giving particular consideration to potential effects on sensitive environments (i.e. the Waipingao catchment and the Kahikatea wetland). In practice a 60:40 weighting was effectively the same as averaging the scores of the sub-criteria. This was considered reasonable considering the significant impact that sedimentation can have on streams.

The scoring of effects assumed that the Project would implement standard mitigation. For the habitat loss sub-criteria standard mitigation included:

- Fish recovery, rescue and relocation of At-risk species
- Providing suitable fish passage through culverts and stream diversions.
- Minimising effects on streams and any temporary piping of streams (for the construction period) would be restored to open channel with moderate ecological functions (an SEV of 0.6). Any off-set compensation (i.e. restoring sections of streams not directly affected by the works) was considered non-standard, and not assumed or factored into the scores assigned. It is likely that all route options will require some off-set compensation to address aquatic habitat loss.

For the sediment yield sub-criteria it was assumed that standard mitigation would include:

[2] This score was to be used where it was considered there would be unacceptable adverse effects associated with the option and that there is no reasonable way to appropriately or adequately avoid, remedy, mitigate or off-set those effects.

- Minimising the foot print discharging to sensitive areas (i.e. Waipingao Stream and Kahikatea wetland),
- Progressive stabilisation,
- Restricting earthwork catchment sizes and the use of “traditional” erosion and sediment control techniques with the use of chemical flocculation likely in some areas.
- Adaptive monitoring programmes to identify effects and implement appropriate management responses, e.g. water quality monitoring.

Table 4.3: Nine Point Scoring System used for options scoring

Scoring	Level of effect
F	Fatal flaw
-4	Very high adverse effects
-3	High adverse effects
-2	Moderate / medium adverse effects
-1	Low / minor adverse effects
0	Neutral / no change
1	Low / minor positive effects
2	Moderate / medium positive effects
3	High positive effects
4	Very high positive effects

4.7 Scoring process and MCA 2 workshop

Prior to the MCA 2 workshop, experts provided independent scoring of sub-criteria within their field of expertise. The scores were reviewed and discussed to come to a consensus view for each sub-criteria.

At the MCA2 workshop the rationale for each sub-criteria score was discussed with a wider group of experts including terrestrial ecologists, design engineers, representatives from Ngāti Tama, Department of Conservation and the design team and NZ Transport Agency. This provided opportunity to share knowledge about the sites, ensure a consistent approach was taken for different criteria and ensure that the scores could be justified. The final score for each sub-criteria was still decided by the lead expert (i.e. Keith Hamill for stream habitat and Graeme Ridley for sedimentation).

The weighting given to each sub-criteria was decided by consensus between the relevant experts (stream habitat and sedimentation). The final score for Aquatic Environment was reviewed to ensure it aligned with the experts' overall professional judgement when considering the overall potential effects on streams.

5 Results

5.1 Aquatic environment scoring results

The overall scores assigned to the Aquatic Environment Criteria (habitat loss and sediment yield combined) was -3 (high adverse effects) for Routes A, E, F and P, and -2 (moderate adverse effects) for Route Z (Table 5.1).

The Habitat Loss sub-criteria scored Route Z as having least adverse effect - at the lower end of 'moderate'. Route E had the worst adverse effects on stream habitat loss (-4) due to the large length of high quality stream being impacted. Also, the stream effected on route E were generally larger than streams on other routes. Although Routes A, F and P were given the same score (-3), Route F had more habitat lost compared to Routes A and P (see Table 5.2). For most routes (A, P, F, E) large lengths of high quality stream will be piped on the north side heading towards the respective tunnels.

From a sediment yield perspective, for the purposes of the MCA 2 process and construction water management there are no specific routes that are not considered achievable from installation, operation and maintenance of erosion and sediment controls. All routes however involve earthworking on slope angles that are very steep and this has an associated high sediment generating potential.

The slope angle will create some challenges for erosion and sediment control but this challenge is assessed as similar for each route option. Earthwork methodologies will need to be carefully managed and sequencing of works and progressive stabilisation will be a key element required throughout. As mentioned in Section 3.0 above all measures installed will be subject to geotechnical considerations to minimise potential of failure. Any wider slope failure that results, including that which may originate outside of the Project alignment, will be managed on site with associated clean-up and engineering works as necessary. There is assessed to be no route which provides for a higher risk of failure of erosion and sediment control devices than any other.

The comparative assessment of the USLE sediment yields illustrates that Routes E and Z have a similar lower potential of sediment yield with Routes F, P and A having a relatively similar high potential. Route F has a slightly higher sediment yield potential overall.

In terms of the overall scores for water environment, Options A, F, P, and Z all received the same scores for both sub-criteria. As such, the overall score for Options A, F and P was -3 (high adverse effect); and the overall score for Option Z was -2 (moderate adverse effect). Option E had an overall score of -3 (high adverse effect) because the sedimentation score (-2) balanced the habitat loss score (-4) (Table 4.1, Appendix A).[3]

Opportunities to reduce the impact of the routes and enhance environmental outcomes include:

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[3] It was agreed by the experts that the -3 overall score was appropriate notwithstanding the 60 / 40 weighting discussed above.

- Reducing impact of enabling works, particularly at northern and southern end of the routes.
- Limiting vegetation disturbance.
- Applying progressive stabilisation and more than “traditional” erosion and sediment control measures with key focus on minimising footprint of area discharging into Waipingao catchment and the Kahikatea swamp forest.
- Further reduce the footprint in the Waipingao catchment by using alternative bridge structures / piers where practical.
- Further reduce the footprint of Route E by using a bridge instead of fill on the northern side of the tunnel.

Table 5.1: Overall scoring for Aquatic Ecology sub-criteria, Habitat Loss and Sedimentation. Scores of -2 = moderate adverse effects, -3 = high adverse effects, -4 = very high adverse effects. The scoring assumes standard mitigation but no off-set compensation is applied.

Sub-criteria	Option A		Option E		Option F		Option P		Option Z	
	Score	Reason for score	Score	Reason for score	Score	Reason for score	Score	Reason for score	Score	Reason for score
Streams Habitat Loss. ECRc x stream area impacted by permanent footprint + enabling works.	-3	Large length of high quality stream impacted	-4	Large length of high quality stream impacted.	-3	Large length of high quality stream impacted. F slightly worse than P &A.	-3	Large length of high quality stream impacted	-2	Limited length of stream impacted. Mostly small, near headwaters and extension of existing culverts.
Sedimentation of streams Esp. prestine areas of Waipingao and the Kahikatea swamp forest. Utilisation of sediment yields to assist with identification of risk	-3	Vegetation clearance in Waipingao catchemnt. Potential sediment yeild >2500 tonnes	-2	Vegetation clearance, earthworks and haul roads upstream of Kahikatea wetland. Potential sediment yeild <2000 tonnes	-3	Vegetation clearance and earthworks in Waipingao catchemnt. Potential sediment yeild >2500 tonnes	-3	Vegetation clearance nd earthworks in Waipingao catchemnt. Potential sediment yeild >2500 tonnes	-2	Potential sediment yeild <2000 tonnes
Overall Score (60:40 weighting to Habitat and Sedimentation respectively)	-3		-3		-3		-3		-2	

Table 5.2: Stream length impacted and Habitat Loss Score for each route. One reasons route E had the highest Habitat Loss Score was because a greater proportion of the streams affected were of high habitat quality.

Route	Stream length footprint (m)	Stream length footprint + enabling work (m)	Habitat Loss Score (ECRc x area)
E	1850	2775	7414
F	2575	4085	5369
P	2358	3778	4807
A	1758	4018	4636
Z	625	805	632

6 Conclusions

The potential effects of the routes on aquatic ecology was assessed based on potential Stream Habitat Loss and Sedimentation. Overall Route Z had the least impacts on aquatic ecology with a score of -2 (moderate adverse effects). The other Route options each had a score of -3 (high adverse effects). For Route E the sub-criteria showed different magnitude of effects, the potential adverse effects from Stream Habitat Loss was very high (-4) and the potential effects from sedimentation was moderate (-2).

The comparative assessment of the USLE sediment yields illustrates that Routes E and Z have a similar lower potential of sediment yield with Routes F, P and A having a relatively similar high potential. Route F has a slightly higher sediment yield potential overall.

Importantly the relative differences between routes of the sediment yields could be considered minor and are within a similar order of magnitude. The scoring however reflects not only this difference in sediment yield but also reflects the sensitivities of receiving environments with the Waipangao Catchment notably more sensitive to sediment yields than the other catchment locations. This is reflected in the sediment yield scoring.

7 References

- Clapcott J 2015. *National rapid habitat assessment protocol development for streams and rivers*. Prepared for Northland Regional Council. Cawthron Report No. 2649. 29 p. plus appendices.
- Hamill K.D. 2017. *Mt Messenger Bypass Investigation: Effect on stream values*. Prepared for Opus International Consultants by River Lake Ltd.
- Storey R.G., Neale M.W., Rowe D.K., Collier K.J., Hatton C., Joy M., Maxted J. Moore S., Parkyn S., Phillips N. & Quinn J. 2011. *Stream Ecological Valuation (SEV): a revised method for assessing the ecological functions of Auckland streams*. Auckland Council Technical Report 2011/009.

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Appendices

Appendix A: Option Footprint Calculations

Table A1. Aquatic Environment Sub-Criteria Weightings and Route Option Scores

Sub-criteria	Option A			Option E			Option F			Option P			Option Z		
	Score	Reason for score	Opportunities to enhance outcome	Score	Reason for score	Opportunities to enhance outcome	Score	Reason for score	Opportunities to enhance outcome	Score	Reason for score	Opportunities to enhance outcome	Score	Reason for score	Opportunities to enhance outcome
Streams Habitat Loss ECRc x stream area. Intgegrates footprint + enabling works weighted for relative effect.	-3	Large length of high quality stream impacted	Reduce impact of enabling work at N and S end.	-4	Large length of high quality stream impacted.		-3	Large length of high quality stream impacted. F slightly worse than P &A.	Reduce impact of enabling work at N and S end.	-3	Large length of high quality stream impacted	Reduce impact of enabling work at N and S end.	-2	Limited length of stream impacted. Mostly small, near headwaters and extension of existing culverts.	
Sedimentation of streams from project works Esp. prestine areas of WaiPingao and the Kahikatea swamp forest. Utilisation of sediment yields to assist with identification of risk	-3	Vegetation clearance and Earthworks in Waipingau catchemnt. Potential sediment yeild >2500 tonnes	Usealternatives to reduce foundation footprints . Use cableway to eliminate the need for haul roads into the Waipingau catchment. Over and above standard ESC with key focus on minimising footprint of area discharging into Waipingau catchment & applying progressive stabilisation.	-2	Vegetation clearance and earthworks and haul roads upstream of Kahikatea wetland. Potential sediment yeild <2000 tonnes	Use alternative to reduce foundation footprints where applicable .Over and above standard ESC with key focus on minimising footprint of area discharging into Kahikatea Wetland & applying progressive stabilisation.	-3	Vegetation clearance and earthworks in Wai Pingao catchemnt. Potential sediment yeild >2500 tonnes	Use alternatives to reduce foundation footprints . Use cableway to eliminate the need for haul roads into the Waipingau catchment. Over and above standard ESC with key focus on minimising footprint of area discharging into Waipingau catchment & applying progressive stabilisation	-3	Vegetation clearance and earthworks in Wai Pingau catchemnt. Potential sediment yeild >2500 tonnes	Use alternatives to reduce foundation footprints . Use cableway to eliminate the need for haul roads into the Waipingau catchment. Over and above standard ESC with key focus on minimising footprint of area discharging into Waipingau catchment & applying progressive stabilisation	-2	Potential sediment yeild <2000 tonnes	Limit vegetation disturbance and earthworks - utilsie existing SH where possible.
Overall Score (60:40 weighting to Habitat and Sedimentation respectively)	-3			-3			-3			-3			-2		

Table A2. Stream length impacted and Habitat Impact Score for each route option

Corridor	Length	Area	Streams				Construction Elements				Tunnels
	(m)	(Plan - ha)	Stream Impacted Length (m)	Stream length footprint (m)	Stream habitat Impact score (ECRc x area)	Length lowland/inanga stream impacted (m)	Total Bridge	Length of bridge above 30m high	No. of Piers	Construction footprint (hectre)	(m)
A	5940	25.9	4018	2575	4636	2488	947	330	15	1.5	235
E	5250	29.7	2775	1850	7414	1595	862	0	23	2.3	230
F	5030	32.3	4085	2575	5369	2488	593	100	8	1.3	250
P	4770	32.5	3778	2358	4807	2368	631	200	10	1.3	220
Z	4230	17.8	805	625	632	0	580	0	7	1.2	240

Appendix B: Option Footprint Calculations (Aquatic Ecology)

Table B1. Environmental Compensation Ratio (ECR) and modified ECRc for sites where the SEV method was applied. ECRc is modified to be based on current SEV values rather than potential values and was used for the purposed of scoring the effects of different route options.

	Scenario	N1	N2	N7	Wai Pingao	S8	S1a	E2	E3	E4	E5	E6	E7
Impact site	Current score (SEVi-C)	0.47	0.58	0.88	0.95	0.71	0.79	0.57	0.62	0.7	0.87	0.93	0.54
	Potential score (SEVi-P)	0.73	0.78	0.88	0.95	0.78	0.8	0.73	0.78	0.78	0.88	0.93	0.73
	After impact pipe (SEVi-I)	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	After impact divert (SEVi-I)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Compensation site	Current Score (SEVm-C)	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
	Pontential score (SEVm-P)	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
ECR for piping		3.0	3.3	3.9	4.3	3.3	3.4	3.0	3.3	3.3	3.9	4.2	3.0
ECR for diversion		1.0	1.1	1.7	2.1	1.1	1.2	1.0	1.1	1.1	1.7	2.0	1.0
ECRc for piped (i.e. based on current SEV)		1.4	2.1	3.9	4.3	2.9	3.4	2.0	2.3	2.8	3.8	4.2	1.9
ECRc for diversion (i.e. based on current SEV)		1.0	1.0	1.7	2.1	1.0	1.1	1.0	1.0	1.0	1.6	2.0	1.0

Compensation site is hypothetical
ECR values <1 default to 1.

Table B2. Habitat impact scores for streams surveyed in June 2017

Habitat parameter	E1	E2	E2a	E3	E4	E5	E6	E7	A2	F2	F4
Deposited sediment	1	1	1	1	5	5	6	1	1	2	4
Invertebrate habitat diversity	4	3	7	4	7	7	9	8	4	6	8
Invertebrate habitat abundance	4	4	2	5	5	8	7	3	2	5	8
Fish cover diversity	4.5	5.5	6	4	7	7	9	7.5	5	7	7
Fish cover abundance	6	4	7	7	4	8	6	6	9	9	5
Hydraulic heterogeneity	4	8	7	7	7	8	8	7	8	7	7
Bank erosion	3	6	4	7	5	7	8	6	7	9	6
Bank vegetation	2	8	7	4	3	8	10	2	5	4.5	9
Riparian width	1	1	1	1	9	10	10	1	3	2	10
Riparian shade	4	4	5.5	1	4	8	9.5	3	8	10	9
Total score (out of 100)	33.5	44.5	47.5	41	56	76	82.5	44.5	52	61.5	73

Each habitat parameter scored on a scale of 1 to 10

Table B3. SEV scores for Mt Messenger sites surveyed during June 2017

		Site name/number					
Function category	**Variable**	**E2**	**E3**	**E4**	**E5**	**E6**	**E7**
	Vchann	0.80	1.00	0.92	0.95	1.00	0.80
	Vlining	0.86	0.96	0.98	1.00	1.00	0.86
	Vpipe	1.00	1.00	1.00	1.00	1.00	0.70
Hydraulic	=	**0.82**	**0.99**	**0.94**	**0.97**	**1.00**	**0.57**
	Vbank	1.00	1.00	1.00	0.92	1.00	1.00
	Vrough	0.20	0.20	0.72	1.00	1.00	0.21
Hydraulic	=	**0.20**	**0.20**	**0.72**	**0.92**	**1.00**	**0.21**
	Vbarr	1.00	1.00	1.00	1.00	1.00	1.00
Hydraulic	=	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
	Vchanshape	0.40	1.00	0.76	0.96	1.00	0.40
	Vlining	0.86	0.96	0.98	1.00	1.00	0.86
Hydraulic	=	**0.71**	**0.97**	**0.91**	**0.99**	**1.00**	**0.71**
Hydraulic function mean score		**0.68**	**0.79**	**0.89**	**0.97**	**1.00**	**0.62**
	Vshade	0.26	0.24	0.44	0.72	0.90	0.36
biogeochemical	=	**0.26**	**0.24**	**0.44**	**0.72**	**0.90**	**0.36**
	Vdod	0.68	1.00	0.60	1.00	1.00	0.68
biogeochemical	=	**0.68**	**1.00**	**0.60**	**1.00**	**1.00**	**0.68**
	Vripar	0.05	0.15	0.60	0.95	1.00	0.04
	Vdecid	1.00	1.00	1.00	1.00	1.00	1.00
biogeochemical	=	**0.05**	**0.15**	**0.60**	**0.95**	**1.00**	**0.04**
	Vmacro	0.75	0.81	0.96	1.00	1.00	0.90
	Vretain	0.60	1.00	0.84	0.98	1.00	0.60
biogeochemical	=	**0.60**	**0.81**	**0.84**	**0.98**	**1.00**	**0.60**
	Vsurf	0.79	0.82	0.42	0.41	0.57	0.59
	Vripfilt	0.80	0.80	0.62	1.00	1.00	0.57
biogeochemical	=	**0.80**	**0.81**	**0.52**	**0.71**	**0.79**	**0.58**
Biogeochemical function mean score		**0.48**	**0.60**	**0.60**	**0.87**	**0.94**	**0.45**
	Vgalspwn	1.00	1.00	1.00	0.85	1.00	0.83
	Vgalqual	0.75	0.25	0.00	1.00	1.00	0.00
	Vgobspwn	0.20	0.20	0.80	1.00	0.80	0.80
habitat provision	=	**0.48**	**0.23**	**0.40**	**0.93**	**0.90**	**0.40**
	Vphyshab	0.58	0.56	0.72	0.99	1.00	0.64
	Vwatqual	0.43	0.62	0.43	0.86	0.95	0.46
	Vimperv	1.00	1.00	1.00	1.00	1.00	0.90
habitat provision	=	**0.64**	**0.68**	**0.72**	**0.96**	**0.99**	**0.66**
Habitat provision function mean score		**0.56**	**0.45**	**0.56**	**0.94**	**0.94**	**0.53**
	Vfish	0.83	0.60	0.60	0.43	0.60	0.83
Biodiversity	=	**0.83**	**0.60**	**0.60**	**0.43**	**0.60**	**0.83**
	Vmci	0.56	0.74	0.96	1.00	1.00	0.90
	Vept	1.00	1.00	1.00	0.50	0.83	1.00
	Vinvert	0.47	0.70	0.35	0.66	0.77	0.58
Biodiversity	=	**0.67**	**0.81**	**0.77**	**0.72**	**0.87**	**0.83**
	Vripcond	0.20	0.20	0.75	1.00	1.00	0.12
	Vripconn	1.00	1.00	1.00	0.90	1.00	0.85
Biodiversity	=	**0.20**	**0.20**	**0.75**	**0.90**	**1.00**	**0.10**
Biodiversity function mean score		**0.57**	**0.54**	**0.71**	**0.68**	**0.82**	**0.59**
Overall mean SEV score		**0.567**	**0.620**	**0.700**	**0.869**	**0.932**	**0.540**

Table B4. Fish and invertebrates caught at Mt Messenger sites during June 2017

Site E7 (6 fine mesh fyke nets over 160m left overnight)

Species		0+	Small	Med	Large	Total
Longfin eel	*Anguilla dieffenbachii*			5	4	9
Giant kokopu	*Anguilla sp.*				1	1
Redfin bully	*Gobiomorphus huttoni*	1		5		6
Paratya shrimp	*Paratya sp.*					173

also kakahi

Site E6 (180m fished using back pack electro-fishing)

Species		0+	Small	Med	Large	Total
Banded kokopu	*Galaxias fasciatus*			4		4
Koura	*Paranephrops planifrons*		8	1		9

Site E5 (150m fished using backpack electro fishing)
9 small redfin bully

Site E4 (120m fished using backpack electro fishing)

Species		0+	Small	Med	Large	Total
Longfin eel	*Anguilla dieffenbachii*			1		1
eel unidentfied	*Anguilla sp.*	1				1
Redfin bully	*Gobiomorphus huttoni*	1	8	6		15

Site E1 (6 fine mesh fyke nets over 200m left over night)

Species		0+	Small	Med	Large	Total
Longfin eel	*Anguilla dieffenbachii*	1	1		3	5
Inanga	*Galaxias maculatus*		24	20	1	45
Redfin bully	*Gobiomorphus huttoni*			6	2	8
Common bully	*Gobiomorphus cotidianus*			3	4	7
Koura	*Paranephrops planifrons*			1		1
Paratya shrimp	*Paratya sp.*					153

also: kakahi

Site A2 (50m fished over 200m rach using back pack electro fishing).
11 koura caught but no fish

Site S5 downstream (80m fished using back pack electro fishing)
No fish caught

Table B5. Location of sites surveyed in June 2017

Site id	Catchment	Route	Riparian cover	latitude	longitude	Catchment area (ha)	Wetted width (m)
E1	Mangapepeke Stream	E	pasture	-38.873345°	174.599765°	328	1.4
E2	Mangapepeke Stream	E	pasture, degraded wetland vegetation	-38.876197°	174.600613°	306	1.4
E2a	Mangapepeke Stream	E	pasture, degraded wetland vegetation	-38.879580°	174.602552°	248	1.3
E3	Mangapepeke Stream	E	pasture, degraded wetland vegetation	-38.885127°	174.603628°	133	1.3
E4	Mangapepeke Stream	E	indigenous forest, cattle access	-38.888551°	174.601769°	116	1.8
E5	Mangapepeke Stream	E	indigenous forest	-38.892085°	174.602897°	64	2.5
E6	Mimi River	E	indigenous forest	-38.899262°	174.596944°	21	1.2
E7	Mimi River	E	pasture	-38.903693°	174.587532°	919	2.1
A2	Mimi River	A	pasture, fenced	-38.895675°	174.572545°	3	0.35
F2	Mimi River	F	bush in gully	-38.901781°	174.579585°	21	0.5
F4	Mimi River	P, F	plantation forest, pasture on flats	-38.898097°	174.576161°	17	1

Table B7. Locations of sites surveyed in February 2017. Widths called 'undefined' were wetland seeps (source, Hamill 2017).

Site id	Catchment	Route	Riparian cover	latitude	longitude	Catchment area (ha)	Wetted width (m)
N1a	Mangapepeke Stream	A, F, P	Pasture	38.873846°	174.593963°	337	1.5
N1	Mangapepeke Stream	A, F, P	Pasture	38.87997°	174.58993°	145	0.9
N2	Mangapepeke Stream	A, F, P	Pasture, long grass	38.883432°	174.588770°	125	1.4
N2 TL	Mangapepeke Stream	A, F, P	Pasture, long grass	38.884058°	174.588241°	30	0.8
N3	Mangapepeke Stream	A, F, P	Pasture	38.885866°	174.591649°	4.4	0.4
N5	Mangapepeke Stream	A, F, P, Z	Regenerating bush in incised gully	38.886579°	174.593652°	4	0.3
N6	Mangapepeke Stream	F, P, Z	Native forest	38.889289°	174.592338°	10	0.7
N7	Mangapepeke Stream	F, P	Native forest	38.891184°	174.591180°	15	0.7
W1	Wai Pingao Stream	A, F, P	Native forest	38.89664°	174.58745°	17	1.2
S1A	Mimi River	A	Native forest	38.895855°	174.567002°	13	0.8
S1	Mimi River	A	Grazed wetland	38.894720°	174.571258°	1.1	undefined
S2	Mimi River	A	Grazed wetland	38.894825°	174.572029°	1	undefined
S3	Mimi River	A	Pasture	38.894878°	174.573234°	0.4	undefined
S4	Mimi River	A	Pasture, manuka	38.895027°	174.574036°	1	undefined
S5	Mimi River	A	Pasture	38.895224°	174.575644°	0.2	n.a.
S6	Mimi River	P	Pasture, manuka	38.896165°	174.579711°	0.8	0.4
S7	Mimi River	P	Pasture, regenerating bush in gully	38.897022°	174.580442°	2.3	0.4
S8	Mimi River	P	Pasture, regenerating bush in gully	38.89859°	174.58117°	3.2	0.7

Appendix C: Option Footprint USLE Calculations

MtMA MCA2 Draft

USLE CALCULATIONS FOR EACH ROUTE

Site Name: MtMA MCA2 Process
Analysis Undertaken By: Graeme Ridley **Date of Analysis:** 27-Jun-17

Route A1

Catchment	SUB CATCHMENTS		hectares	r	k	ls	c	p	time	sdr	sed eff.	Total	
Mimi	SRP Y - A1	1	0.92	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	3.682843885	
Mimi	SRP A2	2	5	90	1.0296	20.816	1	1.32	0.5	0.7	0.95	222.8796844	
Mimi	SRP A3	3	3.37	90	1.0296	20.816	1	1.32	0.5	0.7	0.95	150.2209073	
Mimi	SRP A4	4	2.76	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	11.04853166	
Mimi	SRP A5	5	3.76	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	15.05162283	402.884
Waipingau	SRP A6 - A/B	6	1.69	90	1.0296	8.5706	1	1.32	0.5	0.7	0.95	31.01709582	
Tongaporuto	SRP A7	7	3.56	90	1.0296	54.141	1	1.32	0.5	0.7	0.95	412.7427672	
Tongaporuto	SRP A8	8	4.66	90	1.0296	54.141	1	1.32	0.5	0.7	0.95	540.2756447	
Tongaporuto	SRP A9	9	5.64	90	1.0296	36.386	1	1.32	0.5	0.7	0.95	439.4572358	
Tongaporuto	SRP A10	10	5.29	90	1.0296	36.386	1	1.32	0.5	0.7	0.95	412.1859534	
Tongaporuto	SRP A11	11	2.06	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	8.24636783	
Tongaporuto	Yard A2	12	0.92	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	3.682843885	
Mimi, Tongaporut	Disposal sites D1-D4	13	7.4	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	29.62287473	
Mimi, Tongaporut	Stockpile sites S1-S2	14	3.2	90	1.0296	0.4876	1	1.32	0.5	0.5	0.95	2.386650579	
Tongaporuto	Borrow sites B1-B2	15	5.9	90	1.0296	54.141	1	1.32	0.5	0.7	0.95	684.0399793	2532.64
Waipingau	A Tunnel portal	16	0.75	90	1.0296	54.141	1	1.32	0.5	0.7	0.95	86.91816714	
			56.88										

TOTAL 3053.46 tonnes

Route F1

Catchment	SUB CATCHMENTS		hectares	r	k	ls	c	p	time	sdr	sed eff.	Total	
Mimi	SRP F1	1	4	90	1.0296	8.5706	1	1.32	0.5	0.7	0.95	73.41324454	
Mimi	SRP F2	2	5.06	90	1.0296	36.386	1	1.32	0.5	0.7	0.95	394.264825	
Mimi	SRP F3	3	1.64	90	1.0296	36.386	1	1.32	0.5	0.5	0.95	91.2753124	
Mimi	SRP F4	8	4.59	90	1.0296	36.386	1	1.32	0.5	0.7	0.95	357.6433887	916.597
Tongaporuto	SRP F5	4	3.54	90	1.0296	20.816	1	1.32	0.5	0.5	0.95	112.7134404	
Tongaporuto	SRP F6	5	3.85	90	1.0296	8.5706	1	1.32	0.5	0.5	0.95	50.47160562	
Tongaporuto	SRP F7	6	4.65	90	1.0296	8.5706	1	1.32	0.5	0.7	0.95	85.34289677	
Tongaporuto	SRP F8	7	5.64	90	1.0296	54.141	1	1.32	0.5	0.7	0.95	653.8958446	
Tongaporuto	SRP F9	8	5.29	90	1.0296	54.141	1	1.32	0.5	0.7	0.95	613.3172018	
Tongaporuto	SRP F10	9	2.06	90	1.0296	20.816	1	1.32	0.5	0.7	0.95	91.82642996	
Tongaporuto	Yard F1	10	0.76	90	1.03	0.4876	1	1.32	0.5	0.5	0.95	0.566814521	
Tongaporuto	Yard F2	11	0.92	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	3.682843885	
Waipingau	F Bridge abutments/tunnel porta	12	1.17	90	1.0296	54.141	1	1.32	1.5	0.7	0.95	406.7770222	
Mimi, Tongaporut	Disposal sites D1-D4	13	7.4	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	29.61058753	
Mimi, Tongaporut	Stockpile sites S1-S2	14	3.2	90	1.0296	0.4876	1	1.32	0.5	0.5	0.95	2.385660626	
Tongaporuto	Borrow sites B1-B2	15	5.9	90	1.0296	54.141	1	1.32	0.5	0.7	0.95	683.7562481	2327.57
			43.17										

TOTAL 3650.94 tonnes

Route E1

Catchment	SUB CATCHMENTS		hectares	r	k	ls	c	p	time	sdr	sed eff.	Total	
Mimi	SRP E1	1	3.01	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	12.04430655	
Wetland	SRP E2	2	4.43	90	1.0296	20.816	1	1.32	0.5	0.7	0.95	197.3894917	1810.07
Tongaporuto	SRP E3	3	6.98	90	1.0296	54.141	1	1.32	0.5	0.5	0.95	577.7988634	
Tongaporuto	SRP E4	4	5.21	90	1.0296	54.141	1	1.32	0.5	0.5	0.95	431.2796674	
Tongaporuto	SRP E5	5	5.9	90	1.0296	36.384	1	1.32	0.5	0.5	0.95	328.2142571	
Tongaporuto	SRP E6	6	4.37	90	1.0296	20.816	1	1.32	0.5	0.7	0.95	194.7160449	
Tongaporuto	SRP E7	7	3.34	90	1.0296	8.5706	1	1.32	0.5	0.7	0.95	61.27463269	
Wetland	E Bridge abutment	8	0.75	90	1.0296	36.386	1	1.32	0.5	0.7	0.95	58.41422267	
Mimi	Yard E1	9	0.79	90	1.0296	0.4876	1	1.32	0.5	0.5	0.95	0.588959967	210.023
Tongaporuto	Yard E2	10	2.92	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	11.68417778	
Tongaporuto	Disposal	11	4.8	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	19.20686759	
Tongaporuto	Borrow	12	1.1	90	1.0296	54.141	1	1.32	0.5	0.7	0.95	127.4799785	
			43.6										

TOTAL 2020.09 tonnes

Route P

Catchment	SUB CATCHMENTS		hectares	r	k	ls	c	p	time	sdr	sed eff.	Total	
Mimi	SRP Yard : SRP Y-P1	1	1.17	90	1.0296	8.5706	1	1.32	0.5	0.7	0.95	21.46446714	
Mimi	SRP P1	2	3.42	90	1.0296	8.5706	1	1.32	0.5	0.7	0.95	62.74228857	385.836
Mimi	SRP P2/Z2	3	5.29	90	1.0296	20.816	1	1.32	0.5	0.7	0.95	235.7088964	
Mimi	SRP P3	4	4.45	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	17.80636683	
Mimi	SRP P4	5	1.23	90	1.0296	8.5706	1	1.32	0.5	0.5	0.95	16.11800646	
Waipingau	SRP P5/Treatment tank	6	0.63	90	1.0296	54.141	1	1.32	0.5	0.5	0.95	52.15090028	322.289
Waipingau	SRP P6	7	2.33	90	1.0296	54.141	1	1.32	0.5	0.7	0.95	270.1378223	
Tongaporuto	SRP P7	8	5.23	90	1.0296	8.5706	1	1.32	0.5	0.5	0.95	68.56272659	
Tongaporuto	SRP P8	9	2.01	90	1.0296	8.5706	1	1.32	0.5	0.7	0.95	36.89015538	
Tongaporuto	SRP P9	10	4.99	90	1.0296	54.141	1	1.32	0.5	0.5	0.95	413.2396485	
Tongaporuto	SRP P10	11	4.71	90	1.0296	54.141	1	1.32	0.5	0.5	0.95	390.0518526	
Tongaporuto	SRP P11	12	5.37	90	1.0296	36.384	1	1.32	0.5	0.7	0.95	418.3963905	2203.7
Tongaporuto	SRP P12	13	2.65	90	1.0296	36.384	1	1.32	0.5	0.5	0.95	147.4794406	
Tongaporuto	SRP Yard : SRP Y-P2	14	3.33	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	13.32476439	
Mimi, Tongaporut	Disposal sites D1-D4	13	7.4	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	29.61058753	
Mimi, Tongaporut	Stockpile sites S1-S2	14	3.2	90	1.0296	0.4876	1	1.32	0.5	0.5	0.95	2.385660626	
Tongaporuto	Borrow sites B1-B2	15	5.9	90	1.0296	54.141	1	1.32	0.5	0.7	0.95	683.7562481	
			63.31										

TOTAL 2879.83 tonnes

Route Z

Catchment	SUB CATCHMENTS		hectares	r	k	ls	c	p	time	sdr	sed eff.	Total	
Mimi	SRP Z1	1	5.29	90	1.0296	0.4876	1	1.32	0.5	0.5	0.95	3.943795222	
Mimi	SRP Z2	2	3.02	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	12.08432086	
Mimi	SRP Z3	3	3.11	90	1.0296	20.816	1	1.32	0.5	0.7	0.95	138.5736612	232.905
Tongaporuto	SRP Z4	4	4.74	90	1.0296	8.5706	1	1.32	0.5	0.7	0.95	86.95861047	
Tongaporuto	SRP Z5	5	3.85	90	1.0296	8.5706	1	1.32	0.5	0.5	0.95	50.45067063	
Tongaporuto	SRP Z6	6	5.16	90	1.0296	20.816	1	1.32	0.5	0.7	0.95	229.9164282	
Tongaporuto	SRP Z7	7	2.82	90	1.0296	20.816	1	1.32	0.5	0.7	0.95	125.6520015	
Tongaporuto	SRP Z8	8	2.65	90	1.0296	8.5706	1	1.32	0.5	0.5	0.95	34.72578628	
Mimi	Z Bridge abutments/tunnel porta	9	0.67	90	1.0296	54.141	1	1.32	0.5	0.7	0.95	77.64689597	1256.78
Mimi	SRP Y / Z1	10	0.88	90	1.0296	0.4876	1	1.32	0.5	0.5	0.95	0.656056672	
Tongaporuto	SRP Y- P2 / Z2	11	3.33	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	13.32476439	
Mimi, Tongaporut	Disposal sites D1-D4	13	7.4	90	1.0296	2.6171	1	1.32	0.5	0.5	0.95	29.61058753	
Mimi, Tongaporut	Stockpile sites S1-S2	14	3.2	90	1.0296	0.4876	1	1.32	0.5	0.5	0.95	2.385660626	
Tongaporuto	Borrow sites B1-B2	15	5.9	90	1.0296	54.141	1	1.32	0.5	0.7	0.95	683.7562481	
			52.02										

TOTAL 1489.69 tonnes

Assumptions:

Rainfall is based on a 2 year 6 hour duration rain event to provide the accepted rain volume. HIRDs data utilised for Mt Messenger location

Slope analysis is based on current slope class and is determined through design plans and contours provided. The slope angle is based on average slope taken from design plans and based on slope groups.

Slope length is based on a maximum of 50m which will reflect the natural contours and also installation of contour drains which will be installed during the earthworks programme.
Soil types (particle size distribution) is based on geotechnical advice as 5% clay, 80% silt, 15% sand. Note that this is assumed to be uniform throughout the project routes as advised by geotechnical team. This is also based on this fill occurring over alluvium flats and other locations. PSD data will allow this to be refined for specific route assessment once selected.

C and P Factors based on compacted earthworks surface prior to rainfall.

Duration of earthworks is based on a uniform duration of 6 months for proposed earthworks in each sediment retention pond catchment after which full stabilisation is achieved. This will be revised for specific route assessment once selected and based on a mass haul programme.

Sediment Delivery Ratio is based on 0.7 due to steep slopes (whereby 70% of the sediment generated travels to the sediment retention pond) unless the catchment slope is less than 10 degrees where 0.5 is used (50% of the sediment generated travels to the sediment retention pond).

Efficiency of sediment control measures based on 95% removal of sediment as a standard for MCA2. This can be expected to be achieved for the selected route with chemical treatment etc as required. It also acknowledges that there will be some areas of the site that are treated by measures other than sediment retention ponds which will not achieve the same level of efficiency.

Rainfall

6 Hour Duration 2 Year ARI (mm)	53.7
R = 0.00828*P2.2*1.7	
R Factor	90.037

K Factor

Soil Composition as above	
Nomograph Value	0.64
Correction Factor (0% Organic)	0.14
Metric Conversion	1.0296

LS Factors

Degrees	% Slope Used for MtMA MCA2	LS Factors
0 to 5	4	0.4876
5 to 10	13	2.6171
10 to 20	27	8.5706
20 to 30	47	20.816
30 to 40	70	36.386
40 and above	100	54.141

Appendix D: ESCP Conceptual Plans

RidleyDunphy

Item	Bill description	Unit	Route P1 Quantity	Route Z7 Quantity	Route A1 Quantity	Route E1 Quantity	Route F3 Quantity	Comments and assumptions
	MtMA MCA2 Process - Estimated Costs and Quantities - Dated 18 June 2017							
1	**Erosion & Sediment Control**							
1.1	**Sediment Retention Ponds and Decanting Earth Bunds**							
1.1.1	**SRPs**							**catchment areas assumes the construction footprint a nominal distance either side of the alignment (typically 10-15 m)**
	SRP's up to 3 ha: 1100 m3	**no.**	**9**	**8**	**8**	**3**	**6**	includes ponds for borrow, stockpiling & surplus fill areas > 1ha & ponds for 2 construction yards per route.
	Excavate to bund/stockpile for up to 1100m3 storage - includes approx. 60 m3 (~10%) of excavation for forebays	m3	9900	8800	8800	3300	6600	SRP Volumes to be confirmed however for current purpose this provides an indication of likely volumes including forebay
	Decant - allow 1050 manhole x 1.5m high, 3 x floating decants, 12.5m x 450mm outlet pipe	no.	9	8	8	3	6	
	Misc (riprap, geotextile, concrete etc)	LS ($K)	18	16	16	6	12	Will need to allow a sum for each device - could be $2K per SRP device
	Chemical Treatment Based on Floc shed and chemical	no.	4	3	3	1	2	contingency, assumed 40% of ponds will require floc treatment $1500 Floc testing / $2000 per shed / $2000 chemical per shed per year (dependent upon rainfall)
	SRP's 3-5 ha: 1800 m3	**no.**	**7**	**6**	**7**	**4**	**8**	includes ponds for borrow & fill areas > 1ha & ponds for 2 construction yards per route
	Excavate to bund/stockpile for up to 1800m3 storage - includes approx. 200 m3 (~10%) of excavation for forebays	m3	12600	10800	12600	7200	14400	SRP Volumes to be confirmed however for current purpose this provides an indication of likely volumes
	Decant - allow 1050 manhole x 1.5m high, 3 x floating decants, 12.5m x 450mm outlet pipe	no.	7	6	7	4	8	
	Misc (riprap, geotextile, concrete etc)	LS ($K)	17.5	15	17.5	10	20	Will need to allow a sum for each device - could be $2.5 K per SRP device
	Chemical Treatment Based on Floc shed and chemical	no.	3	2	3	2	3	contingency, assumed 40% of ponds will require floc treatment $1500 Floc testing / $2000 per shed / $2000 chemical per shed per year
	SRP's 5-7 h: 2500 m3	**no.**	**3**	**2**	**4**	**3**	**3**	5-7ha ponds may be replaced with 2x 3ha ponds if space allows
	Excavate to bund/stockpile for up to 2500m3 storage - includes approx. 225 m3 (~10%) of excavation for forebays	m3	5400	3600	7200	5400	5400	SRP Volumes to be confirmed however for current purpose this provides an indication of likely volumes
	Decant - allow 1050 manhole x 1.5m high, 3 x floating decants, 12.5m x 450mm outlet pipe	no.	3	2	4	3	3	
	Misc (riprap, geotextile, concrete etc)	LS ($K)	7.5	5	10	7.5	7.5	Will need to allow a sum for each device - could be $2.5 K per SRP device
	Chemical Treatment Based on Floc shed and chemical	no.	1	1	2	1	1	contingency, assumed 40% of ponds will require floc treatment $1500 Floc testing / $2000 per shed / $2000 chemical per shed per year
1.1.2	**DEBs with floating decant (catchments < 0.3ha)**		**15**	**15**	**15**	**15**	**15**	nominally 15 DEBs assumed for each route with 60m3 volume per DEB required - some of these will be short term only
	Excavate to bund/stockpile for up to 60m3 storage	m3	900	900	900	900	900	
	Floating decants - allow 6m 160mm pvc plus elbow, 2 times 1.8m waratah, 30m2 geotextile	no.	15	15	15	15	15	
	Geotextile - As above	m2	450	450	450	450	450	assumes 30m2/DEB
	Floc Socks - 1 per DEB with replacement times 10 per season	no.	450	450	450	450	450	assumes 3 construction seasons
	Treatment tanks with flocculation							
	Treatment tanks (for activities such as pumping and also difficult access locations)	no.	1	NA	1	NA	NA	Assumed to be required for catchments discharging to Waipingau. $1500 Floc testing / $2000 per shed / $2000 chemical per shed per year
1.2	**Longitudinal Sediment Control**							
1.2.1	**Silt Fence**							
	Standard silt fence	m	2,000	2,000	2,000	2,000	2,000	assumed 2000 m required
	Standard silt fence replacement materials only	m	1000	1000	1000	1000	1000	50% of initial installation
1.2.2	**Super Silt Fence - Culvert #s**		**7**	**10**	**9**	**8**	**9**	
	Super silt fence - around inlets and outlets of all culvert locations	m	560	800	720	640	720	assumed 80 m SSF required per culvert. No. of culverts as priced for Drainage
	Super Silt Fence for Bridge Piers and Similar - Protection of Wetland		100	100	200	200	150	
	Super silt fence replacement materials only	m	330	450	460	420	435	50% of initial installation
1.2.3	**CWD**							
	Topsoil strip and bund establishment - Where possible (Assume same length as DWD) - will attempt to use permanent drainage if available	m	1600	1300	600	700	1000	
	Stabilised earth bunds - allow 3m/Lm of geotextile	LS	-	-	-	-	-	contingency, assumed to be required for 50% of CWD bunds
1.2.5	**DWD, Rock Checks and Flumes**							
	Dirty water diversions (pipes/channels) to divert water into a treatment pond	m	1600	1300	600	700	1000	pipes assumed 200 mm diameter novcoil, channels assumed 1.5 m wid, 0.5 m deep trapezoidal earth channel. Additional to permanent water diversion channels & pipes
	Flumes to take water from fill surface down batters without erosion	no.	10	10	10	10	10	Made from geotextile and rock rip rap or layflat - nominal length 50 m assumed per flume. Note: this is additional to permanent flume structures.
	Rock check dams to be established in drains - 1.5m3 each	LS	-	-	-	-	-	In higher risk locations such earth drains >10% grade , assumed to be required for 50% of the diversion channels. This is additional to the permanent swales/rip rap lined drains
1.3	**Other**							
1.3.1	**Stabilisation (including batters)**							
	Stabilisation - hydroseeding and Mulching - also assumes some staging of EW and winter close down - assume $0.50 per m2 and approx 20ha per year	m2	TBC	TBC	TBC	TBC	TBC	Assumed all non-rock cut and fill batters will be hydroseed. Area to be confirmed with 12D model output
	Batter/Surface stabilisation - in addition to item above - truck hay mulching (based in $0.50 per m2) - assume 5ha per year for 3 seasons per route	LS	750000	750000	750000	750000	750000	For risk items such as temp batters and stockpiles and rain adaptive management. LS only as stockpile extents are unknown.
	Batter stabilisation - temporary grassing / mulching	m2						Back up risk item as necessary, assumed 50% of area will require temporary stabilisation to suit staging of works
	Batter stabilisation - geotextile (over and above bunds as above)	m2						Back up risk item as necessary, assumed 30% of area will require geotextile stabilisation
	Hardfill stabilisation - construction yards, access tracks	m2	16000	16000	16000	16000	16000	assumed 2 construction yards per option, approximate area of 8000 m2 each, 200 mm thick layer of hardfill
1.3.1	**Access tracks**							
	Hardfill stabilisation	m	5300	10000	6000	6000	6000	nominal width of 10 m assumed for access tracks
	Drainage	LS	-	-	-	-	-	lined (geotextile and/or rock) table drain assumed on either side of access track - TBC
	Temporary crossings	no.	7-10	10-12	4-6	10-12	10-12	assumed 300 mm boss pipe, with min 300 mm thick hardfill overtop. No. crossing approximate only and estimated from indicative access track alignment
1.3.2	**Dust Control**							
	Watercart for Dust Control: Summer Months	LS	-	-	-	-	-	assume 2 required full time
	Watercart for Dust Control: Winter Months (provisional)	LS	-	-	-	-	-	assume not required
1.3.3	**Site Entrances**							
	Stabilised entranceways - allow 60m3 GAP40, 2.5m3 asphalt per entrance	LS	TBC	TBC	TBC	TBC	TBC	assumed to be required for construction yards only, 2 yards per route option
	Wheel washing / water blasting - 5 per route at 3K per unit	LS ($K)	15	15	15	15	15	assumed to not be required - contingency should however be provided for some wheel wash (water blaster) options - maybe 5 per route ?
1.3.4	**Stream diversion**							
	Constructing diversion drains	m						Priced as part of drainage
	Sand bags for stream diversions	LS	-	-	-	-	-	Assumed 2000 sand bags required
	Nova coil for temporary piping for stream	m	1000	1000	1000	1000	1000	Contingency item included here for stream diversions, where permanent solution cannot immediately be installed - 1000m ..?
	Stabilising the inlet and outlet of stream diversions (rip rap or geotextile)	LS	-	-	-	-	-	No. of diversion as priced as part of drainage. Assumed a 3 m length of channel to be stabilised at either end
	Temporary controls for enabling works							
	Straw, mulch, log check dams, silt socks	LS	2500	2500	2500	5000	2500	Additional measures to protect the wetland streams during enabling works. Required on all routes with particular applicability for route E
1.3.4	**Miscellaneous Items: Procure or Install**							
	Tree protection fencing	LS	-	-	-	-	-	Unknown
	Hazardous goods shed	no.						Unknown
	Environmental controls to be used throughout the site (sand bags, nova coil, geotextile to stabilise bunds, filter socks bark filled 4 m lengths)	LS	-	-	-	-	-	Covered above
	Pump provision for stream diversions and general pumping / No of pumps	no.	10	10	10	10	10	nominally assumed that 10 pumps required
	Spill Kits - Small "Fish Bin"	no.	10	10	10	10	10	Required on all routes
	Spill Kits - Large "Wheelie Bin"	no.	5	5	5	5	5	Required on all routes
	Spill kit replacement materials	LS	1000	1000	1000	1000	1000	Required on all routes
1.3.5	**Concrete wash out**							
	Low skip	no.						Not necessary - will utilise existing controls on site and bunded areas
	Off-site removal of high pH water	LS	-	-	-	-	-	Not necessary - will utilise existing controls on site and bunded areas
1.4	**Maintenance & Removal**							
	Pond maintenance	LS	-	-	-	-	-	assumed per pond: quarterly forebay maintenance , decant clear out three times, main pond cleaned once
	Other ESC maintenance	LS	-	-	-	-	-	To be included
	Maintenance crew for environmental management	mth						To be included
	Road sweeping	LS	-	-	-	-	-	To be included
	Water quality testing / Monitoring eg WQ Sampling	LS	-	-	-	-	-	May be priced elsewhere but ecology / water sampling / labour and analysis ?
	Removal of ESCP Controls - SSF and Bunds	LS	-	-	-	-	-	To be included
	Removal of ESCP Controls - SRPs & DEBs	LS	-	-	-	-	-	To be included

Appendix L: Cultural heritage

Multi-criteria analysis shortlist: Ngati Tama cultural report

July 2017

Ngati Tama/Tama Hovell

Contents

1 Introduction

The Alliance is investigating alternative options for upgrading or bypassing State Highway 3 (SH3) in the vicinity of Mt Messenger, in North Taranaki.

Following the first MCA process five corridors have been identified as part of the short-listed process. The short-listed options were assessed via a multi-criteria analysis (MCA) process which scored nine criteria: transport, resilience, constructability, landscape, historic heritage, community, property, ecology and cultural heritage. Criteria were scored by specialists prior to presenting at a collaborative workshop on 26-27 June 2017.

This paper summarises the evaluation and scoring of the cultural heritage criteria.

2 2. Background

- The background is set out in the Ngati Tama cultural values assessment.
- A key feature of this project is that it may require the taking of land that was returned to Ngati Tama as part of their Treaty settlement. The land is important given its Treaty settlement and raupatu (confiscation) background. Further, the land has strong value as a place for customary and kaitiaki values and practices.
- The cultural values assessment identified all proposals that involve the taking of Ngati Tama land as essentially fatally flawed. This recognises that any proposal which involves taking of Ngati Tama land conflicts with Ngati Tama mana and cultural values, undermines the Treaty settlement and reinforces past raupatu. While Te Runanga o Ngati Tama understands the need for a safe and efficient state highway through this area, if such proposal is to progress, it must ensure that impacts on the relationship of Ngati Tama with their rohe are fully considered and addressed. The traditional practice of muru provides a conceptual framework for considering means of addressing such impacts and to avert the negative and potentially long-term consequences of such land take and associated effects. All of the short-listed options would seek to traverse Ngati Tama land to lesser or greater extents.

3 Methodology

3.1 Data/information used

The background information is set out in the cultural values assessment. In addition, Ngati Tama members provided direct information for the MCA process.

3.2 Sub-criteria and weightings (including justification)

The sub-criteria used for the MCA process include the following:

- Treaty settlement land
- Ara tupuna (ancestral and customary pathways)

- Kokako (and other native fauna)
- Wahi tapu / maunga - tihi (important mountains / peaks)
- Ngahere / rakau (native bush and trees – Tanemahuta attributes)
- Awa (waterways)
- Mauri
- Mana / kaitiakitanga

3.3 Process for scoring

The process for scoring involved a focused workshop with Ngati Tama representatives in New Plymouth prior to attending the MCA workshop in Wellington, and further discussions during the MCA workshop to refine the scoring. There can be overlaps between cultural values and other matters, such as ecological and landscape assessments. The role of the cultural scoring was to focus on the cultural values, and was a focus of the Ngati Tama group as part of the scoring process. Further, the scoring was related to corridor alignment factors only, with the only design elements being either structure or non-structure (earthwork) options. The scoring is therefore subject to understanding further design elements, such as impacts on waterways, ngahere (bush) and trees, impacts on birds and other fauna etc.

3.4 What determines fatal flaws

For Ngati Tama, any proposal which seeks to take Treaty settlement land is considered a fatal flaw as a starting point. This recognises that such proposal conflicts with Ngati Tama values and tikanga giving rise to impacts on Ngati Tama mana and cultural and spiritual well-being. The tikanga of muru provides a conceptual framework in which it may be possible to achieve some reconciliation of these impacts. For the long-list options fatal flaws were shown in situations where the modifications to the whenua / awa or other features were of such a scale that they went too far, and would be a major and ongoing source of distress (whakama and riri) notwithstanding any restorative measures. While the scoring of the short-listed options do not show any overall scores of fatal flaw, this reflects a good faith position adopted by Ngati Tama to allow for an exploration of whether there are restorative measures that can be taken back to Ngati Tama in order to address the impacts of those options.

3.5 Mitigation assumptions

Some common mitigation approaches are set out in the CVA report, including measures such as a kaitiaki forum for ongoing consultation and input into design, discovery protocols, ceremonial measures, and cultural recognition elements, and it is assumed that these measures will be incorporated into the project, regardless of the option selected. The scoring does not factor in any offset mitigation. There is a parallel process occurring in which Ngati Tama and the Agency are exploring restorative measures. At this stage, the approach to these measures is to explore possible options that can then be taken back to the Ngati Tama collective.

4 Scoring

The attached table provides the scoring. The scoring was undertaken primarily by Ngati Tama members with the assistance of Tama Hovell who gave the presentation and assisted with this report. The sub criteria a briefly discussed below.

4.1 Treaty settlement land

This criterion relates to the impact of the project on the Ngati Tama Treaty settlement land. All short-listed options seek to take Ngati Tama land in different extents. The sub-criterion has been scored -4 / F, recognising the impacts of such taking on Ngati Tama. This criterion also encompasses potential effects on the customary practices, values and relationship of Ngati Tama with the whenua.

4.2 Ara tupuna (ridgelines / connection between cultural spaces and features)

Options A, F and P involve significant cuts on the southern ridge.

4.3 Kokako (and other fauna (location and spatial extent)

All options will likely have an impact on Kokako (and other fauna) to some degree. The -3 for the majority of options is possibly overlay generous and they may more appropriately fall to be treated as a -4, but reflects an acknowledgement at this stage that the structure options (incorporating bridges and tunnels) have been included into the project and assist with the impacts on fauna. Similarly, the -2 for the Z option simply reflects that this is largely the existing corridor alignment. It is possible that the scoring for this sub-criterion may be different on further consideration.

4.4 Wahi tapu / maunga – tihi

The biggest influence in this sub-criterion has been the proximity to the maunga peaks which have cultural and spiritual value to Ngati Tama.

4.5 Ngahere / rakau (valued for its Tanemahuta attributes, forest / wai / manu / kaitiaki)

It has been noted by Ngati Tama that 'there is no such thing as a good option', when you consider the attributes affected by the project. The Ngahere attributes are greatly valued by Ngati Tama. It has even been noted that the established nature of ngahere means that this land is superior to any other land.

4.6 Awa (Waipingao and Tongaporutu are important customary waterways)

In addition to the Waipingao and Tongaporutu, Ngati Tama are also kaitiaki for the Mimi River which has major cultural and spiritual importance, not only to Ngati Tama, but also to Ngati Mutunga. For the particular area impacted, Ngati Tama have kaitiaki responsibilities in relation to the awa and their neighbouring whanaunga iwi. This is another sub-criterion in which the scoring has been very generous. There are more detailed issues to consider such as the mauri of the waterways. While a influential factor was what was noted to Ngati Tama as being minimal impact from runoff from the project to the Waipingao stream, this may require further investigation through the process. Further, there may be consequential effects of taking water from the Waipingao catchment to other systems and thus mixing the mauri of different waterways.

4.7 Mauri / wairua (association with place and features impacted by introduction of road infrastructure)

This sub-criterion reflects impacts of the project on the connection of Ngati Tama with the affected area. There is the possibility that the project may break the relationship of Ngati Tama with their whenua and their confidence in the environment.

4.8 Mana / kaitiaki responsibilities (whakama and riri)

This sub-criterion reflects the overall score for the options, and reflects the well-being of Ngati Tama based on the above factors as well as their cultural and spiritual values and customs. All scores are given a -4. As noted, there are no fatal flaws based on a good faith constructive approach taken by the Runanga. In accordance with cultural and spiritual customs, the proper position is more likely a fatal flaw approach. The Runanga recognises that it needs to go through a process with their people on restorative measures to ensure potential impacts on the people are assuaged.

4.9 Weighted score

The weighted score is purely to provide some assistance on which options may be more favoured by Ngati Tama and are not to be treated as an actual scoring.

4.10 Scoring table

		A	E	F	P	Z
Sub-criteria	Treaty settlement land (Ngati Tama held land)	-4 / F	-4 / F	-4 / F	-4 / F	-4 / F
	Ara tupuna (ridgelines / connection between cultural spaces and features)	-4 (cut on southern ridge)	-3 (severance / barrier / extent of cuts and fill)	-4 (major cut on southern side)	-4 (major cut on southern side)	-3
	Kokako (and other fauna) (location and spatial extent)	-4	-3	-3	-3	-2
	Wahi tapu / maunga - tihi	-3	-2	-4	-4	-4 / F
	Ngahere / rakau (valued for its Tanemahuta attributes, forest / wai / manu / kaitiaki)	-4	-4	-4	-4	-3
	Awa (Waipingao and Tongaporutu are important customary waterways)	-3 (assumes all runoff going out of catchment)	-4 (Tongaporutu catchment)(scale)	-3	-3	-2
	Mauri / wairua	-4	-4	-4	-4	-3

	(association with place and features impacted by introduction of road infrastructure)					
	Weighted score	-3.8	-3.4	-3.8	-3.8	-3.3
Overall	Mana / kaitiaki responsibilities (whakama and riri)	-4	-4	-4	-4	-4

Appendix M: MCA scoring results

Raw scores

Criteria	Owned By	Option A	Option E	Option F	Option P	Option Z
		Score	Score	Score	Score	Score
Constructability	Stephane Riot / Duncan Kenderdine	-4	-3	-2	-2	-4
Transport	Eliza Sutton	3	2	2	2	2
Resilience	Stephen Crawford	-3	1	2	2	1
Landscape	Bruce McKenzie	-3	-1	-4	-3	-1
Historic heritage	Rod Clough	-2	-1	-1	-1	-1
Community	Wendy Turvey	1	1	1	1	0
Property	Mark Spring	-3	-3	-3	-3	-2
Terrestrial ecology	Matt Baber	-3	-3	-4	-3	-3
Water environment	Brett Ogilvie	-3	-3	-3	-3	-2
Cultural heritage	Ngāti Tama	-4	-4	-4	-4	-4
TOTAL		-21	-14	-16	-14	-14
RANK		5	1	4	1	1

Weighted scores: RMA

Criteria	Weighting	Option A	Option E	Option F	Option P	Option Z
		Weighted score	Weighted score	Weighted score	Weighted score	Weighted score
Constructability	**0.5**	-2	-1.5	-1	-1	-2
Transport	**0.9**	2.7	1.8	1.8	1.8	1.8
Resilience	**0.8**	-2.4	0.8	1.6	1.6	0.8
Landscape	**0.9**	-2.7	-0.9	-3.6	-2.7	-0.9
Historic heritage	**0.9**	-1.8	-0.9	-0.9	-0.9	-0.9
Community	**0.6**	0.6	0.6	0.6	0.6	0
Property	**0.5**	-1.5	-1.5	-1.5	-1.5	-1
Terrestrial ecology	**0.9**	-2.7	-2.7	-3.6	-2.7	-2.7
Water environment	**0.9**	-2.7	-2.7	-2.7	-2.7	-1.8
Cultural heritage	**1**	-4	-4	-4	-4	-4
TOTAL		-16.5	-11	-13.3	-11.5	-10.7
RANK		5	2	4	3	1

Weighted score: Environment

Criteria	Weighting	Option A	Option E	Option F	Option P	Option Z
		Weighted score	Weighted score	Weighted score	Weighted score	Weighted score
Constructability	0.5	-2	-1.5	-1	-1	-2
Transport	0.6	1.8	1.2	1.2	1.2	1.2
Resilience	0.6	-1.8	0.6	1.2	1.2	0.6
Landscape	0.7	-2.1	-0.7	-2.8	-2.1	-0.7
Historic heritage	0.5	-1	-0.5	-0.5	-0.5	-0.5
Community	0.5	0.5	0.5	0.5	0.5	0
Property	0.2	-0.6	-0.6	-0.6	-0.6	-0.4
Terrestrial ecology	1	-3	-3	-4	-3	-3
Water environment	1	-3	-3	-3	-3	-2
Cultural heritage	1	-4	-4	-4	-4	-4
TOTAL		-15.2	-11	-13	-11.3	-10.8
RANK		5	2	4	3	1

Weighted score: Transport

MCA2 outcomes	Weighting	Option A	Option E	Option F	Option P	Option Z
		Weighted score	Weighted score	Weighted score	Weighted score	Weighted score
Constructability	0.9	-3.6	-2.7	-1.8	-1.8	-3.6
Transport	0.9	2.7	1.8	1.8	1.8	1.8
Resilience	0.9	-2.7	0.9	1.8	1.8	0.9
Landscape	0.7	-2.1	-0.7	-2.8	-2.1	-0.7
Historic heritage	0.5	-1	-0.5	-0.5	-0.5	-0.5
Community	0.5	0.5	0.5	0.5	0.5	0
Property	0.5	-1.5	-1.5	-1.5	-1.5	-1
Terrestrial ecology	0.7	-2.1	-2.1	-2.8	-2.1	-2.1
Water environment	0.7	-2.1	-2.1	-2.1	-2.1	-1.4
Cultural heritage	0.8	-3.2	-3.2	-3.2	-3.2	-3.2
TOTAL		-15.1	-9.6	-10.6	-9.2	-9.8
RANK		5	2	4	1	3

Appendix N: Indicative consenting risk

N. Indicative consenting risk

Planning analysis (bold emphasis added)

Relevant provisions	Option A	Option E	Option F	Option P	Option Z
Operative New Plymouth District Plan					
*Objective 14: To **preserve** and enhance the natural character of the coastal environment, wetlands, and lakes and rivers and their margins.*					
Policy 14.2: The natural character of wetlands and RIVERS and lakes and their margins **should not be adversely affected** by inappropriate subdivision, use or development and should, where practicable, be restored and rehabilitated.	X	X	X	X	
*Objective 15: To **protect** and enhance outstanding landscapes and regionally significant landscapes within the district.*					
Policy 15.2: Subdivision, use and development **should not result in adverse visual effects** on, and should enhance, where practicable, the following regionally significant landscapes: – White Cliffs and associated conservation forest.	XX		XXX	XX	
Objective 16: To sustainably manage, and enhance where practical, indigenous vegetation and habitats.					
Policy 16.2: Land use, development and subdivision **should not result in adverse effects** on, and should enhance where practical, the quality and intrinsic values of areas of indigenous habitats.	XX	XX	XXX	XX	XX
Draft New Plymouth District Plan					
Waterbodies objectives: WB-01: The values of waterbodies and their surroundings are protected and maintained. WB-02: Waterbodies are enhanced and restored. WB-03: Waterbodies provide a network of indigenous biodiversity.					
Policy WB-P2: **Protect** the values of waterbodies by: a) managing activities on or along the margins of waterbodies which adversely impact on waterbody values; b) **requiring** the erection of structures,	X	X	X	X	

Relevant provisions	Option A	Option E	Option F	Option P	Option Z
including buildings and roads, adjacent to waterbodies and/or waterbody margins to be set back an adequate distance to **avoid** adverse effects on those values; and c) controlling subdivision and earthworks.					
<u>Policy WB-P4</u>: Require that activities proposing to located on or along a priority waterbody demonstrate the activity is located appropriately having regard to the effects of the activity and: a) the particular natural character, ecological, cultural, amenity and/or recreational values of the waterbody and the impact on those values; b) the extent to which the values of the waterbody may be compromised by the activity; c) the purpose of the activity and whether it has a functional need to locate on or along a waterbody; and d) the ability to effectively restore and rehabilitate the waterbody and/or off-set adverse effects.	X	X	X	X	
Indigenous biodiversity objectives: <u>IB-01</u>: Significant areas of indigenous biodiversity are **protected** and maintained. <u>IB-02</u>: Indigenous biodiversity is maintained and enhanced and the threats to areas of biodiversity from pests and stock are managed. <u>IB-03</u>: There are ecological linkages between areas of indigenous biodiversity.					
<u>Policy IB-P3:</u> **Protect**, maintain and enhance significant natural areas by: a) **preventing** the destruction, degradation and/or clearance of indigenous vegetation in significant natural areas; b) ensuring the erection of structures and earthworks within or in proximity to areas of significant natural areas **do not** compromise the area's biodiversity values;	XXXX	XXX	XXXX	XXXX	XXX

Relevant provisions	Option A	Option E	Option F	Option P	Option Z
Outstanding natural landscapes objective: ONL-01: Outstanding landscapes and natural features that are important to the identity of the district are protected and retained.					
Policy ONL-P1: Recognise and schedule the following outstanding natural features and landscapes: (e) Parininihi;	XXX		XXX	XXX	
Policy ONL-P3: **Protect** and maintain outstanding natural landscapes by: a) **avoiding** inappropriate activities on or in proximity to outstanding natural landscapes which compromise the landscape values present; b) ensuring the erection of structures, earthworks and/or clearance of indigenous vegetation, on or in proximity to outstanding natural landscapes **do not compromise** the landscape values present; and c) controlling subdivision of land on or in proximity to outstanding natural landscapes.	XXXX		XXXX	XXXX	
Taranaki Regional Freshwater Plan					
Objective 3.1.5: To maintain and enhance amenity values and the quality of the environment of Taranaki's rivers, lakes and wetlands and their margins.	XX	X	XX	XX	X
Objective 4.1.1: To recognise and provide for the cultural relationship and values of Iwi and hapu of Taranaki with water, and with ancestral land and sites, wāhi tapu and other taonga associated with fresh water, and the beds of rivers and lakes, in a manner reflective of their status as Tangata Whenua and in accordance with Tikanga Maori.	XX	X	XX	XX	X
Policy 6.6.2: Structures in or on river and lake beds will be required to provide for the unrestricted passage of fish, or will be required to contain suitable facilities to		X			

Relevant provisions	Option A	Option E	Option F	Option P	Option Z
enable fish passage through or past the structure.					
Taranaki Regional Soil Plan					
Policy 1.3: The Taranaki Regional Council will encourage the retention of appropriate vegetative cover on erosion-prone land by: a) Discouraging soil or vegetation disturbance where that disturbance is likely to cause significant accelerated erosion;	XX	X	XX	XX	X