Appendix J

Cost Estimate and Value for Money Reports

NZ TRANSPORT AGENCY
WAKA KOTAHI

Peka Peka to Otaki Expressway
Scheme Estimate and Risk Report

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Revision Schedule

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V1	15-9-11	DRAFT Scheme Estimate and Risk Report			

NZ Transport Agency

Contents

1. Introduction

1.1 General

This report focuses on the methodology that has been used to produce the Scheme Estimate (SE) and risk management issues and documents the inputs and outputs for the Peka Peka to Otaki (PP20) Expressway project.

The estimate has been prepared and reviewed in accordance with NZTA's 'Cost Estimation Manual' (SM014), 'Risk Management Process Manual' (AC/Man/1) and Opus' internal 'Cost Estimating Guidelines'.

Project risk management has been undertaken using NZTA's 'Risk Management Process Manual' (AC/Man/1), ISO 31000 Risk Management Principles and Guidelines and generally accepted global best practice.

1.2 Scope of Report

This report identifies the processes undertaken in developing the following:

- Base Estimate;
- Indicative construction programme duration and completion date(s);
- Qualitative risk assessment;
- Quantitative risk analysis;
- Expected and 95th percentile estimates;
- P50 and P95 construction completion dates; and
- Top 10 risks on the project (as defined by the project team).

2. Project Scope

2.1 Defined Scope of Project

The project extents are defined as Taylors Road north of Otaki to Te Kowhai Road north of Peka Peka, a length of approximately 12.2km, as shown in Figure 2-1 below.

Figure 2-1 PP20 Project Extent

The project involves extensive earthworks, bridging and a realigned section of the North Island Main Trunk Line (NIMT) through Otaki, further details on the scope can be found in the Design Philosophy Report and Scheme Assessment Drawings.

3. Estimate Assumptions

3.1 General Assumptions

In forming the Scheme Estimate the following general assumptions have been made:

- NZTA managed costs have allowed for costs associated with the project. No provision has been allowed for extraordinary circumstances such as Environment Court appeals etc. NZTA managed costs for each of the project phases have been provided by the NZTA project manager;
- The project would be a Design and Construct type contract;
- The construction period is 44 months as determined by the Indicative Construction Programme;
- The revocation of SH1 and the off-road pedestrian and cycle way (inclusive of the Otaki River Bridge clip-on) are treated as a separate project and not included in the estimate. The removal of the north and south bound passing lanes either side of Te Horo and direct tie-in costs are however included with the expressway project;
- The expressway is assumed to tie into the new alignment from the MacKay's to Peka Peka expressway project in the south and the existing state highway in the north;
- No allowance has been made for the proposed realignment of the North Island Main Trunk (NIMT) Line at Mary Crest. This is considered part of a separate Kiwi Rail project;
- A 100km/h design speed has been used for the new local arterial alignment at Mary Crest; and
- Parts of the NIMT designation will be used as part of the storm-water system for the project.

3.2 Exclusions

The following items have been excluded from the project estimate:

- GST;
- Escalation beyond the time the estimate was prepared, namely 2nd Quarter 2011;
- Sunk costs, includes those costs associated with 1998-2003 investigations and 2009 consultation. Project costs only include costs incurred after NZTA Board authority in 2009; and
- Operational and maintenance costs once the project is constructed; these are considered separately within the project economic evaluation.

4. Base Estimate

4.1 Quantities and Rates

4.1.1 General

All rates have been assumed to be at 2nd quarter 2011 (Q2/11).

The rates have been developed using a combination, of the following methods:

- Unit rates taken from previous projects and adjusted, where deemed necessary, to reflect the size, nature and location of project and date of the rates;
- Resource based from first principles; and
- Supplier provided estimates.

4.1.2 Quantities

Quantities have been developed using preliminary inputs from various technical specialists as well as utilising AutoCAD drawings an MX outputs to measure quantities and volumes.

4.1.3 Property

Property estimates have been provided by NZTA. They allow for the nett property cost, as defined in SM014, namely "The market value, at the base date, of any property purchased or required to be purchased for a project, less the market value of any surplus property i.e. Nett Property only includes the corridor required".

The costs include the assessed survey and legalisation costs, as well as the capital cost of the land. The proposed footprint of the route was provided to NZTA, including the area in each land parcel. This footprint was the area required to construct the route but the property costs supplied are the costs required to secure the footprint, i.e. in some instances, the purchase of the whole of a parcel of land has been considered necessary to obtain the land required to construct the route, as opposed to only acquiring the route footprint within the parcel. It also includes the value of land already acquired by NZTA for the project.

The cost of acquiring the extra corridor for future double tracking is not included in the cost estimates; however the design allows for this to occur in the future and the corridor width provided includes sufficient room for sub-grade and drainage.

4.1.4 Professional Fees & Client Managed Costs

Consultant and NZTA fees have been allowed for as follows:

- I&R: Consultancy fees and NZTA managed costs are complete (as provided by NZTA);
- D&PD: Consultancy fees (detailed schedule prepared and costed) and NZTA managed costs (as provided by NZTA project manager); and
- MSQA: Consultancy fees (detailed schedule prepared and costed); NZTA managed costs and Consent monitoring (1.5% as provided by NZTA project manager).

4.1.5 Environmental Compliance

The most significant components within Environmental Compliance are the permanent erosion and sediment control measures. The scheme design makes significant use of swales and ponds for dealing with stormwater and as such outside of this there is not a large quantum of permanent erosion and sediment control measures as the swale system provides a significant amount of treatment. Notwithstanding this, we have identified and produced preliminary designs for temporary basin requirements as a matter of completeness.

It is expected that a large portion of the permanent stormwater devices will be able to be used as they are constructed, minimising the need for temporary erosion and sediment control measures.

Due to the predominantly rural nature of the site noise mitigation measures are relatively small. Preliminary investigations into the locations requiring mitigation have been undertaken and the necessary noise bunds or noise walls included within the estimate. Noise mitigation is predominantly provided by the use of low noise surfacing, such as Open Graded Porous Asphalt (OGPA). The mitigation measures are based on the preliminary acoustics report produced during the SARA phase.

4.1.6 Earthworks

Earthworks quantities have been derived from the Mass Haul spreadsheet created using data from the MX model of the Scheme Design. Based on inputs from the technical geotechnical reports produced to date various assumptions regarding suitability of cut material, cut slope requirements and depths of undercut have been incorporated into the earthworks design and quantities.

It has been assumed that all cut to waste can be disposed of on site. Given the current alignment has a shortage of fill, some borrow to fill has been included. Unsuitable undercut material has been assumed to be able to be used for non-structural fill material and for use in noise and landscape bunds.

It has been assumed that in areas of peat that the material is undercut to suitable depth so as to not require any pre-loading. However in some areas where peat is over 3m deep, any remaining peat will be preloaded as the difficulty and cost associated with excavating peat below this depth begins to increase significantly. It is assumed that preloading will be required for 12 months before sufficient settlement is achieved. The rate for undercut to waste of peat material includes for backfilling with suitable fill material.

Using the mass haul developed (refers Figure 4-1and Figure 4-2) first principle based estimates were prepared to determine the rates for the various earthworks operations. The rates were based on the likely type of operation, the machinery expected to be used and the distance of the haul. An allowance was also made for a haul road (between 500m to 9500m) along the route from the main cut on the southern side of the Otaki River to the Mary Crest overbridge.

Figure 4-1provides a grammatical representation of the cut/fill comparison for the scheme design. It shows large cut volumes around chainages 1000, 4000 to 5000, and 10500 which provide a general balance of materials for the project. The estimate has assumed only a small amount of imported fill would be required.

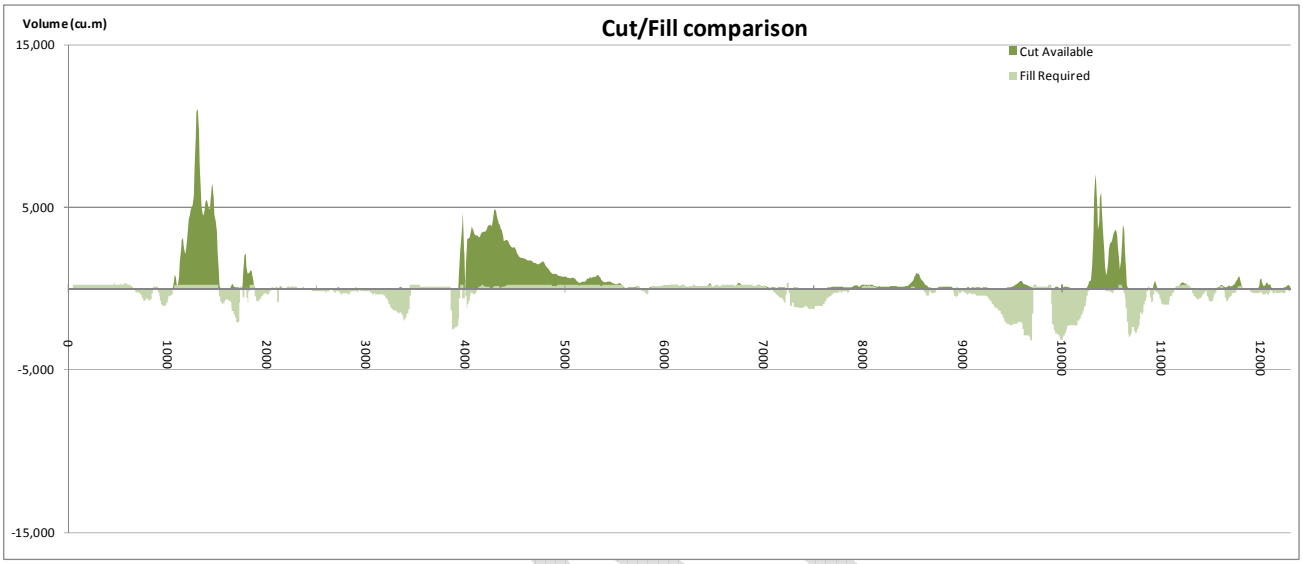

Figure 4-1: Cut/Fill Comparison

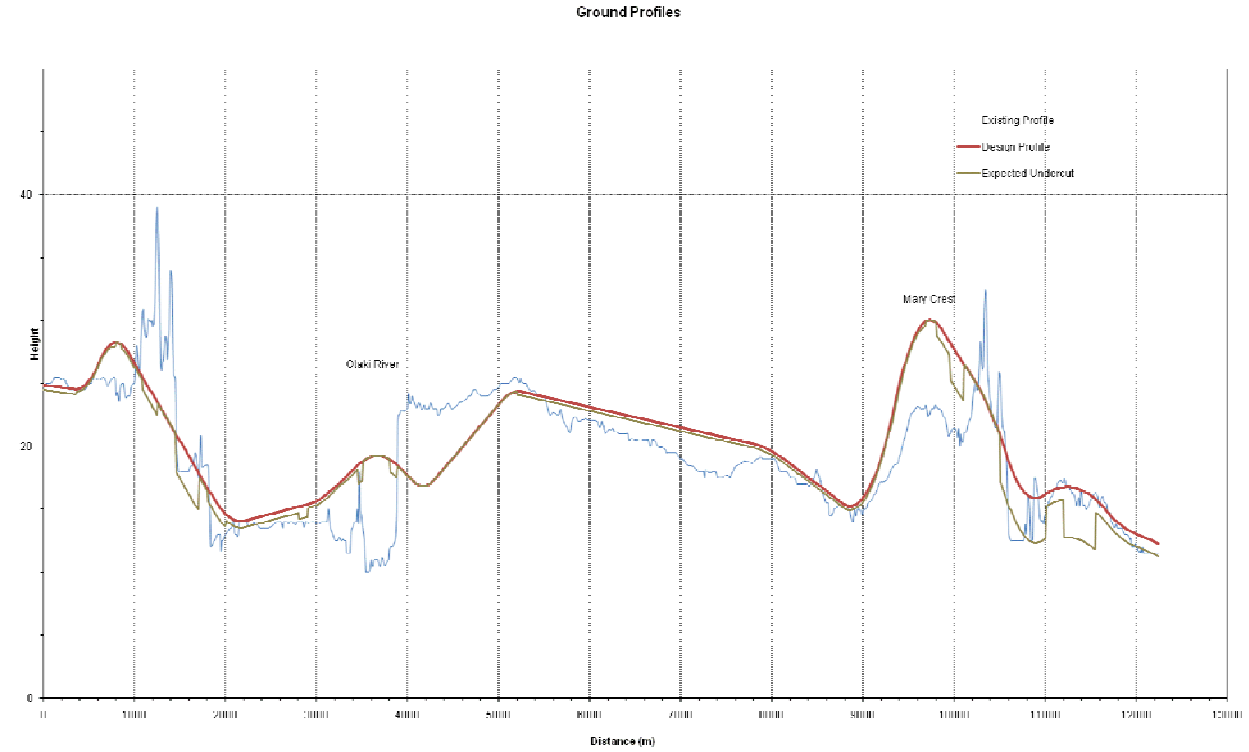

Figure 4-2: Earthworks Ground Profiles

Figure 4-2 shows the existing and design project profile along with expected undercut areas (with relative depths). Again, as with Figure 4-1above, this design knowledge and assumption(s) has been incorporated within the earthworks element of the estimate either within rate build-up or quantum of undercut required.

Figure 4-3 below illustrates the movement of material across the project. This plays an important part in the estimate as these assumptions form an integral part of the earthworks rates, particularly as travel-distance and time is a significant contributing factor in the rates.

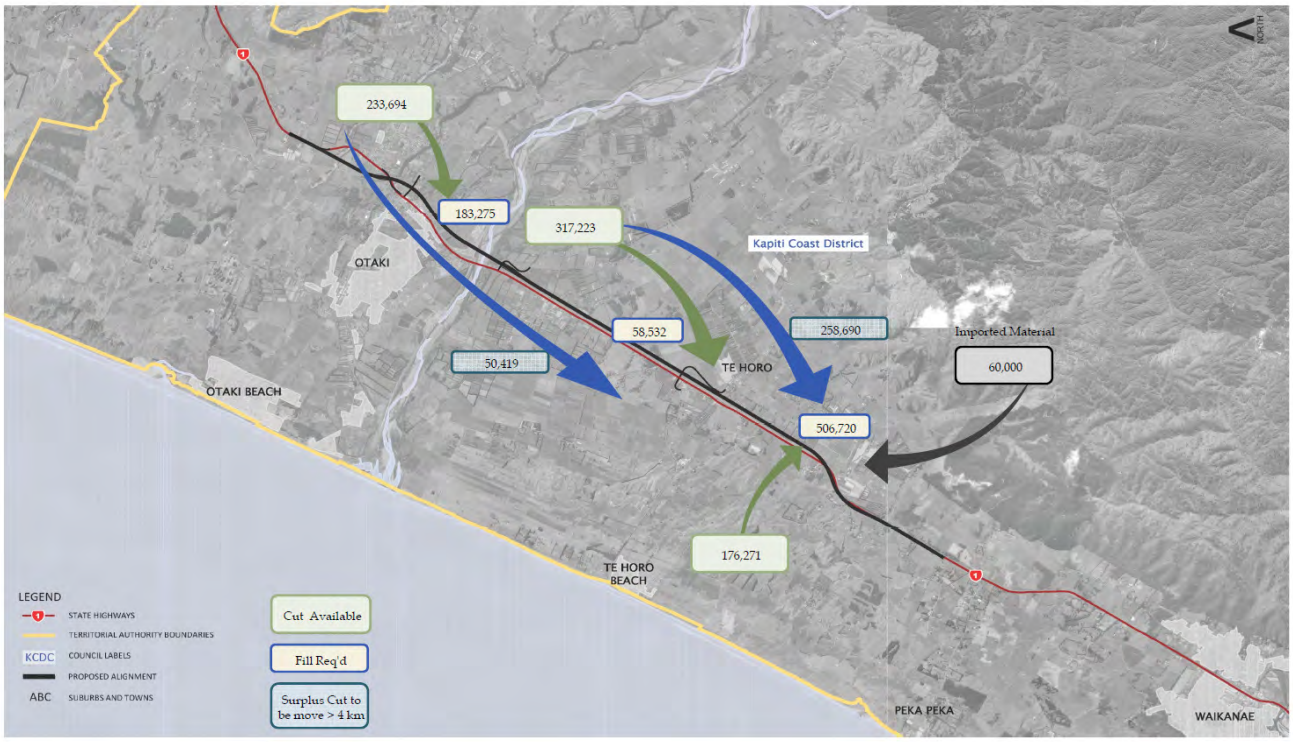

Figure 4-3: Earthworks Material Movement along Site

4.1.7 Ground Improvements

Ground improvements have been based on preliminary geotechnical reports produced. It has been assumed that the fill embankments required for over bridges and underpasses will require some form of geogrid reinforcement.

4.1.8 Drainage

Drainage items have been based on preliminary stormwater design undertaken to date. The majority of the expressway is drained using the swale system and as such there isn't a large number of physical drainage devices such as sumps and manholes. These are generally restricted to local roads and interchanges.

Where a stream diversion is required the cross-section of the channel has been assumed to be no less than three times the area of the downstream culvert.

4.1.9 Pavements and Surfacing

A pavement design based on a subgrade CBR of 10 has been assumed. The subgrade CBR will be either engineered fill or in situ cut materials. There is a risk that up to 30% of the in situ subgrade or subgrade fill material may be below the design CBR 10. This could mean that additional undercut is required or a thicker pavement will be required where subgrade is below the design level. This has been taken account within the schedule risk model (quantity variance).

The typical pavement cross-section for the expressway is shown below;

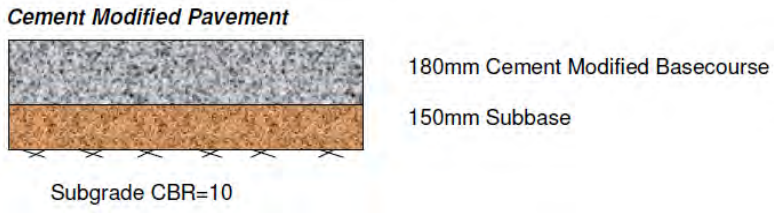

Figure 4-4 Typical Pavement Cross-Section

The local roads have a similar cross-section but the basecourse layer is unmodified.

It has been assumed that OGPA surfacing 30mm thick will be required over a length through Otaki as well as through Te Horo. Local roads and the remaining areas of the expressway will be surfaced with a grade 3/5 chip seal. Noise mitigation measures may result in OGPA being used on some local roads as well, it is also likely that OGPA will be used at local road roundabouts and intersections.

An allowance has also been made for property accesses, these would typically involve reshaping of entranceways, some additional drainage items and sealing from the road edge to property boundary.

The rates developed for the pavement materials are based on a material source within a 10km radius of the site.

4.1.10 Bridges

The rate for each bridge reflects the level of architectural and structural qualities of the structure. The rates are based on the preliminary design of each bridge and there likely structure form, detailed structure design of each bridge has not been undertaken. A number of options were presented for each bridge with various costs associated with each type, if the bridge type's change due to urban design requirements, constructability issues etc, then an associated change in cost is expected.

A 'clip-on' pedestrian / cycle lane to the existing Otaki River bridge has also been excluded (part of the revocation project). The proposed design allows for the additional lane to be supported by piers at the same intervals as the existing SH1 river bridge.

4.1.11 Retaining Walls

Interchange abutments have been assumed to have MSE walls with concrete facing panels. The walls are formed as either vertical walls in areas where space is constricted or as 'spill through' abutments where additional space is available and a more open feel is desired.

4.1.12 Traffic Services

The expressway will have a wire rope barrier along the entire length of the median, except across the Otaki River Bridge where a bridge barrier will be used and where rigid barriers are needed to protect bridge piers. It has been assumed that local roads will require test level 3 barriers with test level 4 or 5 barriers needed on over-bridges across the expressway. The expressway will have test level 4 barriers with test level 5 barriers on bridges.

Side barriers have been included in areas where the fill batters are greater than 2(H):1(V). Where embankments are above 2m they have been steepened from 4(H):1(V) to 2(H):1(V) with side protection barriers also included.

A median width of 6m has been used throughout the project. This includes a 4m grassed strip between the opposing lanes of the expressway, and a 1m sealed shoulder either side of the grassed strip.

We have allowed for 2 gantries along the expressway with directional and distance signage on the expressway, at interchanges and on the local roads. The expressway will also have three variable message signs adjacent to the half interchanges and where the expressway begins at Taylors Road. Lighting has been assumed only at bridges, interchanges and intersections, not along the entire length of the expressway.

4.1.13 Service Relocations

We are still waiting on the cost of services relocations to be provided by the utilities providers (requested early August 2011). An estimate based on previous projects has been undertaken. Once information is received from utilities providers it will be included in the estimate.

4.1.14 Landscaping and Urban Design

The landscaping and urban design work has sought to provide a scope that appropriately reflects the location and impact of the proposals with the aim to ultimately obtaining the necessary consents for the scheme. No specific landscape design has been undertaken to date, although scheme concepts are currently being developed. The estimate is based on other projects of a similar scope and size.

4.1.15 Traffic Management and Temporary Works

No specific design has been undertaken. Preliminary discussions around staging have been held which have been used to develop the estimate. The estimate is based on assumptions from the Scheme Estimate Construction Programme around the time taken to complete various stages which involve interaction with live traffic lanes. The estimate also reflects the importance and traffic volumes of the various affected roads and the corresponding level of temporary traffic management required.

4.1.16 Preliminary and General

The preliminary and general (P&G) costs have been determined using a first principal build rate build up including allowances for site establishment, site staff, and site office requirements.

As the project has been assumed to be procured via a design and construct contract, the P&G costs also include the contractors design fees.

4.1.17 Extraordinary Construction Costs

The realignment of the NIMT through Otaki has been included in this item. It has been assumed that a temporary station will be required while the existing Otaki Station is relocated. There is also a 1000m long switching line which is to be constructed as part of these works, allowance for a stabling is not included in the estimate. The rates are based on the earthworks and drainage required for two tracks but the actual formation of only one rail line, except for where the parallel switching line is included.

4.2 Breakdown of Base Estimate

Item	Base Estimate ($'s M)
Nett Project Property Cost	26.30
Investigation and Reporting	5.45
Design and Project Documentation	5.30
Management, Surveillance, Quality and Assurance	7.95
Environmental Compliance	0.85
Earthworks	17.50
Ground Improvements	2.50
Drainage	11.00
Pavement and Surfacing	15.75
Bridges	53.35
Retaining Walls	2.80
Traffic Services	6.10
Service Relocations	3.45
Landscape and Urban Design	6.50
Traffic Management and Temporary Works	3.40
Preliminary and General	40.70
Extraordinary Construction Costs	10.5
Project Base Estimate	**219.4**

5. Construction Methodology and Programme

5.1 Programme Methodology

Figure 5-1 Project Sections

An indicative construction programme for the PP2O project has been developed. This was done for two reasons:

- To understand a likely duration for the project to help enable a better understanding of cost; and
- To recognise the potential complexities in the build programme, allowing us to identify potential opportunities and to recognise the critical path activities.

The programme has been developed using the project teams construction knowledge and with inputs from contractors, particularly in the area of earthworks and bridge construction.

Figure 5-1 adjacent indicates the project sections used to develop the programme. This split was used as part of the programme make-up in terms of earthworks (mass-haul), potential staging, areas of ground improvements and pre-loading, and bridges needing completion to allow other works to proceed.

The following assumptions have been incorporated within our programme:

- Earthworks productivity: motorscrapers: 200m3/hour, excavators and trucks: 150m3/hour; with number of crews on site at any one time: 6;
- Earthworks sections commenced first: 2 (Otaki River) and 4 (Mary Crest), due to cut fill availability, preloading areas and off-line working, also note: a haul road is required between Sta 5000m to 9500m to facilitate earthworks movements;
- While commencing works at Section 2 may not immediately seem logical, the construction of North Otaki bridge is required before any earthworks can occur in Section 1. By undertaking the works in this order we can complete the realignment of the NIMT, Otaki Station and service relocations prior to any roading works occurring, giving the space and opportunity for unhindered working;
- Bridges – Otaki River Bridge and Otaki North commenced early in programme this is to facilitate movement of cut material and assist works in Otaki township, also bridges are on the programme critical path for this project;
- Preloading materials at Mary Crest impose a 9 to 12 month waiting period prior to any bridge works in that area, the bridge abutments are founded in an area of peat; and
- Site offices would be set-up just south of the Otaki River, with a satellite set-up towards Peka-Peka, assumed necessary given the distance of the site.

5.2 Indicative Construction Programme

Using the above methodology and assumptions an indicative construction programme is included in Appendix C. This programme was prepared using Primavera P6 and as such represents a step-change in project programming for Opus in project delivery.

6. Cost and Programme Risk Assessment and Analysis

6.1 Risk Methodology

6.1.1 Identification

Our aim in risk identification was to generate a comprehensive list of opportunities and threats that may create, enhance, prevent, accelerate or delay the achievement of a successful project delivery. It was considered critical to ensure a complete list, as risks not identified cannot be included in further analysis.

Identification has included risks whether or not their source is under the control of NZTA, and the examination of any knock-on effects of consequences, including cascade and cumulative effects. Along with identifying what might happen, it is necessary to consider possible causes and scenarios that show what consequences can occur.

Relevant and up-to-date information is considered important when identifying risks. In this regard the second risk meeting held 31st of August 2011, started with a blank piece of paper, rather than the existing register, with the aim to encourage fresh thinking (by the project team) rather than be led by previous events. Subsequently, cross-referencing has been made with the existing register and identified risks from the latest meeting to ensure a comprehensive risk understanding.

Both opportunities and threats were identified, with both considered "risks".

Types of risk identification processes include (but not limited to) checklists, one-on-one interviews, facilitated brainstorming workshops. Similarly, active risk identification i.e. as and when it is seen or identified is a powerful identifier.

Identified risks as recorded in the project risk register included the following elements:

- a short descriptive title;
- clearly described with cause and effect descriptors (i.e. sediment control during construction does not meet consent condition requirements due to poor erosion & sediment control management / design / construction of structures leading to consent breach – fines and negativity publicity); and
- assigned a status, one of the following:
    - emerging – the full extent of the risk was still undefined;
    - live – the risk was defined and is being actively or passively managed;
    - parked – the risk was excluded from current management processes; and
    - closed – the risk is no longer a threat or opportunity to the project.

6.1.2 Risk Assessment

Our risk assessment involved developing an understanding of the risk, in terms of likelihood (probability) and consequence (impact). The risk assessment provides an input to risk evaluation, helps define whether the risk needs to be actioned, and guides the most appropriate form of risk treatment strategy and/or mitigation.

Our risk assessment prioritised risks according to their potential effect on project objectives, helping to determine the importance of each risk, and rationalising mitigation/treatment efforts towards areas where there will be demonstrable project benefits.

There are two elements to assessment:

- Likelihood - the assessed probability of any given event (including a consideration of the frequency with which the outcome may arise); and
- Consequence – the assessed affect or the result of any given event.

Table 1a: Rating the Likelihood (L) of a Threat
(Generally applicable to a passive process)

Likelihood	Probability (for short term activities such as asset improvement)	Frequency (for long term activities such as in asset management and Corporate business)	Description
Likely	>50%	Greater than once per year	The threat can be expected to occur *or* a very poor state of knowledge has been established on the threat.
Quite Common	20%-50%	Once per 1-5 years	The threat will quite commonly occur *or* a poor state of knowledge has been established on the threat.
Unlikely	10%-20%	Once per 5-10 years	The threat may occur occasionally *or* a moderate state of knowledge has been established on the threat.
Unusual	1%-10%	Once per 10 – 50 years	The threat could infrequently occur *or* a good state of knowledge has been established on the threat.
Rare	<1%	Less than once per 50 years	The threat may occur in exceptional circumstances *or* a very good state of knowledge has been established on the threat.

Table 6.1: Rating Table Threat(s)

Table 1b: Rating the Likelihood (L) of an Opportunity
(Generally applicable to an active process)

Likelihood	Probability (for long and short term activities)	Description	Rating
Almost Certain	>90%	The opportunity is almost certain to be realised *or* a very high degree of confidence in delivering the gains has been established for the opportunity	5
Expected	75% - 90%	The opportunity is expected to be realised in most circumstances *or* a high degree of confidence in delivering the gains has been established for the opportunity	4
Likely	50% - 75%	The opportunity will probably be realised *or* a moderate degree of confidence in delivering the gains has been established for the opportunity	3
Unlikely	25% - 50%	The opportunity is unlikely to be realised *or* a low degree of confidence in delivering the gains has been established for the opportunity	2
Very Unlikely	<25%	The opportunity is very unlikely to be realised *or* a very low degree of confidence in delivering the gains has been established for the opportunity	1

Table 6.2: Rating Table Opportunity(s)

Table 2: Rating the Consequence

	Descriptor	Health & Safety	Image / Reputation	Environment	Stakeholder Interest	Cost	Time
Threat	Substantial	Multiple fatalities	International Media Cover	Permanent widespread ecological damage	Commission of Inquiry	+$10M	Many years
	Major	Several fatalities	Sustained National Media Cover	Heavy ecological damage, costly restoration	Ministerial Inquiry	+ $1M to $10M	Years
	Medium	Serious Injuries	Regional Media Cover or Short Term National Cover	Major but recoverable ecological damage	Ministerial Questions or 3rd party investigation	+ $100k to $1M	Months
	Minor	Minor Injuries	Local Media Cover	Limited but medium-term negative effects	Official Information Request	+ $10k to $100k	Weeks
	Negligible	Slight Injuries	Brief Local Media Cover	Short-term damage	Minor Complaint	+ $0 to $10k	Days
Opportunity	Negligible	Prevention of Slight Injuries	Brief Local Media Cover	Short-term enhancement	Letter of support	- $0 to $10k	Days
	Minor	Prevention of Minor Injuries	Local Media Cover	Limited but medium-term enhancement	Submission in support for RMA and LTMA	- $10k to $100k	Weeks
	Medium	Prevention of Serious Injuries	Regional Media Cover or Short Term National Cover	Medium to long term ecological enhancement	Champions in community	- $100k to $1M	Months
	Major	Saving of Several fatalities	Sustained National Media Cover	Long Term and important ecological enhancement	Small financial contribution	- $1M to $10M	Years
	Substantial	Saving of Multiple fatalities	International Media Cover	Permanent widespread ecological enhancement	Large financial contribution	-$10M	Many Years

Table 6.3: Consequence/Enhancement Ratings

Table 6.1, Table 6.2 and Table 6.3 above were used in the assessment of risk on the PP2O project.

Ratings for both likelihood and consequence are based on professional judgement and by (team) consensus. Two ratings are required by this risk management process:

1. Current – rated at the time of risk identification, which should incorporate any control measure in place at that time, but not future strategies; and
2. Target – the expected the risk rating (either likelihood or consequence) to finish after all controls and mitigations have been implemented.

6.1.3 Evaluation

The purpose of risk evaluation is to assist in making decisions. It is based on the outcomes of the risk assessment (above) and identifies which risks need treatment and the priority for treatment implementation.

The evaluation matrix assigns each risk event a rank using the likelihood and consequence ratings established through Table 6.1, Table 6.2 and Table 6.3 above.

MITIGATE WHENEVER POSSIBLE

Likelihood	CONSEQUENCES (loss)				
	Negligible (1)	Minor (10)	Medium (40)	Major (70)	Substantial (100)
Likely (5)	5 Low threat ACCEPT ACTIVELY - Enhance systems to minimise potential - Accept - Repair	50 Moderate threat ACCEPT ACTIVELY - Enhance systems to minimise potential	200 Very high threat AVOID - Immediate action - Enhance systems to minimise potential	350 Extreme threat AVOID Immediate action - Cease activity	500 Extreme threat AVOID - Immediate action - Cease activity
Quite Common (4)	4 Low threat ACCEPT ACTIVELY - Enhance systems to minimise potential - Accept - Repair	40 Moderate threat ACCEPT ACTIVELY - Enhance systems to minimise potential - Insure	160 Very High threat AVOID - Immediate action - Enhance systems to minimise potential	280 Very high threat AVOID - Immediate action - Contingency Plans	400 Extreme threat AVOID - Immediate action - Cease activity
Unlikely (3)	3 Negligible threat ACCEPT PASSIVELY - Repair	30 Moderate threat ACCEPT ACTIVELY - Enhance systems to minimise potential - Insure - Contingency Plans	120 High threat ACCEPT ACTIVELY OR TRANSFER - Immediate action - Insure - Contingency Plans	210 Very high threat AVOID - Immediate action - Avoid - Contingency Plans	300 Very high threat AVOID - Immediate action - Avoid - Contingency Plans
Unusual (2)	2 Negligible threat ACCEPT PASSIVELY - Repair	20 Low threat ACCEPT ACTIVELY OR TRANSFER - Repair	80 High threat ACCEPT ACTIVELY OR TRANSFER - Monitor - Insure - Contingency Plans	140 High threat AVOID OR TRANSFER - Monitor - Insure - Contingency & Disaster Plans	200 Very high threat AVOID OR TRANSFER - Monitor - Insure - Contingency & Disaster Plans
Rare (1)	1 Negligible threat ACCEPT PASSIVELY - Repair	10 Low threat ACCEPT ACTIVELY OR TRANSFER - Repair	40 Moderate threat ACCEPT ACTIVELY OR TRANSFER - Monitor - Insure - Contingency Plans	70 High threat AVOID OR TRANSFER - Monitor - Insure - Contingency & Disaster Plans	100 High threat AVOID OR TRANSFER - Monitor - Insure - Contingency & Disaster Plans

MINIMISE WHENEVER POSSIBLE

ENHANCE WHEREVER POSSIBLE

Likelihood	CONSEQUENCES (gain)				
	Negligible (-1)	Minor (-10)	Medium (-40))	Major (-70)	Substantial (-100)
Almost Certain (5)	-5 Low Opportunity ACCEPT ACTIVELY - ENHANCE	-50 Moderate Opportunity ACCEPT ACTIVELY - ENHANCE	-200 Very high Opportunity ACCEPT ACTIVELY - ENHANCE	-350 Extreme Opportunity ACCEPT ACTIVELY - ENHANCE	-500 Extreme Opportunity ACCEPT ACTIVELY
Expected (4)	-4 Low Opportunity ACCEPT ACTIVELY – ENHANCE/MAXIMISE	-40 Moderate Opportunity ACCEPT ACTIVELY – ENHANCE/MAXIMISE	-160 Very High Opportunity ACCEPT ACTIVELY – ENHANCE/MAXIMISE	-280 Very high Opportunity ACCEPT ACTIVELY – ENHANCE/MAXIMISE	-400 Extreme Opportunity ACCEPT ACTIVELY - ENHANCE
Likely (3)	-3 Negligible Opportunity ACCEPT PASSIVELY	-30 Moderate Opportunity ACCEPT PASSIVELY	-120 High Opportunity ACCEPT ACTIVELY – ENHANCE/MAXIMISE	-210 Very high Opportunity ACCEPT ACTIVELY – ENHANCE/MAXIMISE	-300 Very high Opportunity ACCEPT ACTIVELY - MAXIMISE
Unlikely (2)	-2 Negligible Opportunity REJECT	-20 Low Opportunity ACCEPT PASSIVELY	-80 High Opportunity ACCEPT PASSIVELY	-140 High Opportunity ACCEPT PASSIVELY	-200 Very high Opportunity ACCEPT ACTIVELY - MAXIMISE
Very Unlikely (1)	-1 Negligible Opportunity REJECT	-10 Low Opportunity REJECT	-40 Moderate Opportunity REJECT	-70 High Opportunity ACCEPT PASSIVELY	-100 High Opportunity ACCEPT ACTIVELY - MAXIMISE

MAXIMISE WHENEVER POSSIBLE

Table 6.4 Evaluation Matrices

The evaluation matrix is established against the amount of risk NZTA is prepared to tolerate, accept, seek to enhance or manage, i.e. its risk appetite.

6.2 Qualitative Risk Assessment

The project risk register is attached in Appendix D. The qualitative assessment involved identification of risks and then categorising of the potential likelihood of occurrence and consequences. Likelihoods were ranked from 'rare' to 'likely', while consequences ranged from 'negligible' to 'substantial'. The qualitative analysis of the risks identified the risk level which is dependent on the likelihood and the potential consequences. As with global best practice, both opportunities and threats are identified in the same manner.

The quantitative risk analysis involved putting a cost against each of the identified risks, this cost was either in terms of a monetary cost as part of the scheme estimate or a time cost against the scheme estimate programme. Depending on whether the risk was an opportunity or a threat this cost is either negative or positive.

Based on the risk workshops a total of 70 risks have been identified as having a potential to impact the estimate or construction programme or both, of which (15) are opportunities. These are included in the quantitative risk analysis model, refer Appendix G. The number of risks in each category is summarised below:

- 8 Extreme (2 opportunities);
- 33 Very High (6 opportunities);
- 18 High (5 opportunities);
- 9 Moderate (1 opportunity);
- 1 Low; and
- 1 Negligible (1 opportunity).

6.2.1 The Top 10 Project Risks

The top 10 risks as identified and evaluated by the project team include:

Opportunities		
2-6a[1]	Contractor inputs	Contractor achieves value engineering gains over the existing design philosophy
2-6d	Causeway across river	Building of temporary causeway across Otaki River to facilitate construction
2-7b	Consenting approach	Change in consent approach away from EPA

Threats		
2-1c	Benefit Cost Ratio	In isolation project BCR is below 1
2-2c	Rail Corridor	Changes to expectations around rail corridor use
2-1d	Funding Provision	A change in funding provision over the construction period
1-1h	Volume of Imported Fill	Volume of imported fill increases
1-1j	Ground improvement	Peat extent and thickness
1-3d	Bridge foundations	Bridge foundations are deeper than allowed
2-1a	Market conditions	Tender price exceeds engineers estimate due to workload and competition in market

6.2.2 Identified Enhancement and Mitigation Plans

As part of any risk management process, risks must be managed in a timely manner to ensure they are enhanced or mitigated to help enable a successful project outcome. The following provide a high level summary of action plans and timing of enhancement / mitigation for the identified top 10 risks (above). Full details on action plan, timing, ownership and resources can be found in the risk register, refer Appendix D.

[1] References from quantitative risk analysis model, Appendix G

2-6a	Contractor inputs	contractor achieves value engineering gains over the existing design philosophy
Action Plan: part of the intent of a design and construct process is to seek optimised value (and potential lower overall project costs) through the involvement of a contractor within the design process. This opportunity should be realised as the project moves forward, but only if the specimen design and principals requirements are left sufficiently flexible to allow innovation, although clearly there are some areas of design/whole of life cost that NZTA should not compromise.		
Timing: construction tender phase		

2-6d	Causeway across river	Building of temporary causeway across Otaki River to facilitate construction
Action Plan: represents a possible value engineering opportunity, particularly in regards to the construction process, but would require consents to be achieved before being realised. Consenting submission should allow (or at least not preclude) this option to enable the D&C contractor with the flexibility to use, if they require.		
Timing: now, consenting and part of EPA		

2-7b	Consenting approach	Change in consent approach away from EPA
Action Plan: current project strategy is to go to the Environmental Protection Agency (EPA) for consent approval, as part of an overall RoNS strategy. However, there is some belief that seeking consents through the local and regional consenting authorities would realise an overall cost saving and should be explored.		
Timing: now, part of project strategy		

2-1c	Benefit Cost Ratio	In isolation project BCR is below 1
Action Plan: requires a change in mind-set on how to calculate BCR and the inclusions in calculation need to incorporate wider economic benefits rather than just traffic and travel time savings, together with corridor wide consideration (RoNS Package).		
Timing: now, part of project strategy		

2-2c	Rail Corridor (Kiwi Rail)	Changes to expectations around rail corridor use
Action Plan: continue discussions and meetings with Kiwi Rail, document agreements within Memorandum of Understanding and get early sign-off as part of project strategy and development.		
Timing: now, part of project strategy and design		

2-1d	Funding Provision	A change in funding provision over the construction period
Action Plan: this threat is generally outside the control of the project team and it is assumed NZTA have a portfolio programme developed indicating when each project will occur and the cash flow requirements associated with them. On a smaller scale a cash flow for the PP2O project would provide benefit as an indication of likely expenditure over the construction period.		
Timing: keep a watching brief, decision when to tender / construct part of project strategy		

1-1h	Volume of Imported Fill	Volume of imported fill increases
Action Plan: undertake further geotechnical investigations to confirm likely "useable" allowances from cut and improvement in knowledge for likely undercut as part of the project design development.		
Timing: specimen design		

1-1j	Ground improvement	Peat extent and thickness
Action Plan: undertake further geotechnical investigations to confirm peat thicknesses and areas as part of the project design development.		
Timing: specimen design		

1-3d	Bridge foundations	Bridge foundations are deeper than allowed
Action Plan: undertake further geotechnical investigations to confirm likely bearing capacities of soil in bridge pile locations as part of the project design development.		
Timing: specimen design		

2-1a	Market conditions	Tender price exceeds engineers estimate due to workload and competition in market
Action Plan: this threat is generally outside of the control of the project team, however, NZTA should be encouraged to programme their portfolio of project works across an appropriate time period in order to ensure the construction market has a known level of committed work as opposed to "peaks and troughs" where the market is hungry and then too busy to deliver.		
Timing: keep a watching brief, decision when to tender part of project strategy		

6.3 Project Quantitative Risk Analysis

6.3.1 Risk Analysis Methodology

The essence and intent of quantitative risk modelling is to provide input to a project's estimate and programme by modelling potential real-life outcomes.

In terms of estimating, known items of work (i.e. those designed, scheduled and rated) contain an element of uncertainty during the project phases (usually in terms of quantum and / or rate). Our quantitative risk model provides an analysis of this uncertainty. This is referred to as a "schedule" risk model. Our analysis also assesses "residual risk" items by reference to the risk register. By combining both price and residual risk outputs, along with the (base) estimate, we are able to estimate an out-turn cost (Scheme Estimate) at this phase of the project.

It is recommended that as the project proceeds a re-modelling exercise is carried out (ideally at 3 monthly intervals) to enable the cost estimate to be kept up-to-date. These updates are important, as project risks are being actively managed and may change in likelihood and / or consequence; new risks can also be identified while some may "close"; and measured works specifications and quantum may change as further design and investigations are carried out and new information is made available.

Using the same principle, a quantitative model has been developed to provide a project programme Expected (P50) Completion Date.

The project risk register has formed the basis of the quantitative modelling for both the cost and programme analysis, with a defined relationship existing between the all pieces of work, i.e. risk register, estimate and programme. These relationships mean that the qualitative assessments for consequence and probability relate directly to the quantitative inputs for the risk model.

Estimating Forecast Final Out-turn Costs

As defined above, there are 2 elements which make up a project estimate:

- Known Items i.e. those designed, scheduled and rated; and
- Unknown / Uncertain Items i.e. identified risks

Known Items

The model provides an analysis of (price) contingency within the schedule of works, using the 3-pt estimate process. The model takes the expected costs at an item level for each element of work and assesses a minimum and maximum range for each element. Our model provides commentary as to the reasoning behind the selection of the minimum and maximum range.

When preparing 3pt estimate model we have made careful consideration to the choice of statistical distribution used, the correlation and relationships between elements and the "in-built" contingency within the detailed schedule of works breakdown.

As a 3pt estimate, we have generally used pert distribution; however this may not be always appropriate and (if used) may give unrepresentative outputs, therefore for some items we have used uniform or discrete distribution to reflect a true nature of potential likely outcomes. As with most quantitative risk models, some elements have been correlated or modelled with a relationship, e.g. if the maximum cost for time-related staff costs reflects the possibility of an extended construction period.

The overall intent of our model is to represent potential real-life outcomes.

Unknown / Uncertain Items i.e. identified risks

This part of the projects quantitative model assesses the potential amount of (risk) contingency required to be "put-aside" to cover possible risk occurrences, as identified by the risk register. Cross-reference(s) has been undertaken between risk register and quantitative model to ensure consistency of input data.

Again, choice of statistical distribution and correlation has been driven on the requirement to produce potential real-life outcomes for these identified risks.

6.3.2 Risk Adjusted Construction Programme

In order to understand the potential out-turn cost of the project, specifically the construction element, we have prepared an indicative construction programme. Some of the risks identified above have an element of time impact either extending the duration of an activity or delaying the start or finish. To add-value to our estimate and risk processes we have modelled these risks against our indicative construction programme to provide a risk adjusted construction programme analysis and outcome.

The risk adjusted construction programme (refer Appendix E) demonstrates the following:

Project Start Date	**1-10-2014**
Project Deterministic Finish Date (i.e. the indicative construction programme finish date; model shows it has a 15% probability of being achieved).	1-5-2018
P50 Finish Date	1-8-2018
P95 Finish Date	7-2-2019

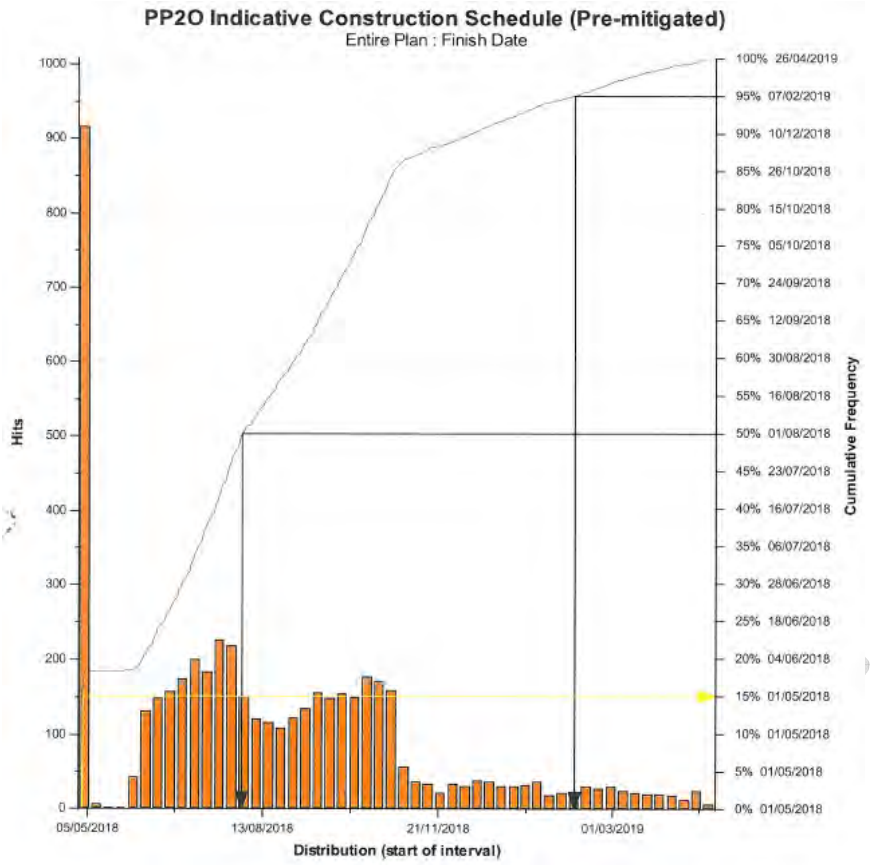

Figure 6-1: Probabilistic Programme Finish Date

6.3.3 Risk Based Cost Estimate

We have undertaken a full risk analysis for the project. Our assessments within the risk analysis use professional judgment, knowledge and experience gained from previous projects and the project risk management process to estimate appropriate risk contingencies and to derive the Expected and 95th Percentile Estimates for the project. Our analysis is statistically based in so far as it does not take just one possible opinion of the out-turn cost, in the way risk assessment does, but models potential real-life scenarios (in this case 10,000 iterations) to produce a statistical model of probable out-turn costs.

In terms of out-turn costs for the project our work and analysis demonstrate the following results:

Project Expected Estimate	**$251.45M**
Property	$29.10M
Investigation and Reporting	$5.45M
Design and Project Documentation	$5.60M
MSQA	$8.70M
Physical Works	$202.60M

Project P95 Estimate	**$277.6M**

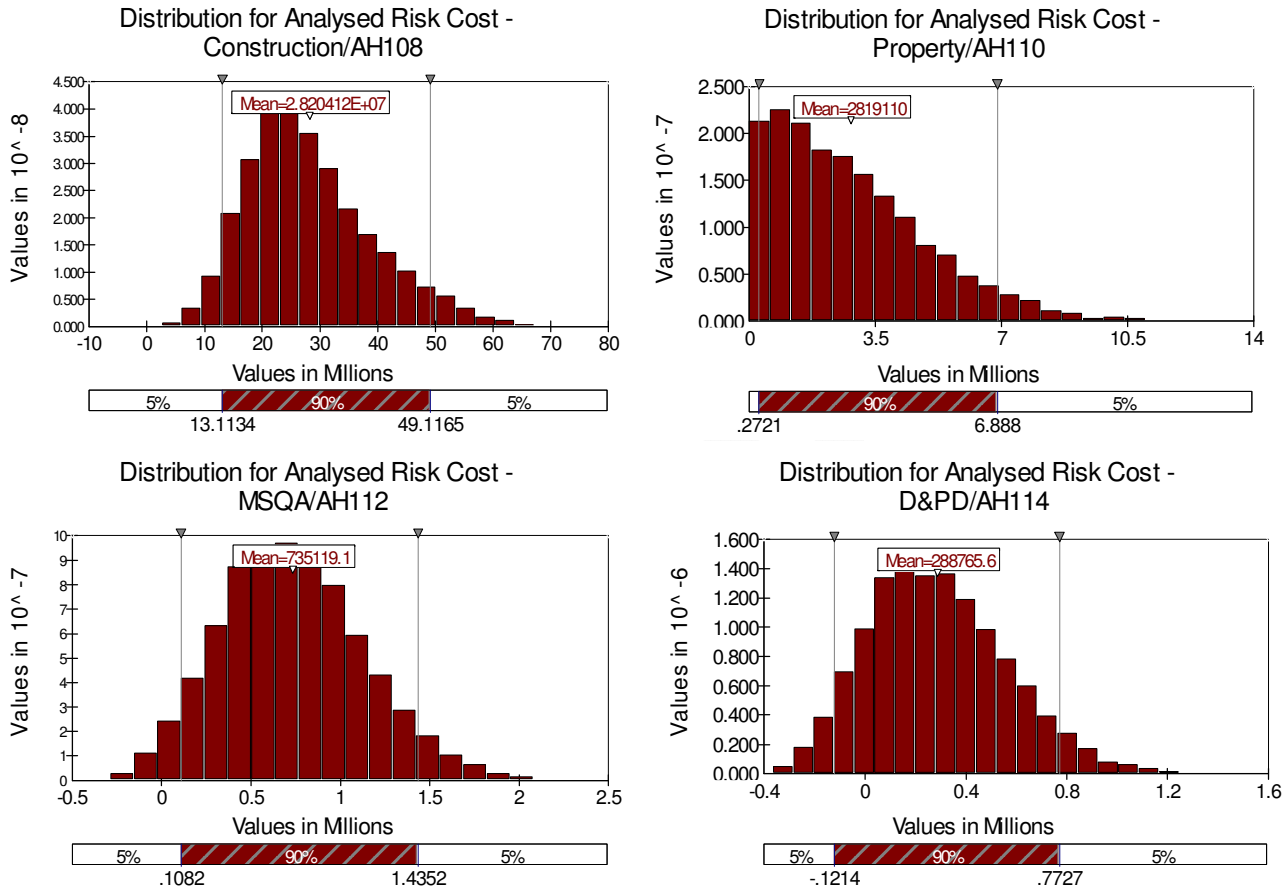

Figure 6-2: Risk Model Histograms

6.4 Comment on Risk Management Activities

The methodology used and inputs provided for developing both the programme and estimate have incorporated both positive and negative risks (i.e. opportunities and threats). These inputs have a real impact on the Expected Out-turn Cost and Construction Programme and as such enhancement and mitigation of risks is imperative in achieving a positive project result.

A lack of effective project risk management as the project proceeds will likely have a detrimental impact on the overall project delivery, programme and cost outcomes noted above. To aid this work, we have included $500k in both the Specimen Design and MSQA phases of the project for specific and active risk mitigation. These costs are additional to the usual design and monitoring fees and should be held by the NZTA project manager and used for risk management actions on the project.

7. Parallel Estimate Process

NZTA commissioned a SM014 parallel estimate process for the PP2O Project. MacDonald International Consulting Engineers (MacDonald) undertook this commission, during August 2011. This exercise included the full development and reconciliation of the base estimate for the project and a technical review of the risk model(s) prepared by Opus.

The table below details the parallel estimate prepared by MacDonald compared to the Opus estimate and shows the percentage differences at Base, Expected and 95th%ile levels.

Item	Opus Base Estimate ($'s M)	MacDonald Base Estimate ($'s M)	Difference ($'s M)
Nett Project Property Cost	26.30	26.30	
I&R	5.45	5.45	
D&PD	5.30	5.30	
MSQA	7.95	7.95	
Environmental Compliance	0.84	0.81	0.03
Earthworks	17.45	17.05	0.40
Ground Improvements	2.50	2.30	0.20
Drainage	11.10	11.65	-0.55
Pavement and Surfacing	15.75	14.70	1.05
Bridges	53.40	52.10	1.30
Retaining Walls	2.80	2.70	0.10
Traffic Services	6.10	5.85	0.25
Service Relocations	3.45	3.45	0
Landscape and Urban Design	6.50	6.25	0.25
Traffic Management and Temporary Works	3.40	3.30	0.10
Preliminary and General	40.70	38.20	2.50
Extraordinary Construction Costs	10.41	10.66	-0.25
Project Base Estimate	**219.36**	**213.98**	**5.38**

As the table above shows the difference between Opus' and MacDonald's base estimate is $5.38M (approximately 2.5% different). The majority of that difference is in 3 separate items (i.e. pavement and surfacing, bridges and preliminary & general) that account for $4.85M. Both Opus and MacDonald are comfortable with these differences and consider them within the bounds of estimating accuracy at this stage of a project's development.

In terms of the risk modelling, contingency allowance and indicative programme dates, rather than preparing their own version for reconciliation MacDonald's have technically reviewed the Opus models. MacDonald's have provided an email comment on 14-9-2011 stating "I can confirm that I am happy with the model for risk and that you have incorporated the feedback...given."

As such, Opus is pleased to be able to confirm the model and outputs are suitable for the project.

Overall, we believe that MacDonald's are happy to sign-off the overall Scheme Estimate (base, expected and P95) for the PP2O project as "being within the bounds of estimating accuracy".

The MacDonald Parallel Estimate Report is included in Appendix F.

Note: At this point Opus would like to point out that this parallel estimate process has (in our opinion) added some value to the process used and outcomes for the Scheme Estimate produced. This outcome would not have been possible within the collaborative working efforts and candour between both Opus and MacDonalds.

8. Differences between Business Case and SE

A Feasibility Estimate (FE) was completed as part of the wider SH1 Strategy Study project during 2008/09. Given concerns around the reliability of escalated estimates of earlier scheme estimates (dating from 2003) a FE was compiled using parameter rates based on previous projects. The FE expected estimate was reported as $215m as at July 2009 in the NZTA business case. This is $36m less than the current $251M expected estimate from the Scheme Estimate (SE) at September 2011.

The 2009 feasibility estimate was undertaken using a parameter based estimating approach involving compilation of typical parameter rates for various items involved in the project. The parameter rates were based on a range of previous projects (separated into rural and urban) for lengths of highway and also for interchanges. The rates were deemed to be all inclusive. For example, the parameter rate developed for 1km of 4 lane expressway included earthworks, pavement and surfacing, drainage, landscaping, preliminary and general etc.

Such an approach does not take into account site specific finer detail given that it is purely based on projects which are of a similar nature and scale. Some of the projects used in developing the parameter rates included:

- Waiohine Bridge;
- Kapiti Western Link Road;
- Transmission Gully;
- Newlands Interchange;
- Kaitoke to Te Marua;
- SH2 Moonshine Hill to Silverstream;
- Ruby Bay Bypass;
- Rural Section (Plimmerton to Pukerua Bay);
- Mungavin Interchange; and
- Avalon Drive Bypass.

The uncertainty (risk) around the estimate was based on a general percentage contingency approach rather than specific risk quantification and analysis. This was considered consistent with the feasibility status and strategic wider corridor nature of the study, and is not inconsistent with SM014. The range of estimate assessed was $215 expected up to $355M at the 95th%ile.
An analysis of the scope evolution and estimates has been completed to ascertain where the key differences arise between the feasibility estimate and the scheme estimate. These are summarised below:

- Escalation of construction costs from July 2009 to September 2011 are approximately 5% or $11M (based on the latest indices), however, a lower rate has been applied of 3% or $7.5M;
- An increase in forecast property costs. $15.4M in the FE as opposed to $29M in the SE. This is due to changes in the areas required, and a better understanding of property accommodation and injurious affects costs;
- Increased understanding of rail requirements through Otaki, $6M in FE as opposed to $10M in the current SE;
- An increased allowance for local road and property access requirements, e.g. the 2009 scheme and FE provided no allowance for a Rahui Road Bridge, whereas approximately $5.2M is included within the current SE;
- A better understanding of the connectivity requirements. For example, a half diamond interchange has now been provided at South Otaki rather than a lower cost southbound onramp at County Road; and
- Increases in estimated fees and preliminary and general costs as the scope and size of the project increases, $6M.

Other items which have had an impact on the project estimate, which are more difficult to quantify include;

- A greater understanding of the bridging requirements, in particular at Mary Crest.
- A greater understanding of the ground conditions, in particular the extent of peat around North Otaki and Mary Crest.
- A greater understanding of flood requirements and what that means for the vertical alignment of the expressway.

A detailed quantified risk assessment has now also been completed based on a far higher level of detail and knowledge, and using the advanced approach in accordance with SM014.

Item	Value
Escalation	$7.5M
Property	$13.5M
Rail Relocation	$4.0M
Rahui Road	$5.0M
P&G	$6.0M
Total	$36.0M

9. Differences between OE and SE

The Option Estimate (OE) was completed as part of the Scoping Report during 2010. The estimate was also generally undertaken on a parameter based approach, however some available quantities were used such as earthwork volumes, pavement volumes, bridge sizes etc.

The table below shows the SE and OE comparison, as well as giving explanations of the differences.

Item	Scheme Estimate ($'s M)	Option Estimate ($'s M)	Difference ($'s M)	Comments
Nett Project Property Cost	26.30	28.60	2.3	Refined design reducing net land area occupied.
Investigation and Reporting	5.45	5.45	0	-
Design and Project Documentation	5.30	9.00	3.70	Revised assumptions around procurement model.
Management, Surveillance, Quality and Assurance	7.95	10.50	2.55	Revised assumptions around procurement model.
Environmental Compliance	0.85	0.50	0.35	Further definition of works.
Earthworks	17.50	25.50	8.00	Optimisation of expressway vertical and horizontal alignment.
Ground Improvements	2.50	10.90	8.40	Improved geotechnical knowledge regarding peat and unsuitable material.
Drainage	11.00	14.25	3.25	Further definition of works and use of swales as opposed to stormwater devices.
Pavement and Surfacing	15.75	23.60	7.85	Optimisation of pavement design and whole of life costs.
Bridges	53.35	63.40	10.05	Improved definition of bridging requirements.
Retaining Walls	2.80	8.90	6.10	Optimisation of expressway vertical alignment.
Traffic Services	6.10	5.80	0.30	Further definition of works.

Item	Scheme Estimate ($'s M)	Option Estimate ($'s M)	Difference ($'s M)	Comments
Service Relocations	3.45	5.50	2.05	Information pending.
Landscape and Urban Design	6.50	7.50	1.00	Further definition of works.
Traffic Management and Temporary Works	3.40	3.95	0.55	Further definition of works.
Preliminary and General	40.70	31.00	9.70	Revised assumptions around procurement model.
Extraordinary Construction Costs	10.50	8.20	2.30	Improved understanding of KiwiRail requirements.
Project Base Estimate	**219.4**	**262.6**	**43.20**	
Project Expected Estimate	**215.4**	**296.4**	**81.00**	**Improvement of risk understanding and detailed risk analysis undertaken.**
Project 95%ile Estimate	**277.6**	**388.9**	**111.30**	

Appendix A: Estimate Summary

Project Estimate - Form C

PP2O Project

SE
Scheme Estimate

Item	Description	OPUS Base	Contingency	Funding Risk
A	**Nett Project Property Cost**	**26,300,000**	**2,820,000**	**4,100,000**
	Investigation and Reporting			
	- Consultancy Fees	4,360,000		
	- NZ Transport Agency Managed Costs	1,090,000		
B	**Total Investigation and Reporting**	**5,450,000**		
	Design and Project Documentation			
	- Consultancy Fees	1,950,000		
	- NZ Transport Agency Managed Costs	2,835,000		
	- Risk Mitigation Costs	500,000		
C	**Total Design and Project Documentation**	**5,285,000**	**290,000**	**500,000**
	Construction			
	MSQA			
	- Consultancy Fees	4,450,000		
	- NZ Transport Agency Managed Costs	3,000,000		
	- Risk Mitigation Costs	500,000		
	- Consent Monitoring Fees	incl		
	Sub Total Base MSQA	**7,950,000**	**740,000**	**700,000**
	Physical Works			
1	Environmental Compliance	836,250		
2	Earthworks	17,458,720		
3	Ground Improvements	2,466,000		
4	Drainage	11,079,500		
5	Pavement and Surfacing	15,769,011		
6	Bridges	53,388,200		
7	Retaining Walls	2,820,000		
8	Traffic Services	6,120,500		
9	Service Relocations	3,450,000		
10	Landscaping & Urban Design	6,492,000		
11	Traffic Management and Temporary Works	3,397,440		
12	Preliminary and General	40,675,000		
13	Extraordinary Construction Costs	10,420,000		
	Sub Total Base Physical Works	**174,380,000**	**28,200,000**	**20,900,000**
D	**Total Construction**	**182,330,000**	**28,940,000**	**21,600,000**
E	**Project Base Estimate (A+C+D)**	**219,370,000**		
	Say	**219,370,000**		

F	**Contingency** (Assessed/Analysed)	**(A+C+D)**	**32,050,000**
G	**Project Expected Estimate**	**(E+F)**	**251,420,000**
		Say	**251,420,000**
		% of Base	**115%**
Project Property Cost Expected Estimate			**29,120,000**
Investigation and Reporting Expected Estimate			**Nil**
Design and Project Documentation Expected Estimate			**5,575,000**
Construction Expected Estimate			**211,270,000**

H	**Funding Risk** (Assessed/Analysed)	**(A+C+D)**	**26,200,000**
I	**95th percentile Project Estimate**	**(G+H)**	**277,620,000**
		Say	**$277,620,000**
		% of Base	**127%**
Project Property Cost 95th percentile Estimate			**33,220,000**
Investigation and Reporting 95th percentile Estimate			**Nil**
Design and Project Documentation 95th percentile Estimate			**6,075,000**
Construction 95th percentile Estimate			**232,870,000**

Date of Estimate	**Cost Index (Qtr/Year)**
Estimate prepared by	**Signed**
Estimate internal peer review by	**Signed**
Estimate external peer review by	**Signed**
Estimate accepted by NZ Transport Agency	**Signed**

Note: (1) These estimates are exclusive of escalation and GST.
(2) I&R Project Phase Estimates are set to Nil as these are now sunk costs.

Appendix B: Estimate Breakdown

PP20 SE
Scheme Estimate

Date of estimate:		**Cost Index:**	
Estimate prepared by:		**Signed:**	
Estimate internal peer review by:		**Signed:**	
Estimate external peer review by:		**Signed:**	

Item	Description	Unit	Quantity	Rate	Amount	Subtotals	Comment/Assumptions
					0		
A	**Project Property Cost**		1	26,300,000	26,300,000	**26,300,000**	NZTA Provided
1..	Land Purchase	sq.m	-		0		
2..	Legal Survey Fees	LS	-		0		
3..	Legalisation Costs	LS	-		0		
					0		
B	**INVESTIGATION & REPORTING**				0	**5,450,000**	NZTA Provided
1..	Consultant's fees	LS	1	4,360,000	4,360,000		
2..	Planning and consents	LS	-		0		
3..	Iwi consultations	LS	-		0		
4..	Designation preparation and lodgement (including hearings)	LS	-		0		
5..	Fees (designation, environment court)	LS	-		0		
6..	Legal costs (including environment court)	LS	-		0		
7..	Mana whenua, waahi tapu, koiui and mauri fees and costs	LS	-		0		
8..	Reviews and audits	LS	-		0		
9.1.	- External estimate	LS	-		0		
9.2.	- Parallel estimate (Industry Expert)	LS	-		0		
9.3.	- Economics	LS	-		0		
9.4.	- Risk	LS	-		0		
9.5.	- Safety audit	LS	-		0		
10..	Geotechnical elements	LS	-		0		
11..	Survey elements	LS	-		0		
12..	Public relations & consultation	LS	-		0		
13..	Consultant's input before contract award (D&C contract inputs only, including specimen design)	LS	-		0		
14..	Speed surveys	LS	-		0		
15..	Council costs / expenses	LS	-		0		
16..	Heritage costs	LS	-		0		
17..	Environmental mitigation costs	LS	-		0		
18..	Supplementary investigation	LS	-		0		
19..	Client managed costs (including property acquisition agent's fees)	LS	1	1,090,000	1,090,000		
					0		
C	**DESIGN & PROJECT DEVELOPMENT**				0	**5,285,000**	
1..	Consultant's design fees	LS	1	1,950,000	1,950,000		
2..	Mana whenua, waahi tapu, koiui and mauri fees and costs	LS	-		0		
3..	Professional fees (e.g. risk management, value management, peer reviews)	LS	-		0		
4..	Legal	LS	-		0		
5..	Resource consent costs (including fees)	LS	-		0		
6..	Building consent costs	LS	-		0		
7..	Reviews and audits	LS	-		0		
7.1.	- External estimate	LS	-		0		
7.2.	- Parallel estimate (Industry Expert)	LS	-		0		
7.3.	- Economics	LS	-		0		
7.4.	- Risk	LS	-		0		
7.5.	- Safety audit	LS	-		0		
8..	Public relations & consultation	LS	-		0		
9..	Contractor's detailed design (D&C Contracts)	LS	-		0		
10..	Advertising	LS	-		0		
11..	Economic assessments	LS	-		0		
12..	Heritage costs	LS	-		0		
13..	Environmental mitigation costs	LS	-		0		
14..	Supplementary investigation	LS	-		0		
15..	Client managed costs (including property acquisition agent's fees)	LS	1	2,835,000	2,835,000		
16	Risk Mitigation Costs	LS	1	500,000	500,000		
					0		
D	**Construction**				0		
1...	**MSQA & CLIENT MANAGED COSTS**				0	**7,950,000**	
1...	Consultant's surveillance during construction phase	LS	1	4,450,000	4,450,000		
1...	Legal	LS	-		0		
1...	Iwi liaison during construction	LS	-		0		
1...	Consent monitoring		-		0		
1...	- Resource Consent	LS	-		0		
1...	- Building Consent	LS	-		0		
1...	Archaeological fees		-		0		
1...	- Archaeologist	LS	-		0		
1...	- Archaeological documentation & treatment of artefacts	LS	-		0		
1...	Reviews and audits		-		0		
1...	- External estimate	LS	-		0		
1...	- Parallel estimate (Industry Expert)	LS	-		0		
1...	- Economics	LS	-		0		
1...	- Risk	LS	-		0		
1...	- Safety audit	LS	-		0		
1...	Public relations & consultation	LS	-		0		
1...	Communications	LS	-		0		
1...	Consultant's input following contract award (D&C Contract)	LS	-		0		
1...	Advertising and tendering costs	LS	-		0		
1...	Newsletters	LS	-		0		
1...	Noise monitoring	LS	-		0		
1...	Heritage costs	LS	-		0		
1...	Environmental mitigation costs	LS	-		0		
1...	Supplementary investigation during the construction phase	LS	-		0		
1...	Partnering costs (workshop and monitoring)	LS	-		0		
1...	Client managed costs (including property acquisition agent's fees)	LS	1	3,000,000	3,000,000		
1...	Miscellaneous other costs	LS	-		0		
1...	Risk Mitigation Costs	LS	1	500,000	500,000		
					0		
	Physical Works				0		
2...	**ENVIRONMENTAL COMPLIANCE**					**836,250**	
2.1..	ENVIRONMENTAL MANAGEMENT PLAN	LS	1.0	10000	10,000		

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Item	Description	Unit	Quantity	Rate	Amount	Subtotals	Comment/Assumptions
2.1.1.	Management of EMP over Contract	mth	44.0	10000	440,000		
2.2..	PERMANENT EROSION & SEDIMENT CONTROL MEASURES				0		
2.2..	Construct & Maintain Permanent Sediment Measures	km	12.2	25,000	305,000		
2.3..	ACOUSTIC ATTENUATION						
2.3..	Allowance for Noise Mitigation						
	Noise Walls	m	130.0	625	81,250		
	Noise Bunds	m	4,410.0	0	0		
3...	**EARTHWORKS**					**17,458,720**	
3.1..	SITE CLEARANCE	LS	-		0		
3.1..	Greenfields	ha	100	10,000	1,000,000		
3.1..	Urbanscape	ha	14.3	30,000	429,000		
3.2..	DEMOLITION		-		0		
3.2..	Properties	ea	47	20,000	940,000		
3.2..	Otaki Ramp Bridge	LS	1	100,000	100,000		
3.3..	TOPSOIL STRIPPING	cu.m					
3.3..	To stockpile	cu.m	118,980	4	475,920		
3.4..	CUT TO FILL/UNDERCUT FOR TYPE 'A' MATERIAL	cu.m	-	8	0		
3.4..	Expressway	cu.m	727,115	9.5	6,907,593		
3.4..	Railway	cu.m	-	8	0		
3.4..	Interchanges	cu.m	-	8	0		
3.4..	Local Roads	cu.m	-	8	0		
3.5..	BORROW TO FILL	cu.m	-		0		
3.5..	Structural fill	cu.m	-	25	0		
3.5..	Non-Structural Fill	cu.m	-	25	0		
3.6..	IMPORTED FILL (Prov. Item)	cu.m	-		0		
3.6..	Expressway	cu.m	50,000	30	1,500,000		(Actual Vol. 44,000, say 50,000)
3.6..	Railway	cu.m	-	30	0		
3.6..	Interchanges	cu.m	-	30	0		
3.6..	Local Roads	cu.m		30	0		
3.6..	Structural fill	cu.m	-		0		
3.6..	Non-Structural Fill	cu.m	-		0		
3.6..	Rock Riprap	cu.m	-		0		
3.6..	Hardfill (Selected fill)	cu.m	-		0		
3.6..	Rock fill (End-tipped into soft ground or water)	cu.m	-		0		
3.7..	CUT TO WASTE		-		0		
3.7..	Expressway	cu.m	47	6	283		
3.7..	Railway	cu.m	-	6	0		
3.7..	Interchanges	cu.m	-	6	0		
3.7..	Local Roads	cu.m	-	6	0		
3.8..	UNDERCUT TO WASTE (Prov. Item)		-		0		
3.8..	Peat Material	cu.m	47	20	944		
3.9..	UNDERCUT TO FILL (Prov. Item)	cu.m	-		0		
3.9..	Un-suitable Material for Bunding	cu.m	128,749	20	2,574,980		
3.10..	TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES		-		0		
3.10.1.	Temporary Erosion and Sediment Control Measures	km	12.2	250,000	3,050,000		
3.10.2.	Maintenance of Temporary ESC Measures	mth	48.0	10,000	480,000		
4...	**GROUND IMPROVEMENTS**					**2,466,000**	
4...	GROUND IMPROVEMENTS				0		
4...	Supply and install wick drains	m	-		0		
4...	Supply and install drainage blanket	sq.m	-		0		
4...	Supply and install reinforcement geogrid	sq.m	20,000	7	140,000		In fill embankments
4...	PRELOAD (Prov. Item)	cu.m	90,000	15	1,350,000		Preloading of fill embakments on peat
4...	GEOTECHNICAL MONITORING		-		0		
	Allowance for Geotechnical Monitoring	km	12	80,000	976,000		
					0		
5...	**DRAINAGE**					**11,079,500**	
5...	REMOVE & DISPOSE OF EXISTING STORMWATER LINES, MANHOLES & SUMPS		-		0		
5...	Remove redundant/surplus stormwater culverts to waste				0		
5...	100mm to 300mm dia	m			0		
5...	450mm to 900mm dia	m			0		
5...	1050mm to 1800mm dia	m			0		
5...	Remove redundant/surplus manholes to waste	ea			0		
5...	Remove redundant/surplus sumps to waste	ea			0		
5...	SUMPS				0		
5...	Street sump (combined side entry)				0		
5...	Single	ea	36	2000	72,000		Assumed on link roads and on/off ramps 2 per 200m
5...	Double	ea	-		0		
5...	Motorway sump				0		
5...	Single	ea	30	3000	90,000		
5...	Double	ea	-		0		
5...	~~Inset sump~~				0		
5...	~~Single~~	ea	-		0		
5...	~~Double~~	ea	-		0		
5...	Yard sump				0		
5...	Single	ea	-		0		
5...	Double	ea	-		0		
5...	CULVERTS				0		
5...	Concrete RCRRJ Class 2 on Type HS2 Bedding				0		
5...	225mm dia.				0		
5...	Up to 2m depth	m	-		0		
5...	Over and above to 4m depth	m	-		0		
5...	300mm dia.				0		
5...	Up to 2m depth	m	-		0		
5...	Over and above to 4m depth	m	-		0		
5...	450mm dia.				0		Assume 50m/1000m of expressway/local road
5...	Up to 2m depth	m	885	300	265,500		
5...	Over and above to 4m depth	m	-		0		
5...	600mm dia.				0		
5...	Up to 2m depth	m	50	350	17,500		
5...	Over and above to 4m depth	m	-		0		
5...	750mm dia.				0		
5...	Up to 2m depth	m	-		0		
5...	Over and above to 4m depth	m	-		0		
5...	900mm dia.				0		
5...	Up to 2m depth	m	-		0		
5...	Over and above to 4m depth	m	-		0		
5...	1050mm dia.				0		
5...	Up to 2m depth	m	-	850	0		
5...	Over and above to 4m depth	m	-		0		
5...	1200mm dia.				0		
5...	Up to 2m depth	m	125	1,000	125,000		
5...	Over and above to 4m depth	m	-		0		
5...	1350mm dia.				0		

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Item	Description	Unit	Quantity	Rate	Amount	Subtotals	Comment/Assumptions
5...	Up to 2m depth	m	270	1,250	337,500		
5...	Over and above to 4m depth	m	-		0		
5...	1600mm dia.				0		
5...	Up to 2m depth	m	420	1,500	630,000		
5...	Over and above to 4m depth	m	-		0		
5...	1800mm dia.				0		
5...	Up to 2m depth	m	-		0		
5...	Over and above to 4m depth	m	-		0		
5...	????mm dia.				0		
5...	Up to 2m depth	m	-		0		
5...	Over and above to 4m depth	m	-		0		
5...	Concrete Box Culvert		-		0		
5...	1500mm x 3000mm		-		0		
5...	Up to 2m depth	m	120	4500	540,000		
5...	2000mm x 4000mm		-		0		
5...	Up to 2m depth	m	307	6000	1,842,000		
5...	3000mm x 4000mm		-		0		
5...	Up to 2m depth	m	527	8000	4,216,000		
5...	Swales	m	17,600	50	880,000		
5...		m	-		0		
5...	INLET/OUTLET STRUCTURES				0		traversable wingwalls?
5...	Precast concrete headwall/wingwall structures				0		
5...	150mm/300mm dia.	ea	-	1500	0		
5...	300mm/600mm dia.	ea	-	2500	0		
5...	600mm/900mm dia.	ea	2	3500	7,000		
5...	1300mm dia.	ea	8	4500	36,000		
5...	1800mm dia.	ea	8	5000	40,000		
5...	Greater than 1800mm dia	ea	22	6000	132,000		
5...	Debris Grille	ea	-		0		
5...	Rock rip-rap aprons/scour protection structures				0		
5...	150mm/300mm dia.	ea	-		0		
5...	300mm/600mm dia.	ea	-		0		
5...	600mm/900mm dia.	ea	2	2500	5,000		
5...	900mm/1200mm dia.	ea	-		0		
5...	1200mm/1500mm dia.	ea	8	3500	28,000		
5...	1500mm/1800mm dia.	ea	8	4000	32,000		
5...	Greater than 1800mm dia	ea	22	4500	99,000		
5...	MANHOLES				0		
5...	1050 dia to 2m depth	ea	-		0		
5...	E/O to 4m depth	ea	-		0		
5...	E/O to 6m depth	ea	-		0		
5...	1200 dia to 2m depth	ea	-		0		
5...	E/O to 4m depth	ea	-		0		
5...	E/O to 6m depth	ea	-		0		
5...	1350 dia to 2m depth	ea	21	3000	63,000		Assume 2/100m of 450mm dia
5...	E/O to 4m depth	ea	-		0		
5...	E/O to 6m depth	ea	-		0		
5...	1500 dia to 2m depth	ea	-		0		
5...	E/O to 4m depth	ea	-		0		
5...	E/O to 6m depth	ea	-		0		
5...	1650 dia to 2m depth	ea	-		0		
5...	E/O to 4m depth	ea	-		0		
5...	E/O to 6m depth	ea	-		0		
5...	1950 dia to 2m depth	ea	-		0		
5...	E/O to 4m depth	ea	-		0		
5...	E/O to 6m depth	ea	-		0		
5...	KERBING/EDGE STRIP				0		
5...	Remove existing	m	2,000	50	100,000		
5...	Kerb and Channel	m	6,720	100	672,000		
5...	Barrier kerb and channel	m	-		0		
5...	Mountable kerb				0		
5...	Full depth	m	-		0		
5...	~~Pinned~~	~~m~~	-		0		
5...	Precast mountable kerb blocks	m	-		0		
5...	Barrier kerb				0		
5...	Full depth	m	-		0		
5...	~~Pinned~~	~~m~~	-		0		
5...	Safety kerb	m	-		0		
5...	Dish Channel	m	-		0		
5...	Nib kerb	m	-		0		
5...	Edging strip	m	-		0		
5...	Roundabout kerb (collar)	m	-		0		
5...	PERMENANT STREAM DIVERSION						
5...	Racecourse Stream Diversion	m	100	2500	250,000		4m deep, 2m wide base, 1:3 sides, 56m2 x-section, Rock Lined
5...	School Road Stream Diversion	m	420	1000	420,000		10m2 Rock Lined Channel
5...	Gear Road Stream Diversion	m	130	1000	130,000		10m2 Rock Lined Channel
5...	Settlement Heights Stream Diversion	m	40	1250	50,000		15m2 Rock Lined Channel
5...							
6...	**PAVEMENT & SURFACING**					**15,769,011**	
6...	CBR TESTING	ea	-		0		
6...	SUBGRADE STABILISATION				0		
6...	Aggregate	cu.m	-		0		
6...	Lime	sq.m	-		0		
6...	Cement	sq.m	-		0		
6...	SUBGRADE PREPARATION				0		
6...	~~Shape and compact~~	sq.m	-		0		
6...	~~Dry back subgrade~~	sq.m	-		0		
6...	Geotextile cloth separation membrane	sq.m	-		0		
6...	Subgrade Improvement Layer	cu.m	-		0		
6...	SUB-BASE	cu.m	-		0		
6...	Sub-Base	cu.m	-		0		
6...	Expressway	cu.m	41,894	80	3,351,499		150mm Deep
6...	Local Roads	cu.m	14,736	80	1,178,885		150mm Deep
6...	E/O Cement Modififed Basecourse	cu.m	41,894	30	1,256,812		Expressway Pavements Only
6...	Additional sub-base for where CBR worse than expected (Prov. Item)	cu.m	-		0		
6...	BASECOURSE	cu.m	-		0		
6...	Expressway		46,083	90	4,147,480		180mm Deep
6...	Local Roads		16,210	90	1,458,870		180mm Deep
6...	E/O Cement Modififed Basecourse	cu.m	46,083	30	1,382,493		Expressway Pavements Only
6...	SURFACING		-		0		
6...	Single coat sealing	sq.m	-		0		
6...	Expressway	sq.m	155,180	4.5	698,310		
6...	Local Roads	sq.m	81,867	4.5	368,402		
6...	Open Graded Porous Asphalt				0		
6...	Preparation of surface including Tack Coat	sq.m			0		

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6...	Supply and pave Open Graded Porous Asphalt including binder				0		
6...	Expressway	sq.m	77,563	20	1,551,260		
6...	Local Roads	sq.m	-		0		
6...	Allowance for Property Accesses	ea	15	25000	375,000		
					0		
7...	**BRIDGES**					**53,388,200**	
7...	Bridge No.1 Waitohu Stream Bridge	LS	1	5,600,000	5,600,000		3-span Super 'T'
7...	Bridge No.2 Otaki North	LS	1	604,500	604,500		Single Span Hollow Core
7...	Bridge No.3 Otaki North Local Road	LS	1	1,831,500	1,831,500		3-span Super 'T'
7...	Bridge No.4 Rahui Road	LS	1	5,190,900	5,190,900		3-span Super 'T'
7...	Bridge No.5 Otaki River Bridge	LS	1	22,000,000	22,000,000		Super 'T'
7...	Existing Otaki River Bridge Ped/Cycle 'clip on'	LS	-	3,960,000	0		
7...	Bridge No.6 South Otaki Rail Crossing	LS	1	604,500	604,500		Super 'T' Span over SH1
7...	Bridge No.7 South Otaki Expressway Crossing	LS	1	2,821,500	2,821,500		Hollow Core Span over Rail
7...	Bridge No.8 Te Horo	LS	1	6,735,300	6,735,300		8-Span 1m Super 'T'
7...	Bridge No.9 Mary Crest	LS	1	8,000,000	8,000,000		Hollow Core Option
					0		
8...	**RETAINING WALLS**					**2,820,000**	
8...	Reinforced Soil Embankment						Design, supply and construct wall complete
8...	Hydroseeded Face, Up to 8m	sq.m	-	0	0		
8...	Mechanically Stabilised Earth Wall		-				Design, supply and construct wall complete
8...	Concrete Facing, Up to 8m	sq.m	3,000	940	2,820,000		
9...	**TRAFFIC SERVICES**					**6,120,500**	
9...	BARRIERS (median barrier and side protection barrier)				0		
9...	Test Level 3				0		
9...	W Section Guardrail - Highway				0		
9...	On timber posts (Single sided)	m	-		0		
9...	On timber posts (Double sided)	m	-		0		
9...	On steel posts (Single sided)	m	300	150	45,000		
9...	On steel posts (Double sided)	m	-		0		
9...	Nu-Guard Barrier				0		
9...	Steel posts (single sided) without blockout	m	-		0		
9...	~~Steel posts (single sided) with blockout~~	m	-		0		
9...	Approach & Departure Terminals	ea	4	2000	8,000		
9...	Nu-Guard transition to Concrete barrier	ea	-		0		
9...	Re-use existing	m	-		0		
9...	W Section Guardrail - Bridge				0		
9...	On timber posts	m	-		0		
9...	On steel posts	m	-		0		
9...	With top rail	m	-		0		
9...	W Section Approach & Departure Terminals	ea	-		0		
9...	Concrete Barrier - F Shape				0		
9...	Single sided units	m	-		0		
9...	Double sided units	m	-		0		
9...	End Treatment	ea	-		0		
9...	Wire Rope Barrier				0		
9...	On steel posts	m	12,200	100	1,220,000		
9...	End treatment	m	1	3000	3,000		
9...	Crash Cushions	ea	-		0		
9...	W Section connection to Concrete barrier	ea	-		0		
9...					0		
9...	Test Level 4				0		
9...	Nu-Guard Barrier				0		
9...	Steel posts (single sided) without blockout	m	6,850	185	1,267,250		
9...	~~Steel posts (single sided) with blockout~~	m	-		0		
9...	Approach & Departure Terminals	ea	34	3500	119,000		
9...	Nu-Guard transition to Concrete barrier	ea	-		0		
9...	G9 Thrie Beam - Highway				0		
9...	On steel posts (Single sided)	m	-		0		
9...	On steel posts (Double sided)	m	-		0		
9...	G9 Thrie Beam - Bridge		-		0		
9...	On steel posts	m	2,820	250	705,000		
9...	With top rail	m	-		0		
9...	G9 Thrie Beam End terminals	ea	-		0		
9...	Concrete Barrier - F Shape				0		
9...	Single sided units	m	-		0		
9...	Double sided units	m	-		0		
9...	End Treatment	ea	-		0		
9...	G9 Thrie Beam connection to Concrete barrier	ea	-		0		
9...	Crash Cushions	ea	-		0		
9...					0		
9...	Test Level 5				0		
9...	Concrete Barrier - 'Texas HT'				0		
9...	Single sided units	m	-		0		
9...	Double sided units	m	-		0		
9...	End Treatment	ea	-		0		
9...	Crash Cushions	ea	2	75000	150,000		
9...					0		
9...	PAVEMENT MARKING	LS	-		0		
9...	Remove redundant markings and markers				0		
9...	Pavement markings	km	1.45	35000	50,750		
9...	RRPMs & Ceramic markers	km	1.45	25000	36,250		
9...	Noise line	m	-		0		
9...	Pavement markings	m	-		0		
9...	Expressway	m	12,200	30	366,000		Rate per m of expressway
9...	Local Road	m	6,450	15	96,750		Rate per m of local road
9...	Re-Mark during Defect Liability Period	LS	1	462,750	462,750		
9...					0		
9...	ROAD SIGNS & SUPPORTS				0		
9...	Road Signs		-		0		
9...	Expressway	m	12,200	40	488,000		Rate per m of expressway
9...	Local Roads	m	6,450	15	96,750		Rate per m of local road
9...	E/O Variable Message Signs	ea	2	100000	200,000		
9...	E/O Gantry Signs	ea	2	100000	200,000		
9...					0		
9...	LIGHTING				0		
9...	New	ea	94	6000	564,000		Assumed 2/100m @ bridges/interchanges
9...	Dispose of existing	ea	28	1500	42,000		Assume 2/100m along existing local roads
9...					0		
					0		
10...	**SERVICE RELOCATIONS ~~(& PROTECTION)~~**					**3,450,000**	
10...	Raise service covers				0		
10...	Local Authority Services				0		
10...	Services Relocated	LS	1	750,000	750,000		
10...			-	0	0		
10...	Telecommunications			0	0		
10...	Services Relocated - Telecom	LS	1	500,000	500,000		

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10...	Services Relocated - Vodaphone	LS	1	200,000	200,000		
10...		LS	-	0	0		
10...	Power	LS	-	0	0		
10...	Services Relocated - Electra	LS	1	1,200,000	1,200,000		
10...		LS	-	0	0		
10...	Gas			0	0		
10...	Services Relocated - Vector	LS	1	100,000	100,000		
10...		LS	-	0	0		
10...		LS	-	0	0		AWAITING SERVICE AUTHORITIES ESTIMATES
10...	Water			0	0		
10...	Services Relocated	LS	1	350,000	350,000		
10...		LS	-	0	0		
10...	Sewer	LS	-	0	0		
10...	Services Relocated	LS	1	350,000	350,000		
10...		LS	-	0	0		
10...	Miscellaneous			0	0		
10...	Supply and install 100m uPVC service ducts	m	-	0	0		
10...	Supply and install 200m uPVC service ducts	m	-	0	0		
10...			-	0	0		
10...	Transpower			0	0		
10...	Pylon/underground cabling relocated	LS	-	0	0		
10...					0		
10...	Contractor's percentage on-cost ...% on $.....	%	-		0		
					0		
11...	**LANDSCAPING & URBAN DESIGN**					**6,492,000**	
11...	LANDSCAPING				0		
11...	Rural	LS	1	2,838,000	2,838,000		
11...	Urban	LS	1	3,654,000	3,654,000		
12...	**TRAFFIC MANAGEMENT & TEMPORARY WORKS**					**3,397,440**	
12.1..	TEMPORARY TRAFFIC MANAGEMENT	LS	1	2,067,600	2,067,600		
12.2..	TEMPORARY DIVERSIONS	LS	1	583,120	583,120		
12.3..	IMPLEMENTATION OF CHANGEOVER(S)	LS	1	746,720	746,720		
					0		
13...	**PRELIMINARY & GENERAL**					**40,675,000**	
13.1..	Allowance for Preliminary & General Costs	LS	1	40,675,000	40,675,000		
13.1.1.	Establishment, temporary accommodation, disestablishment				0		
13.1.1.	Establishment	LS	-		0		
13.1.1.	Temporary accommodation	LS	-		0		
13.1.1.	Disestablishment, Clean-Up & Reinstatement	LS	-		0		
13.1.2.	Contractor's Supervision & Other Time-Related Costs				0		
13.1.2.	Supervision	LS	-		0		
13.1.3.	Insurances, Bond(s), Warranties/Guarantees & Other Non Time-Related Costs				0		
13.1.3.	Insurances	LS	-		0		
13.1.3.	Bond(s)	LS	-		0		
13.1.3.	Warranties/Guarantees	LS	-		0		
13.1.4.	Temporary Works & Contractor's Design				0		
13.1.4.	Temporary Works Design	LS	-		0		
13.1.7.	Supply and erect construction signage	ea	-		0		
13.2..	CLEAN-UP & REINSTATEMENT	LS	-		0		
13.3..	SURVEY & SETOUT	LS	-		0		
13.3.1.	Survey Verification	LS	-		0		
13.3.2.	Protection of Existing Survey marks	LS	-		0		
13.3.3.	Pre-construction Survey	LS	-		0		
13.3.4.	Setting out	LS	-		0		
13.4..	AS-BUILT DRAWINGS	LS	-		0		
13.5..	ADDITIONAL TESTING AS DIRECTED BY ENGINEER	PS	-		0		
13.6..	DAYWORKS (Provisional Items)				0		
13.6.1.	Labour	h	-		0		
13.6.2.	Materials	PS	-		0		
13.6.3.	Percentage on-cost on materials	%	-		0		
13.6.4.	Plant % of 'Blue Book' rates	%	-		0		
13.7..	NOISE MONITORING PLAN & CONTROL	LS	-		0		
13.8..	ENGAGEMENT OF NOMINATED ARCHAEOLOGIST	PS	-		0		
13.9..	SITE SECURITY	LS	-		0		
13.10..	ENVIRONMENTAL MITIGATION PLAN	LS	-		0		
13.11..	ESCALATION	PS	-		0		
13...					0		
13...	**BREAKDOWN AS USED FOR CONTRACT SCHEDULE**				0		
13...	ESTABLISHMENT AND DISESTABLISHMENT	LS	-		0		
13...	CONTRACTOR'S SUPERVISION & OTHER TIME-RELATED COSTS	LS	-		0		
13...	INSURANCES, BOND(S), WARRANTIES/GUARANTEES	LS	-		0		
13...	AS-BUILT INFORMATION	LS	-		0		
13...	ADDITIONAL TESTING AS DIRECTED BY ENGINEER	PS	-		0		
13...	DAYWORKS (Provisional Items)				0		
13...	Labour				0		
13...	a) General Labourers	h	-		0		
13...	b) Foreman Supervisors	h	-		0		
13...	Materials	PS	-		0		
13...	Percentage on-cost on materials	%	-		0		
13...	Plant % of 'Blue Book' rates	%	-		0		
13...	ESCALATION	PS	-		0		
13...	VARIATIONS (<$20,000 each) (Provisional Items)				0		
13..1.	Base Value	PS	-		0		
13..2.	% on-site overheads on Base Value	%	-		0		
13..3.	% off-site overheads & profit on Base Value	%	-		0		
13..4.	Working-Day Rate	W-day	-		0		
					0		
14...	**EXTRAORDINARY CONSTRUCTION COSTS**					**10,420,000**	
14...	EXCAVATION FOR DIVERSION & PROTECTION WORK	cu.m	-		0		
14...	SUPPLY & PLACE RIPRAP PROTECTION	cu.m	-		0		
14...	SUPPLY & PLACE GABION PROTECTION	cu.m	-		0		
14...	DEMOLITION OF EXISTING BRIDGES	LS	-		0		
14...	ANTI-GRAFFITI PROTECTIVE COATING	sq.m	-		0		
14...	VEHICLE DETECTION LOOPS	LS	-		0		
14...	Tunnels		-		0		
14...	Bus Transfer Station	LS	-		0		
14...	Park and Ride Bus station	LS	-		0		
14...	Relocate railway tracks				0		
14...	Single Track	km	1.1	3,000,000.0	3,300,000		
14...	Double Track (Crossing loop)	km	1.1	5,000,000.0	5,500,000		
14...	Relocated Otaki Railway Station	LS	1	1,000,000.0	1,000,000		
14...	Temporary Otaki Railway Station Works	LS	1	500,000.0	500,000		
14...	Allowance for Modifications to Former SH1	LS	1.0	120,000.0	120,000		
14...		LS	-		0		
					0		

PP20 Scheme Estimate — SE

Date of estimate:		**Cost Index:**	
Estimate prepared by:		**Signed:**	
Estimate internal peer review by:		**Signed:**	
Estimate external peer review by:		**Signed:**	

Item	Description	Unit	Quantity	Rate	Amount	Subtotals	Comment/Assumptions
	UNSCHEDULED ITEMS (Tenderer to list any unscheduled items not included above that are considered necessary to complete the works in accordance with the Contract Documents)		-		0 0 0 0		
Total Project Estimate					**219,357,621**	**219,357,621**	
				Say	**219,400,000**	**219,400,000**	

Appendix C: Indicative Construction Programme

PP2O Indicative Construction Schedule | PP2O Construction Layout | 16-Sep-11 16:25

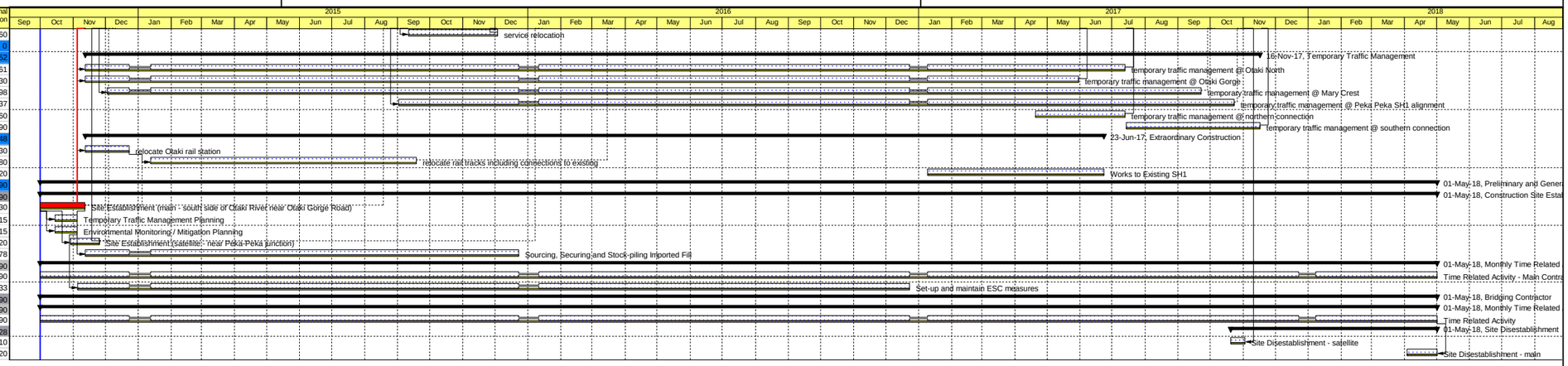
Activity ID	Activity Name	Start	Finish	Original Duration
	PP2O Indicative Construction Schedule	01-Oct-14	01-May-18	890
	Environmental Compliance			0
	Earthworks (Motorscraper crew 200m3/hr moved; Excav...	12-Nov-14	12-Sep-16	454
A1770	haul road for construction purposes (Sta 5000 to 9...	14-Jan-15	24-Feb-15	30
	North Otaki - Sta 0 - 3500	23-Mar-16	25-Aug-16	112
A1550	topsoil strip	23-Mar-16	29-Mar-16	5
A1560	temporary erosion and sediment control measures	25-Mar-16	07-Apr-16	10
	Earthworks within section (motorscraper) 2 crews	08-Apr-16	25-Aug-16	100
A1000	cut to fill	08-Apr-16	30-Jun-16	60
A1220	undercut and replace peat - 2 crews (excavator/du...	12-Aug-16	25-Aug-16	10
	Earthworks to Te Horo (excavator & dumper) 2 crews	01-Jul-16	11-Aug-16	30
A1020	cut to fill	01-Jul-16	11-Aug-16	30
	Otaki River - Sta 3500 - 7000	12-Nov-14	25-Aug-15	192
A1570	topsoil strip	12-Nov-14	25-Nov-14	10
A1580	temporary erosion and sediment control measures	14-Nov-14	13-Jan-15	30
	Earthworks within section (motorscraper) 2 crews	01-Jul-15	25-Aug-15	40
A1060	cut to fill	01-Jul-15	21-Jul-15	15
A1780	undercut and replace peat - 2 crews (excavator/du...	12-Aug-15	25-Aug-15	10
	Earthwork to Te Horo (motorscraper) 2 crews	22-Jul-15	28-Jul-15	5
A1210	cut to fill	22-Jul-15	28-Jul-15	5
	Earthworks to Mary Crest (excavator & dumper) 2 crews	25-Feb-15	30-Jun-15	90
A1790	cut to fill	25-Feb-15	30-Jun-15	90
	Earthworks to Peka Peka (excavator & dumper) 2 crews	01-Jul-15	11-Aug-15	30
A1800	cut to fill	01-Jul-15	11-Aug-15	30
	Te Horo - Sta 7000 - 8500	26-Aug-15	12-Sep-16	262
A1590	topsoil strip	26-Aug-15	01-Sep-15	5
A1600	temporary erosion and sediment control measures	28-Aug-15	10-Sep-15	10
	Earthworks within section (motorscraper) 2 crews	15-Mar-16	12-Sep-16	130
A1080	cut to fill	15-Mar-16	28-Mar-16	10
A1090	imported fill	29-Mar-16	12-Sep-16	120
A1810	undercut and replace peat - 2 crews (excavator/du...	29-Mar-16	11-Apr-16	10
	Mary Crest - Sta 8500 - 11000	26-Nov-14	14-Jan-16	272
A1610	topsoil strip	26-Nov-14	02-Dec-14	5
A1620	temporary erosion and sediment control measures	28-Nov-14	11-Dec-14	10
A1920	preload activity - bridge abutments	12-Dec-14	14-Jan-16	260
	Earthworks within section (motorscraper) 2 crews	06-May-15	28-Jul-15	60
A1120	cut to fill	06-May-15	14-Jul-15	50
A1230	undercut and replace peat - 2 crews (excavator/du...	15-Jul-15*	28-Jul-15	10
	Earthworks unsuitable to Otaki River (excavator & dumper) ...	29-Jul-15	25-Aug-15	20
A1140	undercut and replace peat - 2 crews (excavator/du...	29-Jul-15	25-Aug-15	20
	Peka Peka - Sta 1100 - 12200	26-Aug-15	21-Mar-16	137
A1630	topsoil strip	26-Aug-15	01-Sep-15	5
A1640	temporary erosion and sediment control measures	28-Aug-15	10-Sep-15	10
	Earthworks within section (motorscraper) 2 crews	04-Dec-15	21-Mar-16	65
A1160	cut to fill	04-Dec-15	17-Dec-15	10
A1250	undercut and replace peat - 2 crews (excavator/du...	18-Dec-15*	18-Jan-16	10
A1170	imported fill	23-Feb-16	21-Mar-16	20
	Earthworks unsuitable to Otaki River (excavator & dumper) ...	19-Jan-16	01-Feb-16	10
A1820	undercut and replace peat - 2 crews (excavator/du...	19-Jan-16*	01-Feb-16	10
	Earthworks unsuitable to Te Horo (excavator & dumper) 2 cr...	02-Feb-16	22-Feb-16	15
A1830	undercut and replace peat - 2 crews (excavator/du...	02-Feb-16*	22-Feb-16	15
	Ground Improvements	26-Aug-15	04-Apr-16	147
A1240	Geogrid, Preloading at Mary Crest - embankments ...	26-Aug-15	06-Oct-15	30
A1260	Geogrid at Peka-Peka	23-Feb-16	04-Apr-16	30
	Drainage			0
	Pavement & Surfacing	26-Aug-15	16-Nov-17	560
	North Otaki - Sta 0 - 3500	26-Aug-16	13-Jul-17	219
A1350	sub-base, base course, seal	26-Aug-16	14-Nov-16	57
A1370	final pavement surfacing	22-Jun-17	13-Jul-17	15
	Otaki River - Sta 3500 - 7000	26-Aug-15	30-May-17	438
A1390	sub-base, base course, seal	26-Aug-15	03-Mar-16	125
A1410	final pavement surfacing	26-Apr-17	30-May-17	25
	Te Horo - Sta 7000 - 8500	13-Sep-16	20-Jun-17	191
A1430	sub-base, base course, seal	13-Sep-16	06-Dec-16	61
A1450	final pavement surfacing	31-May-17	20-Jun-17	15
	Mary Crest - Sta 8500 - 11000	15-Jan-16	02-Nov-17	460
A1470	sub-base, base course, seal	15-Jan-16	22-Apr-16	71
A1490	final pavement surfacing	06-Oct-17	02-Nov-17	20
	Peka Peka - Sta 1100 - 12200	05-Apr-16	16-Nov-17	413
A1510	sub-base, base course, seal	05-Apr-16	18-May-16	32
A1530	final pavement surfacing	03-Nov-17	16-Nov-17	10
	Bridges	12-Nov-14	01-May-18	860
	Waitohu Stream Bridge	22-Feb-17	28-Nov-17	200
A1650	construction	22-Feb-17	28-Nov-17	200
	Otaki North Bridge	12-Nov-14	17-Apr-15	100
A1660	construction	12-Nov-14	17-Apr-15	100
	Otaki Ramp Bridge	20-Apr-15	22-Mar-16	230
A1670	construction	20-Apr-15	22-Mar-16	230
	Rahui Road Bridge	10-Feb-16	21-Feb-17	260
A1680	construction	10-Feb-16	21-Feb-17	260
	Otaki River Bridge	12-Nov-14	18-Apr-17	600
A1690	construction	12-Nov-14	18-Apr-17	600
	Otaki Gorge Expressway Overbridge	19-Apr-17	05-Sep-17	100
A1700	construction	19-Apr-17	05-Sep-17	100
	Otaki Gorge Railway Overbridge	12-Jul-17	01-May-18	200
A1710	construction	12-Jul-17	01-May-18	200
	Te Horo Overbridge	21-Oct-16	02-Nov-17	260
A1720	construction	21-Oct-16	02-Nov-17	260
	Mary Crest Underpass	15-Jan-16	23-Mar-17	300
A1730	construction	15-Jan-16	23-Mar-17	300
	Retaining Walls			0
	Included in Bridge Works			0
	Traffic Services			0
	North Otaki - Sta 0 - 2500			0
	Otaki River - Sta 2500 - 7000			0
	Te Horo - Sta 7000 - 8500			0
	Mary Crest - Sta 8500 - 11000			0
	Peka Peka - Sta 1100 - 12200			0
	Service Relocations	12-Nov-14	14-Mar-16	324
	North Otaki - Sta 0 - 2500	12-Nov-14	07-Aug-15	180
A1870	service relocation	12-Nov-14	07-Aug-15	180
	Otaki River - Sta 2500 - 7000	14-Jan-15	30-Jun-15	120
A1880	service relocation	14-Jan-15	30-Jun-15	120
	Te Horo - Sta 7000 - 8500	11-Sep-15	14-Mar-16	120
A1890	service relocation	11-Sep-15	14-Mar-16	120
	Mary Crest - Sta 8500 - 11000	12-Dec-14	05-May-15	90
A1900	service relocation	12-Dec-14	05-May-15	90
	Peka Peka - Sta 1100 - 12200	11-Sep-15	03-Dec-15	60

Suspended Activity | Actual Work | Critical Remaining Work

Primary Baseline | Remaining Work | Milestone

TASK filter: All Activities

Activity ID	Activity Name	Start	Finish	Original Duration
A1910	service relocation	11-Sep-15	03-Dec-15	60
Landscaping & Urban Design				0
Temporary Traffic Management		12-Nov-14	16-Nov-17	752
A1930	temporary traffic management @ Otaki North	12-Nov-14	13-Jul-17	661
A1940	temporary traffic management @ Otaki Gorge	12-Nov-14	30-May-17	630
A1950	temporary traffic management @ Mary Crest	03-Dec-14	22-Sep-17	698
A1960	temporary traffic management @ Peka Peka SH1 ...	02-Sep-15	23-Oct-17	537
A1970	temporary traffic management @ northern connecti...	20-Apr-17	13-Jul-17	60
A1980	temporary traffic management @ southern connect...	14-Jul-17	16-Nov-17	90
Extraordinary Construction		12-Nov-14	23-Jun-17	648
A1740	relocate Otaki rail station	12-Nov-14	23-Dec-14	30
A1750	relocate rail tracks including connections to existing	12-Jan-15	18-Sep-15	180
A1760	Works to Existing SH1	09-Jan-17*	23-Jun-17	120
Preliminary and General		01-Oct-14	01-May-18	890
Construction Site Establishment		01-Oct-14	01-May-18	890
A1270	Site Establishment (main - south side of Otaki Rive...	01-Oct-14	11-Nov-14	30
A1290	Temporary Traffic Management Planning	15-Oct-14	04-Nov-14	15
A1300	Environmental Monitoring / Mitigation Planning	15-Oct-14	04-Nov-14	15
A1280	Site Establishment (satellite - near Peka-Peka junc...	29-Oct-14	25-Nov-14	20
A1320	Sourcing, Securing and Stock-piling Imported Fill	12-Nov-14	23-Dec-15	278
Monthly Time Related Activites		01-Oct-14	01-May-18	890
A1990	Time Related Activity - Main Contract	01-Oct-14	01-May-18	890
A1310	Set-up and maintain ESC measures	05-Nov-14	23-Dec-16	533
Bridging Contractor		01-Oct-14	01-May-18	890
Monthly Time Related Activity		01-Oct-14	01-May-18	890
A1840	Time Related Activity	01-Oct-14	01-May-18	890
Site Disestablishment		20-Oct-17	01-May-18	128
A1860	Site Disestablishment - satellite	20-Oct-17	02-Nov-17	10
A1850	Site Disestablishment - main	03-Apr-18	01-May-18	20



Suspended Activity | Actual Work | Critical Remaining Work
Primary Baseline | Remaining Work | Milestone

TASK filter: All Activities

Appendix D: Risk Register

ADVANCED APPROACH RISK REGISTER FOR: Peka Peka to North Otaki Contract No 440/442PN

P:\projects\5-C1814.00 Peka Peka to North Otaki 440PN\200 Proj Mgt\440PN Engineering\270 Risk\SARA Risk Register\[PP2O Risk Register_SARA version 23-9.xlsm]Sheet1

Prepared by	Neil Beattie
Reviewed by	Tony Coulman
Compilation Date	1 September 2011

Activity	Includes:
Sources of Information	Excludes:
	Links to:

Ref	Risk Title	Description	Cause	Effect	Risk Owner	Risk Status	Threat/ Opportunity	Existing Controls	Likelihood Pre-Mitigation		Consequence Pre-Mitigation		Risk Level	Scores = CxL	Rank
									Rating Reason	Rating	Rating Reason	Rating			
1	Community & Stakeholder														
1.1	Project Expectations of NZTA and KCDC	Differing project expectations between NZTA and KCDC (2-3b & 2-7f)	Political drivers	Extended consultation and resulting delay	A Aburn	Live	Threat	KCDC expectations and drivers identified through the consultation plan and through active stakeholder liaison and staged workshops/meetings.		Quite Common		Medium	Very High	160	
1.2	Culturally significant sites	Culturally significant sites missed	Inadequate consultation	Delays and potential extra costs to overcome	A Aburn	Live	Threat	Iwi Engagement Plan developed, need for CIA identified		Quite Common		Minor	Moderate	40	
1.3	Local economy	The project may impact local economy	Reduction in passing trade	Affecting the business and local community leading to public dissatisfaction.		Closed		Methodology identifies need to develop social and economic impact study utilising overseas case studies/literature and engage/collect local business data on visitors.							
1.4	Local amenity	The project may impact local amenity	Design of route and severance	Affecting property values and life styles leading to public dissatisfaction	A Aburn	Live	Threat	Need for a social impact assessment/study has been identified.		Unlikely		Minor	Moderate	30	
1.5	East / West connectivity	Opportunity to improve social and local community access routes and networks through cross project routes (East-West Connectivity) (2-7g)	Design route and connections, bridges etc	Improvement in social connections and access to amenity.		Closed		Need for a social and economic impact study taking account of the existing rail line and/or SH recognised. Connectivity scenarios and assessments to reflect urban design drivers and desire lines identified.							
1.6	Inadequate consultation	Inadequate consultation and feedback to the community	Poor consultation planning and delivery	May increase frustration and cause opposition to the expressway along with poor public relations and loss of reputation for NZTA		Closed		Robust Consultation plan with clear objectives for each stage of engagement.							
1.7	Community expectations	The project may not meet community expectations	Public and stakeholder opinion	Loss of reputation to NZTA and / or dissatisfaction or causing extended consultation period	R Beals	Live	Threat	Consultation plan prepared, ongoing KCDC liaison, developed urban design and landscape framework to guide project development, plus effective public engagement and feedback		Unlikely		Medium	High	120	
1.8	Public engagement	We may not engage adequately	Public and stakeholder opinion	Poor public relations or public opposition		Closed		Consultation plan							
1.9	Otaki community buy-in	There may be a lack of buy-in from the Otaki community	Public and stakeholder opinion	Poor public relations or public opposition	R Beals	Live	Threat	Consultation plan		Likely		Medium	Very High	200	
1.10	Communication with land-owners and NZTA	Miscommunication and/or misinformation between affected landowners and NZTA and Consultant	Poor consultation (communication) planning and delivery	Leading to disputes and project delays	R Beals	Live	Threat	Consultation plan (communication)		Unusual		Medium	High	80	
1.11	Stakeholder relationship	Breakdown in relationships between Principal, Consultant or Stakeholders	People and relationships	Leading to disputes and project delays	A Aburn A Quinn	Live	Threat	Develop no surprises approach within the team and engage in partnering workshop and strategy		Rare		Medium	Moderate	40	
1.12	SH1 Revocation project	The condition of the former SH1 at handover to KCDC may be a driver to achieving buy in	Good design solutions and asset condition	Achievement of KCDC and stakeholder buy-in to project delivery	D Dunlop	Live	Opportunity	Ensure we understand KCDC requirements for the handover (maintenance standards, speed environment, etc) condition as well as expectations around arterial treatment once the expressway is live.		Likely		Major Op	Extreme	-350	
1.13	KiwiRail design requirements (bridges)	Timing or scope impacts associated with rail elements of project.	Increased KiwiRail requirements, or interface between projects (such as Mary Crest) that delay project.	Impact on scoping and consultation timeframes plus extent of resource input and costs to NZTA. (links with 1.1)	P. Coop	Live	Threat	Have undertaken early engagement and discussions with KiwiRail/KCDC and NZTA - methodology proposes staged option workshops		Quite Common		Medium	Very High	160	
1.14	SH1 existing structures	Condition of existing structures transferred to KCDC does not meet their expectations	KCDC opinion / requirements	Increase in project costs to achieve KCDC buy-in to project delivery	Phil G	Live	Threat	Captured obligations for NZTA in reporting outputs and in developing MOU with KCDC.		Unusual		Medium	High	80	
1.15	KCDC resources	KCDC resources availability inadvertently disrupts the project programme	Inability to commit sufficient resources to project. (2-4a)	Project delays	NZTA	Live	Threat	Invest early in this relationship spending time and effort up-front to help with later negotiations. Create provision in professional services consultation scope of works specifically for this. Create a 'key stakeholders' group and keep regular contact through all phases.		Quite Common		Minor	Moderate	40	
1.16		Backwards step in design from current position, especially around Rahui Road, Te Horo and Mary Crest (2-7h)				Closed		Continue discussions with KCDC on scope and design outcomes.							
1.17	Stormwater and ecology	Stormwater and ecological issues need to be addressed adequately and be consistent with KCDC district plan. (2-7i)		Increase in project costs to achieve KCDC buy-in to project delivery	G. McKay	Live	Threat	Continue discussions with KCDC on scope and design outcomes.		Unlikely		Major	Very High	210	
2	Consents & Approvals														
2.1	Consenting strategy	Gaps in consents strategy	Poor planning and delivery	Delays in obtaining necessary RMA consents	P Coop	Live	Threat	Consents and approval strategy developed, reviewed and implemented		Quite Common		Medium	Very High	160	
2.2	Project designation	Delay in obtaining project designation	Poor planning and delivery	Delays in the programme and increased costs		Closed									
2.3	RATAG Group	Early formation of the approvals (RATAG) Group		Early buy in to our designation/consenting strategy	A Aburn	Live	Opportunity	Remit to be developed with NZTA and Legal team.		Likely		Minor Op	Moderate	-50	
2.4	Building consents	Delay in obtaining and necessary building consent	Poor planning and delivery	Delays in the programme and increased costs		Closed									
2.5	Environment Court appeal	Environment court appeal on the HPT approvals	These are not subject to the EPA process	Delaying start to construction.	A Aburn	Live	Threat	Strategy outlined in approvals strategy		Unlikely		Medium	High	120	

Treatment Type	Treatment Actions	Treatment Owner(s)	Resources	Treatment Timing	Treatment Progress	Monitoring and Reporting	Treatment Cost(s)	Likelihood Post-Mitigation		Consequence Post-Mitigation		Risk Level	Scores = CxL	Rank
								Rating Reason	Rating	Rating Reason	Rating			
1	Community & Stakeholder													
Mitigate	Ensure ongoing communication maintained with KCDC and continue to involve in workshops. NZTA/KCDC Advisory/liaison meetings at a project governance/advisory level.	A Aburn		SAR	Commenced				Rare		Medium	Moderate	40	
Mitigate	Implement plan. Increased input and use of Niketi together with multi-tier level of engagement versus business as usual approach. Iwi engagement strategy developed by project Iwi advisor. Engagement meetings initiated and further staged meetings to be scheduled to engage around issues and options.	A Aburn		SAR	Commenced				Rare		Medium	Moderate	40	
	Impact assesssment to capture negative and positive aspects and mitigation. Interchange form to consider ease of access to shopping destination. Implement business survey.			SAR	Completed									
Mitigate	Complete updated assessment to capture change in environment since earlier assessments. Team have developed Urban Design and Landscape Framework to realise opportunities	A Aburn		SAR	Commenced				Rare		Minor	Low	10	
	Alignment cross section and interchange options to consider avoidance, and/or acceptable mitigation strategies; Look at alignment refinement, interchange options, modal choice across and through Otaki, Peka Peka Rd and Te Horo.			SAR	Completed									
	Closed - covered by other consultation risks under "Planning and Consultation"													
Mitigate	As existing control	R Beals							Rare		Minor	Low	10	
Mitigate	As existing control	R Beals		SAR	Commenced				Unlikely		Minor	Moderate	30	
Mitigate	As existing control	R Beals		Immediate Early Investment	Commenced				Rare		Minor	Low	10	
Mitigate	Engagement plan in place together with regular liaison meetings. Idea of a Project Advisory Group raised but yet to be adopted formally by NZTA/KCDC.	A Aburn A Quinn		Immediate Early Investment	Commenced				Rare		Medium	Moderate	40	
Enhance	Separate SH1 Revocation Project identified to focus on walking/cycling and and further SH1 treatments beyond direct mitigation	D Dunlop		Specimen Design	Commenced				Likely		Major Op	Extreme	-350	
Mitigate	Ongoing liasion and development of MoU and joint consenting strategy.	P.Coop		SAR	Commenced				Rare		Medium	Moderate	40	
Mitigate	Preliminary assessment to be completed including VDM aspects.	Phil G		Specimen Design	Commenced				Rare		Medium	Moderate	40	
Mitigate	As per existing control	NZTA		Specimen Design	Commenced				Rare		Minor	Low	10	
Mitigate	Stormwater DPS developed, continue liasion at AEE sta	G. McKay							Rare		Medium	Moderate	40	
2	Consents & Approvals													
Mitigate	Consents and approvals strategy reviewed by NZTA's legal advisors to ensure robust strategy.	P Coop		SAR	Commenced				Rare		Medium	Moderate	40	
	Risk closed; covered elsewhere													
Enhance	As per existing control	A Aburn		SAR	Completed				Likely		Medium Op	Very High	-200	
	Risk closed; covered elsewhere													
Mitigate	Review approvals strategy with a view to consider whether HPT Authorities should be sought earlier and renewed as required rather than risk separate appeal route that runs beyond BOI process. Seek HPT approval prior to BOI process.	A Aburn		SAR	Commenced				Unlikely		Medium	High	120	

Ref	Risk Title	Description	Cause	Effect	Risk Owner	Risk Status	Threat/ Opportunity	Existing Controls	Likelihood Pre-Mitigation		Consequence Pre-Mitigation		Risk Level	Scores = CxL	Rank
									Rating Reason	Rating	Rating Reason	Rating			
2.6	Corridor alternatives	Potential RMA challenge around assessment of corridor alternatives (S171.b)	The Board of Inquiry or other process challenge	Time impacts to the Board of Inquiry process, the "one attempt" EPA process and a timeline risk to the project.	A Aburn	Live	Threat	We have undertaken assessment/review of the previous work to ensure the 2002/2003/2009 assessment was robust		Unusual		Major	High	140	
2.7	RMA changes	Changes are being made to the RMA - due July 2011.	Statutory legislation	Impact on extent of planning assessment / considerations.	A Aburn	Live	Threat	Planning team to monitor situation.		Likely		Minor	Moderate	50	
2.8	EPA Agency changes	The EPA are changing to an Agency on 1 July 2011 and increasing in size three-fold.	Statutory legislation	Programme delays due to restructuring and EPA internal management processes. (2.7l)	A Aburn	Live	Threat	Early EPA liaison as spelt out in the planning strategy.		Likely		Minor	Moderate	50	
2.9	Restrictive Consents / Conditions	Degree of consent too restrictive / prohibitive reflecting a lack flexibility in statutory approval(s) (2-7a)	Supporting application / design provides too much definition	Stifles D&C innovation and construction initiative	A Aburn	Live	Threat			Unlikely		Medium	High	120	
2.10	Consenting strategy and approach	Change in consenting approach away from EPA. (2-7b)	Change in project strategy	Reduction in costs of professionals	NZTA	Live	Opportunity			Unlikely		Major Op	Very High	-210	
2.11	Gaining consents	Consents are not gained in a timely manner to suit the programme. (2-7c)	Poor planning and implementation	Delaying start to construction.	NZTA	Live	Threat	Early EPA liaison as spelt out in the planning strategy, plus early dialogue/warning on resource expectations/needs.		Likely		Medium	Very High	200	
2.12	Objections to construction works	Objections from local council/residents	Construction noise/vibration/dust/dirt on roads (2-7e)	Leading to disputes, additional costs, project delays and poor public relations	NZTA	Live	Threat	Consultation plan and management plans.		Quite Common		Minor	Moderate	40	
3	Cultural & Heritage														
3.1	Cultural or heritage issues	Cultural or heritage issues may be ignored or not recognised	Poor communication	Poor relationships and potential protests and delays	H. Anderson	Live	Threat	We have undertaken a Heritage Assessment Plan. Iwi engagement strategy developed by project Iwi advisor.		Unlikely		Medium	High	120	
3.2	Archaeological finds (design)	Unknown archaeological issues may arise during investigations		Project delays or increases to costs	H. Anderson	Live	Threat	We have undertaken a Heritage Assessment Plan to identify necessary mitigation measures and HPT requirements.		Rare		Medium	Moderate	40	
3.2A	Archaeological finds (construction)	Unknown archaeological issues may arise during construction (2-7d)		Project delays or increases to costs	H. Anderson	Live	Threat	We have undertaken a Heritage Assessment Plan to identify necessary mitigation measures and HPT requirements.		Rare		Medium	Moderate	40	
3.3		Inappropriate cultural and heritage processes issues relating to for example the existing railway line and station; the Mirek Smisek kilns, pottery and buildings leads to objections,		Project delays and increased costs		Closed		We have undertaken a Heritage Assessment Plan to identify necessary mitigation measures and HPT requirements.							
3.4		Lack of knowledge could result in lack of due consideration to the Ngati Raukawa's whai tapu site concerns		Objections, protests and delays.		Closed		Same as 1.2 & 3.1							
4	Design														
4.1	Flood plain design	Inappropriate flood plain design could worsen flooding/erosion effects about the Otaki River, Waitohu and Mangaone Stream and other areas (1-8b)	Poor professional design and considerations	Exacerbating existing flooding risks on the flood plain causing increased design and construction costs	G Webby	Live	Threat	Undertake flood and erosion assessment studies to identify mitigation requirements including any compensatory storage/overland flow paths etc; avoid sitting bridges etc at inappropriate locations, or with inadequate span arrangements.		Quite Common		Medium	Very High	160	
4.2	Hydraulic modelling information	Timely provision by others of (unverified) hydraulic modelling of some rivers and streams	Poor communication	Timeline delays and need for robust review.		Closed		Opus designers have some specific in-depth design knowledge of the study area covering geotechnical / seismic and hydraulic aspects							
4.3	Engineering design inputs	There may be delays in availability of key design input for various engineering features (bridges, intersections, urban design etc) leading to delays	Poor communication	Project delays and increased costs		Closed									
4.4	Otaki River bridge study	Focus on other studies leads to delays in the commencement of the Otaki River Bridge study	Poor communication regarding programme expectations	Project delays and increased costs		Closed									
4.5	Bridge loading design	Bridge loading design	NZTA VDM rule change	Increased cost of design and construction	P Gaby	Live	Threat	Project team has information to enable early and informed assumptions		Unlikely		Medium	High	120	
4.6	Traffic modelling misalignment	Connectivity assumptions and traffic modelling misalignment between PP20 and W2PP project teams.	Poor communication	Project delays and increased costs, inappropriate design		Closed		Covered by 4.17							
4.7	East / West connectivity and accessibility	Poor accessibility and linkages east / west down the corridor	Poor professional design and modelling	Disbenefit to local road users and the community (pedestrians/cycles/equestrians).		Closed		Covered by 1.5							
4.8	Local road / expressway intersection design	Poorly conceived intersections linking the local road and Expressway could impact on local movements and discourage access to Otaki town centre if the interchange configuration is inappropriate and leads to poor legibility or detours.	Poor professional design and modelling	Leading to disputes, additional costs, project delays and poor public relations		Closed		Urban design and transport assessment of a range of connectivity scenarios and options has identified optimal interchange connectivity configuration. Assessment to include MCAT screening by							
4.9	Interchange constructability	The form of the proposed interchanges may affect future constructability (need to keep existing roads open & full diamond I/C in the north may not be possible)	Poor professional design and modelling	Leading to disputes, additional costs, project delays and poor public relations	K Atkinson	Live	Threat	Constructability considered in SARA during options development.		Unusual		Medium	High	80	
4.10	Mary Crest bridge	The skew rail crossing at Mary Crest may create design issues that increase cost at construction	Professional design requirements	Increased cost of design and construction		Closed		Examine alternative options. Buildability inputs to option development and MCAT assessment							
4.11	Stormwater design standards	Standards for stormwater design have changed	Professional design requirements	Increased cost of design and construction		Closed		This risk is an issue and has been recognised as part of the Base Case							
4..12	not used														
4.13	Traffic data - growth and HPMV	Gaps in traffic data leads to incorrect forecasting of traffic growth and HPMV proportions	Inappropriate modelling inputs	Changes in demand and impacts associated with other projects; affects on project economics	D Dunlop	Live	Threat	We have updated the current traffic counts and modelling		Unlikely		Medium	High	120	
4.14		Construction estimate may exceed project funding leading to delays or scope trimming.				Closed									

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									Rating Reason	Rating	Rating Reason	Rating			
2.6	Mitigate	Independent Route options review completed to cover assessment. To feed into NZTA Board decision on SARA.	A Aburn		SAR	Commenced				Rare		Major	High	70	
2.7	Accept	Monitor RMA changes and implications for project EPA application.	A Aburn		Watching Brief	Completed	issue rather than risk			Likely		Negligible	Low	5	
2.8	Accept	As per existing controls plus early dialogue/warning on resource expectations/needs.	A Aburn		Watching Brief	Completed	issue rather than risk			Likely		Negligible	Low	5	
2.9	Mitigate	Hold a basis of Prelim Design workshop early in AEE phase, together with focus on flexibility sought.	A Aburn		SAR	Commenced				Rare		Medium	Moderate	40	
2.10	Enhance	NZTA to consider project strategy (individual project needs -v- overall RoNS) weighing benefit of 1 project against a unified strategy covering all projects.	NZTA		SAR	Awaiting Approval				Unlikely		Major Op	Very High	-210	
2.11	Mitigate	As per existing control	NZTA		Immediate Early Investment	Commenced				Rare		Minor	Low	10	
2.12	Mitigate	as per existing control. Also considered part of D&C contractor requirement prior to construction commencement (include as part of tender requirements)	NZTA		Construction	On-Hold				Rare		Minor	Low	10	
3	Cultural & Heritage														
3.1	Mitigate	Engagement meetings initiated and further staged meetings to be scheduled to engage around issues and options.	H. Anderson		SAR	Commenced				Rare		Medium	Moderate	40	
3.2	Mitigate	As per existing control and further AEE phase work.	H. Anderson		SAR	Commenced				Rare		Medium	Moderate	40	
3.2A	Mitigate	As per existing control and further AEE phase work.	H. Anderson		Construction	On-Hold				Rare		Medium	Moderate	40	
3.3		As per existing control			SAR	Completed									
3.4		Risk closed; covered elsewhere													
4	Design														
4.1	Mitigate	As per existing control - SAR assessment completed. Further AEE work to complete assessment.	G Webby		SAR	Commenced				Rare		Minor	Low	10	
4.2		Further detailed SARA and AEE assessment and modelling required.			SAR	Completed									
4.3		Risk closed; covered elsewhere													
4.4		Risk closed; covered elsewhere													
4.5	Mitigate	Assessed as part of SARA investigations. Monitor moving forward.	P Gaby		SAR	Commenced				Unusual		Minor	Low	20	
4.6		Risk closed; covered elsewhere													
4.7		Risk closed; covered elsewhere													
4.8		Robust connectivity screening process with MCAT screening and staged stakeholder workshops. Optimal outcome identified = split interchange with Otaki "within" Nth and Sth facing ramps Nth and Sth of the town respectively.			SAR	Completed									
4.9	Mitigate	Incorporated into option development process and MCAT tool plus estimates as per existing control. Further Specimen Design consideration.	K Atkinson		Specimen Design	Awaiting Approval				Rare		Minor	Low	10	
4.10		Further SARA assessment following KiwiRail rail easing feedback at Mary Crest. Adressed in SAR.			SAR	Completed									
4.11		Risk closed													
4..12															
4.13	Mitigate	Further model development and counts completed. Final traffic peer review to be completed.	D Dunlop		SAR	Commenced				Rare		Negligible	Negligible	1	
4.14		Risk closed													

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									Rating Reason	Rating	Rating Reason	Rating												Rating Reason	Rating	Rating Reason	Rating			
4.15		May encounter unexpected ground conditions as the geotechnical investigation has not yet been done preventing early confirmation of bridge foundation type which may lead to increased costs of foundations over that envisaged. Also applies to sub grade treatments.				Closed		Risk passed and other risks now cover									Risk closed													
4.16	Traffic volumes	Risk that traffic volumes from the PP2O model do not match up with the M2PP model	Inappropriate modelling inputs, development and outputs	Model credibility issues (given different models).	D Dunlop	Live	Threat	Working with M2PP team to resolve + appropriate sensitivity testing.		Unusual		Minor	Low	20		Mitigate	As per existing control. Models being combined but further validation of M2PP model needed.	D Dunlop		SAR	Commenced				Rare		Minor	Low	10	
4.17		Availability of GWRC / KCDC Models, could affect timeline due to lack of timely data. Is also linked to credibility of consultation				Closed											Risk Closed - data received.													
4.18	Crossing of Waitohu Stream	Waitohu Stream, scour issues created by being on the bend of the stream	Location of crossing	Increased operational costs.	G Webby	Live	Threat	Methodology identified need to address scour issues in design		Unusual		Medium	High	80		Mitigate	Can be designed out - GWRC bridge span requirement across the Waitohou together with appropriate land spans will mitigate the risk (included in SAR considerations)	G Webby		SAR	Commenced				Rare		Medium	Moderate	40	
4.19	Otaki flood protection	Opportunity to improve flooding pattern around Otaki – with embankments	Professional design improvements	Reduce flood impacts within Otaki Town.	G Webby	Live	Opportunity	Feed opportunity consideration into flood assessment for the scheme at scheme assessment and AEE stage.		Unlikely		Medium Op	High	-120		Enhance	Mitigation must bear in mind upstream and downstream flood impacts and mitigation. Refine opportunity in AEE assessment.	G Webby		SAR	Completed				Likely		Medium Op	Very High	-200	
4.20	Flood level design	Potential impact on expressway levels and extent of dry culverts/secondary flow path provision	Flood mitigation design	Increased costs.	G Webby	Live	Threat	All available GWRC and KCDC flood and model output data sourced. Expressway levels set to appropriate flood levels		Unlikely		Medium	High	120		Mitigate	Detailed modelling and assessment completed at scheme stage, followed by further AEE assessment for EPA process.	G Webby		SAR	Completed				Unusual		Medium	High	80	
4.21	Flood testing	Requirement for additional flood testing for multiple scenarios e.g. Rahui Rd, Underpass, 100 year flood and maximum flood	Flood mitigation design	Programme delay and increase in cost	G Webby	Live	Threat	At SARA stage analysis completed. Further AEE inputs for the AEE and EPA process required.		Unlikely		Medium	High	120		Mitigate	Preliminary mitigation ID in SAR. Further refined for AEE phase.	G Webby		AEE	Completed				Rare		Medium	Moderate	40	
4.22		Timeline risk for developing robust scoping and then scheme philosophies and concept designs for structures - if geometric, geotech and flood data are not available in sufficient time they will impact on delivery programme for SARA.				Closed											Risk Closed - data received.													
4.23		Risk of new options, ideas coming out and not being able to be sufficiently developed for consultation in November				Closed											Risk Closed - consultation deferred to Feb 2012 and general alignment with stakeholders and NZTA at 23rd Sept workshop.													
4.24		Poor communication with M2PP leads to bridge form and aesthetics differing to between the 2 projects.			P Gaby	Live	Threat	RoNS bridge meeting held to discuss bridge requirements		Unusual		Minor	Low	20		Mitigate	On-going liasion meetings held with input to SAR concepts.	P Gaby		SAR	Commenced				Unusual		Minor	Low	20	
4.25	Rail corridor working	More onerous conditions and constraints when working in the rail corridor. (1-7a)	Lack of understanding / experience of KiwiRail requirements	Programme delay and increase in cost	S de Rose	Live	Threat	estimate based on interpretation of existing KiwiRail requirements		Likely		Minor	Moderate	50		Mitigate	Could spend time with KiwiRail management and operations to gain a greater understanding of likely requirements.	S de Rose		Specimen Design	Commenced				Unusual		Minor	Low	20	
4.26	KiwiRail design requirements (bridges)	KiwiRail requirements for bridge spans and clearances more stringent than anticipated resulting in wider and longer bridges. (1-7c)	KiwiRail changes its requirements or rail network development plans.	Cost of bridges goes up. This may be particularly sensitive at Mary Crest where a small change in width and or bridge skew could be very significant in terms of bridge cost	G McKay	Live	Threat	design based on interpretation of existing KiwiRail requirements		Likely		Medium	Very High	200		Mitigate	Rail Basis of Design developed and MoU to be signed.	G McKay		SAR	Commenced				Unusual		Medium	High	80	
4.27	Service utilities	Service utility estimates increase at later project stage. (1-6a)	Utility price data currently outstanding; historically this area of cost increases as project design becomes more defined	Increase in project cost	S de Rose	Live	Threat	requests sent to service authorities requesting estimate information		Quite Common		Major	Very High	280		Mitigate	Spend time with utilities management and estimators detailing project and likely requirements. Unvertainty captured in estimate.	S de Rose		SAR	Commenced				Quite Common		Medium	Very High	160	
4.28	Aggregate price escalation	Escalation in aggregate prices due to limited source with high local demand. (1-2a)	Limited source with high local demand	Increase in project cost	Brabha	Live	Threat			Quite Common		Minor	Moderate	40		Mitigate	Seek to secure aggregate rates with local supplier.	Brabha		SAR	Commenced				Quite Common		Minor	Moderate	40	
4.29	OGPA requirements	Increased requirement for OGPA along entire expressway length. (1-2b)	Public/stakeholder pressure	Increase in project cost c/f base provision which is based on the preliminary noise assessment (Otaki and Old Hautere to Mary Crest).	Sheryn	Live	Threat	design based on interpretation of existing noise reduction requirements		Quite Common		Major	Very High	280		Mitigate	Verify pavement design (noise) interpretations independently.	Sheryn		Specimen Design	Awaiting Approval				Unusual		Medium	High	80	
4.30	Pavement design	Pavement design assumptions (for HCV's) are proven inadequate. (1-2c)	Misinterpretation - current assumption 150mm / 180mm sub-base / base course	Increase in project cost	Sheryn	Live	Threat	design based on existing hpmv knowledge and expert opinion on likely future growth scenario		Quite Common		Medium	Very High	160		Mitigate	Verify pavement design interpretations independently.	Sheryn		Specimen Design	Awaiting Approval				Unusual		Medium	High	80	
4.31	Opportunity to reduce median shoulder provision across expressway bridges	Risk to increase median shoulder provision across expressway bridges if later bridge manual changes come online. (1-3a)	VFM team challenge and potential future update to the NZTA Bridge Manual	Increase of $2.4M in costs with little impact on operational/safety outcomes.	Phil G	Live	Threat			Likely		Major	Extreme	350		Enhance	Design should provide for current regulations/standards - amend bridges as required. Estimate to "catch-up" in Specimen Design phase	Phil G		SAR	Completed				Likely		Major Op	Extreme	-350	
4.32	Local Road Carriageway and Path provision	Potential increase in stakeholder requirements for local road carriageway and path provision, resulting in wider structures. Increasing width reduces the suitability of a 'segmental' approach. (1-3b)	Uncertain/varying stakeholder requirements.	Increase bulk of structures may preclude segmental concept and add to project costs	Phil G	Live	Threat			Quite Common		Major	Very High	280		Mitigate	Design should provide for current regulations/standards - amend bridges as required.	Phil G		Specimen Design	Awaiting Approval				Unusual		Medium	High	80	
4.33	Otaki River Bridge	Opportunity to shorten the length of the Otaki River bridge. (1-3c)	Detail in bridge design	Bridge length is included in consent, with a higher project cost than "optimum"	Phil G	Live	Opportunity	design based on existing geotechnical knowledge and opinion		Unlikely		Major Op	Very High	-210		Mitigate	Design should provide for current regulations/standards - amend bridges as required.	Phil G		Specimen Design	Awaiting Approval				Likely		Major Op	Extreme	-350	
4.34	Bridge Foundations	Bridge foundations are deeper than allowed for in SE (1-3d).	Limited geotechnical investigations at structures	Increased pile depths allowing for scour, poor ground and liquefaction, increased cost and delays to programme	Brabha	Live	Threat	design based on existing geotechnical knowledge and opinion		Likely		Major	Extreme	350		Mitigate	Seek to undertake specific geotechnical investigation to address risk (in next design phase)	Brabha		Specimen Design	Awaiting Approval				Unusual		Medium	High	80	
4.35	Rahui Road Bridge Separation	Separate Rahui Road expressway over bridge and railway over bridge into two structures with reinforced soil embankment between (1-3e).	Opportunity to reduce costs.	Decrease in costs and programme.	Phil G	Live	Opportunity			Quite Common		Medium Op	Very High	-160		Enhance	Seek to enhance design opportunity in next phase of project	Phil G		Specimen Design	Awaiting Approval				Likely		Major Op	Extreme	-350	
4.36	Under-bridge widths increasing	Under-bridge widths increase due to increasing span requirements. (1.3f).	Stakeholder expectations around the widths provided for shoulders and footways	Wider bridges result in increased costs. Otaki North and South bridges are approaching the maximum sensible width for segmental construction. If additional width is continued to be required then construction method will need to change.	Phil G	Live	Threat			Quite Common		Medium	Very High	160		Mitigate	Design should provide for current regulations/standards - amend bridges as required.	Phil G		Specimen Design	Awaiting Approval				Unusual		Medium	High	80	
4.37	Otaki and Waitohu River Bridge flood clearances	Otaki and Waitohu River bridge flood clearances are found to be insufficient. (1-3g)	Initial assumptions found to be optimistic or stakeholder expectations drive for a better level of protection.	Bridges increase in length and or height resulting in cost increases ($75k/linear metre of bridge).	Phil G	Live	Threat			Unlikely		Medium	High	120		Mitigate	Design should provide for current regulations/standards - amend bridges as required.	Phil G		Specimen Design	Awaiting Approval				Unusual		Medium	High	80	
4.38	Otaki and Waitohu River Bridges	Otaki and Waitohu River bridge Super 'T' construction doesn't deliver appropriate urban design outcome for river crossing and are replaced with the segmental form used for the under bridges. (1-3h).	Community/Stakeholder pressure.	Cost of bridges increases.	Phil G	Live	Threat	Bridge Design Statement and ULDF.		Quite Common		Medium	Very High	160		Mitigate	Consultation with stakeholders on bridge forms before preliminary design is undertaken.	Phil G		Specimen Design	Awaiting Approval				Quite Common		Medium	Very High	160	
4.39	Pedestrian / Cycleway Clip on to existing Otaki River Bridge	Reduction in width of pedestrian/cycle clip on to existing Otaki River Bridge. (1-3i).	Cost Savings needed	Reduce width to 3m, cut off existing cantilever footway and replace with clip on.	Phil G	Live	Opportunity			Unlikely		Medium Op	High	-120		Enhance	1. Confirm project strategy and how SH1 Revocation project will be funded. 2. Design should provide for current regulations/standards - amend bridges as required.	NZTA		Specimen Design	Awaiting Approval				Likely		Medium Op	Very High	-200	
4.40	Reduce Bridge Skew	Straighten Otaki North and Rahui bridges to reduce skew. (1-3j)	Cost Savings needed	Save on bridge costs.	Phil G	Live	Opportunity			Quite Common		Medium Op	Very High	-160		Enhance	Bridge designer to confirm design philosophy and statement on basis of best for project outcome(s)	Phil G		Specimen Design	Awaiting Approval				Likely		Medium Op	Very High	-200	

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									Rating Reason	Rating	Rating Reason	Rating			
4.41	Mary Crest Bridge Foundations	Deletion of piling requirements at Mary Crest bridge due to better than expected ground conditions. (1-3k).	Ground conditions are better than expected.	Save on piling.	Phil G	Live	Opportunity			Quite Common		Medium Op	Very High	-160	
4.42	Common structure types between PP20 and M2PP projects	M2PP and PP20 project both make use of segmental construction and use for Otaki and Waitohu Bridges. (1-3m)	Requirement for similarity between the two schemes.	Cost of segmental and super 'T' bridges similar in costs as a result due to savings in gear and shutters. Programme saving due to quicker construction.	Phil G	Live	Opportunity			Unlikely		Medium Op	High	-120	
4.43	Speed of Bridge Construction	Speed up construction of Otaki River Bridge by changing form from super 'T' to segmental. (1-3n)	Need to speed up items on the critical path.	Enable movement of excess material to fill areas south of Otaki River.	Phil G	Live	Opportunity			Unlikely		Medium Op	High	-120	
5	Environmental														
5.1	Environmental Management Plan	Inappropriate EMP leads to amenity effects (air, noise, dust pollution) for residents living adjacent to the route (1-4c)	Poor environmental management practices, lack of definition in project requirements.	Increased project mitigation costs and delays to programme.	H. Anderson	Live	Threat	Development of environmental management plan and appropriate investigations and assessments to support scheme design and EPA process.		Unlikely		Medium	High	120	
5.2		The project might create unacceptable ecological and environmental impact.				Closed									
5.3	Flora and Fauna	Protected flora and fauna on the site	Project investigations	Project delays and increased cost	H. Anderson	Live	Threat	Development of environmental management plan and appropriate investigations and assessments to support scheme design and EPA process.		Unlikely		Minor	Moderate	30	
5.4		There may be watercourse and groundwater protection issues leading to increased cost				Closed									
5.5		There may be impacts on specific protected features or special sites of local importance or heritage value which cause delay and extra costs to overcome				Closed									
5.6		Stormwater design and measures may be difficult to achieve or prove inadequate, leading to increased costs				Closed									
5.7		The proposed project may affect the Hautere Plains totara				Closed									
5.8		We may not provide adequately for stormwater ponds both at construction and in the permanent works				Closed									
5.9		Damage or disruption to the highway infrastructure may arise during investigations				Closed									
5.10	Pare-O-Matangi reserve	Expressway impact on the Pare-O-Matangi reserve (2-7j)	Poor professional inputs	Social and environmental impacts, potential opposition/poor outcomes.	B. Curtain	Live	Threat	Urban design and landscape framework and project plans identify opportunities for reserve development in around Rahui/County Rd as well as wider project. opportunities also.		Quite Common		Medium	Very High	160	
5.11	Swamp forest	GWRC concerns about swamp forest remnants e.g. at Mary Crest & Durham Estate	Poor professional inputs	Approvals challenged if assessments are not robust.	H. Anderson	Live	Threat	John Turner has undertaken a high level fatal flaw assessment		Quite Common		Minor	Moderate	40	
5.12		Raised structures and embankments along the route - especially at Rahui Road		Visual impacts, community concern as to impacts or planning challenges.	H. Anderson	Live	Threat	Alternative crossing and interchange options were considered as part of process with public feedback sought. Robust assessment process		Quite Common		Minor	Moderate	40	
5.13	Social severance	Social severance caused by the expressway especially at Rahui Road and Te Horo if connectivity solution is inappropriate or ill conceived	Poor professional design inputs	Poorer outcome than possible and local community concern impacting on project reputation and progress.		Closed		Risk same as 1.5							
5.14	Long tailed bats	Long tailed bats habitat found in remnant forest.	Poor professional inputs	Approvals challenged if assessments are not robust.	H. Anderson	Live	Threat	John Turner will assess possibility in assessment.		Unlikely		Medium	High	120	
5.15	Otaki Railway station	Community opposition to moving Otaki Railway Station (a HPT listed building and archaeological site underneath)	Poor professional inputs	Approvals challenged if assessments are not robust.	H. Anderson	Live	Threat	Option developed to rotate station on current site.		Quite Common		Medium	Very High	160	
5.16	Ecological or reserve offset mitigation via BOI process	Potential for increased reserve space mitigation at Pare-O-Matangi Reserve, or in vicinity of Mary Crest. (1-4a)	Stakeholder or BOI outcome.	Increased project mitigation costs, and potential property cost.	T Coulman	Live	Threat			Quite Common		Medium	Very High	160	
5.17	Earthworks Disturbance	Conditions of consents limit the amount of 'opened-up' earthworks at any one period. (1-4b)	Consent condition	Increased earthworks element of programme and project costs	T Coulman	Live	Threat			Unlikely		Medium	High	120	
6	Geotechnical														
6.1		Insufficient or incomplete knowledge of ground conditions cause design or construction methodology changes that cause time delays or cost increases				Closed									
6.2		Seismic risk from adjacent escarpments and fault lines			Brabha	Live	Threat	Seismic studies and assessment		Unusual		Major	High	140	
6.3		Fault rupture of the Oharia fault - potential impact on locations or costs to mitigate.			Brabha	Live	Threat	Geotechnical/geological mapping		Quite Common		Major	Very High	280	
6.4		Soft ground, peat foundations / settlement between PP & Mary crest and north of Otaki – leading to high construction costs and/or long term poor performance (profile).			Brabha	Live	Threat	Established geotechnical investigation strategy and inputs to SARA process.		Quite Common		Major	Very High	280	
6.5		Liquefaction – ground improvements may be required around structures - risk relates to extent and costs associated - currently a poor level of geotech data.			Brabha	Live	Threat	Established geotechnical investigation strategy and inputs to SARA process.		Quite Common		Medium	Very High	160	

Treatment Type	Treatment Actions	Treatment Owner(s)	Resources	Treatment Timing	Treatment Progress	Monitoring and Reporting	Treatment Cost(s)	Likelihood Post-Mitigation		Consequence Post-Mitigation		Risk Level	Scores = CxL	Rank
								Rating Reason	Rating	Rating Reason	Rating			
Enhance	Seek to undertake specific geotechnical investigation to address risk (in next design phase)	Phil G		Specimen Design	Awaiting Approval				Likely		Medium Op	Very High	-200	
Enhance	Consultation with Alliance on bridge forms before preliminary design is undertaken.	Phil G		SAR	Commenced				Unlikely		Medium Op	High	-120	
Enhance	Bridge designer to confirm Otaki River Bridge design philosophy and statement on basis of best for project outcome(s)	Phil G		Specimen Design	Awaiting Approval				Unlikely		Medium Op	High	-120	
5	Environmental													
Mitigate	As per existing control - SARA phase focus and AEE phase.	H. Anderson		AEE	Commenced				Rare		Minor	Low	10	
	Risk closed													
Mitigate	As per existing control - SARA phase focus and AEE phase.	H. Anderson		AEE	Commenced				Rare		Negligible	Negligible	1	
	Risk closed													
	Risk closed													
	Risk closed; covered elsewhere													
	Risk closed													
	Risk closed; covered elsewhere													
	Risk closed; covered elsewhere													
Mitigate	Early community engagement with Keep Otaki Beautiful and urban design/landscape inputs to identify opportunities for mitigation planting/relocation etc. Urban design and landscape framework and Masterplan development to include appropriate mitigation agreed with Keep Otaki Beautiful. Consider planting and community involvement	B. Curtain		AEE	Commenced				Quite Common		Minor	Moderate	40	
Mitigate	Inititial ecology and Iwi visit completed. Alternative alignment developed to miss identified remnants.	H. Anderson		SAR	Completed				Unusual		Minor	Low	20	
Mitigate	Rahui Road profile improved; visual perspectives to be included in next stage of public consultation.	H. Anderson		SAR	Commenced				Unusual		Minor	Low	20	
	Risk closed; covered elsewhere													
Mitigate	Ensure terrestrial ecology assessment includes review of likelihood and mitigation includes further assessment if deemed necessary. Identify findings from TG and M2PP	H. Anderson		AEE	Commenced				Rare		Negligible	Negligible	1	
Mitigate	Continue to keep HPT/KCDC informed and consult on options. Design team identified option to re-orientate on existing site - KCDC and Mayor seem OK with this. Subject to further consultation with HPT/KCDC.	H. Anderson		SAR	Commenced				Quite Common		Minor	Moderate	40	
Mitigate	refer treatment action for 5.10	T Coulman		SAR	Commenced				Quite Common		Medium	Very High	160	
Mitigate	Ensure earthworks consents are kept as flexible and as fair and reasonable as possible	T Coulman		Specimen Design	Awaiting Approval				Rare		Negligible	Negligible	1	
6	Geotechnical													
	Closed - addressed by Item 4.16													
Mitigate	Addressed as part of SARA investigation	Brabha		Specimen Design	Awaiting Approval				Rare		Major	High	70	
Mitigate	Mapping may identify need for additional geotechnical / fault investigations that are currently not allowed for. - Need to map location - Keep structures away or provide rupture mitigation (no expressway structures in fault zone)	Brabha		Specimen Design	Awaiting Approval				Rare		Major	High	70	
Mitigate	As per existing control peat replacement up to 3m depth recommended.	Brabha		Specimen Design	Awaiting Approval				Unusual		Medium	High	80	
Mitigate	As per existing control. Limited requirements based on investigation, however risk allowance within estimate.	Brabha		Specimen Design	Awaiting Approval				Unusual		Medium	High	80	

Ref	Risk Title	Description	Cause	Effect	Risk Owner	Risk Status	Threat/ Opportunity	Existing Controls	Likelihood Pre-Mitigation		Consequence Pre-Mitigation		Risk Level	Scores = CxL	Rank
									Rating Reason	Rating	Rating Reason	Rating			
6.6		Uncertainty around ground conditions north of Otaki urban area including liquefaction – potential for high construction costs in poor/wet ground conditions.			Brabha	Live	Threat	Established geotechnical investigation strategy and inputs to SARA process.		Quite Common		Medium	Very High	160	
6.7		Opportunity to utilise topography to the east of the rail at Mary crest for rail crossing and potentially reduce works in peat.				Closed		Seek KiwiRail long term strategy for rail curve easing so that opportunity can be considered at SARA stage in conjunction with geotechnical data.							
6.8		Opportunity for sourcing fill from the Otaki River			Brabha	Live	Opportunity			Likely		Major Op	Extreme	-350	
6.9	Ground Conditions	Assumptions on extent of undercut (1-1a)	Limited geotechnical knowledge	Increase in imported fill, programme delay and increase in project cost	Brabha	Live	Threat			Quite Common		Major	Very High	280	
6.10	Ground Improvement	Assumptions on the extent and thickness of peat extraction (1-1b & 1-1j).	Limited geotechnical investigations, particularly at structures	Greater peat undercut and/or preload period - increased cost and programme delay	Brabha	Live	Threat			Likely		Medium	Very High	200	
6.11	Suitability Assumptions of Cut-Material	Incorrect assumptions regarding the suitability of cut material for fill material (1-1c).	Limited geotechnical knowledge	Increase in project programme and costs	Brabha	Live	Threat			Quite Common		Medium	Very High	160	
6.12	Material Sourced from KiwiRail Project	Ability to use KiwiRail realignment materials as a source of fill at Mary Crest. (1-1d)	Project timing coincides	Reduction in project costs as material does not need to be transported from North Otaki	T Coulman	Live	Opportunity			Unusual		Medium Op	High	-80	
6.13	Contaminated ground	Contaminated materials are found during construction. (1-1e)	Limited geotechnical knowledge	Increase in project programme and costs	Brabha	Live	Threat			Unusual		Medium	High	80	
6.14	Earthwork Production Rates	The production rates used to develop the programme cannot be achieved. (1-1f)	Rates have been too optimistic	The need to increase manpower to maintain programme, amend working hours or possibly extend completion date	Tony	Live	Threat	Verify earthworks productivity assumptions with local contractor(s).		Unlikely		Medium	High	120	
6.15	Liquefaction Risk - Ground Improvement	Liquefaction risk at bridge structures requiring ground improvement. (1-1i)	Limited geotechnical investigations at structures	Greater ground improvements, e.g. Geogrid etc, increased cost and programme delay	Tony	Live	Threat			Quite Common		Major	Very High	280	
6.16	Slope Instability	Instability during construction in cuts and fills leads to redesign and additional costs. (1-1k)	Limited geotechnical investigations, incorrect geotech assumptions.	Delays in programme, additional costs.	Tony	Live	Threat			Unlikely		Major	Very High	210	
7	Health&Safety														
7.1	HSE Plan (design)	Non-compliance with HSE Plan during design periods	Poor management and process	Injury to staff or public during consultation, site investigations or survey	T Coulman	Live	Threat	Project HSE Plan prepared and implemented		Unlikely		Minor	Moderate	30	
7.2	Rail Incident Disruption	Incident disrupts rail network whilst working near/on top of railway lines. (1-7b)	Working in close proximity to the rail and with the railway tracks.	Fines (estimate) and delays to programme.	T Coulman	Live	Threat			Unusual		Minor	Low	20	
7.3	HSE during construction	Injury to staff or public during construction. (2-6g)	Poor construction management and process	Injury to staff or public during consultation, site investigations or survey	T Coulman	Live	Threat			Unlikely		Minor	Moderate	30	
8	Land&Property														
8.1	Property acquisition project delay	Land requirements not appropriately identified leading to delays on land acquisition (2-2a)	Landowners reluctant to sell, compulsory acquisitions taking longer than expected, additional property required to that identified, difficulties with Maori land	Programme starts later	I Gray	Live	Threat	Development of land requirement plan and property acquisition strategy		Quite Common		Major	Very High	280	
8.2		Lack of land designation could lead to a need to acquire property with no project need, leading to extra costs				Closed									
8.3		Land value or property purchase price could exceed compensation valuation within project budget allowance, causing delays while additional funding is sought. Close? Meaningless and not a risk				Closed									
8.4		Compulsory land purchase might be required leading to time further delays or cost increases				Closed									
8.5	Rail Corridor	Unknown KiwiRail rail requirements leading to delays and extra costs (2-2c)	Current verbal/meeting agreements (with KiwiRail) are re-visited down the track	Increased property requirement and project delay	G McKay	Live	Threat	Commence early engagement with Ontrack to identify needs, standards and requirements		Unusual		Medium	High	80	
8.6	Land entry	Landowners refuse entry to land or frustrate obtaining land entry agreements for geotechnical and other investigations	Relationships	Project investigation delay	I Gray	Live	Threat	Undertake negotiations for global land entry now, or focused land entry in light of Geotech and survey requirements.		Quite Common		Medium	Very High	160	
8.7	Residual Packets of Land	Opportunities to release/exchange residual packets of land to land owners that have lost areas of land as part of the project solutions. (2-2e)	Relationships	Reduction in project property cost.	I Gray	Live	Opportunity			Unlikely		Minor Op	Moderate	-30	
8.8		Duration of Maori land court process may cause delays to the project - it is a 24 month long process once begun.			I Gray	Live	Threat	Initiated Landowner discussions and Maori land court process underway.		Likely		Medium	Very High	200	

Treatment Type	Treatment Actions	Treatment Owner(s)	Resources	Treatment Timing	Treatment Progress	Monitoring and Reporting	Treatment Cost(s)	Likelihood Post-Mitigation		Consequence Post-Mitigation		Risk Level	Scores = CxL	Rank
								Rating Reason	Rating	Rating Reason	Rating			
Mitigate	As per existing control. Limited requirements based on investigation, however risk allowance within estimate.	Brabha		Specimen Design	Awaiting Approval				Unusual		Medium	High	80	
	KiwiRail confirmed desire to ease Mary Crest rail curves at 23rd Sept workshop. Opportunity to be assessed in light of KiwiRail strategy and wider factors including land use etc. NZTA decision made to explore these factors ahead of any further engagement on this opportunity			SAR	Completed									
Enhance	Consider further as project progresses.	Brabha		Specimen Design	Awaiting Approval				Likely		Major Op	Extreme	-350	
Mitigate	Undertake further geotechnical investigations as part of the project design development.	Brabha		Specimen Design	Awaiting Approval				Unusual		Medium	High	80	
Mitigate	Undertake further geotechnical investigations as part of the project design development.	Brabha		Specimen Design	Awaiting Approval				Unusual		Medium	High	80	
Mitigate	Undertake further geotechnical investigations as part of the project design development.	Brabha		Specimen Design	Awaiting Approval				Unusual		Medium	High	80	
Enhance	Undertake discussions with KiwiRail regarding project timing and implementation - could present a mutual benefit and a lowering of both project costs.	T Coulman		Specimen Design	Awaiting Approval				Likely		Medium Op	Very High	-200	
Transfer	Will be a contractor risk during construction, transfer as part of contract conditions. Screening exercise to completed for AEE phase.	Brabha		Construction	On-Hold				Rare		Medium	Moderate	40	
Transfer	Will be a contractor risk during construction, transfer as part of contract conditions	S de Rose		Construction	On-Hold				Unusual		Medium	High	80	
Mitigate	Undertake further geotechnical investigations as part of the project design development.	T Coulman		Specimen Design	Awaiting Approval				Unusual		Major	High	140	
Transfer	Will be a contractor risk during construction, transfer as part of contract conditions	T Coulman		Construction	On-Hold				Unusual		Medium	High	80	
7	Health&Safety													
Mitigate	HSE Plan in place and documented in PQP. Sam Thornton has advised all team members of protocol and need to fill in site specific visit H&S form prior to each visit. Audit/monitor compliance.	T Coulman		SAR	Commenced				Rare		Minor	Low	10	
Transfer	Will be a contractor risk during construction, transfer as part of contract conditions	T Coulman		Construction	On-Hold				Rare		Minor	Low	10	
Transfer	Will be a contractor risk during construction, transfer as part of contract conditions	T Coulman		Construction	On-Hold				Rare		Minor	Low	10	
8	Land&Property													
Mitigate	Commence early acquisition of property in areas where the project needs are unlikely to change; use good property acquisition and consultation strategies, with project scope changes to be communicated with affected parties. Property Consultant and NZTA tracking spreadsheet and plan for communication to team. LRPs and links to partial property requirements to be clearly identified in project programme. Focus on LRPs during SARA phase as environmental buffers/requirements are refined e.g. SW basins.	I Gray		SAR	Completed				Rare		Medium	Moderate	40	
	Risk closed; covered elsewhere													
	Risk closed													
	Closed - covered by Risk Item 8.9.													
Mitigate	Liaison underway with staged workshops and technical meetings competed, Further liaison ongoing. Develop Service Level Agreement	G McKay		SAR	Commenced				Rare		Minor	Low	10	
Mitigate	Land agent and NZTA to follow up one on one with landowners to try and avert need for any compulsory s111 access. Consider alternative locations where possible. Register/schedule maintained and reported weekly.	I Gray		Specimen Design	Commenced				Unusual		Minor	Low	20	
Enhance	Review opportunities as option selection and definition is progressed.	I Gray		SAR	Commenced				Likely		Minor Op	Moderate	-50	
Mitigate	24 month timeframe will be a critical path activity therefore property acquisition strategy and funding availability may need to target these properties at earliest opportunity. Include risks within programme.	I Gray		Immediate Early Investment	Commenced				Unlikely		Negligible	Negligible	3	

Ref	Risk Title	Description	Cause	Effect	Risk Owner	Risk Status	Threat/ Opportunity	Existing Controls	Likelihood Pre-Mitigation		Consequence Pre-Mitigation		Risk Level	Scores = CxL	Rank	Treatment Type	Treatment Actions	Treatment Owner(s)	Resources	Treatment Timing	Treatment Progress	Monitoring and Reporting	Treatment Cost(s)	Likelihood Post-Mitigation		Consequence Post-Mitigation		Risk Level	Scores = CxL	Rank
									Rating Reason	Rating	Rating Reason	Rating												Rating Reason	Rating	Rating Reason	Rating			
8.9		Section 18/23 processes are a risk to the timeline for the project. Process is a potentially an 18 month process following a 3 month good faith period and requires sign off from the minister.			I Gray	Live	Threat	Identify high risk properties. Opus property team has been engaged. Target/focus on these from an early stage in order to minimise downstream time delays.		Quite Common		Medium	Very High	160		Mitigate	As per identified control. Include risk within programme.	I Gray		Immediate Early Investment	Commenced				Unlikely		Negligible	Negligible	3	
8.10		Assessment of current property purchase funding allocation to allow proactive early purchase - potential to delay construction start.			I Gray	Live	Threat	Preliminary property purchase budget identified by IG and Property Team - NZTA to manage funding requirements.		Quite Common		Major	Very High	280		Mitigate	As per identified control. Land Requirement plan finalisation at Scheme Stage will also be a critical input.	I Gray		SAR	Commenced				Unlikely		Major	Very High	210	
8.11	Land owner (accommodation) works	Landowner requirements not fully articulated in contract documents (2-2b)	Miscommunication / misunderstanding	Property negotiations extended with price increase	I Gray	Live	Threat	Preliminary property purchase budget identified by IG and Property Team - NZTA to manage funding requirements.		Quite Common		Medium	Very High	160		Mitigate	Advance property negotiations; seek agreement on mitigation/compensation works in advance of settlement, create management reserve to deal with this during construction phase.	I Gray		Specimen Design	Awaiting Approval				Rare		Negligible	Negligible	1	
8.12	Iwi Relationships	Iwi involvement in property acquisition process (2-2d)	Relationships	Protracted negotiations increasing project programme and costs	I Gray	Live	Threat			Unlikely		Medium	High	120		Mitigate	Investing early in this relationship, spending time and effort up-front to help with later negotiations.	I Gray		Immediate Early Investment	Commenced				Rare		Negligible	Negligible	1	
9	Planning &Consultation															9	Planning &Consultation													
9.1		Delays due to inadequate assessments or lack of information may arise during the Scoping and Scheme Design Phases			P Coop	Live	Threat	P Coop managing planning process with H.Anderson managing environmental assessment inputs. Appropriate peer reviews and technical reviews to be implemented.		Unlikely		Minor	Moderate	30		Mitigate	As per existing controls.	P Coop		AEE	Commenced				Rare		Minor	Low	10	
9.2		Decisions on alternatives already made may not be robust leading to delays at the Board of enquiry or the Environment Court				Closed		Refer to Item 2.2									Risk closed; covered elsewhere													
9.3		Our submission is inadequate leading to additional hearings				Closed											Risk closed - targeting EPA and BOI process.													
9.4		There are no previous designations or consents to be adapted to the project				Closed											Risk closed													
9.5																														
9.6																														
9.7		The public expectation that they can influence the choice of corridor is unrealistic			R.Beals	Live	Threat	Clearly identify NZTA Board decisions that have been made and what is open to influence through the current round of consultation as outlined in the public engagement plan.		Unlikely		Medium	High	120		Mitigate	As per existing controls.	R.Beals		SAR	Commenced				Unlikely		Minor	Moderate	30	
9.8		Delays in submission of the NOR plan could lead to delays.				Closed		Same as 9.1?									Risk closed; covered elsewhere													
9.9		Delay in consultation impacting on delivery of Scheme Addendum and EPA application process due to: - Not getting agreement with key stakeholders - Political involvement in consultation dates / form - Further stage(s) of consultation being required			A Aburn	Live	Threat	Engagement strategy prepared with NZTA. Staged meetings held with stakeholders to gain buy-in to option proposals. Programme review to include a second stage of consultation post SARA and to examine opportunities to progress scheme aspects now public engagement is deferred.		Quite Common		Medium	Very High	160		Mitigate	NZTA DMT agreement to a 2 stage public engagement approach. Action = team to review programme to explore aspects of AEE work that could be progressed to mitigate impact on EPA lodgement.	A Aburn		AEE	Commenced				Unlikely		Minor	Moderate	30	
10	Public Relations															10	Public Relations													
10.1		Bad publicity in local press around MC2PP expressway may affect this project.				Closed		Risk closed									Risk closed													
11	Scope															11	Scope													
11.1		The project scope might be inadequately defined which then causes poor outcomes				Closed		Define scope and agree with NZTA and all stakeholders									Risk closed; covered elsewhere													
11.2		Project outcomes may not be agreed or are not defined which then causes poor outcomes				Closed		Agree outcomes with NZTA and all stakeholders									Risk closed; covered elsewhere													
11.3		Base project programme timelines and assumptions may be unrealistic leading to delays and potential extra costs				Closed		Agree timelines with NZTA and all stakeholders									Risk closed; covered elsewhere													
11.4		Base project productivity assumptions may be incorrect leading to incorrect costs				Closed		Assess programme and assumptions									Risk closed; covered elsewhere													
11.5		Staged construction might not be fully considered, which could lead to inadequate cash flow projections for the overall project.				Closed		Consider staging in option assessment - can an Otaki bypass be achieved within value for money bounds?									Address as part of Scoping and later SARA investigation			SAR	Completed									
11.6	Scope Creep	Design scope creep over period up to contract award (including design standard changes) (2-3a)	Public/stakeholder pressure	Increase in project cost	G McKay	Live	Threat			Likely		Major	Extreme	350		Mitigate	Recommended 'Scope Freeze' with NZTA statement on zero change (after EPA).	G McKay		Specimen Design	Awaiting Approval				Unusual		Major	High	140	
11.7	Scope of Local Arterial Works	Removal of the costs for SH Revocation from PP20 project costs (2-3c)	Project funding strategy	Revocation incorporated into current project costs	NZTA	Live	Opportunity			Unusual		Substantial Op	Very High	-200		Enhance	Confirm project strategy and inclusions/exclusions of scope. Confirm how SH1 Revocation Project will be funded.	NZTA		Immediate Early Investment	Commenced				Likely		Substantial Op	Extreme	-500	
12	Supply Chain															12	Supply Chain													
12.1		We may have insufficient design resource to meet the programme which could cause delays				Closed											Risk closed; covered elsewhere													
12.2	Market Conditions	Other NZ construction projects create (labour, plant & materials) supply and demand issues increasing project costs or affecting programme (2-1a and 2-1b)	Workload and competition in marketplace	Programme delay and increase in project cost	T Coulman	Live	Threat	Review and update procurement strategy and availability of market resources		Likely		Medium	Very High	200		Accept	As per existing control PLUS identification/review of available aggregate and imported fill sources in conjunction with adjacent RoNS.	T Coulman		Specimen Design	Awaiting Approval				Likely		Minor	Moderate	50	
12.3	Demonstrable Benefits	Project costs outweigh benefits, in isolation project BCR is below 1. Benefits of project cannot be demonstrated post construction completion. (2-1c & 2-1e))	Insufficient or inappropriate measures are in place against which benefits can be measured post construction	Reputation damage to NZTA and political embarrassment for MoT	D Dunlop	Live	Threat	Requires a change in mind-set on how to calculate BCR and the inclusions in calculation, need to incorporate wider economic benefits rather than just traffic and travel time savings.		Likely		Major	Extreme	350		Accept	As per existing control	D Dunlop		Watching Brief	Commenced				Likely		Major	Extreme	350	
13	Political															13	Political													
13.1		There may be a change in the political environment following the forthcoming local body elections later this year (2010)				Closed		Not relevant to project									Risk closed; time period passed													
13.2	Funding Provision	Government policy change regarding funding for Transportation / RoNS projects leading to project delay or significant reduction in scope. (2-1d)	Overspending on other NZTA projects with greater priority than PP2O	A need to delay construction start or extend the construction programme having possible knock on impact to associated (Wellington Northern Corridor) projects and increased construction cost associated with an extended construction period.	A Aburn	Live	Threat	NZTA management at portfolio and ministerial level.		Likely		Major	Extreme	350		Accept	N/A at project level.	A Aburn		Watching Brief	On-Hold				Unusual		Substantial	Very High	200	
14	Existing Alignment															14	Existing Alignment													
14.1		Damage or disruption to the existing utility services due to site investigations			T Coulman	Live	Threat	Project HSE Plan prepared. Requirements to be spelt out for any physical investigations contracts		Unlikely		Minor	Moderate	30		Mitigate	As per existing controls.	T Coulman		Specimen Design	Awaiting Approval				Unusual		Minor	Low	20	

Ref	Risk Title	Description	Cause	Effect	Risk Owner	Risk Status	Threat/ Opportunity	Existing Controls	Likelihood Pre-Mitigation		Consequence Pre-Mitigation		Risk Level	Scores = CxL	Rank
									Rating Reason	Rating	Rating Reason	Rating			
14.2		Damage or disruption to the existing rail infrastructure due to site investigations			T Coulman	Live	Threat	Project HSE Plan prepared. Requirements to be spelt out for any physical investigations contracts. Note $50M PL Insurance needed for work in the rail corridor		Unlikely		Minor	Moderate	30	
15	Construction														
15.1	Adverse Weather	Adverse weather (above that which can be reasonably expected for the time of year) (1-1g)	Weather cannot be predicted or controlled	Increase in project programme and costs	T Coulman	Live	Threat			Likely		Minor	Moderate	50	
15.2	Volume of Imported Fill Increases	Volume of imported fill increases (1-1h).	Assumptions behind estimate and mass haul spreadsheet are incorrect	Additional imported fill required	T Coulman	Live	Threat			Likely		Major	Extreme	350	
15.3	Underground Services	Causing damage to unknown services during excavation works. (1-6b)	Causing damage to unknown STATS during excavation works	The need to halt work to enable reinstatement with associated costs and delay and the possible requirement to provide protective measures	S de Rose	Live	Threat	Spend time with utilities management and estimators detailing project and likely requirements.		Quite Common		Minor	Moderate	40	
15.4	Traffic Management	Traffic management proposals not being approved. (1-5a).	Consent condition	Increase in project cost	T Coulman	Live	Threat			Unlikely		Minor	Moderate	30	
15.5	Construction Methodology	Tracked cranes permitted in river channel allowing quicker and cheaper construction as less staging is required. (1.3p)	Having the cranes in the river bed is Environmentally Acceptable.	Less staging required, quicker and cheaper construction, and less vulnerability to flood damage to staging and equipment.	T Coulman	Live	Opportunity			Quite Common		Medium Op	Very High	-160	
15.6		A separate enabling contract is let to build the Otaki River bridge early.			T Coulman	Live	Opportunity			Unusual		Negligible Op	Negligible	-2	
15.7	Post Construction Settlement	Post construction settlement due to ineffective treatment of peat areas. (2-5a).	Limited geotechnical knowledge; choice of solution incorrect	Increase in project cost; public perception of NZTA lowered	Brabha	Live	Threat			Unlikely		Medium	High	120	
15.8	Contractor inputs	Contractor achieves value engineering gains over current design philosophy (2-6a)		Reduction in project cost	T Coulman	Live	Opportunity			Likely		Major Op	Extreme	-350	
15.9	Contract delays	Delay in construction programme due to unforeseen circumstances (2-6b).	Latent conditions not in contractors risk e.g. Excessive wet, rail approvals / possession / availability	Claims for delay , increased project costs for clean-up	T Coulman	Live	Threat			Quite Common		Medium	Very High	160	
15.10	Delivery/Procurement Model Change	Change in delivery model e.g. to traditional measure & value or alliance. (2-6c)	Government decision, change in policy	Possible increased costs	T Coulman	Live	Opportunity			Unusual		Substantial Op	Very High	-200	
15.11	Causeway across river to haul materials.	Given the need to haul materials across the Otaki River and provide access for bridge construction, a temporary causeway could be built across the river. (2-6d)	Opportunity to move material along the route earlier and assist with bridge construction.	Faster construction, lower costs and reduced programme	T Coulman	Live	Opportunity			Quite Common		Major Op	Very High	-280	
15.12	Construction Access Issues	Disruption to site access during construction due to traffic issues, weather etc. (2-6h)	Traffic issues, weather, protest action etc.	Programme delays.	T Coulman	Live	Threat			Quite Common		Medium	Very High	160	
15.13	Client/Client Rep Resources	Client and clients rep resourcing are inadequate during construction. (2-6i)	Lack of resources/appropriate resources from client and client rep.	Programme delays and potential cost increases.	T Coulman	Live	Threat			Unusual		Major	High	140	

Treatment Type	Treatment Actions	Treatment Owner(s)	Resources	Treatment Timing	Treatment Progress	Monitoring and Reporting	Treatment Cost(s)	Likelihood Post-Mitigation		Consequence Post-Mitigation		Risk Level	Scores = CxL	Rank
								Rating Reason	Rating	Rating Reason	Rating			
Mitigate	As per existing controls.	T Coulman		Specimen Design	Awaiting Approval				Unusual		Minor	Low	20	
15	Construction													
Transfer	Will be a contractor risk during construction, transfer as part of contract conditions	T Coulman		Construction	Awaiting Approval				Likely		Minor	Moderate	50	
Transfer	Will be a contractor risk during construction, transfer as part of contract conditions	T Coulman		Construction	Awaiting Approval				Unusual		Medium	High	80	
Transfer	Will be a contractor risk during construction, transfer as part of contract conditions	S de Rose		Construction	Awaiting Approval				Unusual		Minor	Low	20	
Transfer	Will be a contractor risk during construction, transfer as part of contract conditions	T Coulman		Construction	Awaiting Approval				Unusual		Minor	Low	20	
Enhance	Explore as part of consenting strategy, this opportunity appears to offer the project significant gains and should not be ruled out by a limiting consent	T Coulman		Construction	Awaiting Approval				Quite Common		Medium Op	Very High	-160	
Avoid	This risk should be avoided, does not provide significant benefit to the project solution.	T Coulman		Construction	Awaiting Approval				Unusual		Negligible Op	Negligible	-2	
Transfer	Will be a contractor risk during construction, transfer as part of contract conditions	Brabha		Construction	Awaiting Approval				Unusual		Minor	Low	20	
Enhance	Considered part of reasoning for heading into a D&C procurement model. Refer treatment action 15.10 and confirm procurement strategy.	T Coulman		Immediate Early Investment	Awaiting Approval				Likely		Major	Extreme	350	
Transfer	Will be a contractor risk during construction, transfer as part of contract conditions	T Coulman		Construction	Awaiting Approval				Unlikely		Medium	High	120	
Enhance	Current project strategy has procurement model ass D&C although this seems to be inappropriate for this project. Suggest we undertake a procurement strategy session to identify the most appropriate model	T Coulman		Immediate Early Investment	Awaiting Approval				Quite Common		Substantial Op	Extreme	-400	
Enhance	Explore as part of consenting strategy, this opportunity appears to offer the project significant gains and should not be ruled out by a limiting consent	T Coulman		Immediate Early Investment	Awaiting Approval				Quite Common		Major Op	Very High	-280	
Transfer	Will be a contractor risk during construction, transfer as part of contract conditions	T Coulman		Construction	Awaiting Approval				Unlikely		Minor	Moderate	30	
Mitigate	Part of NZTA project strategy and programme of deliverables	NZTA		Construction	Awaiting Approval				Unusual		Medium	High	80	

Live	112	92	**Threat**	**Extreme**	9
Closed	47	20	**Opportunity**	**Very High**	45
Parked	0			**High**	30
Emerging	0			**Moderate**	24
				Low	3
				Negligible	1
	159	112			112

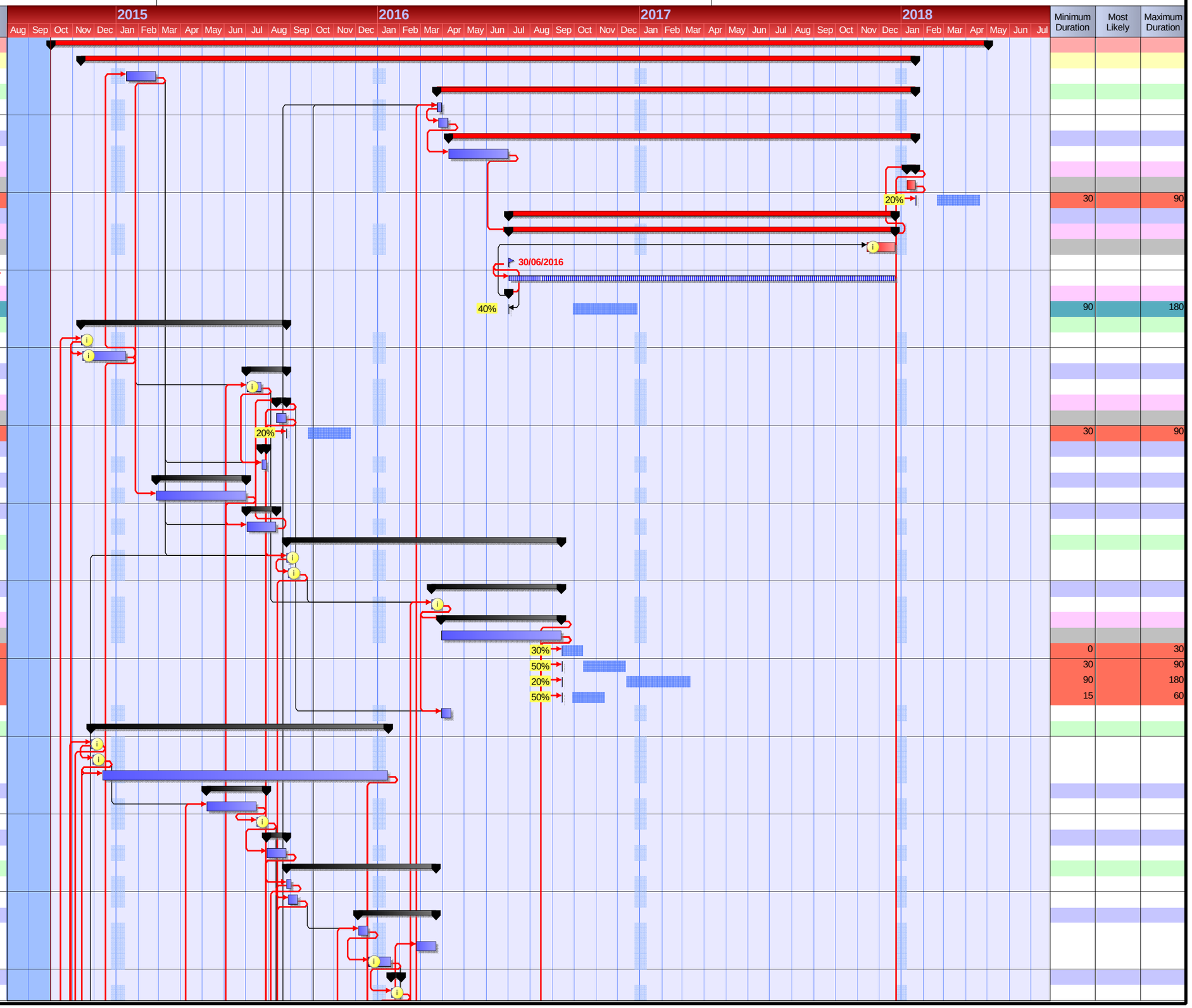
Extreme	9
Very High	14
High	27
Moderate	25
Low	28
Negligible	9
	112

Appendix E: Risk Adjusted Programme

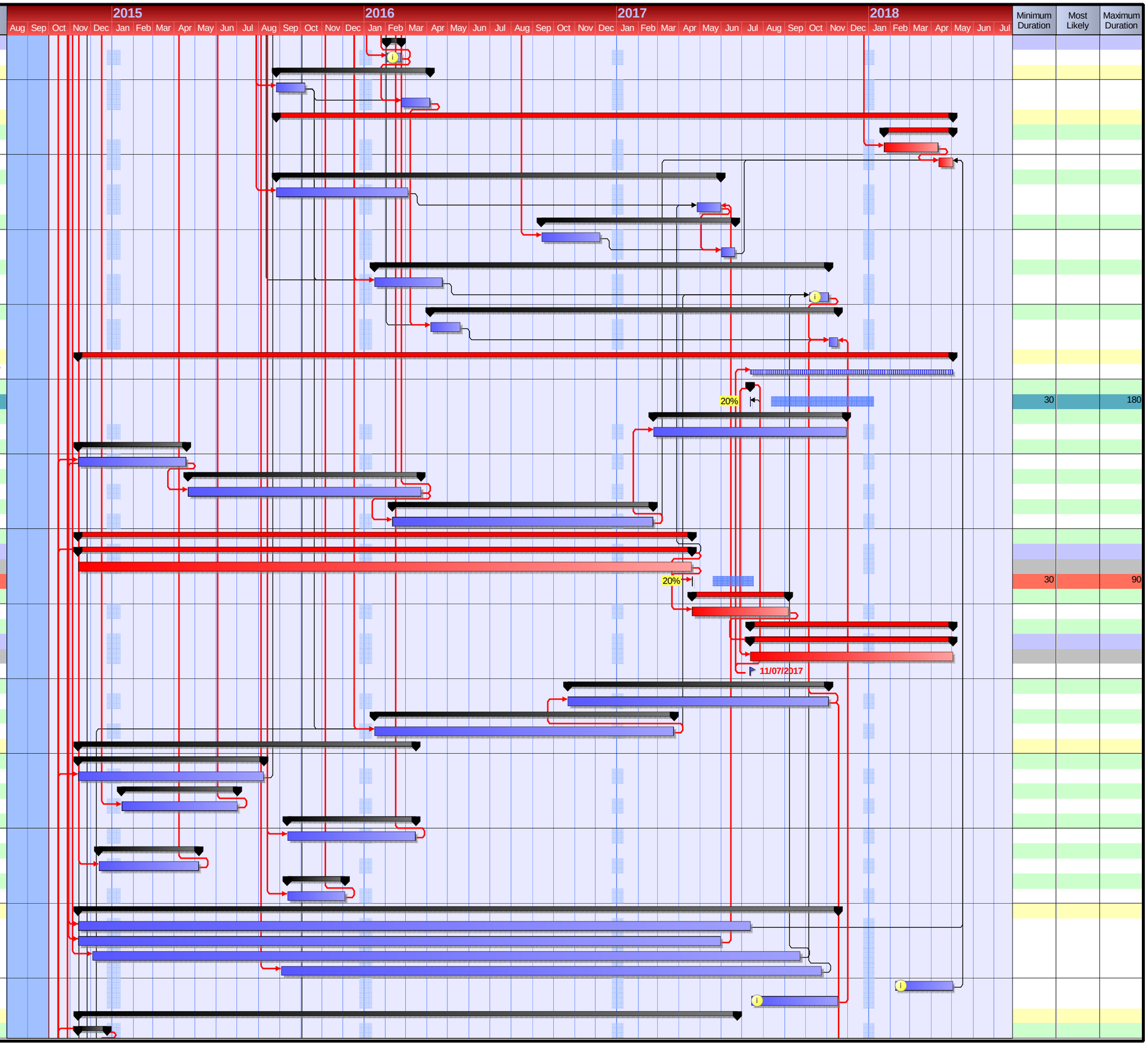
PP2O Indicative Construction Schedule (Pre-mitigated)

Primavera Gantt

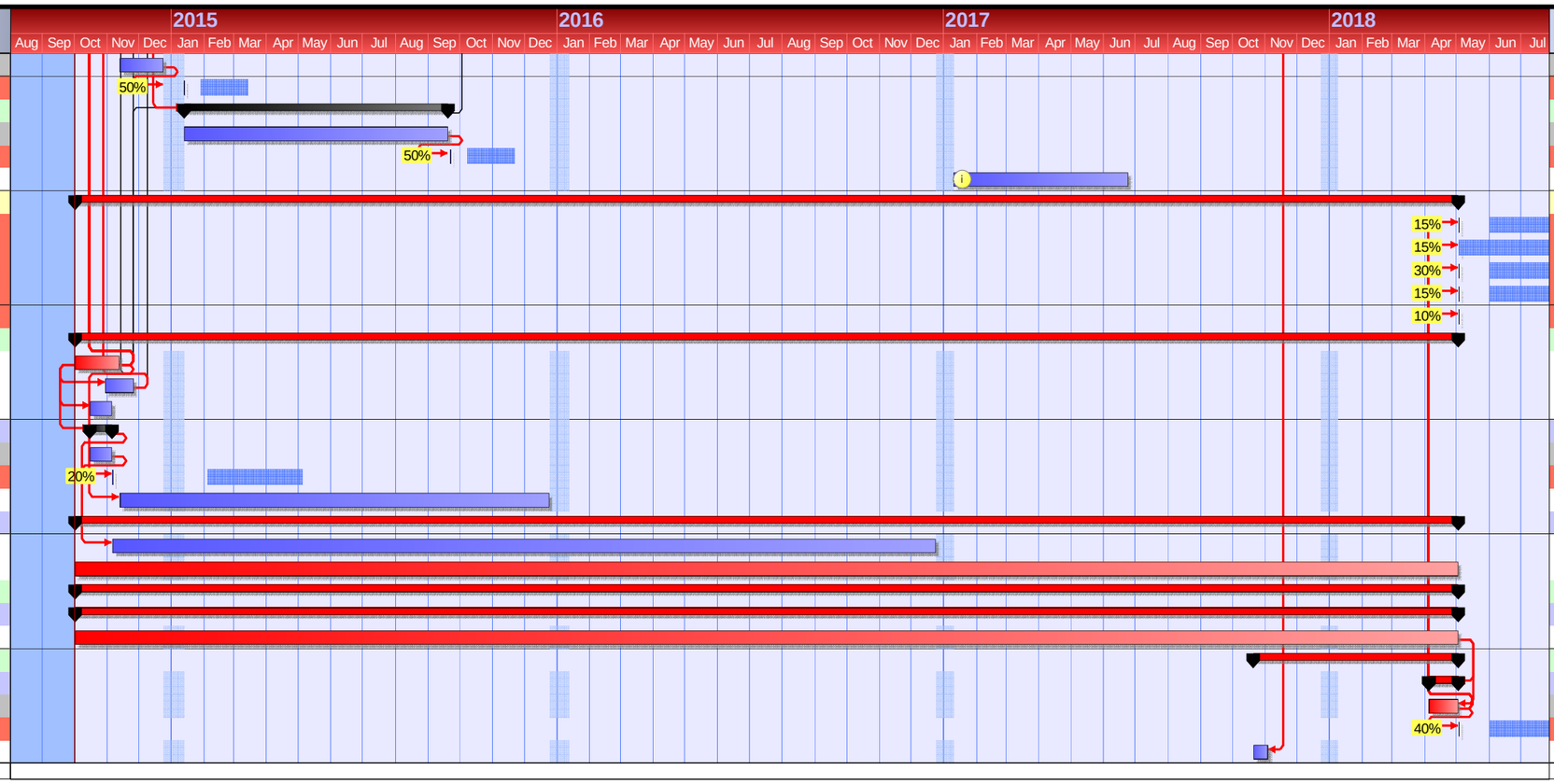
ID	Description	Remaining Duration	Start	Finish	Minimum Duration	Most Likely	Maximum Duration
PP2O-IC	**PP2O Indicative Construction Sch...**	**1309**	**01/10/2014**	**01/05/2018**			
PP2O-I	**Earthworks (Motorscraper crew 20...**	**1165**	**12/11/2014**	**19/01/2018**			
A1770	haul road for construction purposes (...	30	14/01/2015	24/02/2015			
PP2O-	**North Otaki - Sta 0 - 3500**	**668**	**23/03/2016**	**19/01/2018**			
A155	topsoil strip	5	23/03/2016	29/03/2016			
A156	temporary erosion and sediment con...	10	25/03/2016	07/04/2016			
PP2(	**Earthworks within section (motor...**	**652**	**08/04/2016**	**19/01/2018**			
A10	cut to fill	60	08/04/2016	30/06/2016			
A12	**undercut and replace peat - 2 cre...**	**10**	**08/01/2018**	**19/01/2018**			
A1	undercut and replace peat - 2 crews ...	10	08/01/2018	19/01/2018			
PF	Slope Instability	0	20/01/2018	19/01/2018	30		90
PP2(	**Earthworks to Te Horo (excavator...**	**540**	**01/07/2016**	**22/12/2017**			
A10	**cut to fill**	**376**	**01/07/2016**	**22/12/2017**			
A1	cut to fill	30	*13/11/2017	22/12/2017			
PF	**Opportunity Link Node**	**0**		**30/06/2016**			
PP2	*Earthworks to Te Horo (excavator ...*	*540*	*01/07/2016*	*22/12/2017*			
PP2	**Opportunity Link Node Collector**	**0**	**01/07/2016**	**30/06/2016**			
PF	Causeway Across River for Material ...	0	01/07/2016	30/06/2016	90		180
PP2O-	**Otaki River - Sta 3500 - 7000**	**287**	**12/11/2014**	**25/08/2015**			
A157	topsoil strip	10	*12/11/2014	25/11/2014			
A158	temporary erosion and sediment con...	30	*14/11/2014	13/01/2015			
PP2(	**Earthworks within section (motor...**	**56**	**01/07/2015**	**25/08/2015**			
A10	cut to fill	15	*01/07/2015	21/07/2015			
A17	**undercut and replace peat - 2 cre...**	**10**	**12/08/2015**	**25/08/2015**			
A1	undercut and replace peat - 2 crews ...	10	12/08/2015	25/08/2015			
PF	Slope Instability	0	26/08/2015	25/08/2015	30		90
PP2(	**Earthwork to Te Horo (motorscra...**	**7**	**22/07/2015**	**28/07/2015**			
A12	cut to fill	5	22/07/2015	28/07/2015			
PP2(	**Earthworks to Mary Crest (excavat...**	**126**	**25/02/2015**	**30/06/2015**			
A17	cut to fill	90	25/02/2015	30/06/2015			
PP2(	**Earthworks to Peka Peka (excavat...**	**42**	**01/07/2015**	**11/08/2015**			
A18	cut to fill	30	01/07/2015	11/08/2015			
PP2O-	**Te Horo - Sta 7000 - 8500**	**384**	**26/08/2015**	**12/09/2016**			
A159	topsoil strip	5	*26/08/2015	01/09/2015			
A160	temporary erosion and sediment con...	10	*28/08/2015	10/09/2015			
PP2(	**Earthworks within section (motor...**	**182**	**15/03/2016**	**12/09/2016**			
A10	cut to fill	10	*15/03/2016	28/03/2016			
A10	**imported fill**	**120**	**29/03/2016**	**12/09/2016**			
A1	imported fill	120	29/03/2016	12/09/2016			
PF	Suitability Assumptions of Cut-Material	0	13/09/2016	12/09/2016	0		30
PF	Adverse Weather	0	13/09/2016	12/09/2016	30		90
PF	Limited Earthworks Disturbance	0	13/09/2016	12/09/2016	90		180
PF	Working Around Rail Corridor	0	13/09/2016	12/09/2016	15		60
A18	undercut and replace peat - 2 crews ...	10	29/03/2016	11/04/2016			
PP2O-	**Mary Crest - Sta 8500 - 11000**	**415**	**26/11/2014**	**14/01/2016**			
A161	topsoil strip	5	*26/11/2014	02/12/2014			
A162	temporary erosion and sediment con...	10	*28/11/2014	11/12/2014			
A192	preload activity - bridge abutments	260	12/12/2014	14/01/2016			
PP2(	**Earthworks within section (motor...**	**84**	**06/05/2015**	**28/07/2015**			
A11	cut to fill	50	06/05/2015	14/07/2015			
A12	undercut and replace peat - 2 crews ...	10	*15/07/2015	28/07/2015			
PP2(	**Earthworks unsuitable to Otaki Ri...**	**28**	**29/07/2015**	**25/08/2015**			
A11	undercut and replace peat - 2 crews ...	20	29/07/2015	25/08/2015			
PP2O-	**Peka Peka - Sta 1100 - 12200**	**209**	**26/08/2015**	**21/03/2016**			
A163	topsoil strip	5	26/08/2015	01/09/2015			
A164	temporary erosion and sediment con...	10	28/08/2015	10/09/2015			
PP2(	**Earthworks within section (motor...**	**109**	**04/12/2015**	**21/03/2016**			
A11	cut to fill	10	04/12/2015	17/12/2015			
A11	imported fill	20	23/02/2016	21/03/2016			
A12	undercut and replace peat - 2 crews ...	10	*18/12/2015	18/01/2016			
PP2(	**Earthworks unsuitable to Otaki Ri...**	**14**	**19/01/2016**	**01/02/2016**			
A18	undercut and replace peat - 2 crews ...	10	*19/01/2016	01/02/2016			



ID	Description	Remaining Duration	Start	Finish	Minimum Duration	Most Likely	Maximum Duration
PP2(	**Earthworks unsuitable to Te Horo...**	**21**	**02/02/2016**	**22/02/2016**			
A18	undercut and replace peat - 2 crews ...	15	*02/02/2016	22/02/2016			
PP2O-I	**Ground Improvements**	**223**	**26/08/2015**	**04/04/2016**			
A1240	Geogrid, Preloading at Mary Crest - ...	30	26/08/2015	06/10/2015			
A1260	Geogrid at Peka-Peka	30	23/02/2016	04/04/2016			
PP2O-I	**Pavement & Surfacing**	**980**	**26/08/2015**	**01/05/2018**			
PP2O-	**North Otaki - Sta 0 - 3500**	**100**	**22/01/2018**	**01/05/2018**			
A135	sub-base, base course, seal	57	22/01/2018	10/04/2018			
A137	final pavement surfacing	15	11/04/2018	01/05/2018			
PP2O-	**Otaki River - Sta 3500 - 7000**	**644**	**26/08/2015**	**30/05/2017**			
A139	sub-base, base course, seal	125	26/08/2015	03/03/2016			
A141	final pavement surfacing	25	26/04/2017	30/05/2017			
PP2O-	**Te Horo - Sta 7000 - 8500**	**281**	**13/09/2016**	**20/06/2017**			
A143	sub-base, base course, seal	61	13/09/2016	06/12/2016			
A145	final pavement surfacing	15	31/05/2017	20/06/2017			
PP2O-	**Mary Crest - Sta 8500 - 11000**	**658**	**15/01/2016**	**02/11/2017**			
A147	sub-base, base course, seal	71	15/01/2016	22/04/2016			
A149	final pavement surfacing	20	*06/10/2017	02/11/2017			
PP2O-	**Peka Peka - Sta 1100 - 12200**	**591**	**05/04/2016**	**16/11/2017**			
A151	sub-base, base course, seal	32	05/04/2016	18/05/2016			
A153	final pavement surfacing	10	03/11/2017	16/11/2017			
PP2O-I	**Bridges**	**1267**	**12/11/2014**	**01/05/2018**			
PP2O	*Bridges*	*294*	*12/07/2017*	*01/05/2018*			
PP2O-	**Opportunity Link Node Collector**	**0**	**12/07/2017**	**11/07/2017**			
PP2(	Common Structure Types between ...	0	12/07/2017	11/07/2017	30		180
PP2O-	**Waitohu Stream Bridge**	**280**	**22/02/2017**	**28/11/2017**			
A165	construction	200	22/02/2017	28/11/2017			
PP2O-	**Otaki North Bridge**	**157**	**12/11/2014**	**17/04/2015**			
A166	construction	100	12/11/2014	17/04/2015			
PP2O-	**Otaki Ramp Bridge**	**338**	**20/04/2015**	**22/03/2016**			
A167	construction	230	20/04/2015	22/03/2016			
PP2O-	**Rahui Road Bridge**	**378**	**10/02/2016**	**21/02/2017**			
A168	construction	260	10/02/2016	21/02/2017			
PP2O-	**Otaki River Bridge**	**889**	**12/11/2014**	**18/04/2017**			
A169	**construction**	**600**	**12/11/2014**	**18/04/2017**			
A16	construction	600	12/11/2014	18/04/2017			
PP2	Speed of Bridge Construction	0	19/04/2017	18/04/2017	30		90
PP2O-	**Otaki Gorge Expressway Overbrid...**	**140**	**19/04/2017**	**05/09/2017**			
A170	construction	100	19/04/2017	05/09/2017			
PP2O-	**Otaki Gorge Railway Overbridge**	**294**	**12/07/2017**	**01/05/2018**			
A171	**construction**	**200**	**12/07/2017**	**01/05/2018**			
A17	construction	200	12/07/2017	01/05/2018			
PP2	**Opportunity Link Node**	**0**		**11/07/2017**			
PP2O-	**Te Horo Overbridge**	**378**	**21/10/2016**	**02/11/2017**			
A172	construction	260	21/10/2016	02/11/2017			
PP2O-	**Mary Crest Underpass**	**434**	**15/01/2016**	**23/03/2017**			
A173	construction	300	15/01/2016	23/03/2017			
PP2O-I	**Service Relocations**	**489**	**12/11/2014**	**14/03/2016**			
PP2O-	**North Otaki - Sta 0 - 2500**	**269**	**12/11/2014**	**07/08/2015**			
A187	service relocation	180	12/11/2014	07/08/2015			
PP2O-	**Otaki River - Sta 2500 - 7000**	**168**	**14/01/2015**	**30/06/2015**			
A188	service relocation	120	14/01/2015	30/06/2015			
PP2O-	**Te Horo - Sta 7000 - 8500**	**186**	**11/09/2015**	**14/03/2016**			
A189	service relocation	120	11/09/2015	14/03/2016			
PP2O-	**Mary Crest - Sta 8500 - 11000**	**145**	**12/12/2014**	**05/05/2015**			
A190	service relocation	90	12/12/2014	05/05/2015			
PP2O-	**Peka Peka - Sta 1100 - 12200**	**84**	**11/09/2015**	**03/12/2015**			
A191	service relocation	60	11/09/2015	03/12/2015			
PP2O-I	**Temporary Traffic Management**	**1101**	**12/11/2014**	**16/11/2017**			
A1930	temporary traffic management @ Ota...	661	12/11/2014	12/07/2017			
A1940	temporary traffic management @ Ota...	630	12/11/2014	30/05/2017			
A1950	temporary traffic management @ Ma...	698	03/12/2014	22/09/2017			
A1960	temporary traffic management @ Pe...	537	02/09/2015	23/10/2017			
A1970	temporary traffic management @ nor...	60	*07/02/2018	01/05/2018			
A1980	temporary traffic management @ sou...	90	*14/07/2017	16/11/2017			
PP2O-I	**Extraordinary Construction**	**955**	**12/11/2014**	**23/06/2017**			
A1740	**relocate Otaki rail station**	**30**	**12/11/2014**	**23/12/2014**			



ID	Description	Remaining Duration	Start	Finish	Minimum Duration	Most Likely	Maximum Duration
A174	relocate Otaki rail station	30	12/11/2014	23/12/2014			
A174	Working Around Rail Corridor	0	12/01/2015	23/12/2014	15		60
A1750	**relocate rail tracks including conn...**	**180**	**12/01/2015**	**18/09/2015**			
A175	relocate rail tracks including connecti...	180	12/01/2015	18/09/2015			
A175	Working Around Rail Corridor	0	21/09/2015	18/09/2015	15		60
A1760	Works to Existing SH1	120	*09/01/2017	23/06/2017			
PP2O-I	**Preliminary and General**	**1309**	**01/10/2014**	**01/05/2018**			
PP2O-	Propert Acquisition Project Delay	0	02/05/2018	01/05/2018	30		180
PP2O-	Iwi Relationships	0	02/05/2018	01/05/2018	0		360
PP2O-	KCDC Relationships	0	02/05/2018	01/05/2018	30		90
PP2O-	Consent Approvals	0	02/05/2018	01/05/2018	30		180
PP2O-	EPA Process	0	02/05/2018	01/05/2018	90	180	360
PP2O-	**Construction Site Establishment**	**1309**	**01/10/2014**	**01/05/2018**			
A127	Site Establishment (main - south sid...	30	01/10/2014	11/11/2014			
A128	Site Establishment (satellite - near P...	20	29/10/2014	25/11/2014			
A129	Temporary Traffic Management Plan...	15	15/10/2014	04/11/2014			
A130	**Environmental Monitoring / Mitiga...**	**15**	**15/10/2014**	**04/11/2014**			
A13	Environmental Monitoring / Mitigation...	15	15/10/2014	04/11/2014			
A13	Environmental Management Plan	0	05/11/2014	04/11/2014	90		180
A132	Sourcing, Securing and Stock-piling I...	278	12/11/2014	23/12/2015			
PP2(	**Monthly Time Related Activites**	**1309**	**01/10/2014**	**01/05/2018**			
A13	Set-up and maintain ESC measures	533	05/11/2014	23/12/2016			
A19	Time Related Activity - Main Contract	890	01/10/2014	01/05/2018			
PP2O-	**Bridging Contractor**	**1309**	**01/10/2014**	**01/05/2018**			
PP2(	**Monthly Time Related Activity**	**1309**	**01/10/2014**	**01/05/2018**			
A18	Time Related Activity	890	01/10/2014	01/05/2018			
PP2O-	**Site Disestablishment**	**194**	**20/10/2017**	**01/05/2018**			
A185	**Site Disestablishment - main**	**20**	**04/04/2018**	**01/05/2018**			
A18	Site Disestablishment - main	20	04/04/2018	01/05/2018			
PP2	Contract Delays	0	02/05/2018	01/05/2018	30		180
A186	Site Disestablishment - satellite	10	20/10/2017	02/11/2017			
TOTALS							



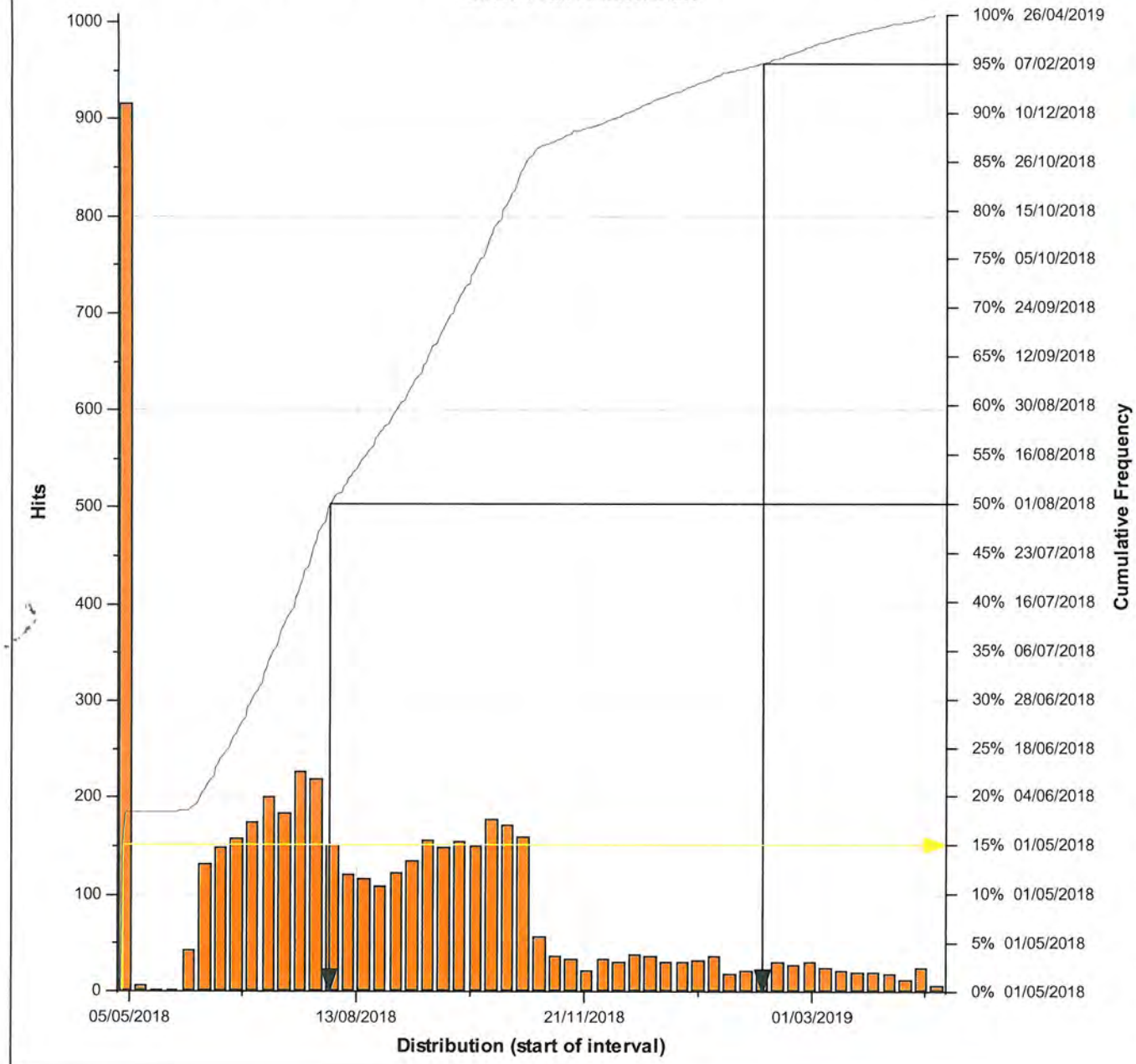
Normal Task | Normal, Critical | Summary Task | Summary, Critical | Summary, Start | Summary, Finish

ORACLE
PRIMAVERA RISK ANALYSIS

Company: Opus International Consultants Ltd	Page 3 of 3	Sort: Organizational Breakdown...
Manager:	Plan Finish: 01/05/2018	Filter: None
Planner: Neil Beattie		

PP2O Indicative Construction Schedule (Pre-mitigated)

Entire Plan : Finish Date



Data	
Finish Date of:	
Entire Plan	

Analysis	
Iterations:	5000

Statistics	
Minimum:	01/05/2018
Maximum:	26/04/2019
Mean:	15/08/2018
Bar Width:	week

Highlighters	
Deterministic (01/05/2018)	15%
50%	01/08/2018
95%	07/02/2019

Appendix F: Parallel Estimate Report

MacDonald International consulting engineers

Report Number: ZC100008 Draft 2

Scheme Estimate

Peka Peka to Otaki Parallel Estimate

Prepared for:
NZTA

Date: 16th September 2011

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E-mail:mi@miengineers.com

Issue No:	Date	Signatures		
		Prepared by	Checked by	Approved for Distribution by
Draft 1	07/09/11	CD	TJ	
Draft 2	16/09/11	CD	TJ	

Limitations Statement

Please refer to the company website for the MacDonald International Limitations Statement relating to this report.

MacDonald International Limitations Statement - Version 1

or at www.miengineers.com go to the About menu and choose Limitations Statement.

Table of Contents

1. Executive Summary

The New Zealand Transport Agency (NZTA) commissioned MacDonald International to undertake a Parallel Estimate for the Peka Peka to Otaki (PP2O) project. MacDonald International has prepared a Scheme Estimate in parallel with the project designers, Opus, with the aim of reconciling project estimates. Opus provided MacDonald International with a schedule of quantities comprising the scope of works included in the estimate.

The Peka Peka to Otaki Expressway is an approximately 12.2 km long four lane expressway, which runs from Peka Peka Road, north of Waikanae, to Taylors Road, north of Otaki. The Expressway forms one part of the proposed road improvements along the Wellington Northern Corridor Roads of National Significance (RoNS).The estimate is for the construction of the four lane expressway, bridges and associated works.

Absolute reconciliation of MacDonald International's and Opus' estimates was not necessarily intended during the reconciliation process. The common aim was to identify areas of significant difference and bring those differences to within acceptable limits. This has been achieved with the estimate effectively reconciled as evidenced by the final difference in the Expected Estimate which is within 2.5% of the Opus Estimate.

A comparison summary of the MacDonald International and Opus Estimate can be found in the table below. The percentage shown is the difference over Opus's Estimate. A more detailed comparison can be found in Appendix 1.

PP2O			
Element	**Opus Estimate**	**MacDonald International Estimate**	**% Difference**
Nett Project Property Cost	**$26,300,000**	**$26,300,000**	**0%**
Design and Project Documentation	**$5,450,000**	**$5,450,000**	**0%**
MSQA, NZTA Managed Costs and Consent Fees	**$5,285,000**	**$5,285,000**	**0%**
Base Physical Works	**$174,380,000**	**$168,869,456**	**3.2%**
Total Construction	**$182,330,000**	**$176,819,456**	**3.0%**
Total Base Estimate	**$219,370,000**	**$213,850,000**	**2.5%**
Project Expected Estimate (Rounded)	**$251,420,000**	**$245,060,000**	**2.5%**
95th Percentile Estimate (Rounded)	**$277,620,000**	**$270,630,000**	**2.5%**

The above figures are in Q2 2011 dollars and are based on Design and Construct competitive tender model.

Please note that the estimates exclude:

- Goods and Services Tax (GST),
- Risk, and
- Escalation.

Summaries and details of the estimates can be found in Appendices 1 to 3.

2. Introduction

The New Zealand Transport Agency (NZTA) commissioned MacDonald International to undertake a Parallel Estimate for the Peka Peka to Otaki (PP2O) project. MacDonald International has prepared estimates in parallel with the project designers, Opus, with the aim of reconciling project estimates. Opus provided MacDonald International with a schedule of quantities comprising the scope of works included in the estimate.

The Peka Peka to Otaki Expressway is an approximately 12.2 km long four lane expressway, which runs from Peka Peka Road, north of Waikanae, to Taylors Road, north of Otaki. The Expressway forms one part of the proposed road improvements along the Wellington Northern Corridor Roads of National Significance (RoNS).The estimate is for the construction of the four lane expressway, bridges and associated works. The route passes through the Te Horo and Otaki townships. It crosses the NIMT railway line and a number of main watercourses including the Otaki River, Waitohu Stream, and Mangaone Stream.

3. Supplied Information

The following documents that formed the basis of MacDonald International's estimate were supplied by Opus.

- Road Design preferred proposal drawings with aerial overlay - shts 1101-1107_PLANS + LONG SECTIONS 1101 (DRAFT) to shts 1101-1107_PLANS + LONG SECTIONS 1109 (DRAFT)
- Mass Haul 040811 – Excel Spreadsheet (earthworks quantities)
- Road Design preferred proposal drawings 5_2664_1_5504_1101 Road Design to 5_2664_1_5504_1109 Road Design
- Scheme Estimate - Scope and Assumptions_Revision_03_08_11
- Risk Register Peka Peka_Post Workshop_Scoping Report version – Excel Spreadsheet
- Drainage Plan 5/2664/1/5504 Sheet 1 - Drainage Plan 5/2664/1/5504 sheet 8
- Structure Plans – Bridge Plans 23/8/11 sheet S01 to S15
- Programme PP20 Indicative Construction Schedule – layout_ 30.08.11_OPUSINTERNATIONAL.
- Figure 1 – Site Investigation Plans
- Figure 2 – Engineering Geology Maps
- Figure 3 - Fault Avoidance Zones
- PP2O_Geotechnical Interpretative Report_DRAFT1
- PP2O_Paper GA1_cut slope assessment_Issue 1_25 Mar_11
- PP2O_Paper GA2_ground improvement_Issue 1_21 Mar_11
- PP2O_Paper GA3_Otaki River Bridge_Issue 1_21_Apr_11
- PP20 - Scheme Estimate - OpusMacDonald Original Comparison.xlsm and PP20 - Scheme Estimate - OpusMacDonald FINAL from Opus 5/9/11
- PP2O Risk model_sep 5 working copy v1.xlsm from Opus 7/9/11
- PP2O Risk model_sep 9 working copy v2.xlsm from Opus 9/9/11 and 12/9/11
- PP2O Risk model_sep 13 working copy v3.xlsm from Opus 13/9/11.
- PP2O Risk model_sep 15 working copy v4.xlsm from Opus 15/9/11.

4. Methodology

MacDonald International undertook a Parallel Estimate for the Peka Peka to Otaki project based on the following:

- The supplied documents were reviewed.
- A Schedule of Quantities was provided by Opus and MacDonald International undertook a quantity check of the major cost items,
- Preparation of a parallel estimate which involved:
    - Developing First Principles Rates for the Key Cost Drivers (pavements, bridges, earthworks, stormwater drainage, Preliminary and General).
    - For some items we reviewed/accepted the costs provided. These costs include Property Acquisition, Utilities Costs, Investigation and Reporting, Professional Fees for Design and Project Development and MSQA.
- Internal review of estimates by senior estimators,
- Attendance at reconciliation meetings in Wellington on 29th-30th August 2011,
- Review and revision by both parties, of estimate items of significant difference during the reconciliation process,
- Attendance and participation at a Risk Workshop on 31st August 2011 in order to facilitate probabilistic risk analysis.
- Some amendments were made to the estimate based on the scope advised by Opus.
- The inputs and results of the probabilistic risk analysis were agreed by Opus and MacDonald International.
- Preparation of a parallel estimate report.

5. Process

5.1. Quantity Checks

The Schedule of Quantities along with drawings, reports and other documentation were reviewed by MacDonald International. Quantities for Environmental Compliance, Earthworks, Pavement and Rail Works were checked. Some quantities such as Drainage and Traffic Services were unable to be verified as they were not detailed on the provided plans.

Environmental Compliance

In checking the quantities for Environmental Compliance MacDonald International discovered a duplication of the costs for Noise Bunding in earthworks. Following discussions at the Reconciliation Meetings the item for Acoustic Attenuation Noise Bunds was not included in the Environmental Compliance estimate.

Earthworks

Design model output spreadsheets were reviewed against the scheduled earthworks quantities provided. Initially there was considered to be a discrepancy in the Cut to Fill volumes. However, upon investigation and further discussion the supplied figures were accepted.

Pavement

Pavement quantities were checked by measuring pavement areas from the supplied plans and using details from the provided schedule. The supplied areas and associated quantities were within acceptable limits (from 3% to 6% difference) to those measured and hence the pavement quantities provided by Opus were used in the estimate schedule.

Rail Works – Extraordinary Construction Costs

Based on the drawings supplied, there were initially some discrepancies in the quantity of rail works included in the estimate. Upon further discussion

and clarification, the scope of works was identified and the quantities provided by Opus accepted.

5.2. Parallel Estimate

Direct Cost Item Rates were developed using first principles, resource based, estimating methods using Benchmark Estimating Software. This required the assessment of resource quantities, resource costs and production rates to determine a Direct Cost Item Rate.

Once the Direct Cost Item Unit Rates were finalised they were then marked up by 15% for offsite overheads and profit.

Preliminary construction cost estimate outputs were reviewed by senior estimators from MacDonald International and adjusted as required to reflect the anticipated construction requirements.

5.3. Reconciliation

Representatives from MacDonald International and Opus attended Reconciliation Meetings on 29th and 30th August 2011 at Opus' offices in Wellington.

Estimate Summary Documents prepared by Opus and MacDonald International were exchanged. The documents showed that Opus' Project Base Estimate was approximately $39.5 million higher than MacDonald International's. This equated to approximately 16% of the Opus price. A comparison of the estimates at the sectional level can be found in Appendix 2.

Areas of difference between MacDonald International and Opus estimates were identified and addressed in order of monetary value starting with the highest cost differential items.

Changes were made to Opus and MacDonald International's estimates during the reconciliation process.

As a result of reconciling the key cost differences, MacDonald International's and Opus' Expected Estimate costs have an overall difference of 2.5% and as such are considered reconciled. A summary of the comparison can be found in Appendix 1.

6. Non Construction Costs

6.1. Project Property Cost

MacDonald International has included Project Property Costs as provided by Opus on 15/09/11.

6.2. Investigating and Reporting

MacDonald International has included the Investigation and Reporting costs as provided by Opus.

6.3. Design and Project Development

MacDonald International has included Design and Project Development costs as provided by Opus. As advised by NZTA there is also an allowance of $500,000 for Risk Mitigation Costs (Mitigation outside of normal design process).

6.4. MSQA & Client Managed Costs

MacDonald International has included the costs for Monitoring, Surveillance and Quality Assurance as provided by Opus. As advised by NZTA there is also an allowance of $500,000 for Risk Mitigation Costs (Mitigation outside of normal design process).

7. Construction Costs

The following sections outline the more significant allowances and assumptions behind the Construction Costs. Comments around key uncertainties and opportunities have also been included.

7.1. Environmental Compliance

Permanent erosion and sediment control measures – As identified in Opus' drainage plan we have included costs for 4 attenuation ponds and 2 soakage areas.

Noise Walls – For the purposes of the estimate we have allowed for timber noisewalls.

7.2. Earthworks

The earthworks volumes were provided by Opus in a MS Excel spreadsheet which were extracted from the MX design model. From the volume information, an indicative mass haul diagram and graph was prepared by MacDonald International to ascertain campaign quantities/haul lengths upon which unit rates were developed from first principles.

The key considerations in estimating the earthworks are as follows:

- MX modelling indicates that approximately 727,000 cubic metres of suitable cut and 777,000 cubic metres of fill being required for the entire route (includes rail and local roads). This results in around 50,000 cubic metres of imported fill.
- Some of the earthworks will need to cross the Otaki River and we have allowed for one of the Otaki River twin bridges to be constructed before this occurs.
- In addition to the above volumes approximately 129,000 cubic metres is estimated as unsuitable undercut to noise bunds.

One of the key risks with earthworks is the variability of the undercut volumes associated with the peat material near Mary Crest. Additional geotechnical testing will reduce the uncertainty and this is recommended as the design is developed.

Temporary erosion and sediment control measures – As identified in Opus' drainage plan we have included costs for 84 temporary sedimentation ponds. This corresponds to a spacing of one every 145m on average. In our experience this appears to be high.

7.3. Ground Improvements

The Ground Improvements estimated are as per the quantities supplied by Opus. We have priced these items based on the comments included in the quantity spreadsheet and geotech report supplied by Opus as well as previous experience.

7.4. Drainage

The drainage schedule was supplied by Opus. We have priced these items based on the item description and some local contemporary price enquires with suppliers.

7.5. Pavement and Surfacing

The pavement and surfacing estimates are based on the information and quantities provided by Opus. The typical pavement is as follows:
Open Graded Porous Asphalt (30mm thick) – in some locations only
Single Coat Sealing
180mm thick AP 40 – base (includes E/O cement modified for expressway pavement)
150mm thick GAP 65 – sub-base (includes E/O cement modified for expressway pavement)

Based on there being a shortfall of material in earthworks; and as such, no opportunity for the use of site won material, the base and subbase materials have been allowed to be imported from a nearby quarry.

7.6. Bridges

The estimate for the bridges was calculated using the drawings provided and First Principles Rates taking into account the site specific nature of each bridge. The approximate deck areas of the bridges are as follows:

Bridge	Area (m2)
Waitohu Stream - Bridge 1	2,050
Otaki North - Bridge 2	233
Otaki North local road - Bridge 3	555
Rahui Road - Bridge 4	1,573
Otaki River - Bridge 5	8,300
South Otaki Rail Crossing - Bridge 6	233
South Otaki Expressway Crossing - Bridge 7	855
Te Horo - Bridge 8	2,041
Mary Crest Underpass - Bridge 9	2,934

At the Risk Workshop there was some uncertainty as to the typical shoulder widths to be included on the expressway and local road bridges. These risks have been included in the probabilistic risk analysis.

During the Reconciliation Meetings MacDonald International voiced concerns over the constructability of the Mary Crest Underpass. In particular the concrete tie beams under the existing rail require further investigation as to how they will be installed. Further consideration of staging and Kiwirail requirements is recommended.

7.7. Retaining Walls

The exact location and extents of the Mechanically Stabilised Earth (MSE) retaining walls is uncertain. It appears that most of them are located at bridge abutments.

The estimate has been based on the required quantity of select backfill material for the MSE walls being obtained from onsite excavations. The extra over processing of the backfill includes screening and some crushing to GAP65.

7.8. Traffic Services (Road Furniture + Lighting)

The traffic services schedule was supplied by Opus and we have priced these items based on the item descriptions provided.

7.9. Service Relocations

The costs for Service Relocations were provided by Opus with no details available. Price enquiries were issued by Opus to suppliers/subcontractors but were not available at the time of reconciliation. Without detail indicating contrary action, the estimated costs provided by Opus have been adopted.

7.10. Landscaping & Urban Design

The Landscaping costs were a kilometre allowance based on previous experience. No design had been undertaken at the time of the estimate.

7.11. Traffic Management and Temporary Works

The allowances included for Traffic Management and Temporary Works were based on high level construction sequencing. The estimate used First Principles techniques taking into account the site specific nature of each location. Allowances were made for temporary pavement, labourers, temporary traffic barriers, signage and some nightworks in the estimate.

7.12. Preliminary and General (P&G)

The Preliminary and General (P&G) costs have been built up from first principles based on the construction contract being undertaken through a single Design and Construct contract.

The main cost is staffing and this has been based on our experience on similar types of projects and the anticipated construction duration.

The P&G cost has been calculated for the complete project including rail and local roads.

Some of the allowances included in the P&G include:

- Detailed Design of the project
- Geotechnical and materials testing
- Site Offices and Sheds
- Contractor's onsite staffing is based on the anticipated level of staffing, the construction duration and rates for each staff. There is also an inclusion for site vehicles and transportation.
- Insurances

Subcontractors' P&G costs have been assumed to be included in their respective rates.

7.13. Extraordinary Construction Costs

The rail works include relocating the existing Otaki Railway Station including temporary works. There is a large amount of uncertainty associated with the station relocation because of the following:

- Exact railway staging is not certain
- The heritage requirements to relocate the station building may be onerous and hence costly.
- The design specification of the new platform is not known and its size is uncertain.

8. Risk

In accordance with NZTA's 'Risk Management Process Manual' (AC/Man/1) a quantitative risk analysis was undertaken following inputs from the project team at a Quantitative Risk Workshop on 31st August 2011. Opus facilitated the workshop with representatives from Opus, NZTA and MacDonald International in attendance. The inputs and results from the workshop and subsequent analysis were reviewed by Opus and MacDonald International and incorporated into the estimate. This involved correspondence for about a week between MacDonald International and Opus.

The objective of the quantitative risk analysis is to determine the:

- Expected Estimate.
- 95th Percentile Estimate.

The risk process was broken into two components: the uncertainty associated with the Quantity and Rate of items included in the schedule and the Assessed Risks identified by the project team.

Schedule Risk

1. Based on Opus'/MacDonald International's experience and knowledge of the project design and construction risk profile, each item in the estimate was rated with a confidence limit for the variation in the quantity and rate.
2. Opus International ran simulations with @RISK software based on these inputs.

Assessed Risks

Assessed Risks were analysed by Opus/MacDonald International using the following procedure:

1. From information supplied by various team members, a collated risk register of construction risks was developed.

2. This risk register was then partially quantified in the risk workshop based on people's knowledge and experience.
3. Each item was then rated for both consequence (in terms of $) and likelihood (in terms of a %).
4. These results were distributed to those in attendance at the Risk Workshop for review and feedback.
5. Following feedback and discussions between Opus and MacDonald International the quantification was finalised and Opus ran simulations with @RISK software based on these inputs.

The agreed results from the workshop and risk quantification formed the basis of the probabilistic analysis used in MacDonald International's estimate.

The results of the risk analysis are detailed in the table below.

Item	% of Base
Project Base Estimate	100%
Project Expected Estimate	115%
95th percentile Project Estimate	127%

9. Estimate Outcome Summary

PP2O			
Element	**Opus Estimate**	**MacDonald International Estimate**	**% Difference**
Nett Project Property Cost	**$26,300,000**	**$26,300,000**	**0%**
Design and Project Documentation	**$5,450,000**	**$5,450,000**	**0%**
MSQA, NZTA Managed Costs and Consent Fees	**$5,285,000**	**$5,285,000**	**0%**
Base Physical Works	**$174,380,000**	**$168,869,456**	**3.2%**
Total Construction	**$182,330,000**	**$176,819,456**	**3.0%**
Total Base Estimate	**$219,370,000**	**$213,850,000**	**2.5%**
Project Expected Estimate (Rounded)	**$251,420,000**	**$245,060,000**	**2.5%**
95th Percentile Estimate (Rounded)	**$277,620,000**	**$270,630,000**	**2.5%**

The above figures are in Q2 2011 dollars and are based on Design and Construct competitive tender model.

Please note that the estimates exclude:

- Goods and Services Tax (GST),
- Risk, and
- Escalation.

Summaries and details of the estimates can be found in Appendices 1 to 3.

Appendix 1 – Estimate Summary Comparison following Reconciliation

Project Estimate - Form C

PP2O Project

SE
Scheme Estimate

Item	Description	OPUS Base Estimate	MacDonald Base Estimate	$ Difference	% Difference
A	**Nett Project Property Cost**	**26,300,000**	**26,300,000**	**0**	**0%**
	Investigation and Reporting				
	- Consultancy Fees	4,360,000	4,360,000		
	- NZ Transport Agency Managed Cos	1,090,000	1,090,000		
B	**Total Investigation and Reporting**	**5,450,000**	**5,450,000**	**0**	**0%**
	Design and Project Documentation				
	- Consultancy Fees	1,950,000	1,950,000		
	- NZ Transport Agency Managed Costs	2,835,000	2,835,000		
	- Risk Mitigation Costs	500,000	500,000		
C	**Total Design and Project Documentation**	**5,285,000**	**5,285,000**	**0**	**0%**
	Construction				
	MSQA				
	- Consultancy Fees	4,450,000	4,450,000		
	- NZ Transport Agency Managed Costs	3,000,000	3,000,000		
	- Risk Mitigation Costs	500,000	500,000		
	- Consent Monitoring Fees	incl			
	Sub Total Base MSQA	**7,950,000**	**7,950,000**	**0**	**0%**
	Physical Works				
1	Environmental Compliance	836,250	809,350	26,900	3%
2	Earthworks	17,458,720	17,073,397	385,323	2%
3	Ground Improvements	2,466,000	2,290,400	175,600	7%
4	Drainage	11,079,500	11,661,570	-582,070	-5%
5	Pavement and Surfacing	15,769,011	14,675,465	1,093,546	7%
6	Bridges	53,388,200	52,113,785	1,274,415	2%
7	Retaining Walls	2,820,000	2,655,000	165,000	6%
8	Traffic Services	6,120,500	5,833,589	286,911	5%
9	Service Relocations	3,450,000	3,450,000	0	0%
10	Landscaping & Urban Design	6,492,000	6,240,000	252,000	4%
11	Traffic Management and Temporary Works	3,397,440	3,323,400	74,040	2%
12	Preliminary and General	40,675,000	38,200,000	2,475,000	6%
13	Extraordinary Construction Costs	10,420,000	10,543,500	-123,500	-1%
	Sub Total Base Physical Works	**174,380,000**	**168,869,456**	5,510,544	3.2%
D	**Total Construction**	**182,330,000**	**176,819,456**	5,510,544	3.0%
E	**Project Base Estimate (A+C+D)**	**219,370,000**	**213,854,456**	**5,515,544**	**2.5%**
	Say	**219,370,000**	**213,850,000**		
F	**Contingency** (Assessed/Analysed)	32,050,000	31,206,852		
G	**Project Expected Estimate**	**251,420,000**	**245,061,307**		
	Say	**251,420,000**	**245,060,000**	**6,360,000**	**2.5%**
	% of Base	**115%**	**115%**		
H	**Funding Risk** (Assessed/Analysed)	26,200,000	25,564,335		
I	**95th percentile Project Estimate**	**277,620,000**	**270,625,642**		
	Say	**277,620,000**	**270,630,000**	**6,990,000**	**2.5%**

Appendix 2 – Estimate Summary Comparison at Exchange

Project Estimate - Form C

Peka Peka to Otaki

SE

Scheme Estimate

Item	Description	Opus Base Estimate	MacDonald Base Estimate	$ Difference	% Difference
A	**Nett Project Property Cost**	**24,595,000**	**24,593,739**	**1,261**	**0%**
	Investigation and Reporting				
	- Consultancy Fees	4,360,000	4,360,000		
	- NZ Transport Agency Managed Costs	1,090,000	1090000		
B	**Total Investigation and Reporting**	**5,450,000**	**5,450,000**	**0**	**0%**
	Design and Project Documentation				
	- Consultancy Fees	1,950,000	1,950,000		
	- NZ Transport Agency Managed Costs	2,835,000	2,835,000		
C	**Total Design and Project Documentation**	**4,785,000**	**4,785,000**	**0**	**0%**
	Construction				
	MSQA				
	- Consultancy Fees	4,450,000	4,450,000		
	- NZ Transport Agency Managed Costs	3,000,000	3,000,000		
	- Consent Monitoring Fees				
	Sub Total Base MSQA	**7,450,000**	**7,450,000**	**0**	**0%**
	Physical Works				
1	Environmental Compliance	1,345,000	777,950	567,050	42%
2	Earthworks	18,592,120	15,271,002	3,321,118	18%
3	Ground Improvements	5,890,000	1,981,200	3,908,800	66%
4	Drainage	10,637,500	12,323,663	-1,686,163	-16%
5	Pavement and Surfacing	17,912,889	14,355,686	3,557,203	20%
6	Bridges	61,100,640	50,948,495	10,152,145	17%
7	Retaining Walls	2,820,000	2,655,000	165,000	6%
8	Traffic Services	6,706,250	4,804,039	1,902,211	28%
9	Service Relocations	3,450,000	3,450,000	0	0%
10	Landscaping & Urban Design	4,592,996	7,193,250	-2,600,254	-57%
11	Traffic Management and Temporary Works	9,950,000	3,323,400	6,626,600	67%
12	Preliminary and General	45,848,436	31,300,000	14,548,436	32%
13	Extraordinary Construction Costs	15,900,000	16,921,500	-1,021,500	-6%
	Sub Total Base Physical Works	**204,745,831**	**165,305,185**	39,440,646	19%
D	**Total Construction**	**212,195,831**	**172,760,000**	39,435,831	19%
E	**Project Base Estimate (A+C+D)**	**247,025,831**	**207,590,000**	**39,435,831**	**16.0%**
	Say	**247,026,000**	**207,590,000**		

Appendix 3 – MacDonald International Parallel Estimate after Reconciliation

Project Estimate - Form C

Peka Peka to Otaki Parallel Estimate

SE

Scheme Estimate

Item	Description	Base Estimate	Contingency	Funding Risk
A	**Nett Project Property Cost**	**26,300,000**	**2,820,000**	**4,100,000**
	Investigation and Reporting			
	- Consultancy Fees	4,360,000		
	- NZ Transport Agency Managed Costs	1,090,000		
B	**Total Investigation and Reporting**	**5,450,000**		
	Design and Project Documentation			
	- Consultancy Fees	1,950,000		
	- NZ Transport Agency Managed Costs	2,835,000		
	- Risk Mitigation Costs (Mitigation outside of normal design process)	500,000		
C	**Total Design and Project Documentation**	**5,285,000**	**290,000**	**500,000**
	Construction			
	MSQA			
	- Consultancy Fees	4,450,000		
	- NZ Transport Agency Managed Costs	3,000,000		
	- Risk Mitigation Costs (Mitigation outside of normal design process)	500,000		
	Sub Total Base MSQA	**7,950,000**	**740,000**	**700,000**
	Physical Works			
1	Environmental Compliance	809,350		
2	Earthworks	17,073,397		
3	Ground Improvements	2,290,400		
4	Drainage	11,661,570		
5	Pavement and Surfacing	14,675,465		
6	Bridges	52,113,785		
7	Retaining Walls	2,655,000		
8	Traffic Services	5,833,589		
9	Service Relocations	3,450,000		
10	Landscaping & Urban Design	6,240,000		
11	Traffic Management and Temporary Works	3,323,400		
12	Preliminary and General	38,200,000		
13	Extraordinary Construction Costs	10,543,500		
	Sub Total Base Physical Works	**168,869,456**	**27,356,852**	**20,264,335**
D	**Total Construction**	**176,819,456**	**28,096,852**	**20,964,335**
E	**Project Base Estimate (A+C+D)**	**213,854,456**		
	Say	**213,850,000**		

F	**Contingency** (Assessed/Analysed)	**(A+C+D)**	**31,206,852**
G	**Project Expected Estimate**	**(E+F)**	**245,061,307**
		Say	**245,060,000**
		% of Base	**115%**
Project Property Cost Expected Estimate			**29,120,000**
Investigation and Reporting Expected Estimate			**Nil**
Design and Project Documentation Expected Estimate			**5,575,000**
Construction Expected Estimate			**204,916,307**

H	**Funding Risk** (Assessed/Analysed)	**(A+C+D)**	**25,564,335**
I	**95th percentile Project Estimate**	**(G+H)**	**270,625,642**
		Say	**270,630,000**
		% of Base	**127%**
Project Property Cost 95th percentile Estimate			**33,220,000**
Investigation and Reporting 95th percentile Estimate			**Nil**
Design and Project Documentation 95th percentile Estimate			**6,075,000**
Construction 95th percentile Estimate			**225,880,642**

Date of Estimate 16/09/11	**Cost Index (Qtr/Year) Q2/2011**
Estimate prepared by MacDonald International	**Signed**
Estimate internal peer review by	**Signed**
Estimate external peer review by	**Signed**
Estimate accepted by NZ Transport Agency	**Signed**

Note: (1) These estimates are exclusive of escalation and GST.
(2) I&R Project Phase Estimates are set to Nil as these are now sunk costs.

PP20 Parallel Estimate — SE
Scheme Estimate

Date of estimate: 16/09/11		**Cost Index: Q2/2011**	
Estimate prepared by: MacDonald International		**Signed:**	
Estimate internal peer review by:		**Signed:**	
Estimate external peer review by:		**Signed:**	

Item	Description	Unit	Quantity	Rate	Amount	Subtotals	Comment/Assumptions
A	**Project Property Cost**		1	26,300,000	26,300,000	**26,300,000**	Provided by Opus 15/09/11
B	**INVESTIGATION & REPORTING**					**5,450,000**	NZTA Provided
1..	Consultant's fees	LS	-	4,360,000	4,360,000		
19..	Client managed costs (including property acquisition agent's	LS	-	1,090,000	1,090,000		
C	**DESIGN & PROJECT DEVELOPMENT**					**5,285,000**	Provided by Opus 13/09/11
1..	Consultant's design fees	LS	-	1,950,000	1,950,000		
15..	Client managed costs (including property acquisition agent's	LS	-	2,835,000	2,835,000		
	Risk Mitigation Costs (mitigation outside of normal design process)	LS	-	500,000	500,000		
D	**Construction**						
1...	**MSQA & CLIENT MANAGED COSTS**					**7,950,000**	Provided by Opus 13/09/11
1...	Consultant's surveillance during construction phase	LS	-	4,450,000	4,450,000		
1...	Client managed costs (including property acquisition agent's	LS	-	3,000,000	3,000,000		
1...	Risk Mitigation Costs (mitigation outside of normal msqa	LS	-	500,000	500,000		
	Physical Works						
2...	**ENVIRONMENTAL COMPLIANCE**					**809,350**	
2.1..	ENVIRONMENTAL MANAGEMENT PLAN	LS	1	55000	55,000		
2.1.1.	Management of EMP over Contract	mth	44	10000	440,000		
2.2..	PERMANENT EROSION & SEDIMENT CONTROL MEASURES						
2.2..	Construct & Maintain Permanent Sediment Measures	km	12.2	19,000	231,800		
2.3..	ACOUSTIC ATTENUATION						
2.3..	Allowance for Noise Mitigation						
	Noise Walls	m	130.0	635	82,550		
	Noise Bunds - Priced in earthworks	m	0.0		0		
3...	**EARTHWORKS**					**17,073,397**	
3.1..	SITE CLEARANCE						
3.1..	Greenfields	ha	100	7,850	785,000		
3.1..	Urbanscape	ha	14.3	19,550	279,565		
3.2..	DEMOLITION						
3.2..	Properties	ea	47	20,000	940,000		
3.2..	Otaki Ramp Bridge	LS	1	132,250	132,250		
3.3..	TOPSOIL STRIPPING	cu.m					
3.3..	To stockpile	cu.m	118,980	6.50	773,370		
3.4..	CUT TO FILL/UNDERCUT FOR TYPE 'A' MATERIAL						
3.4..	Expressway	cu.m	727,115	10.00	7,271,150		
3.6..	IMPORTED FILL (Prov. Item)						
3.6..	Expressway	cu.m	50,000	31	1,550,000		(Actual Vol. 44,000, say 50,000)
3.7..	CUT TO WASTE						
3.7..	Expressway	cu.m	47	12	566		
3.8..	UNDERCUT TO WASTE (Prov. Item)						
3.8..	Peat Material	cu.m	47	12	566		
3.9..	UNDERCUT TO FILL (Prov. Item)						
3.9..	Un-suitable Material for Bunding	cu.m	128,749	21	2,703,729		
3.10..	TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES						
3.10.1	Temporary Erosion and Sediment Control Measures	km	12.2	154,000	1,878,800		
3.10.2	Maintenance of Temporary ESC Measures	mth	48.0	15,800	758,400		
4...	**GROUND IMPROVEMENTS**					**2,290,400**	
4...	GROUND IMPROVEMENTS						
4...	Supply and install reinforcement geogrid	sq.m	20,000	9.20	184,000		In fill embankments
4...	PRELOAD (Prov. Item)	cu.m	90,000	15	1,350,000		Preloading of fill embankments on peat
4...	GEOTECHNICAL MONITORING						
	Allowance for Geotechnical Monitoring	km	12.2	62,000	756,400		
5...	**DRAINAGE**					**11,661,570**	
5...	SUMPS						
5...	Street sump (combined side entry)						
5...	Single	ea	36	2130	76,680		Assumed on link roads and on/off ramps 2 per 200m
5...	Motorway sump						
5...	Single	ea	30	2130	63,900		
5...	CULVERTS						
5...	Concrete RCRRJ Class 2 on Type HS2 Bedding						
5...	450mm dia.						Assume 50m/1000m of expressway/local road
5...	Up to 2m depth	m	885	265	234,525		
5...	600mm dia.						
5...	Up to 2m depth	m	50	345	17,250		
5...	1200mm dia.						
5...	Up to 2m depth	m	125	960	120,000		
5...	1350mm dia.						
5...	Up to 2m depth	m	270	1,175	317,250		

PP20 Parallel Estimate SE
Scheme Estimate

Date of estimate: 16/09/11		**Cost Index: Q2/2011**	
Estimate prepared by: MacDonald International		**Signed:**	
Estimate internal peer review by:		**Signed:**	
Estimate external peer review by:		**Signed:**	

Item	Description	Unit	Quantity	Rate	Amount	Subtotals	Comment/Assumptions
5...	1600mm dia.						
5...	Up to 2m depth	m	420	1,665	699,300		
5...	Concrete Box Culvert						
5...	1500mm x 3000mm						
5...	Up to 2m depth	m	120	5720	686,400		
5...	2000mm x 4000mm						
5...	Up to 2m depth	m	307	7215	2,215,005		
5...	3000mm x 4000mm						
5...	Up to 2m depth	m	527	8685	4,576,995		
5...	Swales	m	17,600	60	1,056,000		
5...							
5...	INLET/OUTLET STRUCTURES						traversable wingwalls?
5...	Precast concrete headwall/wingwall structures						
5...	600mm/900mm dia.	ea	2	2650	5,300		
5...	1300mm dia.	ea	8	6775	54,200		
5...	1800mm dia.	ea	8	12000	96,000		
5...	Greater than 1800mm dia	ea	22	25300	556,600		
5...	Rock rip-rap aprons/scour protection structures						
5...	600mm/900mm dia.	ea	2	370	740		
5...	1200mm/1500mm dia.	ea	8	830	6,640		
5...	1500mm/1800mm dia.	ea	8	1130	9,040		
5...	Greater than 1800mm dia	ea	22	1470	32,340		
5...	MANHOLES						
5...	1350 dia to 2m depth	ea	21	4375	91,875		Assume 2/100m of 450mm dia
5...	KERBING/EDGE STRIP						
5...	Remove existing	m	2,000	22	44,000		
5...	Kerb and Channel	m	6,720	49	329,280		
5...	PERMENANT STREAM DIVERSION						
5...	Racecourse Stream Diversion	m	100	1680	168,000		4m deep, 2m wide base, 1:3 sides, 56m2 x section, Rock Lined
5...	School Road Stream Diversion	m	420	335	140,700		10m2 Rock Lined Channel
5...	Gear Road Stream Diversion	m	130	335	43,550		10m2 Rock Lined Channel
5...	Settlement Heights Stream Diversion	m	40	500	20,000		15m2 Rock Lined Channel
5...							
6...	**PAVEMENT & SURFACING**					**14,675,465**	
6...	SUB-BASE	cu.m	-				
6...	Sub-Base	cu.m	-				
6...	Expressway	cu.m	41,894	76	3,183,924		150mm Deep
6...	Local Roads	cu.m	14,736	82	1,208,357		150mm Deep
6...	E/O Cement Modified Basecourse	cu.m	41,894	28	1,173,025		Expressway Pavements Only
6...	BASECOURSE						
6...	Expressway		46,083	84	3,870,982		180mm Deep
6...	Local Roads		16,210	88	1,426,451		180mm Deep
6...	E/O Cement Modified Basecourse	cu.m	46,083	28	1,290,327		Expressway Pavements Only
6...	SURFACING						
6...	Single coat sealing						
6...	Expressway	sq.m	155,180	4	620,720		
6...	Local Roads	sq.m	81,867	4	327,468		
6...	Supply and pave Open Graded Porous Asphalt including binder						
6...	Expressway	sq,m	77,563	17.25	1,337,962		
6...	Allowance for Property Accesses	ea	15	15750	236,250		
7...	**BRIDGES**					**52,113,785**	
7...	Waitohu Stream - Bridge 1	m2	2,050	2,650	5,432,500		3-span Super 'T'
7...	Otaki North - Bridge 2	m2	233	2,705	630,265		Single Span Hollow Core
7...	Otaki North local road - Bridge 3	m2	555	3,620	2,009,100		2-span segmental box
7...	Rahui Road - Bridge 4	m2	1,573	3,040	4,781,920		5-span segmental box
7...	Otaki River - Bridge 5	m2	8,300	2,625	21,787,500		11 Span Super 'T'
7...	Existing Otaki River Bridge Ped/Cycle 'clip on'	m2	-	0	0		Removed from scope as advised 9/9/11. Now in risk assessment
7...	South Otaki Rail Crossing - Bridge 6	m2	233	2,840	661,720		Single Span Hollow Core
7...	South Otaki Expressway Crossing - Bridge 7	m2	855	3,620	3,095,100		2-span segmental box
7...	Te Horo - Bridge 8	m2	2,041	3,040	6,204,640		5-span segmental box
7...	Mary Crest Underpass - Bridge 9	m2	2,934	2,560	7,511,040		Precast beam and slab
8...	**RETAINING WALLS**					**2,655,000**	
8...	Mechanically Stabilised Earth Wall						Design, supply and construct wall
8...	Concrete Facing, Up to 8m	sq.m	3,000	885	2,655,000		
9...	**TRAFFIC SERVICES**					**5,833,589**	
9...	BARRIERS (median barrier and side protection barrier)						
9...	Test Level 3						
9...	On steel posts (Single sided)	m	300	120	36,000		
9...	Nu-Guard Barrier						
9...	Approach & Departure Terminals	ea	4	2500	10,000		
9...	Wire Rope Barrier						
9...	On steel posts	m	12,200	100	1,220,000		
9...	End treatment	m	1	1650	1,650		
9...							
9...	Test Level 4						
9...	Nu-Guard Barrier						
9...	Steel posts (single sided) without blockout	m	6,850	120	822,000		
9...	Approach & Departure Terminals	ea	34	2500	85,000		

PP20 Parallel Estimate SE
Scheme Estimate

Date of estimate: 16/09/11		**Cost Index: Q2/2011**	
Estimate prepared by: MacDonald International		**Signed:**	
Estimate internal peer review by:		**Signed:**	
Estimate external peer review by:		**Signed:**	

Item	Description	Unit	Quantity	Rate	Amount	Subtotals	Comment/Assumptions
9...	G9 Thrie Beam - Bridge						
9...	On steel posts	m	2,820	242	682,440		
9...							
9...	Test Level 5						
9...	Crash Cushions	ea	2	74750	149,500		
9...							
9...	PAVEMENT MARKING	LS	-				
9...	Remove redundant markings and markers						
9...	Pavement markings	km	1.45	10350	15,008		
9...	RRPMs & Ceramic markers	km	1.45	1725	2,501		
9...	Pavement markings	m	-				
9...	Expressway	m	12,200	36	439,200		Rate per m of expressway
9...	Local Road	m	6,450	15	96,750		Rate per m of local road
9...	Re-Mark during Defect Liability Period	LS	1	535,950	535,950		
9...							
9...	ROAD SIGNS & SUPPORTS						
9...	Road Signs		-				
9...	Expressway	m	12,200	27	329,400		Rate per m of expressway
9...	Local Roads	m	6,450	15	96,750		Rate per m of local road
9...	E/O Variable Message Signs	ea	2	150000	300,000		
9...	E/O Gantry Signs	ea	2	230000	460,000		
9...							
9...	LIGHTING						
9...	New	ea	94	5500	517,000		Assumed 2/100m @ bridges/interchanges
9...	Dispose of existing	ea	28	1230	34,440		Assume 2/100m along existing local roads
9...							
10...	**SERVICE RELOCATIONS ~~(& PROTECTION)~~**					**3,450,000**	Provided by Opus 26/08/11. Awaiting service authorities estimates
10...	Local Authority Services						
10...	Services Relocated	LS	1	750,000	750,000		
10...	Telecommunications						
10...	Services Relocated - Telecom	LS	1	500,000	500,000		
10...	Services Relocated - Vodaphone	LS	1	200,000	200,000		
10...	Power						
10...	Services Relocated - Electra	LS	1	1,200,000	1,200,000		
10...	Gas						
10...	Services Relocated - Vector	LS	1	100,000	100,000		
10...	Water			0	0		
10...	Services Relocated	LS	1	350,000	350,000		
10...	Sewer						
10...	Services Relocated	LS	1	350,000	350,000		
10...							
11...	**LANDSCAPING & URBAN DESIGN**					**6,240,000**	
11...	LANDSCAPING						
11...	Rural	LS	-	3,365,000	3,365,000		
11...	Urban	LS	-	2,875,000	2,875,000		
12...	**TRAFFIC MANAGEMENT & TEMPORARY WORKS**					**3,323,400**	
12.1..	TEMPORARY TRAFFIC MANAGEMENT	LS	1	1,732,300	1,732,300		
12.2..	TEMPORARY DIVERSIONS	LS	1	407,600	407,600		
12.3..	IMPLEMENTATION OF CHANGEOVER(S)	LS	1	1,183,500	1,183,500		
13...	**PRELIMINARY & GENERAL**					**38,200,000**	
13.1..	Allowance for Preliminary & General Costs	LS	1	38,200,000	38,200,000		
14...	**EXTRAORDINARY CONSTRUCTION COSTS**					**10,543,500**	
14...	Single Track	km	1.1	2,990,000	3,289,000		
14...	Double Track (Crossing loop)	km	1.1	4,945,000	5,439,500		
14...	Relocated Otaki Railway Station	LS	1	1,600,000	1,600,000		
14...	Temporary Otaki Railway Station Works	LS	1	215,000	215,000		
14...	Allowance for Modifications to Former SH1	LS	0	0	0		Removed from scope as advised 9/9/11. Now in risk assessment
	UNSCHEDULED ITEMS (Allowance in Risk Model)	LS	1	0	0		
Total Project Estimate					**213,854,456**	**213,854,456**	
				Say	**213,900,000**	**213,900,000**	

NZ TRANSPORT AGENCY
WAKA KOTAHI

Peka Peka to Otaki Expressway
Value for Money Report
Investigation Phase - March 2012

Quality Assurance Statement

NZTA Project Manager:	Andrew Quinn
Prepared by:	Tony Coulman, Simon De Rose
Reviewed by:	Neil Beattie
Approved for issue by:	Tony Coulman

Revision Schedule

Rev. No	Date	Description	Prepared by	Reviewed by	Approved by
1	Aug 11	First Draft	T. Coulman	N. Beattie	T. Coulman
2	Mar 12	For SARA	N. Malkoti	G. McKay	G. McKay

NZ Transport Agency

Contents

1. Executive Summary

The Peka-Peka to Otaki Expressway is a part of the Wellington Northern Corridor, one of the Roads of National Significance (RONS). The Government has established the RONS programme as a catalyst for economic growth and productivity; the New Zealand Transport Agency (NZTA) has reflected this in its Statement of Intent and delivery of the RONs programme is consequently one of its strategic priorities.

Value for money is also a key priority both for Government and for the NZTA. Put simply it means "doing the right thing at the right time for the right money".

This is a report on the "Value for Money" outcomes from the Scheme Assessment stage.

It recommends that the NZTA Board endorse the preferred option at an expected cost of $251M including an additional $6.0M for improved outcomes in driver experience (median width), surfacing, urban design and traffic services.

2. Introduction

2.1 Objectives

"To provide a modern 4-lane expressway that will support economic development by providing a strategic arterial route to improve trip reliability and efficiency through the Wellington region, whilst providing legible quality connections to the Otaki township, and providing for community connections across the corridor. The expressway is to be integrated with the Otaki Vision and opportunities to enhance urban and landscape outcomes are to be explored."

Given the importance of delivering an integrated transport and urban design solution along the corridor (particularly through Te Horo and Otaki), together with enhancing community benefits and outcomes, it is considered necessary to invest in appropriate levels of urban and landscape design treatment in order to meet the overall project objectives and to leave a legacy for the local community.

An engineering, economic, social and environmental assessment process has been adopted to identify and assess appropriate levels of expressway and local network connectivity and these are documented within the SARA 2011 Report.

2.2 Purpose

The purpose of this value for money (VFM) report is to document the key VFM outcomes from the scheme assessment stage of the project. It demonstrates how the scheme phase investigation and PP2O expressway proposal aims to deliver the best value for money spent in terms of meeting the desired social and environmental outcomes and the project objectives for quality, whole of life costs and operational/safety outcomes.

A number of basis of design meetings have been held to focus on value improvement areas, together with ongoing value engineering through the scheme development process. This culminated in a VFM Challenge workshop held on the 2nd August involving NZTA and members of the project team (refer to Appendix A).

2.3 Scope

A full description of the project is contained in the PP2O Scheme Assessment Report Addendum (SARA) 2011. The extent of the project and high level scope assumptions are summarised below.

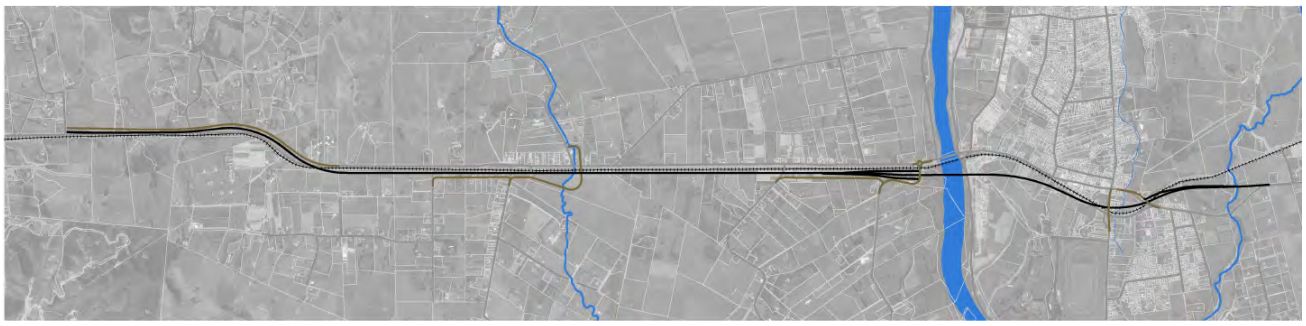


Figure 1 PP2O Project Extents

The project estimates for this 4 lane rural expressway between Taylor's Rd (North Otaki) to Peka-Peka Rd were $215-$355m in 2009 (Business case based on an expected of $215m.

Following scheme assessment the cost range has improved to $245 - $280M (Expected $251.5M).

The project extents are illustrated in Figure 1 above, and are shown on drawings 5/2664/1/5504, sheets 1101 to 1108, in the 2011 SARA. A proposed new 4-lane median separated expressway will run from a tie-in to the existing SH1 just north of Taylors Road (north of Otaki) through to approximately Te Kowhai Road in the south (a distance of 12.2km) where the scheme will tie into the Mackays to Peka Peka (M2PP) expressway.

The project scope also includes realignment of the North Island Main Trunk Line (NIMT) through central Otaki, a new local arterial from approximately Mary Crest through to Peka Peka, and an allowance for direct mitigation work for interface with the existing SH1.

The following key scope assumptions have been adopted to-date:

- The expressway will tie into the new expressway alignment from the MacKay's to Peka Peka project in the south and the existing state highway in the north. The Peka Peka interchange and associated ramps are captured within the M2PP project scope.

- Works to the Existing SH1 have been limited to direct mitigation at interface areas, line re-marking and removal of existing passing lanes. Any further enhancement work to the Existing SH1 corridor will be captured by the SH1 Revocation project.

- A parallel off-road walking and cycling facility will be provided along the local arterial corridor. A decision around the final form of this and associated costs are to be captured within the SH1 revocation project scope.

- The realignment of the NIMTL through Otaki is a core part of the project works. It has been assumed that a temporary station will be required while the existing Otaki Station is relocated. There is also a 1,000m long switching line which is to be re-constructed as part of these works, allowance for a future stabling area is not included in the scope, however formation for double tracking through north Otaki has been allowed for to minimise disturbance and win material.

- Staging for a potential Otaki bypass was considered at scoping stage, but has not been pursued further given the significant impact it would have on the form and cost associated with the South Otaki Interchange.

2.4 Report Structure

This report has been structured to cover the key cost and value areas on the project. Each section is presented in tabular form in order to summarise the key scope, value, cost and risk issues. The key sections include:

- Achieving Objectives
- Geometrics
- Earthworks and Ground Improvements
- Pavements
- Drainage & Flood Provision
- Urban Design and Structures
- Landscape Design
- Traffic Services
- Procurement Model
- Walking/Cycling and SH1 Revocation

3. Achieving Objectives

The following table summarises the NZTA Board's directive from December 2009, the relevant project objectives, and how the current scheme proposal has addressed these aspects.

Objectives:	Original Scheme (Business Case):	Current SARA Proposal:
NZTA Board 2009 Directive:		
Review of interchange locations in light of 2009 consultation feedback.	Negative feedback from stakeholders and public regarding interchange and connection proposals. Split access to expressway in the south and no vehicular connection at Rahui Road.	Half interchange provided to north and south of Otaki giving improved and intuitive connectivity outcome. Maintaining a road bridge connection across Rahui Road.
Review requirement for destination signage.	Not considered.	Primary focus has been on an intuitive interchange arrangement. Concept guide signage proposals developed.
Allow for future rail double tracking.	Unclear.	Double track provision catered for within proposed footprint, including future station duplication.
Reassess alignment against current planning requirements.	N/A	Further assessment completed with wider corridor alternatives re-assessed and refinements made at Mary Crest to improve cultural, heritage, ecological and cost outcomes.
Work with KCDC and the OCB with a view to integrate the expressway with proposals set out in the Otaki Vision Document	Not developed.	Urban and landscape design proposals developed to integrate with Otaki Vision document, including extensive stakeholder input.
Project Objectives:		
To build a modern, high standard four-lane highway between Peka Peka Rd and Taylor's Rd bypassing Otaki Village, and including a new four lane bridge over the Otaki River	4-lane expressway proposal with 15m wide rural median.	4-lane expressway consistent with the current RoNS and Austroads Guidelines. Median width reduced to 6m (inclusive of median shoulders) to deliver efficiencies whilst recognising predominantly rural context.
To provide high quality connections to the realigned SH1 at Otaki Village and maintain connections to local roads at Otaki Gorge, Te Horo and Gear Rd/School Rd	Connections to and from Otaki identified as requiring further development to meet identified feedback issues.	Enhanced connectivity proposal with support from key stakeholders, including half interchanges to the north and south of Otaki and local road connections at Rahui and Te Horo Beach Road. An at-grade link is proposed to retain connectivity at Old Hautere Rd.
To provide a reliable and resilient route offering superior ride comfort, convenience and journey time savings	Further flood and geotechnical assessments were recommended.	Lifelines approach adopted for flood and earthquake mitigation. Whole of lifecycle analysis adopted for ground improvement and pavement selection to ensure reduced risk relating to settlement or rutting type failures.
Contribute to the economic growth and productivity and significantly improve transport		Consistent with the overall RoNS strategy.

links to the lower North Island		
To enhance the urban and rural landscape where practicable using urban design principles and environmental best practice	Not developed.	ULDF and landscape proposals developed for the scheme in conjunction with NZTA, Otaki Vision, district plan, stakeholders, and liaison with adjacent RoNS project teams.
To mitigate where practicable the social and environmental impact of construction	Not developed.	Being further developed as part of the AEE process. Key focus to-date has been on social, and community connectedness together with development of environmental mitigation proposals.
To provide connectivity to local road networks and provide a safe experience for vulnerable road users e.g. cyclists and walkers		Connectivity demands identified through the ULDF process and stakeholder/community liaison. Connectivity has been addressed through the appropriate provision of connections and linkages across and beside the expressway. A potential offroad walking/cycling path within the local arterial corridor can provide for vulnerable users, while commuter/road cyclists can utilise road shoulder provision.
To ensure efficient, local and stageable interfaces with the adjacent RoNS projects to the North and South	At-grade tie in provided back to Taylors Rd in the north, and interface to the expressway to the south.	Refined tie-in to the existing SH1 just north of Taylors Road with removal of passing lanes immediately to the north and improvement to vertical sight lines. This tie-in location provides maximum flexibility for the expressway extension being considered by the Otaki to Levin project. Sequencing assumes that the M2PP project will be constructed prior to the PP2O Project and that the PP2O project will interface with the M2PP Peka Peka interchange.

4. Geometrics

Proposals for the geometric highway design philosophy are summarised within the project Design Philosophy Statement (DPS). Project costs associated with the adopted highway geometric assumptions are included within the relevant earthworks and bridges costs.

The adopted geometry for the proposed expressway meets the overall RoNS and current Austroads Guidelines, however the central median width has been reduced in width relative to the RoNS guidelines 9m to achieve an improved value for money outcome.

Given a predominantly rural route there is an urban and landscape desire to maintain a 'green' median rather than apply a narrow sealed median along the whole corridor.

The standards adopted in the project DPS and approach to treatment of batter slopes have resulted in value savings in the order of $5M over the base RoNS/Austroad Guidelines. While further value efficiencies could potentially be achieved, as described below, it is recommended that the current proposals are endorsed for this scheme stage, recognising that there is potentially a premium of 0.5% relating to further potential value opportunities. This represents an investment of only approximately $1M or 0.5% of the total estimated project cost.

	Scope assumptions	Description of Value Added Over Base Provision	Value c/f base provision	Risk/impact of reducing provision.
Geometrics	Geometrics are to RONS guidelines to 110/100 km/h design speed. Min curve radius is 820m. Cross-section includes 6m median. 9m clear zones and 1:4 batter slopes unless fill embankments are greater than 2m then barrier and steeper fill slopes adopted.	o Reduction in median width from 9m RoNS Guideline down to 6m while still retaining a green median. Resulted in earthworks and structures cost savings while not adding to longer term operational maintenance costs.	o Saving of $3M identified and incorporated into the base scheme estimate.	N/A
		o Retention of 6m median over a 4m sealed median provides better landscape outcome, does not compromise sight lines around the 820m curves through Otaki/Mary Crest and avoids lane closures for maintenance. The Need and treatment for median bridge piers at high skew structures is also easier to manage.	o Further potential saving of $1M for reduction from 6m to 4m. No significant cost saving identified at the main river crossings.	Reduction in sight lines, and long term maintenance considerations, compared with relatively small cost saving.
		o Scheme has partially utilised rail designation for rear slopes of swales and provided barriers/steeper slopes for highway slopes above 2m height (achieved a $2M saving). Further safe system opportunity may exist to use edge barriers @3m offset and steepen all	o Savings of approx $2M achieved to-date. More widespread barrier use in lieu of clear zones could further reduce footprint, however national position on clear zones not yet fixed.	Wider adoption of barriers in lieu of clear zones could reduce designation flexibility at this early scheme stage.

	Scope assumptions	Description of Value Added Over Base Provision	Value c/f base provision	Risk/impact of reducing provision.
		batters.		
Geometrics	**TOTAL Value c/f Basic option**		**$1M over basic option** (0.5% of $220M SE base).	

5. Earthworks and Ground Improvements

Significant value engineering has been undertaken in order to deliver a scheme that optimises the cut-fill opportunities along the route. To this effect significant efficiencies have been delivered by depressing the expressway south of the Otaki River to win material and to reduce costs associated with a southern interchange.

A key consideration for ground improvement treatments has included whole of life and risk consideration around the treatment of peat deposits that sit under the proposed corridor south of the NIMT rail bridge crossing at Mary Crest. The value for money and risk management proposal on PP2O is to undercut and replace peat deposits with depths less than or equal to 3m to avoid preloading requirements and to eliminate long term carriageway deformation and rehabilitation. While complete removal of unsuitable peat materials reduces long term maintenance cost, the cost of excavation increases with depth. For areas greater than 3m in depth the proposed approach is to excavate and replace to 3m and then surcharge.

In order to manage costs, and improve sustainability, it is proposed that excavated peat is dried and re-placed in non-structural fills or landscape bunds.

The need for extensive liquefaction mitigation treatment at bridge abutments is typically not required given the local geology and proposal to undercut upper layers of loose/unsuitable materials at these locations.

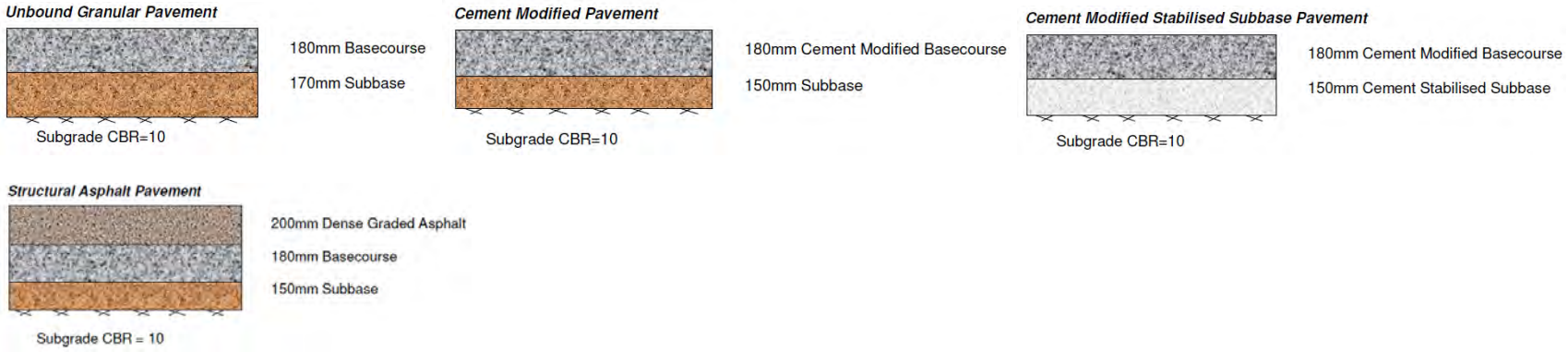
There is no significant premium identified to provide the above ground improvements and therefore to provide an improved project risk profile with improved long term performance of the expressway (this is due to the depth of peat undercut adopted being in the cost neutral range when compared to the application of drainage and surcharge treatments).

	Scope assumptions	Description of Value Added Over Base Provision	Value c/f base provision	Risk/impact of reducing provision.
Earthworks And GI	Optimisation of overall cut-fill balance has been a prime focus to reduce demand for imported fill, including depression and widening of the corridor at Sth approach to Otaki River. Currently a neutral cut-fill result. Three main types of soils; peat, terrace and alluvial gravels. Base	o Peat re-use in bunding/landscaping/outer fills to avoid offsite cartage/disposal of unsuitable materials. o Peat replacement approach versus drainage and insitu preloading to manage construction timelines and improve long term performance, ride quality and maintenance.	o Significant cost saving – factored into base estimate ($650,000). o Peat removal and preloading are effectively cost neutral however, peat removal reduces the long term risk of settlement issues. It can lead to shorter term risks with difficulty in removing the	Increased costs and haulage if offsite disposal was adopted. Increased risk of premature failures, or reduced ride quality through ongoing settlements if peat is left insitu and surcharged. Increased maintenance requirements.

	Scope assumptions	Description of Value Added Over Base Provision	Value c/f base provision	Risk/impact of reducing provision.
	assumption is that areas of peat < 3m will be dug out and replaced, while areas greater than 3m+ in depth will be dug out and replaced to 3m and then surcharged. There are opportunities to use river gravels from the Otaki river mouth or extract from the Winstone's quarry for any sub-grade improvement layers. Sub-grade material generally not at risk from liquefaction but some further investigation needed around the Ohariu fault-line (location relative to Te Horo local road bridge).		material.	
Earthworks & GI	**TOTAL Value c/f Basic option**		**$0M over bas**ic option	

6. Pavements

A risk based lifecycle cost analysis has been completed to assess the optimal pavement selection for the PP2O project. Analysis considered the following options:



In order to deliver a pavement with an improved risk profile (reduced risk associated with rutting) and overall improved long term performance it is recommended that a premium is applied over the base case of an unbound granular pavement. For the purposes of the scheme design and estimate it is therefore recommended that a pavement with a cement modified basecourse is adopted. This represents a capital cost premium of approximately $0.4M (3% of $15.7M base estimate), but is considered value for money given that it will deliver a lower maintenance pavement with reduced risk of early rutting type failures.

	Scope assumptions	Description of Value Added Over Base Provision	Value c/f base provision	Risk/impact of reducing provision.
Pavements	Pavement analysis based on 9% heavies and growth of 1.6% assumed rather than the high growth scenario from the regional model (WTSM) which yields unrealistic %HCVs. A CBR 10 has been adopted for the base case, with risk recognition for areas of lower CBR.	o Opportunity to utilise river abstraction (gravels) as a subgrade/subbase improvement layer in areas of poorer CBR.	o The value opportunity adopted is a CBR10 based on available geotech interpretation with allowance for an additional 150mm river gravel layer (or subgrade improvement) captured in the risk based estimate for areas of CBR down to about 5.	Risk allowance for uncertainty around outturn CBR and hence extent of improvement.

	Scope assumptions	Description of Value Added Over Base Provision	Value c/f base provision	Risk/impact of reducing provision.
	Pavement choice has been risk based with whole of life cycle analysis; base option is 150mm sub-base, 180mm base-course with two coat chip seal (grade 3/5). Extent of OGPA used for noise mitigation still to be confirmed but likely through Otaki and Te Horo. The current AADT is 17,162 and growth model assumes 21,000 by 2026. Both the Saturn models are being integrated by Beca.	o Use of cement modified basecourse is currently preferred due to improved resilience/risk profile and longer term benefits.	o Nett Present Value analysis of options identifies that a cement stabilised pavement provides the best risk and lifecycle outcomes. The preferred option costs $0.4M more than an unmodified pavement, however from a risk management perspective this is considered to be money well invested (reduced risk of premature rutting failures).	Increased risk profile if an unmodified basecourse flexible pavement is adopted. Premium of circa $0.4M capital cost.
		o Extent of OGPA for noise mitigation – preliminary BCR and BPO analysis identifies strong benefit/need through Otaki. Opportunity to further assess benefit through rural sections outside of Te Horo (with a potential to reduce the extent of OGPA).	o Potential opportunity to reduce the area of OGPA given a low BCR for noise treatment efficacy using OGPA outside main settlement areas. Potential $1.1M premium within current SE estimate.	Public expectation will be for a quiet road surfacing or equivalent localised noise mitigation treatments. Issue may be debated through a BOI process. Further Best Practicable Option and BCR analysis required at AEE stage.
Pavements	**TOTAL Value c/f Basic option**		**$1.5M over basic option** (10% of $15.7M SE base).	

7. Drainage & Flood Provision

Drainage:
The overall stormwater and drainage philosophy (for water quality and attenuation) has been to deliver a scheme that provides a best practicable option that aligns with NZTA's Environmental Policy Manual and Stormwater Treatment Standard for State Highway Infrastructure (May 2010), while also meeting local regional and district requirements.

In order to deliver a value for money solution the process outlined in Figure 7-3 of NZTA's SWTS (2010) has been followed to identify appropriate levels of treatment and attenuation, while being cognisant of GWRC and KCDC's requirements. A range of potential treatment train approaches have been considered, from conventional swale and basin approaches through to attenuation and treatment swales without basins.

Capital cost and whole life cost analysis has concluded that, in general, attenuation swales with simple hydraulic controls would be the most cost effective in situations where the longitudinal grade is less than 1.5% and that swales together with dry ponds would be cost effective in situations where the longitudinal grade is greater than 2.5%. The preferred configuration has adopted these findings and presents both the lowest capital cost and net present value outcome.

Temporary erosion and sediment control basin locations have been identified to determine temporary construction land requirements. The proposed solution provides a concept that meets the necessary standards while not imposing any cost premium on the project.

Flood Plain Mitigation:
A lifelines approach has been adopted for the route with design flood levels set to meet the NZTA Bridge Manual requirements at significant waterways and provision of a 0.3 to 0.5m freeboard across larger floodplains. This level of provision is considered appropriate given that this is an expressway proposal and that the future local arterial (existing SH1) is prone to flooding through locations such as Te Horo and Taylors Road. However, value opportunities to explore reducing this are identified in the table below.

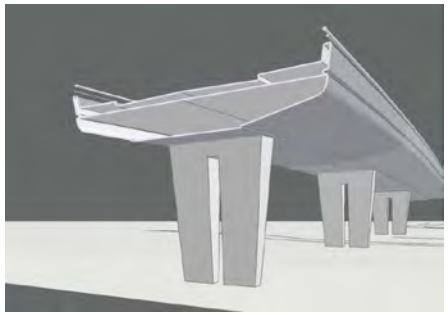
The philosophy adopted for flood plain mitigation through Otaki and Te Horo (agreed in principle with KCDC and GWRC) is to protect settlements to the west of the existing railway by retaining existing flow and flood constraints through the provision of 'undersize' culverts, and to demonstrate through further flood modelling that flood inundation is not worsened at dwellings on the upstream side of the expressway. This has resulted in relatively low cost mitigation treatments for these locations.

No significant cost premiums have been incurred in delivering treatment over and above that required to mitigate direct effects.

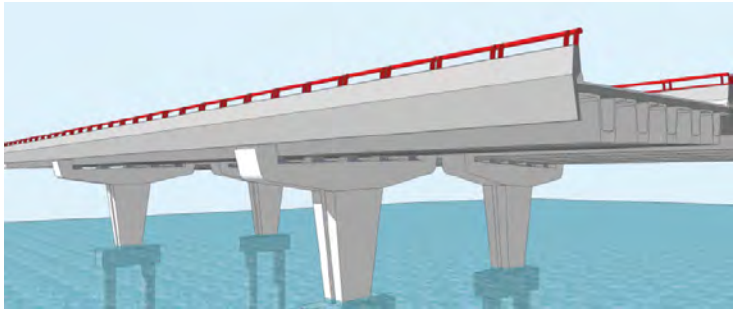
	Scope assumptions	Description of Value Added Over Base Provision	Value c/f base provision	Risk/impact of reducing provision.
Flood Provision	In most situations design allows for 0.5m free-board over 1 in 100yr flood event (inc climate change) through areas of identified overland flooding. North of Otaki river stopbank free-board has been reduced to 0.3m as majority of water is likely to be ponding rather than flowing, and elevation of structures at Rahui Rd are critical.	o Opportunity to consider reducing free-board and accept a level of risk of flooding inundation for 1 in 100yr events. Has been considered as part of Basis of Design assessment – NZTA requirements at flowing watercourses (river bridge freeboards and culvert freeboards) limit the ability to deliver significant further value opportunities.	o Rough order potential value saving of $0.23M by lowering alignment between main waterway crossings and having no freeboard.	Increased frequency of inundation. Reducing freeboard at main culvert and river crossings has increased erosion/scour risk potential and is not recommended.
Flood Provision	**TOTAL Value c/f Basic option**		**$0.23M VE opportunity** (1% of $17.5M SE base earthworks)**.**	

8. Urban Design & Structures

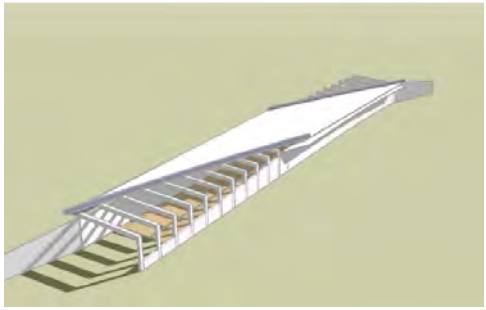
Proposals for the key bridge structures are described within the Project Urban and Landscape Design Framework and Bridge Statement. The key types of structures are illustrated as follows:



Local Overbridges (Otaki/Te Horo)



Expressway River Bridges



Mary Crest NIMT Bridge

Given the need to deliver an integrated urban design outcome through Otaki and Te Horo, the urban and landscape design framework has confirmed the importance of incorporating elegant, yet cost effective bridge solutions within these communities to achieve the right amenity, aesthetic and social outcomes. To achieve an appropriate and added value urban design outcome that will meet the projects urban design objectives, it is recommended that a premium is focused on enhancing the bridge aesthetic outcomes. The recommended premium is considered necessary to achieve the desired project outcomes and to progress smoothly through the relevant statutory process, and represents an investment of only approximately $4.0M or 7% of the total estimated structures (and MSE wall abutment costs) ($56.2M).

	Scope assumptions	Description of Value Added Over Base Provision	Value c/f base provision	Risk/impact of reducing provision.
Structures	There are 9 major bridge structures. Bridge solutions with good architecture and form that are sympathetic with the local surroundings have been identified as important given that local bridges across the expressway are visually prominent. Urban design	o An enhanced architectural and urban design focus has been applied around Rahui Road, the local bridges over the expressway at Nth and Sth Otaki	o An additional $1.6M has been utilised to deliver enhanced urban design outcomes at the key local overbridge locations given the visual prominence and	A workable solution at Otaki for a Rahui Rd bridge crossing demands a slender bridge structure to achieve acceptable grades and provide an elegant

	Scope assumptions	Description of Value Added Over Base Provision	Value c/f base provision	Risk/impact of reducing provision.
	and architectural input have influenced the forms proposed. Options considered for these bridges included: 1. Low cost option – Super 'T' beams on circular column and reinforce concrete hammerhead caps. 2. Intermediate option – Super 'T' beams on architecturally designed piers with elegant precast barriers (7% cost premium over option 1) 3. Best visual outcome – Architecturally designed segmental box bridge deck and substructure (18% cost premium over option 1) 4. Long-span arch bridge across the Otaki River (substantially more expensive that any of the above solutions). Option 4 was eliminated at the early stages on the grounds that a gateway or iconic form did not fit with this part of the RoNS. At Mary Crest (where the expressway crosses the NIMT) options of a hollow core 'tunnel' (similar to McKay's Crossing) and a more open beam and slab deck have been considered.	and the local bridge at Te Horo. The premium over cheaper super-T solutions is approximately 11%. o The two main river bridges will be viewed mainly by the expressway users and any recreational users beneath the bridges. From the main urban area of Otaki the new river bridges will be generally obscured by the existing rail bridge. The recommended architectural and engineering form aims to adopt Rahui-style articulations through the proposed extended barrier profile, yet retaining Super-T beams with architectural designed piers as a cost effective solution. The estimated increase in cost over Option 1 is in the order of 7%. o The architectural option proposed at Mary Crest aims to reduce the area of 'enclosed' structure and provide a more open aesthetically pleasing solution. No cost premium is necessary to achieve this outcome. o For the NIMT crossings at Nth and Sth Otaki the structures are set into cuttings, or embankments and are less prominent than the expressway bridges. Simple hollow core structures have been proposed at these locations.	setting of these structures (local bridges over expressway). o An additional $2.1M has been utilised at these structures to deliver architectural forms that will sit well with the local environment and provide consistency to expressway users. o From a route consistency perspective the proposed expressway bridges over the rail and river corridors will provide consistency with M2PP. o The architectural and structural treatment to local bridges crossing the expressway differ to M2PP due to the specific nature of the local environment, scale and setting of these bridges.	curved solution. A basic structure here, at Nth Otaki, or Te Horo will meet strong resistance from the local community and KCDC through the BOI process.

	Scope assumptions	Description of Value Added Over Base Provision	Value c/f base provision	Risk/impact of reducing provision.
	Median shoulder width assumed for main river bridge crossings – the base option assumes that the expressway shoulder widths (1m) will be continued across the main structures in accordance with the RoNS Guidelines [v6_101109]. Shoulder provision for the expressway is 2.5m outer and 1m median shoulder provision.	N/A		
	Twin structures proposed at Waitohu and Otaki River bridges – earlier work identified no significant premium over single v double structures, however advantages with double structures relating to day-lighting below, construction staging, and median consistency. This also provides the greatest degree of consenting flexibility.	o Negligible premium identified.	o N/A.	
	Local road bridge footpath and carriageway provision. Most over-bridges carry local roads and have space allocated for footpaths on either both or one side, depending on the degree of demand. **The current scope assumes:**			
	Kerbside lanes of 4.2m in width to provide space for on-road cycling. Turning lanes to be 3.5m wide.	o No added value/premium over Austroads/KCDC guidelines.	o Nil	KCDC have expressed desires for increased footpath width provision to all local bridge structures of between 4 and 5m total allocation.
	Bridges 2&3 (North Otaki): 1.5m path (West side), 2.5m combined path (East side). Total width ~ 15.9m between barriers.	o 1.5m path to north side across expressway onramp added to meet lower demand on Nth side.	o $0.25M premium.	
	Bridge 4 (Rahui Rd): 2m path (North), 2.5m path (South). Total width ~ 12.9m between barriers..	o Given level of demand/location no premium over base provision.	o Nil	
	Bridges 6&7 (South Otaki): 2.5m path (North side), no path (South side – safety/avoid ramp conflicts). Total width ~ 14.4m between barriers.	o No added value/premium over Austroads/KCDC guidelines.	o Nil	
	Bridge 8 (Te Horo): no path (North side), 2.5m path (South side). Total width ~ 11m between barriers. Footpath/lane width allocation can be re-distributed	o 2.5m shared path with low likely demand. $0.2M premium over a 2m path, however no alternatives for vulnerable users.	o $0.2M	

	Scope assumptions	Description of Value Added Over Base Provision	Value c/f base provision	Risk/impact of reducing provision.
	during design.			
Structures	**TOTAL Value c/f Basic option**		**$4.0M over basic** (7% of $56.2M SE base).	

9. Landscape Design

The proposed landscape treatment aims to integrate the expressway proposal within the existing environment while also recognising the wider Otaki vision. Along rural sections of the expressway the proposal aims to integrate the expressway within the wider landscape, with treatments predominantly within the expressway corridor and attention given to life cycle maintenance considerations.

At Otaki a wider area of landscape treatment is required to ensure that the impact on existing reserve space (Pare-o-Matangi Reserve) and introduction of new grade separated crossings (e.g. Rahui Road), and railway relocation are mitigated adequately.

Where opportunities exist for complementary enhancement these have been identified as opportunities but not priced within the project scope.

The landscape proposals presented are considered necessary for mitigation of the project effects and for delivering on the stated objectives within the Project Urban and Landscape Design Framework (Draft August 2011). Value for money considerations have included balancing the appropriate selection of grassed versus planted treatment areas to ensure appropriate operational and long term maintenance outcomes, while delivering a solution that aligns with NZTA's landscape design related priorities for the expressway (integrated solution that achieves an appropriate balance between functional requirements of the highway while addressing social, land use, and environmental impacts).

The premium for providing enhanced urban and landscape design has been focused around treatments at the main bridge structures, together with their integration. No significant premium is considered necessary to deliver the landscape outcomes proposed. As an indication the overall landscape component of the current base scheme estimate is approximately 3% ($6.5M of $220M) which is considered appropriate in the context of this project.

	Scope assumptions	Description of Value Added Over Base Provision	Value c/f base provision	Risk/impact of reducing provision.
Landscape	As documented in the Draft ULDF and Draft scheme plans. Mitigation applied to corridor and affected reserve areas at Otaki. Existing SH1 treatment limited to new sections south of Mary Crest and tie-ins at interchanges/new local connections.	o None	o N/A	If current levels of treatment are reduced significantly then there is a risk the proposal will be challenged through the BOI process.
Landscape Provision	**TOTAL Value c/f Base option**		**$0M over base**	

10. Other Items

10.1 Traffic Services

The project proposal has currently been developed to a scheme assessment level of detail. A draft proposal for guide signage has been developed for further discussion with KCDC and GWRC in line with the NZTA Board's directive to further consider destination signage. Based on discussion at the August VFM challenge workshop some basic design assumptions have been adopted for the following extent of variable message sign and camera provision:

VMS boards to be allowed for either side of the interchanges at North and South Otaki to enable messaging a routing for traffic to leave the expressway along with associated cameras. An allowance has also been made for future proofing for ATMS by including ducting along the length of the corridor.

A corridor study is being commissioned separately by NZTA to review and confirm the preferred integrated solution across the wider RoNS and local network. The current added value included for future proofing is approximately 12% of the $3.4M base traffic services schedule item.

	Scope assumptions	Description of Value Added Over Base Provision	Value c/f base provision	Risk/impact of reducing provision.
Traffic Services	Basic design assumptions to date i.e. VMS boards either side of interchanges + cameras. Extent of operational requirements not yet scoped.	o Inclusion of 3 x 100mm ducts over entire length of the expressway to provide future proofing for later ATMS/traffic services and avoid the need for later trenching.	o $0.43M	Limited risk provided clear utilities/service zone identified.
Landscape Provision	**TOTAL Value c/f Basic option**		**$0.4M over basic (12% of $3.4M SE base)**	

10.2 Procurement Model

A construction start is currently scheduled for 2014/15. Design and construct has been identified as the preferred procurement route by NZTA and the statutory process and consents will need to maintain flexibility for innovation by the D&C designers and contractors.

The Principal's Requirements (for the D&C contract) will need to capture the key "must haves" so that the desired level of urban design outcomes are delivered through the D&C process, over lowest cost conforming solutions.

It is likely that further value engineering efficiencies could be realised through the D&C process, however the key opportunities identified to-date are captured within Appendix A.

10.3 Walking/Cycling and SH1 Revocation

Walking & Cycling – walking, cycling and bridle provision have been considered as an integrated part of the overall urban and landscape design development and are documented within the ULDF and transport package. The overall philosophy adopted has been to provide and safeguard for identified desire lines across the proposed expressway and to investigate the appropriate placement for a parallel offroad facility that can provide for vulnerable road users (identified as part of the transport package by NZTA). Cross corridor facilities have been integrated with the interchange and local road overbridge proposals as described above under urban design and structures.

Consideration of a parallel offroad facility for vulnerable users has been discussed with stakeholders and raised through public consultation. A parallel off-road walking and cycling facility is proposed along the local arterial corridor rather than the expressway corridor as this will provide improved connectivity with destinations and the local communities that the path connects. A decision around the final form of this and associated costs are to be captured within the SH1 revocation project scope. This will link into consideration of operational speeds on the existing SH1 e.g. provision of threshold treatments.

SH1 Revocation - Works to the Existing SH1 (under the scope of the PP2O project) have been limited to direct mitigation at interface areas, line re-marking and removal of existing passing lanes. Any further enhancement work to the Existing SH1 corridor will be captured by a separate assessment of treatments for input into the SH1 Revocation process.

11. Conclusions & Recommendation

The following table summarises the overall value for money proposition relative to a more basic scheme solution (one that merely provides minimum standards, or lowest cost solutions). Given the objectives, context and setting for the PP2O Road of National Significance it is considered necessary to deliver an integrated urban design solution that is consistent with the aims of the Otaki Vision (an NZTA Board requirement). In order to achieve this it is recommended that a capital cost premium is accepted in order to deliver an appropriate quality outcome, combined with a solution that is robust and aims to optimise longer term maintenance inputs.

The table below summarises an assessment of a basic provision versus the value for money proposition, together with a brief justification. More detailed descriptions are included above within the body of this report. It is recommended that the scheme proposal is adopted to ensure that the project will meet the stated objectives and win support through the Board of Inquiry process.

	Basic Provision	Scheme Proposal	Value Proposition ($)	Justification.
Geometrics	4m median (Costs within other elements)	6m median proposed (Costs within other elements)	$1M	Achieving desired urban design outcomes, good sight/shy lines through Otaki (safety).
Earthworks & Ground Improvements	$17.5M – lowest capital construction cost approach.	Same as basic – improved lifecycle maintenance and reduced risk profile.	$0M	Improved risk profile & reduced operational costs (maintenance) due to ongoing differential settlement.
Pavements & Surfacing	$15.3M – lowest capital construction cost approach.	$15.7M – improved lifecycle maintenance and reduced risk profile.	$0.4M	Reduced risk of early rutting failures & improved lifecycle costs.
Drainage & Flood Provision	$11.1M	Same as basic	$0M	Lifelines resilience and limited savings if compromised.
Urban design & Structures	$52.1M	$56.2M	$4.1M	Meeting urban design outcome objectives across the project and specifically at Otaki and Te Horo.
Landscape	$6.5M	Same as basic	$0M	Required for mitigation purposes.
Traffic Services	$3M	$3.4M	$0.4M	Future proofing and flexibility.
Procurement Model	N/A			
Walking/cycling & SH1 Revocation	Covered under structures.			
TOTAL (Total Project)	**$214.1 basic provision (base estimate)**	**$220M SE (base estimate)**	**$5.9M**	More resilient and consentable project with improved outcomes.

Appendix A
Value for Money Challenge Workshop

PP2O VALUE ENGINEERING CHALLENGE WORKSHOP

Minutes for 2nd August 2011 (9.00am to 3.30pm)

Location: Opus Boardroom, Level 9, Majestic Centre, 100 Willis St, Wellington

Attendees: Graham Taylor (NZTA), Fergus Tate (NZTA), Andy Quinn (NZTA), Tony Coulman, Mark Edwards, Gareth McKay, Rob Prestland (Holmes), Brabha, Simon de Rose (minutes), Tessa Cox, Sheryn Reilly.

Distribution: Attendees, Phil Gaby, Bruce Curtain, David Dunlop.

Purpose of Meeting:

The main objectives of this exercise are to:

- Optimise the value being achieved on all RoNS and other significant projects.
- Ensure consistency of standards.
- Reduce costs where possible without compromising the standards of the performance of the project.

Actions and Outcomes:

The key items raised for the project team to consider are listed in the table attached.

There were a number of additional items that were raised during the session as follows:

- In preparing the guide signage layout the outcomes should also be discussed with GWRC. (Action: **GM**)
- Graham suggested that there were recent lessons that could be learnt on the outcome of Grade 2/4 vs 3/5 chip seals (linked to binder application/design). (Action: **SR** to discuss with Dave Alabaster)
- Graham noted that the LOS should be stated for the mid-block expressway, not just interchanges etc. (Action: **DD**)
- A Value for Money Statement/Report is to be prepared to support the project approval process. Tauranga Eastern Arterial was cited as a having a possible example/template (*Post meeting note: TEA PM contacted but not aware of such a report).* The report should aim to quantify where value has been added, or where extra expenditure (over and above minimum requirements) is proposed to meet the project objectives. Workshop agenda provides an idea of structure. (Action: **TC)**

Outcomes of Value Engineering NZTA Review Workshop – 2nd August 2011

Project Outline	4 lane rural expressway from Taylor's Rd (North Otaki) to Peka-Peka Rd (interchange by M2PP). Project estimate $215-$355m (Business case $215m). Last estimate at scoping stage $296m

	Scope assumptions	Value challenges	Value of the opportunity	Risk & impact
Geometrics	Geometrics are to RONS guidelines to 110/100 km/h design speed. Min curve radius is 820m. Cross-section includes 6m median. 9m clear zones and 1:4 batter slopes unless fill embankments are greater than 2m then barrier and steeper fill slopes adopted. Large corridor width where local road runs parallel to expressway and NIMT rail corridor.	o Reduce separation between road/rail and between road and local road.	o Potential reduction in property costs, although incursion in to rail corridor will also incur property cost. Current position based on partial utilization of the rail corridor to accommodate rear swale slopes, and to utilize part of the Te Horo rail station reserve.	o Potential for future widening is lost, however 6m median provision and shoulders adopted would permit reconfiguration for additional lanes.
		o Use edge barrier @3m offset and steepen batters to max for soil type. National position on clear zones being considered by NZTA.	o Potential reduction in footprint. Has been considered as part of Basis of Design assessment – current philosophy based on barrier provision for fill heights > 2m, resulting in estimated $2M saving.	o Care to ensure flexibility within designation.
		o Termination at Taylor's Rd and the timing of the Levin section suggests that there are short term 3-5yrs safety improvements north of Otaki though to Pukehou worth investigating.		o Cost of the investigation, overlap with the Levin project team, delay to the project timeline to lodgement.
		o Agreed that sightline improvements (southbound approach to Taylors Road) should be considered as part of PP2O project.		o Additional cost to project to resolve existing problem.
		o Reduce median to 4m through whole length.	o Potential savings considered as part of Basis of Design assessment. Reduction from 9m to 6m achieved $3M reduction and adopted for SARA design to-date. Further potential saving of $1M for reduction from 6m to 4m. No significant cost saving identified at the main river crossings.	o Graham Taylor noted that the story for a 6m median should be clearly documented. Key issues in adopting a 4m median include compromising sight distances around the tighter curves, smaller median widths requiring lane closures for maintenance, median width effect on bridge pier locations. Reduced landscape outcome, particularly through rural sections.
		o Consider roundabout on east side of South Otaki interchange to allow reduction in bridge width from three to two lanes	o To be investigated following completion of SARA. Potential value of opportunity to be assessed once value of additional land requirement known (cover in VFM statement).	o Cost associated with additional land take required.
Geotechnical	Three main types of soils; peat, terrace and alluvial gravels. Base assumption is that areas of peat < 3m will be dug out and replaced, while areas greater than 3m+ in depth will be dug out and replaced to 3m and then surcharged. No source identified for the fill as yet although there are opportunities to use river gravels from the Otaki river mouth or extract from the Winstone's quarry. Sub-grade material generally not at risk from liquefaction but some further investigation needed around the Ohariu fault-line (location relative to Te Horo local road bridge).	o Opportunities to round dune batters and win additional fill material (balanced against cultural considerations). o Peat re-use in bunding/landscaping/outer fills to avoid offsite cartage/disposal of unsuitable materials.	o Relatively small scale opportunities to be combined with landscape treatment and later design development. o Significant cost saving – factored into base estimate ($ to be stated in VFM statement).	
Earthworks & pavement	Optimisation of overall cut-fill balance has been a prime focus to reduce demand for imported fill, including depression and widening of the corridor at Sth approach to Otaki River. Currently a neutral cut-fill result. Pavement analysis based on 9% heavies and growth of 1.6% assumed	o Opportunity to utilise river abstraction (gravels) as a	o The value opportunity adopted is a CBR10 based	o Risk allowance for uncertainty around outturn CBR

	Scope assumptions	Value challenges	Value of the opportunity	Risk & impact
	rather than the high growth scenario from the regional model (WTSM) which yields unrealistic %HCVs. A CBR 10 has been adopted for the base case, with risk recognition for areas of lower CBR. Pavement choice has been risk based and whole of life cycle; base option is 150mm sub-base, 180mm base-course with two coat chip seal (grade 3/5). Extent of OGPA used for noise mitigation still to be confirmed but likely through Otaki and Te Horo. The current AADT is 17,162 and growth model assumes 21,000 by 2026. Both the Saturn models are being integrated by Beca.	subgrade/subbase improvement layer in areas of poorer CBR. o Use of cement modified basecourse is currently preferred due to improved resilience/risk profile and longer term benefits. o Extent of OGPA for noise mitigation – preliminary BCR and BPO analysis identifies string benefit/need through Otaki. Opportunity to further assess benefit through rural sections outside of Te Horo.	on available geotec interpretation with allowance for an additional 150mm river gravel layer captured in the risk based estimate for areas of CBR down to about 5. o Cheaper unmodified pavement. Nett Present Value analysis of options identifies that the preferred option costs $1M more than an unmodified pavement, however from a risk management perspective this is considered to be money well invested. o Potential opportunity given low BCR for application of OGPA outside main settlement areas. To be quantified in the VFM statement.	and hence extent of improvement. o Reduced risk profile through adoption of modified basecourse flexible pavement. Premium of circa $0.7M capital cost ($1M NPV). o Public expectation will be for a quiet road surfacing or equivalent localised noise mitigation treatments. Further Best Practicable Option and BCR analysis required at AEE stage.
Structures	9 bridge structures. Architectural design being undertaken at present prior to development of engineering solutions. Twin structures proposed at Waitohu and Otaki River bridges – earlier work identified no significant premium over single v double structures, however advantages with double structures relating to day-lighting below, construction staging, and median consistency. Full width shoulders assumed to carry over structures. Most over-bridges carry local roads and have space allocated for footpath on either both or one side.	o Level of aesthetic value improvement appropriate. o Rationale for differences of approach with M2PP to be clearly documented. o Check the overall width of the Mary Crest overpass (rail + road reserve & personal security issues). o Allocation of space for ped/cycle on overbridges – comfortable with width of structures but how road space is assigned to be reconsidered. o Bridge Manual is currently being updated to require a 2m median shoulder, current project assumption is 1m. Noted that change to be included as part of project scope. (post meeting note – RoNS guidelines [v6_101109] do not appear to state this requirement). o Opportunity of removing the local access from under the Mary Crest bridge and providing an alternative access for Mary Crest properties to Sutton Road. o	o Value statement/report to document additional value invested in urban design/architectural outcomes relative to basic designs. o To be documented in ULDF/SARA – location specific drivers such as at Rahui where more slender/sleek architectural outcomes are desired. o Likely to increase construction cost but may be necessary to address KCDC local access requirements. o Reduction in cost unlikely but prioritisation of movement may help concentrate use and remove safety risks. Value aspects to be captured in VFM statement. o Likely to add to project cost in the order of $2.4M over the two river bridges. May be an item worth raising as a potential (future) departure given significance of cost at these bridges, fact that full shoulder widths are carried over, and fact that projects such as TGM have not adopted this standard. o This would enable narrowing of the expressway overbridge, however does not eliminate rail crossings and requires increased detour effect. There was not significant enthusiasm for this option, however could be considered at a later date if KiwiRail look to ease the railway alignment to the east (would open up the opportunity to eliminate rail crossings and narrow the bridge). To be monitored.	o $2.4M increase in base structures cost estimate.
Urban Design and Environmental	Landscape gateway treatment proposed in lieu of iconic structures (structures occur too late to signal arrival). Separation between local road and expressway used for some landscaping enhancement/offset mitigation for loss of existing shelter belt.	o Need to be clear on mitigation planting versus amenity planting, recognise opportunities but be clear on scope of work. o Planting within rail corridor cuttings to be minimised.	o Potential cost savings, but likely to be minimal. o Team to aim to capture the added value/extra over landscape provision within the VFM statement. TC noted this is fairly subjective and that base allowance will cover all mitigation required.	o Appropriate balance important as inadequate provision for mitigation could be challenged by the BOI.

	Scope assumptions	Value challenges	Value of the opportunity	Risk & impact
	Shelter belts on eastern side re-created where intersected, and higher level of treatment at the Rahui Rd/Pare-o-Matangi Reserve area given the high significance of this area. Noise mitigation assessment has been based on high levels of HCVs as predicted through regional model (WTSM) and as used for M2PP and TG. This should be conservative.	o Explore the appropriate balance of planted versus grassed areas. i.e. mitigate expressway effects but get the right balance versus community involvement in planting areas.		
Traffic Services	Basic design assumptions to date i.e. VMS boards either side of interchanges + cameras. Extent of operational requirements not yet scoped.	o Include 3 times 100mm ducts along full length of project as future-proofing.	o None identified.	
Flooding	In most situations design allows for 0.5m free-board over 1 in 100yr flood event (inc climate change) through areas of identified overland flooding. North of Otaki river stopbank free-board has been reduced to 0.3m as majority of water is likely to be ponding rather than flowing, and elevation of structures at Rahui Rd are critical.	o To reduce free-board and accept a level of risk of flooding in 1 in 100yrs	o Has been considered as part of Basis of Design assessment – NZTA requirements at flowing watercourses (river bridge freeboards and culvert freeboards) limit the ability to deliver significant further value opportunities. Rough order potential value saving of tbc through preliminary assessment and reported in VFM statement.	o Increased frequency of inundation. o Reducing freeboard at main culvert and river crossings has increased risk potential and is not recommended.
Rail	Track realignment required around Otaki station area (and re-orientation of the historic station building. Earthworks for double–tracking of the realigned rail have been included as part of the project scope (but not ballast or rail unless part of existing passing loop). This is to win more fill material at the north end and avoid significant later disturbance through the Pare-o-Matangi reserve area.	o None identified. o Rationalisation of rail/expressway corridor discussed under geometrics. o Service agreement to be developed to capture project scope and any additional items that sit with KiwiRail.		
Walking and Cycling	Off-road facility included in the project alongside existing SH1. Requires a clip-on bridge to the existing Otaki river bridge. On road facilities (shoulder) also included on local road.	o VFM team challenged provision of an offroad facility. Offroad walking and cycling has been communicated publicly as part of overall proposal to provide for vulnerable users. o Ensure there is a cost share agreement with Council for community facilities. o Walking and cycling along SH1, together with other wider revocation inputs to be captured within SH1 revocation project estimate and process.		
Revocation of SH1	Minimum scope included i.e. line marking and removal of passing lanes. Plus direct tie-in mitigation. Speed environment desired by KCDC is likely to be 80km/h but no other specific requirements as yet (to be captured under separate SH1 Revocation project).	o Ensure there is a cost share agreement with Council for community facilities		
Procurement	Construction start is currently 2014/15 so design and construct is the preferred route but need to maintain flexibility in outline plan approval/management plan approach.			