Before a Board of Inquiry
Transmission Gully
Notices of Requirement and Consents

---

under: the Resource Management Act 1991

in the matter of: Notices of requirement for designations and resource consent applications by the NZ Transport Agency, Porirua City Council and Transpower New Zealand Limited for the Transmission Gully Proposal

between: **NZ Transport Agency**
Requiring Authority and Applicant

and: **Porirua City Council**
Local Authority and Applicant

and: **Transpower New Zealand Limited**
Applicant

Statement of evidence of Mark Alan Edwards (Project design and construction) for the NZ Transport Agency and Porirua City Council

---

Dated: 16 November 2011

REFERENCE: John Hassan (john.hassan@chapmantripp.com)
Nicky McIndoe (nicky.mcindoe@chapmantripp.com)

Chapman Tripp
T: +64 4 499 5999
F: +64 4 472 7111

10 Customhouse Quay
PO Box 993, Wellington 6140
New Zealand

www.chapmantripp.com
Auckland, Wellington,
Christchurch

STATEMENT OF EVIDENCE OF MARK ALAN EDWARDS FOR THE NZ TRANSPORT AGENCY AND PORIRUA CITY COUNCIL

QUALIFICATIONS AND EXPERIENCE

1 My full name is Mark Alan Edwards.

2 I am the Team Leader for Opus' Road Design team within the Wellington Region's Transportation & Engineering team and a partner with Opus International Consultants (*Opus*). My particular area of expertise is highway engineering, with particular emphasis on geometric design.

3 I have a BTEC Higher National Certificate in Civil Engineering Studies from Leeds Polytechnic (UK), achieved in 1991.

4 I have twenty-four years professional experience in the planning, design and management of a broad range of road projects ranging from local improvements to major highways and motorways in New Zealand, the UK and Australia. I have specialised in the highway geometry and scheme assessment of major road projects throughout my career. I am experienced in the use of international design standards and geometric design tools.

5 Throughout my career I have been involved in the investigation and design of a number of major projects similar to the Transmission Gully Project (*TGP* or *Project*). Some recent examples of these are:

5.1 SH1 MacKays Crossing (Design and Construct) – I was the Senior Highway Designer and Design Manager responsible for producing the road design elements. The design provided for 3km of rural four lane state highway, grade separated interchange, connecting ramps and bridge structures. I was also the contractor's design site supervisor for the construction phase of the project.

5.2 SH2 Muldoons Corner - I was the Design Manager and lead road designer responsible for undertaking investigation, detailed design and contract documentation. Tasks included the delivery of the design reports, cost estimates and construction staging plans and programming.

5.3 SH73 Christchurch Southern Motorway - I was responsible for producing the geometric alignment and interchange designs for the specimen design of a new expressway alignment and widening of an existing section of highway to a four lane expressway. Tasks included design of grade-separated interchanges, at-grade intersections, local access arrangements and final preparation of specimen design drawings for a design and construct tender. I also provided

specialist technical support during the tender evaluation process.

5.4 SH2 Dowse to Petone Project - I was responsible for preliminary design to support Transit New Zealand's Notice of Requirement, followed by the detailed design and preparation of tender documents. Design included a grade-separated interchange at Dowse, linkages over the railway corridor to connecting local roads, geometric design of two overbridges and connecting roads, and provision for a new service lane.

5.5 For the SH1 Paremata to Plimmerton project I was the senior geometric designer responsible for the detailed design of a four lane rural and urban road alignment. The design included the construction of two roundabouts, five signalised intersections, carriageway edge widening and the re-grading of property accesses throughout the urban section.

6 I understand the Transmission Gully Proposal lodged with the Environmental Protection Authority comprises three individual projects, being:

6.1 The 'NZTA Project', which refers to the construction, operation and maintenance of the Main Alignment and the Kenepuru Link Road by the New Zealand Transport Agency (*NZTA*);

6.2 The 'PCC Project', which refers to the construction, operation and maintenance of the Porirua Link Roads[1] by the Porirua City Council (*PCC*); and

6.3 The 'Transpower Project' which refers to the relocation of parts of the PKK-TKR A 110kV electricity transmission line between MacKays Crossing and Pauatahanui Substation by Transpower New Zealand Limited.

7 My evidence is given in support of the NZTA and PCC Projects, which I refer to collectively as the TGP. It does not relate to the Transpower Project.

8 I confirm that I am very familiar with the area that the Project covers, and the State Highway and road network in the vicinity of the Project.

9 I am the author of the Road Design Philosophy (Technical Report 1) which formed part of the Assessment of Environmental Effects (*AEE)* lodged in support of the Project.

[1] The Porirua Link Roads are the Whitby Link Road and the Waitangirua Link Road.

10 I have read the Code of Conduct for Expert Witnesses as contained in the Environment Court Consolidated Practice Note (2011), and I agree to comply with it as if this Inquiry were before the Environment Court. My qualifications and experience as an expert are set out above. I confirm that the issues addressed in this brief of evidence are within my area of expertise unless otherwise stated in my body of evidence. While, bridge design is not within my area of expertise, I have worked with the specialist bridge engineers and visual and urban designers on this and other projects, so my evidence regarding bridge design is on this basis. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

11 My evidence will deal with the following:

11.1 Background and role;

11.2 Roading and structures design rationale;

11.3 The safety audit process and its relationship to design;

11.4 Likely construction programme and methods;

11.5 Alternatives considered;

11.6 Response to submissions; and

11.7 Proposed conditions.

SUMMARY OF EVIDENCE

12 The Main Alignment has been designed to expressway standards, although in most respects it will meet motorway standards. Given the complex terrain and environmental constraints, the Project team has had to carefully consider appropriate design standards, the makeup of the road width and earthworks footprint, and show how these interface with the existing topography. My evidence provides a summary of some of the key design considerations that have helped shape the Project.

13 The Project has been through a formal safety audit process, and the Project design team has considered the issues and recommendations raised by the external road safety audit team and addressed many of these throughout the design development. A high level summary of the process and its relationship to the design outcomes is summarised in my evidence.

14 The Project mainly traverses through rural land with pockets of lifestyle blocks and associated dwellings, for example along Flighty's Road and Paekakariki Hill Road. At the southern end the Project lies in the vicinity of residential suburbs. I will discuss the likely scale, duration and type of construction activities which have been considered to enable potential effects to be identified and any necessary mitigation measures developed.

15 My evidence also outlines the historic development of the Project design leading to the selection of the proposed option. This is detailed further in Chapters 2 and 9 of the AEE. I summarise the method used in the options analysis and describe the key points of the Scheme Assessment Report that documents this process. Ultimately, Opus and the Project team recommended an alignment that is unconstrained by the existing designation for further consultation, design and assessment of effects.

BACKGROUND AND ROLE

16 Opus was commissioned by the NZTA in mid-2007 to identify the preferred alignment for this alternative to the existing SH1 route, using the existing designation as a base. I was the lead road designer responsible for developing alternative options and provided civil (roading) engineering inputs into the option selection process.

17 Opus was engaged by the NZTA as part of a consortia team to assist with the investigation and engineering design of the Project. My role within the environmental assessment phase was to lead the road design team and either carry out or directly oversee various tasks, including:

17.1 To undertake geometric and other highway designs to support the social, environmental and ecological assessments that may affect the highway design;

17.2 Integrate the design solutions with outputs and recommendations from bridge structures, geotechnical, urban design, landscape, ecology, water, heritage and other specialist advisors to ensure a co-ordinated solution;

17.3 Review the findings of the road safety audit report and either implement design changes or obtain the necessary departures;

17.4 Provide mass haul quantities and diagrams to the cost and construction programme advisors and have input into, and be involved in the development of the construction programme and methodology;

17.5 Co-ordinate inputs and prepare the draft Site Specific Environmental Management Plan (*SSEMP*) for Kenepuru Interchange and provide construction methodology inputs into all the other SSEMPs;

17.6 To prepare a Road Design Philosophy report (Technical Report 1);

17.7 Prepare all necessary scheme and land requirement plans for submission with the notice of requirement (*NoR*) documentation;

17.8 Provide technical briefings for technical and regulatory stakeholders and participate at public meetings; and

17.9 Attend group meetings with directly affected property owners to provide technical engineering support to the consultation and engagement process.

ROADING AND STRUCTURES DESIGN RATIONALE

Roading

18 This section of my evidence discusses the key design considerations that have shaped the form of the proposed Transmission Gully Project. I will discuss the relationship between design standards, topographical, environmental and social constraints and their influence on the final form of the Project.

19 A key assumption of the Project's design philosophy is to provide a "National State Highway[2]" to motorway or expressway standard.

20 The key difference between an expressway and a motorway is that no side-access is permitted to a motorway, whereas "rigid access control" is required for an expressway. Also, a motorway has completely uninterrupted flow with all intersections being fully grade-separated, whilst at-grade intersections (e.g. traffic signals or roundabouts) are permitted on an expressway.

21 Notwithstanding that, the Main Alignment is designed to a motorway standard in most respects. For example, all intersections are grade separated interchanges, and no direct access will be permitted for properties adjoining the route.

22 However, given the topographical constraints of the route, and the possibility that there may be a need for temporary access in special circumstances (for example to harvest forests on adjacent

[2] In the Wellington area State Highway 1 is identified in NZTA's National State Highway Strategy (NSHS) 2007. The NSHS proposes SH1 will have four or more lanes for approximately 75km north of Wellington within 30 years.

properties where there is no possible alternative access), it was decided that an expressway standard was more appropriate than a motorway standard overall.

23 The key design features of the Main Alignment are:

23.1 Minimum of four lanes (two lanes in each direction) with continuous median barrier separation;

23.2 Additional crawler / climb lanes on some steep gradient sections to address potential safety issues arising from speed differences between heavy and light vehicles;

23.3 Rigid access control;

23.4 Grade separated interchanges;

23.5 Minimum horizontal and vertical design speeds of 100km/h and 110km/h respectively;

23.6 Maximum gradient of 8%[3];

23.7 Arrestor bed or run-off areas (gravel catch pits) on the northbound descent from the Wainui Saddle for any out of control vehicles;

23.8 Brake check / vehicle inspection lay-bys at the summit of the Wainui Saddle; and

23.9 Provision for connections to eastern Porirua (Porirua Link Roads) and western Porirua (Kenepuru Link Road).

24 The geometric design of the Project has been based on the NZTA's State Highway Geometric Design Manual (*GDM*), which is accepted best practice. Topographic, environmental, engineering, and/or economic considerations make it impractical to meet the standards required by the GDM in all areas. This is normal and best practice when delivering appropriate and cost-effective solutions.

25 Where design standards have not been met, specific departures from the GDM were referred to NZTA's Scope and Standards Review Committee (*SSRC*) for approval. These are covered in more detail later in my evidence (paragraph 38).

[3] 8% grade is the same gradient as SH1 Ngauranga Gorge, however TGP has the 8% grade contained within an horizontal straight unlike Ngauranga Gorge which contains horizontal curves.

26 The Kenepuru Link Road and the Porirua Link Roads will serve as local link roads and have therefore been designed to local road standards, although it is noted that the Kenepuru Link Road is intended to be gazetted as a state highway.

Structures

27 A key tenet of the design philosophy is that the road does not collapse, and that limited access can be restored quickly in the event of a major earthquake. The crossing of active faults on embankments or cuttings has been preferred to bridges or tunnel options. After a rupture event embankments can be reinstated within days, and in cuttings (where a fault rupture would lead to large landslides) reinstatement could take days to weeks[4]. This is likely to be significantly quicker than reinstatement of a bridge.

28 In some instances bridge solutions[5] have been adopted where culverts would have provided a satisfactory and cheaper engineering solution. When crossing steep gullies that could otherwise be filled to utilise the surplus cut material, a bridge solution minimises the footprint of the road to the width of the carriageway above.

29 Bridges 17, 18 and 19 are examples of bridges being used in lieu of culverts. These bridge structures cross over relatively small tributaries of Duck Creek. The Project ecologist felt that the resultant loss of habitat, if culverts were adopted, would be unacceptable. In particular, encroachment of the embankment fill slopes on the tributaries, valleys and the main channel of Duck Creek would be substantial with a culverting solution. Adopting longer spans at Cannons Creek Bridge (Bridge 20) minimises the construction effects on the native bush below.

30 Aesthetic considerations have informed bridge designs resulting in bridges with fewer but larger piers to minimise the visual and physical effect of the bridges on the landscape. Superstructures which provide elegant uncluttered solutions have been selected in more visible or landscape sensitive locations. A consistent treatment of abutment wrapped with MSE[6] walls has been adopted to provide continuity of design through the Project.

---

[4] For a more detailed discussion of fault ruptures, refer to **Mr Brabhaharan's** evidence and also Chapter 7 of Technical Report 3.

[5] Refer to Chapter 3 of Technical Report 2.

[6] Mechanically stabilised embankments.

ROAD SAFETY AUDITS

The Road Safety Audit process

31 The 'Road Safety Audit' (*RSA*) is an internationally used term to describe an independent review of a project to identify road safety concerns. The objectives of RSAs are to identify potential road safety concerns for all road users and others affected by a project and to ensure that measures to eliminate or reduce the concerns are considered fully.

32 RSAs are typically undertaken at four key stages of a project's development:

32.1 Feasibility / Concept Stage;

32.2 Preliminary Design / Scheme Assessment Stage;

32.3 Detailed Design Stage; and

32.4 Pre-Opening / Post Construction Stage.

33 In order to gauge the relevant importance of identified road safety concerns, a simple ranking system was used and is summarised below:

33.1 Serious Concern: a major safety concern that should be addressed and requires changes to avoid serious safety problems.

33.2 Significant Concern: a significant safety concern that requires consideration of changes to improve safety.

33.3 Minor Concern: a safety concern of lesser significance, but which should be addressed as it may improve overall safety.

33.4 Comment: a concern or an action that may be outside the scope of the RSA, but which may improve overall design or be of wider significance.

Road safety audits undertaken

34 A series of independent feasibility and scheme Road Safety Audits were carried out on the proposed Transmission Gully Project concepts, options and scheme designs. These audits were undertaken by a team consisting of four experienced consultants from MWH (Dr F.Tate, J. England & K. Weale) and TPC, Auckland (J. Vroegop).

35 Firstly, an audit was carried out on the 37 different viable options for the various sections of the route identified during the scheme

assessment. Issues raised by the auditors formed part of the option assessment and evaluation decision making process.

36 A second scheme stage audit was then carried out following the evaluation process on the preferred / recommended alignment. This audit raised some serious and significant concerns, many of which were addressed and incorporated into the scheme design. Where the safety audit recommendations were not adopted because they generated a wider footprint which increased the earthworks quantities and land take required, dispensation was sought from NZTA's Scope and Standards Review Committee.

37 The Committee considered various dispensations from design standards for the Project at a meeting held on 15 May 2008. The Committee approved all requested dispensations but with conditions or improvements to be considered as part of the future design and project development process.

38 Key design departures that NZTA's SSRC approved were:

38.1 A relaxation of the current sight distance standards, such that the K value proposed for the crest curve at Wainui Saddle is now appropriate for a design speed of 110km/h. This now maintains good practice horizontal and vertical relationship between curves and negates the need for further lowering of the alignment at the saddle;

38.2 A relaxation of safe stopping sight distances at locations where these are limited by horizontal curvature, median barriers, and/or guardrails. In many cases this allowed the design team to maintain the minimum road section width and minimised the required earthworks cut and land take requirements; and

38.3 A reduced shoulder width where crawler lanes are proposed on the steepest sections of the route. The SSRC accepted a minimum of a 1m shoulder where there are significant space constraints. This has reduced the overall earthworks footprint at Te Puka and on the approaches to Kenepuru Interchange.

Phase 2 addendum audit

39 Following the design changes recommended from the scheme stage safety audit and changes that were made as a result of the on-going technical assessments, a further audit was carried out on the Main Alignment but specifically focused on the interchanges and link road connections.

40 The most serious concerns raised were associated with the steepness of the approach to the intersection with Kenepuru Drive. The horizontal and vertical alignment was completely re-designed to

provide a much flatter approach to the intersection with Kenepuru Drive; delivering a substantial improvement over the original proposal. The new alternative alignment will also see a realignment of the existing SH 1 which will improve its horizontal geometry.

LIKELY CONSTRUCTION PROGRAMME AND METHODS

41 A possible construction programme (attached to my evidence as **Appendix A**) has been developed for the Project. Contractor inputs were also necessary in the development of the construction methodology[7] at Cannons Creek. I provided earthworks inputs and information for use by MacDonald International[8] and I draw on the expertise of MacDonald International and my knowledge of the process in the following summary of the key construction considerations.

42 The construction programme was developed to enable an assessment of the likely timing of earthworks and bridge construction, aggregate and construction water demands and hence the effects on traffic, water supply requirements and sediment discharge. The final programme will be developed by the Project contractor and will therefore evolve further at the stage of detailed design and construction.

Timing and staging

43 Prior to the commencement of construction of the Project, it is proposed that some early enabling works will be undertaken, namely the re-alignment of sections of the existing electricity transmission line, placement of temporary culverts for construction access tracks, and the establishment of site compounds. It will also be necessary to remove some of the forestry which currently exists on the hills to the east of the Porirua town centre.

44 In order to construct bridge piers and abutments, well formed access tracks will be required, often in steep terrain, for up to 85-tonne cranes, concrete trucks and material supply trucks. Due to the size of the bridges, the access tracks will need to be up to 8m to 10m wide. In many locations, initial access will not be possible from both sides of the stream, resulting in the need for temporary bridging or culverting during construction.

45 The relocation and strengthening of the existing electricity transmission lines is described in the AEE supporting Transpower's application. It will, I understand, start early in the construction programme and take up to 24 months to be completed. It is expected that there will be some overlap with the main contractor

---

7 Refer to Section 8, of the AEE for further details.

8 MacDonald International, engaged by NZTA to give specialist advice on cost and construction programme.

co-ordinating some activities, such as the construction of access tracks and earthworks, and to ensure that they are placed in locations that suit both parties. Construction on the road project in this area will depend on the overall road methodology and programme developed, and will include consideration as to how best construction activity can be coordinated.

46 It is anticipated that construction of the Project will be staged with construction likely to commence on a number of work fronts linked by the need to manage overall earthworks cut and fill, and in response to any consent conditions. These work fronts essentially could be:

46.1 Front 1: State Highway 58 to Cannons Creek, including James Cook Interchange, Porirua Link Roads and construction of bridges 17, 18 and 19;

46.2 Front 2: MacKays Crossing to State Highway 58. Mechanical stabilised embankments (*MSE*) through Te Puka and Horokiri requiring stream diversions; and

46.3 Front 3: Cannons Creek to Linden. Kenepuru Link Road, existing SH1 works, fill sites and the Porirua Gun Club contaminants removal.

47 A construction programme is likely to see commencement of Fronts 1 and 2 in early 2016 and Front 3 in mid 2017, with all fronts completed by the end of 2021 (a total period of approximately six years).

48 A key driver for the programme will be the consideration of the movement of earthworks material around the Project (i.e. approximately 6.3 Million cubic metres of cut and 5.8 Million cubic metres of fill being required). A key part of this consideration will be the consent conditions and how potential sedimentation effects on the harbour can be managed. The Project will generate approximately 0.5 Million[9] cubic metres of surplus material, that will be disposed of as non-structural fill by flattening of fill batters, or alternatively at identified fill sites:

48.1 The earthworks productivity used in the programme can vary from 1,250m³ per crew per day to 400m³ per crew per day, depending on the terrain, weather, environmental issues, traffic conflicts and other identified site specific constraints;

48.2 Up to 12 earthworks crews could be utilised throughout the Project with generally three (and sometimes up to four) crews operating together as a team. The exact composition of the

[9] Dependent on cut material being used within the Project.

crews will vary depending on the terrain and length of the hauls, with dozers and/or scrapers being used in areas where the haul distances are short and the terrain allows, and excavators and generally off-road trucks utilised in other areas. Coinciding with the earthworks operation up to 6 bridge crews will be utilised throughout the Project;

48.3 A review of the weather history for the Wellington area has been carried out and an estimate of three months (mainly over winter) for non-working due to wet weather has been allowed in the construction programme, although there have been in recent years some examples of very little reduction in construction productivity over winter months.

Overall construction processes and construction management

49 Prior to any works commencing a site wide Construction Environmental Management Plan (*CEMP*)[10] will be prepared to outline all environmental management processes. For each specific area of the works a SSEMP will be developed to detail the specific environmental management measures that will be implemented as part of the works.

Earthworks

50 Earthworks will be managed on a logical section-by-section basis with appropriate erosion and sediment controls established prior to site clearance in any section. Proposed conditions[11] set the limit of non-stabilised earthworks open at any one time with progressive stabilising proposed to manage potential sediment run-off. Calculations of earthwork areas and volumes by catchments are attached to my evidence as **Appendix B**.

51 Topsoil will be removed and stockpiled prior to road and earthworks excavation. This material will be re-used on fill slopes and to regenerate fill areas. Stockpile areas will be selected to avoid areas with significant stormwater runoff, and erosion and sediment control measures will be put in place.

52 The Contractor will be required to submit a detailed construction methodology and programme for approval which will clearly demonstrate how earthworks will be staged to comply with conditions E.1 and E.2. SSEMPs will then be prepared for each stage for certification by Regional Council prior to construction commencing. Regular inspection, monitoring and reporting will enable compliance checks to be carried out.

53 Experience gained from recent earthworks projects such as Muldoons Corner and West Wind confirms that the overall approach

[10] **Ms Rickard** will describe the function of the CEMP in more detail in her evidence.

[11] Proposed condition E.1, E.2 and E.31 to E.33.

of staging the earthworks is the right approach to reduce the potential risk of sediment discharges. This includes ensuring that surface collector drains, sediment retention ponds, and silt fences are installed ahead-of-time, and mulching and hydro-seeding carried out as soon as practicable after excavation and filling has been completed.

54 Along most of the route, material excavated to construct the road will be able to be used as embankment fill material. In wetter areas, or following heavy rain, some drying of material by harrowing or disking may be required prior to placement. Where excavated material is too large to be used in reinforced embankments, some crushing or screening may be needed to remove the larger rocks.

Fill sites

55 The fill site selection strategy involved selecting sites as close as practicable to the areas of surplus cut. This enables reduced haul distances, reduces road traffic and dust generation. Selection of sites has also focused on appropriately constrained and sized sites to control the area of disturbance and control later re-generation.

56 Areas such as gullies or valleys with perennial watercourses and areas of native vegetation with high ecological values were avoided. A preference for sites at the upper reaches of gentle sided small or shallow valleys, with smaller catchment areas to minimise the risk of erosion and damming of natural drainage paths, were chosen where possible.

57 In total, six potential fill sites have been identified; these sites are all located towards the southern end of the Project.

57.1 Two sites near Cannons Creek are on rolling ridgelines above the saddle between Duck Creek and Cannons Creek. Neither of these sites will directly affect perennial, intermittent or ephemeral streams.

57.2 Three sites are located near the Kenepuru Interchange south of Bridge 22. These sites lie on land that is currently in pine forest. Small ephemeral streams are present in all three sites. However, no perennial or intermittent streams are present. These streams have been assessed and found to have no aquatic value and can be filled as long as the appropriate drainage and sediment controls are undertaken.

58 The sixth site is on a hill slope above the existing SH1 at Linden, where the natural drainage is already modified and the land cover currently comprises pine plantation.

Table 1: Fill site locations and capacities

Fill Site	Site Capacity	Maximum Fill Height
#1 (23,000m)	100,000m³	6m
#2 (24,250m)	26,000m³	3m
#3 (Kenepuru)	151,500m³	20m
#4 (Kenepuru)	394,000m³	23m
#5 (Kenepuru)	31,000m³	5m
#6 (Kenepuru)	38,000m³	3m

59 There is more than enough capacity within these sites to accommodate the currently identified volume of surplus fill. Approximately 510,000m³ of the 740,000m³ identified capacity of the sites is required.

60 The disposal area construction sequence involves the removal of topsoil to stockpile, bench and toe construction as required, subsoil drainage, placement and compaction of fill, surface shaping, re-spreading of topsoil and re-grassing.

61 Fill placed within the disposal area will be compacted to provide sufficient strength for stability and minimise settlement. The surface of the disposal sites will be formed with adequate fall to provide surface drainage and to minimise erosion. Surface collector drains will collect runoff from the disposal areas and convey it to either a sediment retention pond or a decanting earth bund. Depending upon the grade of the collector drain and the material in which it has been formed, the drain may require armouring to prevent erosion.

62 It is proposed that cut-off drains will be installed uphill from the disposal sites to intercept surface water and direct it away from the disposal sites. This will minimise the potential for erosion and sediment discharges. Fill sites will be shaped and track rolled to minimise the potential for sediment generation. Further details are outlined in the Kenepuru Interchange SSEMP and drawings which show indicative designs for fill sites[12]. I also note that conditions NZTA.46 - 47 provide for landscape management plans to have input into earthworks contouring.

[12] See AEE, Volume 5 Draft Management Plans: Kenepuru Interchange SSEMP and Technical Report 15.

Site Compound

63 The main site compound will be located next to the proposed SH58 Interchange. The overall site area is approximately 28,000m² (about 350m long by 80m wide). The compound will contain features such as the main workers' office and workshop, car parking, fuel storage, plant and materials storage areas with maintenance facilities, wheel washing and cleaning facilities as well as the concrete batching plant[13].

64 Three satellite site compound locations have been identified at Paekakariki, Battle Hill and Kenepuru Interchange. These will be smaller than the main compound, but will contain similar features. These sites will not contain concrete batching plants but, where appropriate, may contain a mobile rock crushing plant.

Concrete Batching Plant

65 Located within the main site compound the concrete batching plant is approximately 30m x 20m; a typical batching plant layout is shown in **Appendix C** to my evidence. The concrete batching plant layout comprises of hoppers, aggregate storage bins, a cement silo, conveyors and a concrete mixing drum.

66 The expected concrete output from the batching plant is approximately 75,000m³, mainly in the production of concrete beams, wall facing panels and culvert headwalls.

67 The site will be fully enclosed within an earth bund and will have a single designated "dirty" area, comprising of the concrete batching plant and the concrete truck access, delivery and loading area. All runoff from the "dirty" areas will drain to holding tanks where it will be treated and held for re-use as the main water supply for the concrete batching plant and for dust control for earthworks. With the use of holding tanks, the concrete batching plant is not expected to result in any discharge of water to either land or water.

68 The remainder of the concrete batching plant activities comprise cast concrete and aggregate storage areas which will be located within the yard area. The water from the yard areas drains to a combination of stormwater treatment devices and/or swales which will be designed to provide treatment before discharging to the receiving environment.

69 The conditions also provide that a Concrete Batching Plant Management Plan (*CBMP*) is to be prepared prior to the commencement of operation of the batching plant. The CBMP will address specific and additional precautionary controls as well as detail regular maintenance and inspection during the operation of the plant (conditions CBP.23 to CBP.25).

---

[13] See AEE Section 8.3.

Mobile Crushing Plant

70 Mobile crushing plant will be required for rock crushing for the treatment of fill material behind the various MSE and Reinforced Soil Embankment walls. I anticipate that these crushing machines will be utilised at various locations throughout the Project over the duration of the earthworks (approximately 5 years).

71 The unit will incorporate mist spray equipment to control dust. A typical crushing plant will include the plant itself, raw and processed material stockpiles and dust control equipment. The crushing plant will require a number of small temporary Portacom style support buildings for staff, equipment maintenance and storage. A typical crushing plant is attached to my evidence as **Appendix D**.

Aggregate Requirements

72 Aggregate will be required for a number of elements for the Project. The proposed road will require pavement (sub basecourse and basecourse) and the fabrication of concrete bridge beams, retaining wall facing panels and culvert headwalls.

73 The NZTA's preferred approach for obtaining pavement and concrete aggregates for construction is to source suitable material from local quarries. Belmont quarry located on SH2 is approximately 10km away from the batching plant and has been identified as one suitable source to provide the aggregates required for the Project. **Table 2** below summarises the aggregate requirements.

Table 2: Aggregate requirements

Aggregate type	Quantity (tonnes)
Concrete Sand	50,000
Aggregates 14-5mm	50,000
Aggregates 20-10mm	40,000
Basecourse AP40	270,000
Sub basecourse GAP65	390,000

74 Preliminary geotechnical appraisals indicate that while some material could be sourced from within the Project area, there are disadvantages associated with this:

74.1 Between chainage 6,000 m and 7,500 m at the northern end of the Project there is an overall deficit of material; hence it is not beneficial to obtain the material from here; and

74.2 Material south of Cannons Creek at the southern end of the Project is proposed to be excavated relatively late in the

programme when the majority of pavements should already be completed; and so is not considered likely to be utilised significantly.

Control of sediment

75 An overriding principle for the Project has been to minimise the land disturbance required in order to restrict sediment entering streams.

76 This has significant implications for the construction timing and erosion and sediment control requirements. The key erosion and sediment control principle has been to minimise the area and length of time that particular areas of ground are left bare. In general, the extent of open areas in any one catchment, and watershed, will be restricted and will be stabilised as soon as practicable[14].

77 The installation of erosion and sediment control measures will be staged in co-ordination with earthworks, with site preparation measures being installed progressively, in advance of land disturbance activities. This is critical to reducing sediment generation.

78 In total, up to approximately 300 sediment control ponds are proposed throughout the construction phase of the Project. Generally ponds will be formed from bunded earth, but where topographical constraints prevent this, other methods, such as the use of shipping containers as basins, may be employed.

79 An essential aspect of the erosion and sediment control measures will be the stabilisation of disturbed land as soon as practicable. In some areas techniques such as top soiling and seeding will be adequate, but in many areas (particularly on steep faces) geotextile, mulching and hydroseeding will be required.

80 It is standard practice for the contractor to monitor the weather forecast and have a plan should wet weather occur at the start and end of each day or heavy rain warnings be predicted. Such a plan would include pre and post event inspections of sediment ponds, silt fences and cut-off, impoundment[15] or stabilising of open earthworks.

Water demands

81 Water will be required for concrete production and for dust and soil moisture suppression during earthworks construction. Peak water demand has been estimated at around 1.2 million litres per day, although the volume of water required will be reduced during periods of wet weather. The assessment of construction traffic and

[14] **Mr Gough** will describe erosion and sediment measures in detail in his evidence.

[15] A temporary berm or ridge of compacted earth constructed to create areas where ponding of runoff can occur, and suspended material can settle before runoff is discharged.

construction noise has been conservatively undertaken on the basis of all water being transported by water tankers to the site.

82 An option the constructor may adopt is to obtain the necessary consents to obtain water from within the construction site by constructing a number of small temporary dams along the alignment. Additional options include drawing water from existing bulk water supplies and transporting water to the site.

Deforestation

83 Forestry clearance at the Kenepuru Interchange will be kept to a minimum beyond the earthworks footprint or to where access tracks, stream diversions or temporary sediment ponds are required. Approximately one fifth (10ha) of the total pine forest area will be removed for construction activities with vegetation planting proposed on cut and fill batters and fill areas as detailed in SSEMP6 Section 8.6.2.

84 Proposed conditions[16] set criteria for the management of the forestry clearance and re-vegetation. As discussed in the CTMP[17], construction traffic including trucks will be required to gain access to the area via local roads. It is proposed that logs would be felled and then stockpiled on site until such time as access back onto SH1 has been constructed (i.e. as part of the construction of the Project main alignment). At this time, it is proposed that logs would be transported off-site directly onto the State Highway network from accesses constructed specifically for the Project.

ALTERNATIVES CONSIDERED

85 Figure 9.1 of the AEE report shows the progression of the option analysis and evaluation during the Project's scheme design phase. The following paragraphs summarise that process.

Scheme Assessment phase (Phase 1)

86 Phase 1 of the Project's development, undertaken throughout 2007 and 2008, involved a new evaluation of the inland corridor. A key objective was to identify the most advantageous Transmission Gully route alignment when considered against the overall Project objectives and social, environmental and physical constraints.

87 A review of previous work (pre 2007) suggested that while there was some scope for alignment optimisation, there could be benefits in identifying options either wholly or partly outside the existing designation. Particular benefits could include cost-optimisation, as well as the mitigation of environmental and other adverse impacts of the in-designation route. It was therefore decided that the

[16] Conditions E.34 to E.38

[17] Refer to CTMP table 4-1

existing designation should not be a constraint, and that two alignments should be identified:

87.1 The best practicable scheme design within the existing Designation (In-Designation Alignment); and

87.2 An Unconstrained Alignment, unconstrained by the designation.

88 To facilitate this, the route was divided into discrete lengths (nine sections), and route options within each section were identified, developed and evaluated for cost, benefits, impact and feasibility. The best options within each section were developed so that, when combined, they would form the optimal alignment for the route as a whole.

89 In total, the option identification process identified 37 different viable options in the nine project sections. Options ranged from box cut, cut and cover or tunnel options at Wainui Saddle, splitting the alignment east and west at Horokiri, to considering different interchange forms and link road connections. These options were then assessed by the wider Project team against the following five key criteria:

89.1 **Cost** such as construction and operating/maintenance costs and current market value property costs;

89.2 **Timeliness** which included the RMA process timeframes, the construction programme based on the extent of works, access, complexity, and a subjective assessment of the timing and potential for adjacent land use changes and economic opportunities;

89.3 **Social and environmental impacts** which included an assessment of heritage and archaeological sites, an assessment of the social and community cohesion based on impact of traffic changes on urban areas, potential effects on existing residents by the proposed alignment and health and wellbeing (a subjective assessment of noise, fuel consumption, greenhouse gas emissions and additional pollutants on residential properties);

89.4 **Physical environmental impacts** related to land stability, sites of geological interest, the exposure to sedimentation risk, changes in catchment run-off, severity of effects, and space availability to control run-off, and natural habitats and fauna (loss of fresh water and terrestrial habitat and the effect on ecological integrity); and

89.5 **Network flexibility** which included traffic benefits, predicted accident savings, the integration with other transport modes, improvements to access and mobility, future-proofing and land transport integration which is to support regional growth.

90 Two alignments for the Transmission Gully route were identified following an exhaustive technical investigation and evaluation process, including traffic modelling, site visits, detailed option assessment and workshops involving a large number and variety of technical experts, and a thorough assessment of route alternatives and cost estimates.

91 One alignment was the best that can be achieved within the existing designation, the other is the best alignment unconstrained by the designation. Of the two, the alignment unconstrained by the designation was preferred because it provided advantages in terms of route security, had less impact on environmentally important streams and Pauatahanui Inlet, was less intrusive on the landscape and was significantly cheaper than the best In-Designation Alignment.

92 In December 2008 the NZTA Board confirmed the preferred alignment (i.e. the Unconstrained Alignment) to be a more robust, cost effective and environmentally responsive proposal compared with the existing designations. On that basis, the NZTA has continued more detailed investigations (Phase 2 investigations) into the preferred alignment and carried out further public consultation and more direct consultation with property owners and other interested parties.

Addressing issues raised during consultation

93 Immediately following the Phase 1 investigations a public consultation process was undertaken to gauge public views on the preferred alignment. This consultation confirmed broad support for the Preferred Alignment and also identified a number of specific items that warranted further investigation during Phase 2, namely:

93.1 Parks and Reserves / farming operations. At Battle Hill Farm Forest Park, the potential impact of the Preferred Alignment on the viability of the existing farming operation needed to be considered. The Project team and GWRC met to discuss the Battle Hill Management Plan and agreed an approach to ensure that the Project can be effectively integrated into the operational management of the park. The agreed approach was to consider land exchange within the park that is required for the Project with areas of Crown owned land adjacent to Battle Hill (including the former Toomey property which was purchased specifically for that purpose) to avoid adversely affecting the Park's farming operation;

93.2 Access to a number of existing properties on a private road / right of way off SH58 adjacent to the SH58 interchange was proposed to be directly onto the interchange roundabout, which was raised as a significant safety concern by the safety auditors. In discussion with the affected land owners, the need was identified for further design work to ensure that access to the properties could be provided safely. The SH58 Interchange has been subtly re-designed to enable adjacent properties to have access (via their existing private road and the existing SH58 carriageway) onto the realigned SH58 carriageway east of the interchange roundabout, rather than directly onto it;

93.3 Porirua Link Roads:

a) Discussions with land owners, tenants and with PCC identified opportunities to enhance the proposed design to provide better integration with the existing land boundaries as well as a more favourable solution for proposed developments in the area. A number of land owners, particularly at the western end of the Waitangirua Link Road, offered alternate solutions which needed further consideration. As part of the urban design workshops and consultation on the Waitangirua Link Road, the proposed intersection with Warspite Avenue was changed from a roundabout to a signalised intersection;

b) Two alternative alignment options were investigated for the Whitby Link Road. One option was through the Silverwood property and the other was through Whitby Coastal Estates land. These alternatives were considered with regard to the alignment's proximity to and potential impacts on Duck Creek. The Whitby Coastal Estates option was selected as it avoids earthworks encroachment into the stream. It also reduces the cut volumes, and height of cuts in poorer quality material.

Further Phase 2 design refinements

94 Throughout Phase 2, the Preferred Alignment was refined on the basis of further, more detailed environmental and engineering investigations. Many relatively minor alignment changes were made to the design but the most important changes are described below, namely:

94.1 Further refinements were investigated during Phase 2 to integrate the road into the landscape though this area. This involved moving the alignment further west to better follow the natural topography which also meant that Gas line ridge screened the road from the western side of Battle Hill Farm Forest Park. It also moved the alignment further from Horokiri Stream which had ecological benefits;

94.2 During the ecological assessment, an area to the east at Wainui Saddle was identified as of high ecological value. As a result an alternative option was assessed that moved the alignment to the west by 10 m to reduce impacts on the identified area of ecological value;

94.3 The Te Puka valley section of the Main Alignment is the most vulnerable to natural hazards, in particular earthquakes, and has the potential to reduce the security of the route. The geotechnical assessment identified risks associated with retaining walls on steep slopes in Te Puka and the vulnerability of bridges directly adjacent to steep slopes due to earthquake induced landslides. The Project's lead geotechnical engineer[18] was part of the New Zealand Society for Earthquake Engineering Learning from Earthquakes team which visited the earthquake damaged areas of China in late 2007. Extensive landslides, in steep terrain somewhat similar to the Te Puka Valley, were observed to have led to closures of many highways in Sichuan. As a result **Mr Brabhaharan** recommended reconsideration of the options for the Main Alignment through the Te Puka valley. Options assessed to address these issues included:

(a) 25 m high vertical retaining walls;

(b) 45 degree reinforced soil embankments (*RSE*);

(c) 51 degree earth embankments; and

(d) 63 degree stepped walls.

94.4 The options were discussed with the roading, structures, hydrology and ecology teams. The project team agreed that the option of using RSE was the preferred option, because it gives a higher level of route security, and because the stream impacts can be mitigated by additional stream works, without overall additional costs to the Project (additional stream works costs would be more than offset by savings in costs due to elimination of the viaducts and vertical walls);

94.5 The alignment was shifted east by approximately 20 m at the base of the Te Puka Valley in order to avoid impacting on the historic brick blast retention structure. This structure was built by the NZ Public Works Department for the US Army during WWII for storage of fuel and has been recognised by the Historic Places Trust as a feature of significance. NZTA hopes that public access can be provided to this historic structure as part of the Project.

[18] **Mr Pathmanathan Brabhaharan**.

95 The revisions and refinements are described in chapter 9 of the AEE and have achieved a cut volume significantly less than that reported at the end of the Scheme Assessment phase. The revised total cut volume is 6.3 Million cubic metres compared with the previous 7.9 Million cubic metres. The volume of fill required has remained the same at 5.8 Million cubic metres. A key benefit has been a reduction in the volume of surplus cut for disposal around the site by about 1.6 Million cubic metres to 0.5 Million cubic metres.

96 Throughout the design and assessment phase the Project team has engaged with utility companies and operators including GWRC, Transpower and Kiwi Rail. Together we have identified effects on assets, minimised effects through design refinements where possible, and developed alternative solutions in agreement with the relevant utility provider.

RESPONSE TO SUBMISSIONS

97 I have read the submissions lodged on the Project that raise road design or construction related issues and address these individually below.

Kenepuru Interchange configuration

98 Submission **0002** has requested that the proposed Kenepuru Interchange be changed to include links directly from the interchange onto the existing SH1 heading north towards Mungavin.

99 Options were investigated during the scheme assessment phase as to whether access was provided to Porirua City via a Kenepuru link, or via SH1 and Mungavin Interchange. Traffic modelling showed that although the concept via SH1 performed well, it attracted less traffic than the concepts that provide a link to Kenepuru Drive. It would, as well, place greater demand on the Mungavin Interchange, which already has capacity constraints. This was consequently not favoured as highly as other options that provided a direct Kenepuru link.

Shift southern terminal to Takapu Road

100 Submission **0007** suggests that the southern terminal of the Project should be at Takapu Road as had been proposed prior to 1997, rather than Linden as now intended. As part of the existing designation approval several options were considered with a connection at Linden selected as the preferred solution because it would have fewer property impacts compared to the Takapu Valley route, it would likely have less environmental and social effects and it would allow for the Kenepuru Link Road, which would provide increased accessibility to western Porirua and Tawa.

Belmont Regional Park access

Submission **0012** from the Ranui Residents Association asks that provision could be made for the Ribbonwood Terrace site entrance to become an entrance into the Belmont Regional Park for walking and mountain biking when the Project is complete. I believe that the Residents Association may mistakenly think that the Landcorp farm area just on the other side of Rainui Forest is part of Belmont Regional Park.

101 The NZTA would look to reduce the designation after construction is complete back to the minimum needed for the earthworks with residual land sold. Access will not be provided along the alignment as part of the Project as there is already access into Belmont Regional Park from the Cannons Creek lakes.

Property access

102 Submission **0014** requests that provision can be made for construction of suitable width and gradient two-way vehicle access between the submitter's property and the proposed Waitangirua Link road and adequate mitigation measures are imposed as conditions to address potential adverse environmental effects.

103 Access onto the proposed link road can be provided with the most suitable access point towards the eastern edge of the property. This is where the earthworks (cuts) are relatively small and where the appropriate design standards[19] can be better achieved. I am satisfied that vehicular access can be safely provided.

104 In relation to construction effects, conditions are proposed that set criteria for the management of the construction effects of noise, discharges to water and emissions to air. The detail of how these effects will be managed is specified in the CEMP and its sub-plans. In particular, the Construction Noise and Vibration Management Plan (*CNVMP*), Construction Air Quality Management Plan (*CAQMP*), Erosion and Sediment Control Plan (*ESCP*) and Ecological Management and Monitoring Plan. I consider that the conditions and these plans will adequately address the submitters' concerns.

105 Submitter **0056** seeks a track constructed to access a large paddock within his property which would be severed by the current proposal. NZTA would work with the property owner in developing solutions for temporary access both during construction and on final completion of the works when temporary sediment ponds are removed and final boundary fences confirmed.

106 Submission **0065** by Transpower NZ Limited raises the issue of potential effects on Pauatahanui and Takapu Road Substations and vehicular access both during construction and operation of the

[19] Porirua City Council Code of Land Development and Subdivision Engineering.

Project. The construction works will be subject to the CEMP, its attached sub management plans and the resource consent conditions. Maintaining access, or restricted access at times during heavy machinery being transported to site, will be managed as part of the Construction Traffic Management Plan (*CTMP*).

Moving the designation east

107 Submissions **0019, 0020** and **0057** have requested that the proposed designation is moved east further away from their properties. They request "tweaking" to the proposed route whilst acknowledging the constraints of the bridge crossing over the Horokiri Stream.

108 Considerable work during the assessment phase has been carried out in an attempt to avoid stream diversions in this area. The proposed location of the alignment avoids the main stem of Horokiri Stream. The location and orientation of Bridge 8 and associated earthworks eliminate the need for any stream diversions in this area, however the bridge location means the road alignment has to be where it is proposed (which is west of the existing designation and closer to a number of properties).

109 I acknowledge, as stated by the submitters, that minor "tweaking" of the bridge is an option and following a recent on-site meeting I have considered other possible alignment options. By rotating the bridge by about eight degrees some horizontal shift to the road can be made. I estimate this to be more in the region of about 20 m to 30 m from its current alignment as it passes through the property owned by submitters 19 and 57. This would place the road and earthworks outside of the northern most property but would still require land to accommodate temporary sediment ponds.

110 A more considerable alignment shift of around 100 m as presented in submission **0057** will, in my opinion, result in a significant change to how the road will traverse through Battle Hill (from Bridge 7) through to the Pauatahanui Golf Course. Shifting the alignment to the east would shift it to higher terrain and raise the road roughly 30m higher. This would increase the road gradient to above the maximum recommended for the Project; alternatively, maintaining current gradients would increase the cut heights significantly compared to the proposed design.

111 Submission **0019** also comments that the existing designation was approximately 500 m away and that the proposed designation is now only 100 m from his house. I have accurately measured the distance from the house and calculate that the proposed designation is 180 m away. I have also measured to the existing designation (confirmed in 2002) and found this to be 270 m away. Therefore the proposed designation, road and associated earthworks have moved about 90 m closer to his house.

Pedestrian crossing facilities

112 Submission **0021** enquires if there is provision for pedestrians to cross the new road and, if not, could they be provided. There are several bridges along the proposed route which cater for different forms of access under the proposed route (farm access, pedestrian or cycling). In total there are eleven bridges which will allow for cycle and pedestrian access underneath them.

Wainui Saddle rest area

113 Submissions **0022** and **0059** ask whether it would be possible to include a Rest Area at the top of the Wainui Saddle to give people a viewing opportunity and the use of Portaloos. They also ask that signage advising of road gradients and the location of truck run-off areas are provided.

114 Brake check and truck rest areas are provided both north and southbound at Wainui Saddle. They have been designed for heavy vehicle use but would be available for other vehicles to access. NZTA does not intend to provide a formal viewing area with the appropriate roadside signage. However, an un-manned kiosk with information boards could be provided.

115 Austroads guides[20] recommend appropriate containment facilities are provided on highways with steep grades. The NZTA has incorporated an arrester bed and truck run-off areas into the design and will include the appropriate advisory signage, as mentioned by the submitter, into the final design.

Kapiti Coast District Council Submission

116 I address key issues raised by Submission **0023** from Kapiti Coast District Council and submission **0028**[21] that relate to a provision for a local route from SH1 at Paekakariki to MacKays Crossing and the effect on Council's water supply to Paekakariki.

Local route from SH1 at Paekakariki to MacKays Crossing

117 During the scheme assessment phase route options and connections were developed and assessed through a three day workshop attended by key stakeholders. Of the five options presented at Paekakariki three proposed the main alignment to be offset from the existing state highway which could then be utilised as a local link. These options were not considered as favourably as the preferred option better utilised the existing highway, could be integrated into the landscape, and minimised encroachment into adjacent properties.

---

[20] Austroads Guide to Road Design, Part 6: Roadside Design, Safety and Barriers, Section 7.

[21] Kapiti Coast Grey Power Association.

118 The Transmission Gully route within this section is wider than the existing highway. It provides five lanes of sealed road, which for most part, is elevated above the existing ground. This would provide greater resilience if there is a significant event on the highway compared with alternatives at ground level. I consider that the proposed option provides for better route resilience and the provision of a local link would not offer more security.

119 The local road connections suggested would require additional land from the Sang Sue property (a Market Garden). This would especially be the case at the southern end where an intersection would be required to manage the conflicting vehicle movements generated by the on / off ramps, access under Bridge No. 2, and to the Market Gardens. Both of the options suggested in the submission would also require land to be taken from the MacKays Crossing wetland (site K106).

120 Cycle and Pedestrian facilities will be provided along the proposed northbound onramp from Paekakariki which will then link to the old state highway and onto MacKays Crossing. The 3m wide facility is separated from the onramp by a low mound and is discussed in the Urban Design and Landscape Framework: Section 1 Pedestrian and Cycle paths.

121 If Transmission Gully Project is tolled the proposed southbound exit ramp from the expressway to Paekakariki (immediately north of Bridge No. 1) would be the logical point to leave the expressway and continue along the coastal road. There would be no tolling facility travelling north from Paekakariki onto the short section of expressway to MacKays Crossing.

Effect on Council's water supply at Paekakariki

122 The position of the Council's new water supply bore has yet to be finalised and as such the NZTA has included sufficient land within the designation to allow for a range of possible locations whilst maintaining access. Boundary adjustments and easements where required can be made on final confirmation of the water bore location.

123 Access to the proposed water supply bore and facilities would be from under Bridge No.2 and along a new constructed track which also provides access to several nearby properties.

Construction effects

124 Submission **0027** from the New Zealand Railways Corporation (*KiwiRail*) seeks that the proposed Kenepuru Link Road is designed and implemented so as to maintain its railway operations. When constructing the bridge, construction time over the live rail will be of a relatively short duration, the new bridge is currently proposed as a Super T design. The beams will be fabricated off-site, and lowered

into place by crane over successive days. This will require night time works with co-ordination of rail operations.

125 Discussions with KiwiRail regarding the location of the piers adjacent to the substation has resulted in positions which will not impede in the operation and maintenance of the substation, and specifically access to existing transformers.

126 Submission **0037** from the Pauatahanui Residents Association raises concerns over some of the potential adverse effects from the main site compound and concrete batching works sited at the intersection with SH58.

127 As discussed previously, the main site compound and batching plant layout has been developed for the Project. Assessments have been carried out of potential dust, noise, traffic and water discharges effects from the compound.

128 A Specific Concrete Batching Plant Management Plan will be prepared prior to the commencement of operation of the batching plant. This plan will address specific and additional precautionary controls as well as detail regular maintenance and inspection during the operation of the plant. Condition CBP.3 sets out what the Plan must include. Further conditions on the batching plant are proposed as conditions CBP.1 to CBP.38. I consider that these conditions and the management plans will adequately address the submitters concerns.

129 Submitter **0024** suggests that the construction of the Project should be split into sections, starting at the south, with the construction of the northern section only when other sections are operational. Further, it is suggested that the road only be constructed to two lanes initially, with provision for duplication.

130 The work needs to be scheduled and undertaken on a Project-wide and continuous basis. This will retain flexibility and will enable the earthworks to be in better balance across the Project and minimise the amount of surplus material to be disposed of. Additionally, construction of bridges and culverts has been logically staged in order that access to earthworks cut material can be moved efficiently within the earthworks footprint which will minimise the use of existing tracks.

131 Constructing initially two lanes was considered during the scheme investigation phase and not recommended due to:

131.1 Much of the Project would still need to be constructed in full. Road gradients would necessitate climbing lanes for significant lengths of the Project, bridges and culvert

structures, reinforced earth embankments and construction of the interchanges would still need to be built in full.

131.2 Initially constructing earthworks for two lanes would only defer approximately 10% to 15% of earthworks material. The cost to complete the remaining earthworks would then be higher due to access, wasted work and construction difficulties.

131.3 Building four lanes now would be the least disruptive in the future, and avoid risk associated with future funding and changes in standards.

132 Submission **0043** from the Department of Conservation seeks to introduce new or amend existing conditions, I have responded to those that deal with construction related activities.

133 Paragraph 33 (l) suggests contingency plans for wet weather periods be required, including addressing shut down and limitations on construction works in winter months. Major earthworks will be required during some winter months to meet the expected construction programme. The programme allows for greywacke material (which is easier to excavate during winter months) to be excavated then; this practice was successfully carried out on the recent SH2 Muldoons Corner project. I consider that conditions restricting winter working would reduce the earthworks productivity and lengthen the overall construction programme. These matters can be addressed in the CEMP, as proposed condition G.12(3) requires the construction programme to be addressed in the CEMP. In addition, proposed condition G.16 provides for contingency measures to be undertaken in particular circumstances.

134 Paragraph 33 (m) requires a condition preventing discharges of contaminants to water and impacts on water quality occurring in sensitive areas. The CEMP and its sub management plans identify a suite of measures to avoid or minimise adverse effects in sensitive ecological areas. Fill disposal sites have been specifically located away from perennial or intermittent streams and will implement "best practice" sediment and erosion control measures during construction. The proposed batching plant, located within the main site compound, will incorporate bunds to contain any contaminant run-off, which will then be treated and reused, or where excess concrete is left this will be removed from site.

Earthbunds

135 Submissions **0041** and **0056** seek some additional earthworks build up at the back of their property to block views of the road and noise. The Urban Design and Landscape Framework recommends the use of low earth bunds and overfilling the batters of the short embankments in order to further reduce prominence of the

carriageway and traffic from adjacent properties as well as reduce the extent of short sections of roadside barriers.

136 The NZTA has applied this principle along other sections of the route, at Flighty's Road, and I would support this here as a way of reducing sections of barrier from along the highway (if a barrier was in fact required for noise or visual reasons), on the condition that the additional cut material is available and where new culverts are proposed the increased pipe length (due to the additional fill) will not affect the culverts performance.

Lowering the road

137 Submissions **0053** and **0054** seek the proposed road to be lowered directly in front of their property so that the visual effect is mitigated. The new road height in this area is controlled by the need to balance the cut and fill earthworks and by the proposed culvert levels and stream diversion gradients. As such, lowering the road may not be possible as to achieve the desired effect requested by the submitters, and the use of earth bund, overfilling the batters and screen planting may result in a better solution to reduce prominence of the carriageway and traffic.

Whitby Coastal Estates Limited

138 Submission **0060** from Whitby Coastal Estates Ltd (*WCEL*) seeks amendments to the Whitby Link Road alignment and earthworks so as not to hinder future residential development in that area.

139 Minor alterations to the road layout and earthworks in order to allow more practical access to adjacent land will be reviewed with the landowner during the development of the detail design. PCC and the Project team have been working with the landowner and will continue to do so to achieve outcomes that satisfy the need for a link road of a suitable standard while also assisting in realising the developmental objectives of landowners.

140 The submitter is also concerned that frontage access would be restricted to adjacent residential sections. That is not intended to be the case; as with other local arterial roads PCC would permit access other than where safety considerations preclude it.

141 Construction access plans have been developed to show intended construction access points that would be available to the contractor. As the area around Spyglass Lane is currently being developed, I agree this would not be practical to use for access. In the development of the final Construction Management Plans the NZTA will work with WCEL to finalise a suitable access point for the Project.

142 I agree with the submitter that better quality surplus material from the main Project could be utilised and deposited beside the Link

Road and/or in other parts of Whitby and so reduce the need for cleanfill sites beside the main Project. This however will be dependent on the detail design quantities, the contractors' construction methodology and mass haul earthworks programme. Any additional consents which may be required for this would be sought at a later date.

PROPOSED CONDITIONS

Construction Environmental Management Plan

143 Proposed construction management conditions are included in the AEE at NZTA.11 -13 and PCC.10 - 12. These conditions require that a Construction Environmental Management Plan (*CEMP*) be prepared as part of the Outline Plan for any stage of the works. The CEMP establishes the structure and systems to manage the potential adverse environmental effects that may arise from the Project.

144 A key benefit of this management plan approach is that the specific detail of mitigation measures, for example the type of sediment controls, will be developed to best suit the intended construction methodology whilst meeting the desired performance requirements.

145 Implementing the CEMP (including its sub-management plan appendices) will ensure, as far as is practicable, that any potential adverse environmental effects of the Project's construction will be appropriately avoided, remedied or mitigated. The proposed CEMP conditions also provide flexibility to review and modify practices according to changing circumstances.

Site Specific Environmental Management Plans

146 Draft site specific environmental management plans (*SSEMPs*) have been developed to show how construction could be undertaken and how environmental management techniques can be effectively used to manage effects during construction. The SSEMPs have been developed to a level of detail that demonstrates confidence in design, how works might be staged and programmed and to assist in assessing effects and developing mitigation strategies.

147 I consider the provision of these plans as required by conditions E.20 and E.21 represents a 'best practice' approach for the following reasons:

147.1 The preparation of the SSEMPs are a collaborative effort involving council representatives, contractors, landowners, NZTA and NZTA's independent ecological and environmental management advisors;

147.2 They are a suitable method for managing the effects of projects, particularly for infrastructure projects covering substantial land areas, where enough design and specification

has been undertaken to assess environmental effects (and how they should be avoided, remedied or mitigated) but where the detail design has not yet been undertaken;

147.3 The plans are designed to be pragmatic, with each Plan itself being a simple guide for the civil contractor and their staff to easily use in the field, and to be able to determine compliance with the plan.

148 In my experience, these management plans are commonly used for major road and highway earthworks projects. I confirm that in my view the proposed conditions associated with the CEMP and sub-management plans are acceptable from a civil design and construction perspective.

149 My evidence discusses conditions relating to the concrete batching plant, forestry removal, and construction staging when discussing those issues.

Mark Alan Edwards
16 November 2011

Appendices:

Appendix A – Indicative construction programme

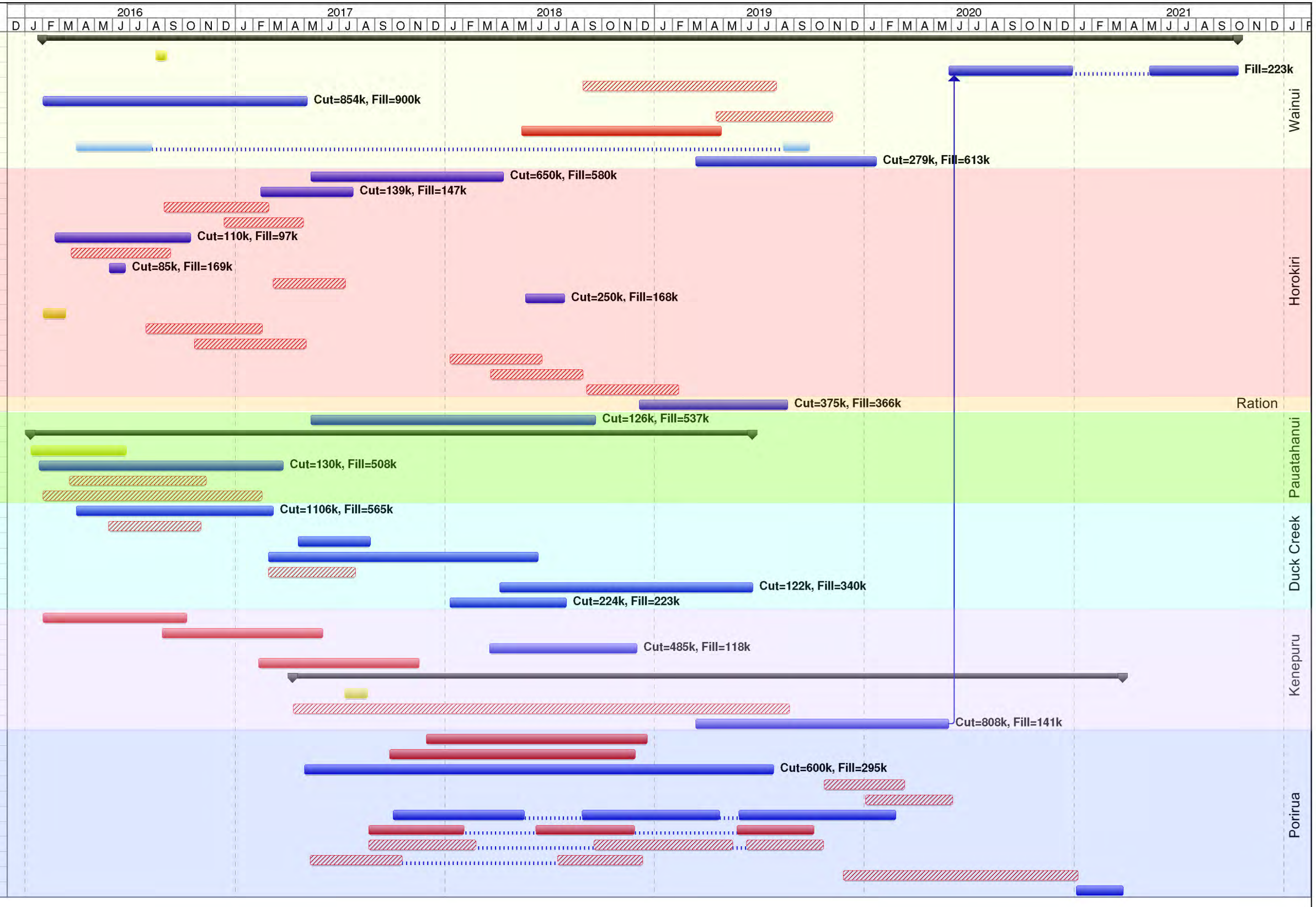
Appendix B – Earthworks areas and volume by catchment table

Appendix C – Typical concrete batching plant layout

Appendix D – Typical mobile rock crushing plant

APPENDIX A: INDICATIVE CONSTRUCTION PROGRAMME

ID	Task Name
1	**FRONT 2 (Sta 0m to 16610m)**
2	Site Compound
3	Roadworks - 0 to 1800
4	BRIDGE 1 - Underpass (110m x 12m)
5	Roadworks - 1800 to 4400
6	BRIDGE 2 - Underpass (43m x 7m)
7	BRIDGE 3 - River Crossing (74m x 22m)
8	Te Puka Stream Diversion
9	Roadworks - 4400 to 5000
10	Roadworks - 5000 to 7500
11	Roadworks - 7500 to 9000
12	BRIDGE 4 - River Crossing (27m x 22m)
13	BRIDGE 5 - Underpass (28m x 7m)
14	Roadworks - 9000 to 10000
15	BRIDGE 6 - River Crossing (37m x 22m)
16	Roadworks - 10000 to 11100
17	BRIDGE 7 - Underpass (28m x 6m)
18	Roadworks - 11000 to 12500
19	Site Compound
20	BRIDGE 8 - River Crossing (67m x 22m)
21	BRIDGE 9 - Farm Access bridge (26m x 6m)
22	BRIDGE 10 - Underpass (35m x 7m)
23	BRIDGE 11 - Underpass (25m x 7m)
24	BRIDGE 12 - Underpass (31m x 7m)
25	Roadworks - 12500 to 14750
26	Roadworks - 14750 to 16610
27	**FRONT 1 (Sta 16610m to 23600m)**
28	Site Compound SH58
29	Roadworks - 16500 to 17700
30	BRIDGE 13 and 14 (SH58 Interchange)
31	BRIDGE 15 (Pauatahanui Stream)
32	Roadworks - 17700 to 19600
33	BRIDGE 16
34	James Cook Link
35	Waitangirua Link
36	BRIDGE 29 - Culvert (56m x 4m)
37	Roadworks - 19600 to 20600
38	Roadworks - 20600 to 22200
39	BRIDGE 17 - Duck Creek 1 (142 x 22m)
40	BRIDGE 18 - Duck Creek 2 (147m x 22)
41	Roadworks - 22200 to 23600
42	BRIDGE 19 - Duck Creek 3 (162m x 22)
43	**FRONT 3 (Sta 23600m to 27700m)**
44	Site Compound
45	BRIDGE 20 - Cannons Creek
46	Roadworks - 23600 to 26000
47	BRIDGE 21 - (55m x 11m)
48	BRIDGE 22
49	Roadworks - 26000 to 27700
50	BRIDGE 23
51	BRIDGE 24
52	SH1 Realignment
53	BRIDGE 25 - TG over SH1
54	BRIDGE 26 - Collins Avenue
55	BRIDGE 27 - Kenepuru Underpass
56	BRIDGE 28 - Kenepuru Link
57	Kenepuru Link Rd and Tie-ins



Project: TG Programme_SIMPLE.mpp
Date: Fri 21/10/11

Roadworks	Fabricated on-site	Inactive Task	Manual Task	Manual Summary			
Split	Precast off-site	Inactive Milestone	Duration-only	Start-only			
Summary	Site Compound	Inactive Summary	Manual Summary Rollup	Finish-only			

APPENDIX B: EARTHWORKS AREAS AND VOLUME BY CATCHMENT TABLE

Earthworks Areas and Volumes Based on Catchment

Catchment				Designation Area		Earthworks Fottprint		Earthworks Volumes	
No	**Description**	area	road length	area	area	area	area	cut	fill
		Ha		m2	Ha	m2	Ha	m3	m3
1	Whareroa	1,572	0.58	77,426	8	19,350	1.93	0	53,000
2	Te Puka / Wainui	830	3.93	783,585	78	280,388	28.04	1,253,000	1,717,000
3	Horokiri	3,306	7.39	1,222,230	122	353,224	35.32	1,131,000	1,145,000
4	Ration	680	3.19	612,500	61	182,538	18.25	419,000	745,000
5	Pauatahanui	4,170	2.51	538,353	54	167,888	16.79	232,000	897,000
6	Duck	1,030	4.55	946,240	95	332,620	33.26	1,551,000	956,000
7	Kenepuru	1,265	2.50	433,040	43	114,073	11.41	675,000	135,000
8	Porirua	4,107	4.66	517,551	52	172,556	17.25	1,071,000	302,000

APPENDIX C: TYPICAL CONCRETE BATCHING PLANT LAYOUT

APPENDIX D: TYPICAL MOBILE ROCK CRUSHING PLANT