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

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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

Second statement of rebuttal evidence of Craig Murray Martell (Hydrology) for the NZ Transport Agency and Porirua City Council

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Dated: 16 February 2012

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SECOND STATEMENT OF REBUTTAL EVIDENCE OF CRAIG MURRAY MARTELL FOR THE NZ TRANSPORT AGENCY AND PORIRUA CITY COUNCIL

INTRODUCTION

1 My full name is Craig Murray Martell.

2 I have the qualifications and experience set out at paragraphs 2-4 of my statement of evidence in chief (*EIC*), dated 17 November 2011.

3 I repeat the confirmation given in my EIC that I have read, and agree to comply with, the Code of Conduct for Expert Witnesses (Consolidated Practice Note 2011).

4 In this second statement of rebuttal evidence I comment on the matters of:

4.1 Winter works;

4.2 Stabilisation events;

4.3 The Soil Moisture Water Balance Model (*SMWB Model);*

4.4 The length of storm events; and

4.5 Consent conditions.

5 These matters were raised in the section 42A reports of Dr Hicks, Mr McLean and Mr Kyle, and in the supplementary evidence of Mr Handyside for the Director-General of Conservation, and Ms Grant for the Regional Council.

6 The fact that this rebuttal statement does not respond to every matter raised in the evidence of submitter witnesses or the section 42A reports within my area of expertise should not be taken as acceptance of the matters raised. Rather, I rely on my evidence, including this further rebuttal statement, to set out my opinion on what I consider to be the key hydrology matters for this hearing.

WINTER WORKS

7 The supplementary evidence of Ms Grant and Mr Handyside, and the section 42A report by Mr McLean, all suggest that a condition be imposed on the regional consents which restricts the carrying out of winter works. I have considered rainfall data, to determine whether this would suggest that such a condition was justified.

8 The following table (**Figure 1**) outlines data from the rainfall records of the six gauging stations across the Project site. The table

identifies the number of rainfall events that have exceeded 40mm / day for each month of the year. This number was chosen on the basis that this is the trigger being used for a stabilisation event, i.e. where works will be shut down due to high rainfall.

9 For each station, I have shown the three months that have most frequently exceeded the 40mm threshold (in red) and the three that have least frequently exceeded (in green).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Judgeford	5	8	4	6	17	10	6	7	3	9	7	5
Paekakariki Hill	20	20	17	23	28	23	16	13	14	22	17	19
Warwicks	26	25	21	19	17	19	26	18	23	42	39	40
Whenua Tapu	4	10	1	1	6	6	4	3	2	9	2	2
Seton Nossiter	5	7	1	4	4	9	9	6	3	9	1	3
Blue Gum Spur	25	19	9	5	10	10	14	8	6	23	27	26

Figure 1 – Number of days, per month, where rainfall has exceeded 40mm/day

10 As to be expected, there is variability across the stations. Notwithstanding this, I do not consider that the data supports a winter shutdown condition being imposed. Spring appears to be generally wetter, and the latter half of the winter (August, September) drier. It would seem that a rainfall based measure would be more appropriate as a risk management tool for sediment control, than imposing restrictions during a defined period of the year. On this basis the conditions previously proposed (stabilisation in large events, monitoring in smaller events and high quality sediment control) are, in my view, adequate.

11 Of course this does not allow for the fact that drying of soils is harder in the winter, and I support the concept of having a condition attached to soils that need to be carefully managed from an earthworks perspective.

STABILISATION EVENTS

12 Following the comments made in the evidence in chief of Ms Grant, I proposed in my rebuttal statement of evidence a 40mm/day trigger for implementing stabilisation on site. This was in response to the 20mm/day "heavy rainfall event" trigger that Ms Grant had

proposed. During conferencing[1], it became clear that Ms Grant's proposal was intended as a test for monitoring efficiency (I note that more testing than this will be undertaken, but nonetheless the Regional Council would like to see this trigger remain). As part of the same discussion it was suggested that the frequency of stabilisation (4-10 times a year) is too high and a less conservative measure could be implemented. My comments on this are as follows:

12.1 The initial measure proposed was hourly rainfall intensity (15mm/hr) and, as such, analysis was undertaken of distributions using rain gauges that collect continuous data (every 5 to 15 minutes) which can then be used to set short term intensities. Using the map below (**Figure 2**) the Warwicks station was used as the upper value, as Paekakariki Hill Road is a daily recorder (i.e. not continuous). When reanalysed for daily rainfall, initially the same recorder stations were used as this data was available and the Warwicks station represented the upper bound (10 times a year).

12.2 Since then, the Warwicks station has been replaced with the daily record at Paekakariki Hill in the assessment. On this basis, all of the stations indicate that on average 40mm/day would occur approximately 1% of the time or less, i.e. 0-4 times a year on average. If 50mm/day had been used this would represent an approximation (as it is different at each site) of an annual return period across the site (i.e. on average it would occur once a year) and 70mm/day would be an approximation of the mean annual rainfall (on average it occurs once every 2.3 years).

[1] Planner and Sediment Expert conferencing, 8th February 2011.

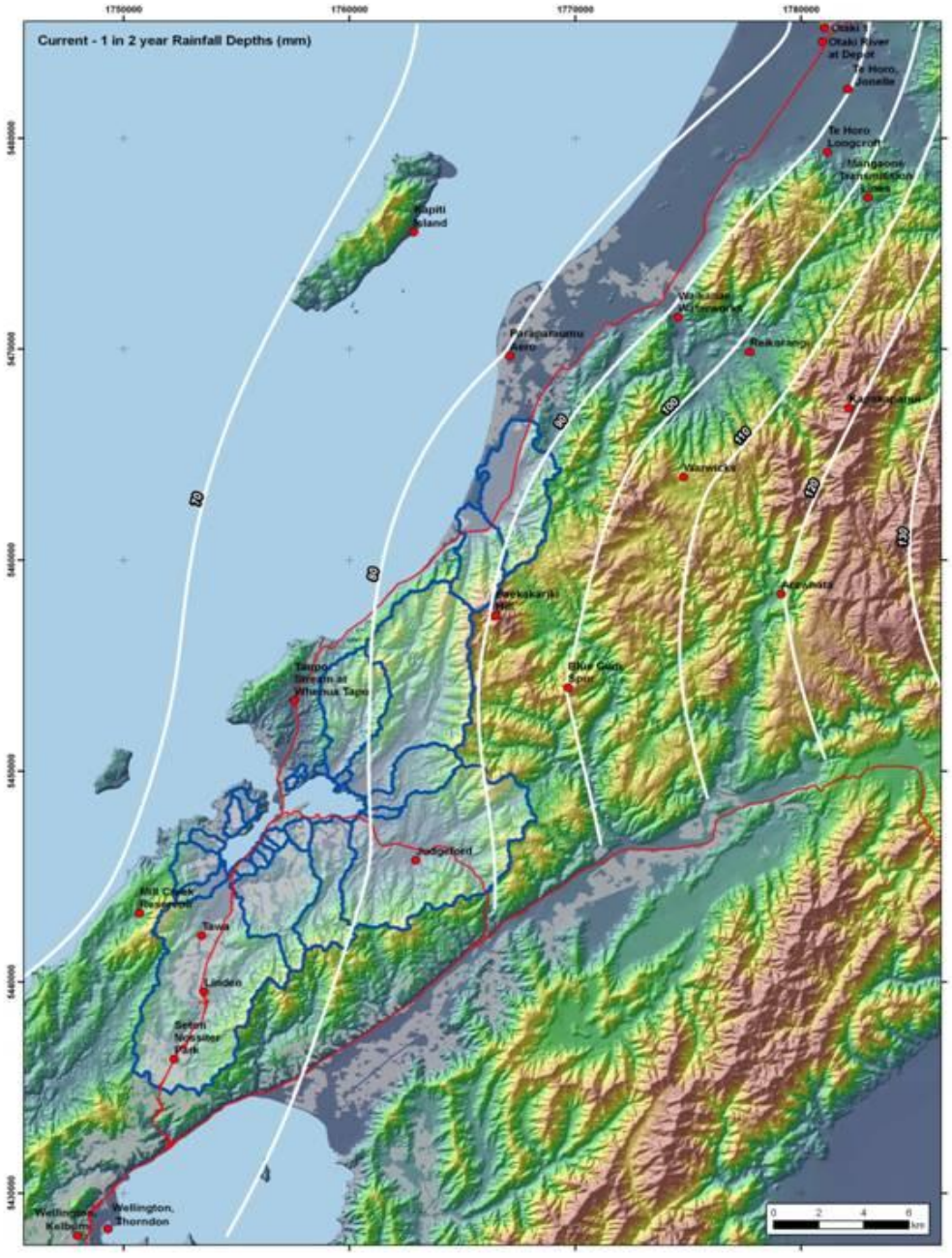


Figure 2 – Location of rainfall stations

13 The reason for selecting 40mm/day trigger was to create some conservatism in the actions taken by the contractor on the basis that the forward estimate of daily rainfall is a **forecast estimate**. On this basis, actual rain could occur that is greater than this (or less) so a conservative measure was wanted. It could be suggested that as the erosion and sediment controls proposed are of a high standard they will cope with anything up and over a mean annual flood and on this basis the trigger could be elevated to as high as

70mm/day and still leave some conservatism for errors in the forecasts of rainfall that are being provided.

14 My preference is to keep the trigger level lower rather than higher as this will drive better behaviours with the contractor. In particular it will focus them on having smaller areas of earthworks open at any one time to reduce the cost for stabilising sites. I would be most comfortable raising the trigger to 50mm/day.

15 In light of the assessment above on winter works (paragraphs 6-10) I considered it appropriate to reassess the assumptions on the basis of the increased daily rainfall trigger (i.e. 50mm/day) to ensure that my conclusions were still supported. **Figure 3** below shows that with a higher trigger the distribution of heavy rainfall events is even more skewed towards spring and autumn, thus confirming the previous analysis.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Judgeford	2	4	2	5	8	3	2	3	0	5	5	2
Paekakariki Hill	11	17	8	16	16	13	8	6	5	13	10	9
Warwicks	17	18	13	8	13	14	12	8	9	26	27	23
Whenua Tapu	2	6	1	1	3	2	1	0	0	4	1	1
Seton Nossiter	3	5	1	1	3	5	4	2	0	7	1	0
Blue Gum Spur	14	10	5	2	9	6	8	6	3	14	20	15

Figure 3 – Number of days, per month, where rainfall has exceeded 50mm/day

DR HICKS' SECTION 42A REPORT

16 In the first paragraph of page 16 of his section 42A report, Dr Hicks has questioned the calibration methodology for the SMWB Model.

17 While not the author or reviewer of Technical Report 15 I am comfortable that the appropriate approach has been taken as the intention of this model was to provide the basis for a long term simulation into the harbour, with calibration across the full range of flows being important. The match shown for the Horokiri stream is typical of the variation that is found when viewing a calibrated model against real data. This occurs due to the fact that assumptions made in the simulation, such as even rainfall distribution across the catchment, and rainfall depths for a specific event, may not match what occurred in reality. If the Horokiri

stream record had been longer, I would expect a more even distribution of "unders and overs" and this can be seen in the longer calibrated record for the Pauatahanui stream (**Figure 4** below).

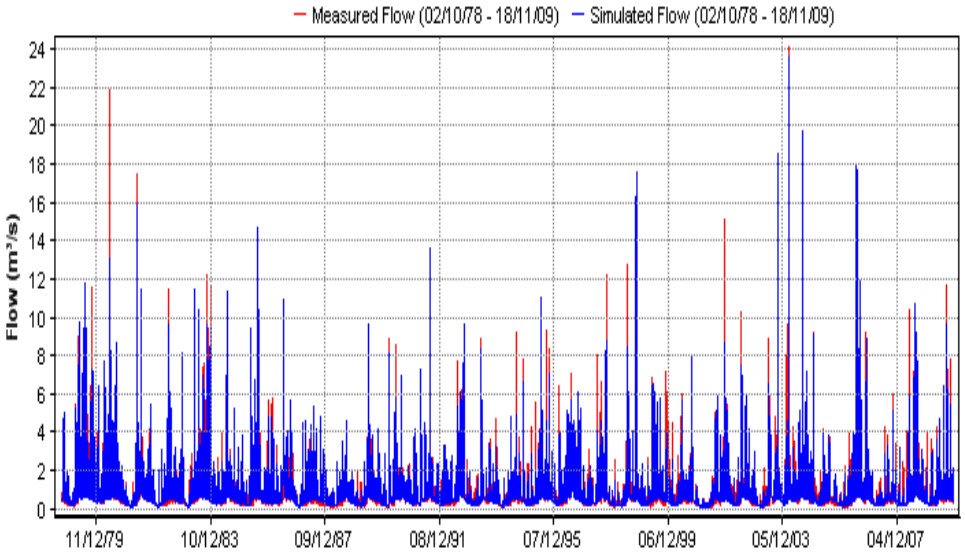


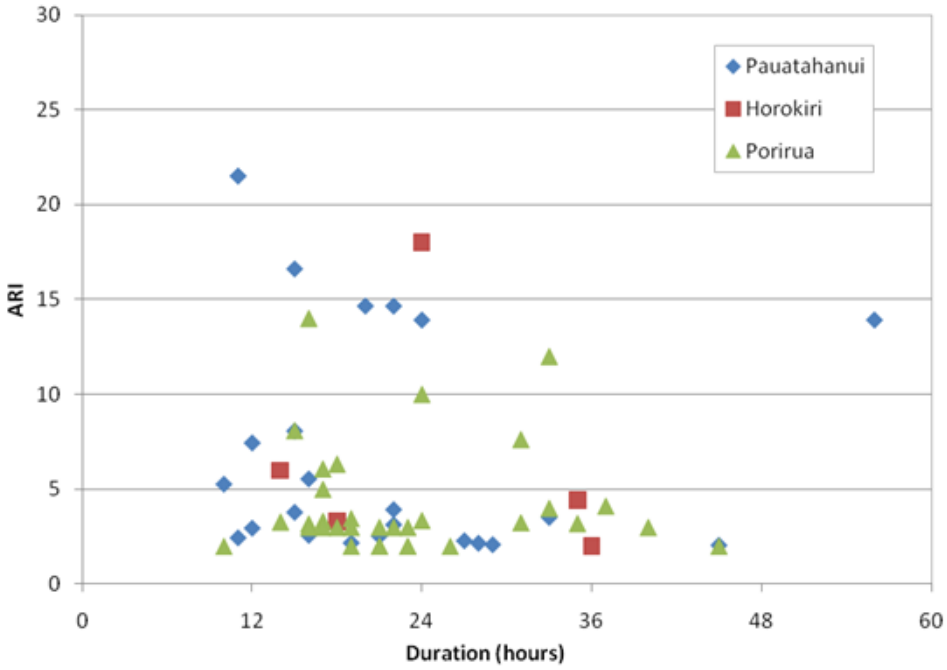
Figure 4 – Pauatahanui Stream: Observed and Simulated Average Daily Flows

18 Peakflow calibration and analysis was undertaken using an alternate methodology, which is covered in section 4.4 of Technical Report 14, and this is what was used to model "events" of specific return period into the harbour.

19 Dr Hicks has also questioned the use of a 24 hour storm event to provide a reasonable estimate of peak sediment into the harbour on an event basis[2]. To test whether the use of a 24 hour storm event is reasonable, I have reviewed the length of storms of a 2 year ARI or greater in the three gauged catchments. **Figure 5** below provides a summary of this information.

[2] See paragraph 4 on page 18.

Figure 5 – Storm length represented against return period of the event



20 The figure shows that the majority (approx 70%) of storms recorded above a 2 year ARI at the three existing gauging stations are less than 24 hours long.

21 It should be noted that the other catchments along the alignment are all smaller than these gauged catchments and as such I would expect that, on average, they would have shorter storm durations.

22 On this basis, whilst a more conservative approach could be taken, I consider it is not unreasonable to have selected a 24 hour storm as a fair average for the assessment of single events into the harbour.

23 Dr Hicks has also questioned why the unit hydrograph model has been used to set return period high flows for the event simulations of sediment[3]. The unit hydrograph model was calibrated specifically for peak events and was used for a range of tasks. If it had not been used to set peak return periods for the event based assessments there would have been a lack of consistency across the technical reports.

24 I have compared the results of the derived unit hydrographs to the gauged record, and the SMWB model outputs. I consider the peak flows used in the assessment are comparable and more

[3] See paragraph 4 on page 18.

conservative than other estimates. This was seen as positive at the time the assessment was undertaken.

MR KYLE'S SECTION 42A REPORT

25 Mr Kyle has raised concerns that the conditions proposed in my EIC relating to design of bridges and diversions have not been incorporated into the proposed conditions for the project.

26 I have discussed conditions further with **Ms Rickard**, and I understand the reasoning for the comments made in her supplementary evidence of 13 February (paragraph 15). I understand that she considers that a condition(s) may be useful to make sure that potential flooding/flow management effects are addressed at the time of the detailed design and that this is consistent with my assessments. As the Board is aware, conditions are a work in progress and I understand that a further iteration will be presented in due course.

CONCLUSIONS

27 Rainfall data does not appear to support a winter shutdown for management of erosion and sediment control.

28 I am happy to support Ms Grant's request to retain the heavy rainfall trigger. I have also reconsidered the stabilisation trigger event following conferencing and have proposed a higher trigger of 50mm/day. I have been informed that this is now reflected in current conditions.

29 I believe that the calibration of the SMWB model is appropriate considering its use within the long term simulation.

30 I believe the 24 hour storm was an appropriate storm length for consideration of "event" based modelling of sediment in the harbour.

31 I believe the use of calibrated peakflows, as opposed to peakflows from the SMWB model, was an appropriate decision to provide consistency of event based analysis. This approach was recognised as conservative which was seen as a positive at the time of modelling.

32 I understand that a further iteration of conditions will be presented in due course, as I have discussed above.

Craig Murray Martell
16 February 2012