



Response to submissions – Urban Major Projects - North

Report for the Commerce Commission

November 2013

Preface

Partna Consulting Group (PCG) is a specialist energy consulting firm that partners with clients to deliver projects involving investment strategy, commercial strategy, asset management, organisational change, and energy policy. Established in 2004, we work with clients' right across the value chain and have undertaken projects in both New Zealand and Australia.

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Disclaimer

This report has been prepared for the Commerce Commission (the Commission) to assist the Commission's review of Orion's customised price path (CPP) application. The report has been based on information provided to PCG by Orion and the Commission as part of the CPP application and evaluation process. PCG will not be responsible for the accuracy or completeness of the information provided to PCG or any conclusions based on inaccurate or incomplete information. This report is not designed to be used or relied on by any party other than the Commission, and PCG will not be liable in tort, contract or for any other cause of action as a result of the use of this report by others.

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Introduction

1. The Commerce Commission (Commission) has requested Partna Consulting Group (PCG) to respond to the issues raised by submitters in relation to the Commission's Draft Decision in respect of the expenditure allowance for Orion's Urban Major Projects – North (CPP1 and CPP2). This report sets out our findings.

Summary

2. After reviewing submissions on the Commission's Draft Decision, our conclusions are:
 - a. No further technical information¹ has been provided by submitters on the Major Urban Project North (CPP1) that would provide a basis to alter the Commission's Draft Decision.
 - b. The network development allowed for within the Draft Decision aligns with Orion's pre-earthquake security criteria² and therefore meets Orion's stated objective of "*restoring the network resilience and reliability to near pre-earthquake security levels.*" It also provides for additional resilience by allowing for independent cable routes to zone substations as per Orion's resilience criteria.
 - c. The timing for Waimakariri and Marshlands substations allowed for in the Draft Decision also aligns with that sought by Orion.
 - d. We therefore conclude that the expenditure allowed for in the Draft Decision is appropriate³ in respect to the establishment of the Waimakariri and Marshlands substations and associated 66kV circuits.
 - e. Within the Draft Decision the Commission allowed for the continued use of the temporary overhead line to Rawhiti. Should the environmental consents not be extended beyond 2014, continued use of the temporary line would not be possible. This would leave the load at Rawhiti on N security at a 66kV level. The load involved (peak demand circa 30MVA) is such that this breaches Orion's pre-earthquake security standard.
 - f. Therefore, we recommend that an allowance be made for a second cable supply to Rawhiti. The most efficient means for a second supply appears to be a cable from Dallington. A high level estimate for a new cable from Dallington to Rawhiti, based on Orion's quoted rates for 630Cu cable, the estimated cable length and the inclusion of an additional bay at Dallington is in the order of \$6.8m⁴.

¹ Such as load growth profiles, engineering or cost modelling to demonstrate that the amounts allowed for are inappropriate or infeasible.

² Orion "Asset Management Plan – From 1 April 2010", s 5, p. 159

³ The expenditure allowances are based solely on the costs submitted to the Commission by Orion. We have not verified the accuracy or otherwise of the costs involved.

⁴ This cost is a high level estimate only. It is based on an estimated distance between Dallington and Rawhiti and Orion's quoted costs per meter for 630Cu cable.

3. The result from these findings is set out in the tables below. Table 1 shows the detailed breakdown of Orion’s CPP1 project proposal. Table 2 sets out the detailed breakdown of the Capex in the Draft Decision with an additional Rawhiti cable.

Table 1 - Orion's CPP1 proposal (capex during the CPP period)

| Project code | Description | Project ID | 2015 | 2016 | 2017 | 2018 | 2019 | TOTAL |
|--------------|-------------------------------------|------------|------------------|------------------|-------------|-----------------|-------------|------------------|
| CPP1 | Waimakariri substation stage 1 | | \$ 5,312 | | | | | |
| CPP1 | Hawthornden-Waimakariri 66kV link | | \$ 7,494 | | | | | |
| CPP1 | Marshland to Waimakariri 66kV link | | \$ 10,738 | | | | | |
| CPP1 | Rawhiti to Marshland 66kV link | | | \$ 11,429 | | | | |
| CPP1 | Belfast diesel generation - stage 1 | | | \$ 1,285 | | | | |
| CPP1 | Marshland zone substation | | | | | \$ 6,255 | | |
| CPP1 | Hawthornden T-off | | | | | \$ 1,300 | | |
| CPP1 | Waimakariri substation stage 2 | | | | | \$ 2,377 | | |
| CPP1 | Total - Major urban (North) | | \$ 23,544 | \$ 12,714 | \$ - | \$ 9,932 | \$ - | \$ 46,190 |

Table 2 - Draft Decision capex with a second circuit to Rawhiti

| Project code | Description | Project ID | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|--------------|-------------------------------------|------------|------------------|-----------------|-------------|------------------|-------------|------------------|
| CPP1 | Waimakariri substation stage 1 | | \$ 5,312 | | | | | |
| CPP1 | Hawthornden-Waimakariri 66kV link | | \$ 7,494 | | | | | |
| CPP1 | Marshland to Waimakariri 66kV link | | \$ - | | | | | |
| CPP1 | Rawhiti to Marshland 66kV link | | | \$ - | | | | |
| CPP1 | Belfast diesel generation - stage 1 | | | \$ 1,285 | | | | |
| CPP1 | Marshland zone substation | | | | | \$ 6,255 | | |
| CPP1 | Hawthornden T-off | | | | | \$ - | | |
| CPP1 | Waimakariri substation stage 2 | | | | | \$ - | | |
| CPP1 | McFaddens-Marshland 66kV link | | | | | \$ 5,828 | | |
| CPP1 | Dallington-Rawhiti 66kV link | | \$ 6,800 | | | | | |
| CPP1 | Total - Major urban (North) | | \$ 19,606 | \$ 1,285 | \$ - | \$ 12,083 | \$ - | \$ 32,974 |

Issues raised in submissions

4. A number of submitters raised issues either directly or indirectly related to the urban major projects, CPP1 or CPP2. These potential issues are:
- Restoration of resilience and reliability to pre earthquake security levels;
 - Supply to Rawhiti; and
 - Quality trade-off.

5. Each of these issues is addressed below.

a) Restoration of resilience and reliability

6. A number of submitters cited the importance of network resilience. Examples of comments include:

“Network resilience is fundamentally important when big events occur.”⁵

“Network resilience is important for reducing the potential damage to the network that could occur as a result of future catastrophic events.”⁶

⁵ Orion “Orion CPP proposal: Draft Decision” (20 September 2013), p.9.

7. We agree with many of the comments related to the benefits of resilience and regard the resilience of a network to be an important consideration. As noted by Orion, the National Infrastructure Plan acknowledges the importance of resilience by including such comments as *“Both physical and system resilience are crucial”*⁷ and *“acknowledging the value of adaptability and redundancy in a network to improve business confidence.”*⁸
8. However, it is also important to recognise that resilience is always a mix between the physical network in place and operational systems and processes (including the likes of holding strategic spares) that allow adaptability to a situation where, by definition, the scope and consequence is unknown in advance.
9. In response to a number of severe storms and natural events, the UK Government developed and published a Guide⁹ (the Guide) entitled *“Keeping the country running: Natural Hazards and Infrastructure.”*
10. The Guide defines resilience as *“the ability of assets, networks and systems to anticipate, absorb, adapt to and / or rapidly recover from a disruptive event.”*¹⁰ It lists the four components of resilience as consisting of:
 - a. Resistance – the extent to which damage or disruption can be prevented¹¹;
 - b. Reliability – ensuring that infrastructure components are inherently designed to operate under a range of conditions¹²;
 - c. Redundancy – the capacity of the network or system and the availability of backup installations and alternative infrastructure¹³; and
 - d. Response and Recovery – enabling fast and effective response to and recovery from disruptive events.¹⁴
11. The Guide notes that *“Each of these components can be utilised and adopted at different levels. Given the range of risks, organisations should select combinations of responses from all four of these components to develop a strategy that will deliver the most cost effective and appropriate risk management response to the hazards and threats.”*¹⁵

⁶ Wellington Electricity “Draft Decision on Orion’s CPP Proposal” (20 September 2013), p.3.

⁷ National Infrastructure Plan, 2011, p.14.

⁸ Ibid.

⁹ Civil Contingencies Secretariat, Cabinet Office, UK, “Keeping the Country Running: Natural Hazards and Infrastructure”, 2011, Retrieved October 2013, from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/61342/natural-hazards-infrastructure.pdf

¹⁰ Civil Contingencies Secretariat, Cabinet Office, UK, “Keeping the Country Running: Natural Hazards and Infrastructure”, 2011, p.14

¹¹ Ibid, p.15

¹² Ibid, p.15

¹³ Ibid, p.16

¹⁴ Ibid, p.16

¹⁵ Ibid, p.14

12. As such, it is our view that resilience is not a reason in itself to build a meshed network in its entirety upfront, in the event that it might be required at some future date. The economic value to consumers should always be considered and factored in with an assessment of the options and consequences of particular arrangements and involve all of the four components. As we noted in our previous report to the Commission, it's highly uncertain when and how such events might occur and that a flexible means of managing resilience is likely to be more effective and efficient over the longer term.
13. Orion's stated objective is to *"...restore network resilience and reliability to near pre-earthquake levels."*¹⁶ This places a context around the assessment of Orion's proposal. In relation to the level of resilience and reliability within Orion's network, we note:
- a. Orion's 2010 AMP sets out clearly the network configuration¹⁷ and security standard¹⁸ that existed pre-earthquake. For ease of reference we have included Orion's pre-earthquake security standard in Appendix A.
 - b. Orion's consumers appear to be satisfied with the level of reliability provided pre-earthquake, *"Over time our consumers have shown that they are happy with our planning standards."*¹⁹
 - c. The demand on the Orion network is lower than which existed pre-earthquake. This is acknowledged by Orion when they state *"...that energy volumes remain well below pre-earthquake levels."*²⁰
14. In our initial report to the Commission in June 2013 we recommended the establishment of the Waimakariri and Marshland substations in accordance with the timing proposed by Orion at a minimum of a switched N-1 security level at 66kV. The purpose for these new substations is to cater for the expected growth in northern Christchurch.
15. With the high capacity 11kV back feed capability within Orion's network and the level of expected demand growth within the CPP period, an initial single 66kV cable link to these substations is within Orion's pre-earthquake security standards and retains options for the longer term network development. This was allowed for by the Commission in the Draft Decision.
16. Notwithstanding the above, in our view the expenditure allowed for in the Draft Decision allows for additional resilience to be built into Orion's network beyond pre-earthquake levels. In particular:
- a. The construction of a new high capacity cable from Dallington to McFaddens prior to the CPP period along with the restoration of the Dallington substation and the cable from

¹⁶ Orion "Orion CPP proposal: Draft Decision" (20 September 2013), p.9.

¹⁷ Orion "Asset Management Plan – From 1 April 2010", s 4.2, p.77.

¹⁸ Ibid, s 5, p.159.

¹⁹ Orion "Orion CPP proposal: Draft Decision" (20 September 2013), p.43.

²⁰ Ibid, p.30.

Bromley to Dallington (CPP2) will increase the resilience of the network compared to pre-earthquake levels.

- b. Acceptance that, given the geological conditions in Christchurch, establishment of independent cable routes when providing N-1 security of supply to zone substations is reasonable. This was adopted and illustrated in the potential for an alternative architecture described in our previous report.
17. Therefore, many of the resilience features sought by Orion, which exceed “pre-earthquake” levels, are allowed for in the Draft Decision.
18. In our view the principle difference between Orion’s proposal and the Draft Decision relates to two aspects of the network development:
 - a. The staging of investments to meet demand growth and the need to present NPV analysis demonstrating the selected option reflects the efficient cost to consumers; and
 - b. The demonstrated need for, and the impact of, an additional high capacity GXP link to the north of Christchurch.
19. From our understanding of Orion’s pre-earthquake network, the pre-earthquake levels of resilience did not include any cross GXP links to the north of the city. In addition to providing resilience for the supply to McFaddens and Dallington zone substations, the new Dallington to McFaddens cable provides an additional GXP link, albeit constrained by the limited cable capacity between Papanui and McFaddens. This is in addition to the level of resilience provided by the transmission circuits between Islington and Bromley; the resilience that results from the design and redundancy built into Transpower’s GXPs; the holding of critical spares; rapid response plans and other transmission level contingency plans.
20. In our view it is important that the additional need for resilience provided by GXP links be considered within this context. Clearly if supply from Islington was lost then Transpower and all the upper South Island Electricity Distribution Businesses would be co-ordinating their activities to restore supply as quickly as possible.
21. Orion records in its 2012 Network Architecture Review that the cost of the additional GXP ties is in the order of \$3.8m p.a. The question becomes what could be done for this level of expenditure and is it necessary in light of plans and equipment that are already in place to manage such an event?
22. In light of the above, our view is that Orion’s CPP Proposal did not substantiate the requirement for the additional expenditure within the CPP period. However, we note that nothing in the Draft Decision limits the efficient long term development of Orion’s network and the addition for further resilience as demand grows.
23. Therefore, based on the information provided by Orion, in our view, the network configuration allowed for in the Draft Decision complies with its pre-earthquake security standards, and in conjunction with Orion’s CPP2 project it provides additional resilience to the network.

24. It is our view that Orion's statement "*The assumptions in the Draft Decision will prevent us from restoring our pre earthquake performance*"²¹ is not supported by the evidence presented by Orion to the Commission.

b) Supply to Rawhiti

25. The Commission has requested that we consider the impact that the removal of the temporary line to Rawhiti will have on supply security. As this was associated with expenditure prior to the CPP period it was previously outside the scope of our original review.

26. The Draft Decision relied upon the continued operation of the temporary line to provide N-1 supply to the Rawhiti substation. This is clearly the most effective option from a marginal cost perspective. The peak load at Rawhiti is in the order of 30MVA, which sits within a C2 (N-1) security classification under Orion's pre-earthquake planning standards.

27. Orion has noted in its submission on the Draft Decision that the relevant environmental consents for the line expire in 2014. Without considerable community goodwill and a significant amount of work by Orion in developing an application for an extension, the ability to use the temporary line will cease thereby leaving Rawhiti on N security at a 66kV level.

28. Therefore, in accordance with Orion's pre-earthquake security standards we would recommend that N-1 is an appropriate security standard and as such provision for an additional cable route should be made.

29. The most efficient means of supplying Rawhiti, which meets Orion's resilience criteria for diverse cable routes, appears to be an additional cable from Dallington. By allowing for a larger cable the additional route would also support supply to Dallington and McFaddens in the event of a loss of the Bromley to Dallington cable. It's important to note this is only a notional supply route for the purposes of establishing an expenditure amount and in no way restricts Orion implementing other network development options.

30. Utilising the 66kV cable costs provided by Orion, an estimate of the cable length and inclusion of an additional bay at Dallington would be in the order of \$6.8m.²²

c) The quality trade-off

31. Orion estimates that for the 66kV urban network the quality difference between the levels described in its CPP Proposal and the Draft Decision as being five SAIDI minutes²³ in 2019. According to Orion this is due to the Draft Decision allowing for N security at the new Waimakariri substation rather than N-1.

²¹ Orion "Orion CPP proposal: Draft Decision" (20 September 2013), p.45.

²² This cost is approximate only based on the distance between Dallington and Rawhiti and applying Orion's costs cost per meter for 630Cu cable.

²³ Five SAIDI minutes equates to all of Orion's customers losing power for a total of five minutes throughout the year or half of its customers losing power for ten minutes.

32. In our view, the quality difference between Orion's CPP1 proposal and the notional projects allowed for in the Draft Decision is driven from the 66kV N security level at the new Waimakariri substation from 2017 to 2019, and from Marshlands in 2019.
33. However, the actual quality impact on the 66kV urban network that would result from the Draft Decision will depend on a number of factors. These include:
- a. The growth rate in the region being supplied from Waimakariri and Marshlands;
 - b. The rate at which Orion transfers load from neighbouring (N-1) security level zone substations;
 - c. The expected interruption rates of the 66kV cables (1 in 100 years or 0.01), and interconnecting transformers (1 in 50 years or 0.02);
 - d. The time taken to switch the load using alternative 11kV back feed (between five minutes and two hours);²⁴ and
 - e. The overall performance of the other components of Orion's 66kV Urban network.
34. With the low probability of failure in 66kV equipment, the small number of consumers being fed from the Waimakariri and Marshland substations and short restoration times, the quality impact is likely to be in the order of 0.4 to 0.5 SAIDI minutes per year per substation. Therefore the expected quality impact is likely to be small in the context of an overall SAIDI on Orion's network of 80 plus minutes p.a.

²⁴ Orion's calculations appear to assume an average switching time of 60 minutes.

Appendix A – Orion’s Pre-earthquake security criteria

The following has been extracted from the Orion’s “Asset Management Plan – From 1 April 2010”, Page 159.

| Distribution network supply security standard | | | | | |
|---|---|----------------|--|--|---|
| Class | Description | Load size (MW) | N-1 cable, line or transformer contingency | N-2 cable, line or transformer contingency | Bus fault or switchgear failure |
| Urban – Transpower GXPs | | | | | |
| A1 | Lines, buses and supply banks | 15-200 | No interruption | Restore within 2hrs | No interruption for 50% and restore rest within 2 hrs |
| Rural – Transpower GXPs | | | | | |
| B1 | Lines, buses and supply banks | 15-60 | No interruption | Restore within 4hrs (1) | No interruption for 50% and restore rest within 4 hrs (1) |
| B2 | Supply banks | 0-1 | Restore in repair time | Restore in repair time | Restore in repair time |
| Urban – Orion network | | | | | |
| C1 | Zone substations with CBD or special industrial load | 15-40 | No interruption | Restore within 1hr | No interruption for 50% and restore rest within 2 hrs |
| C2 | Zone substations without CBD or special industrial load | 15-40 | No interruption | Restore within 2hrs | No interruption for 50% and restore rest within 2 hrs |
| C3 | Zone substations or 11kV ring with Christchurch CBD or inner urban load | 2-15 | Restore within 0.5 hr | Restore 75% within 2hrs and the rest in repair time | Restore within 2 hrs |
| C4 | Outer, mainly residential zone substations | 4-15 | Restore within 2 hrs | Restore 75% within 2hrs and the rest in repair time | Restore within 2 hrs |
| C5 | Inner 11kV distribution feeder | 0.5-2 | Restore within 1 hr | Restore in repair time | Restore 90% within 1 hr and the rest in 4 hrs (use generator) |
| C6 | Outer, mainly residential 11kV distribution feeder | 0.5-4 | Restore within 1 hr | Restore in repair time | Restore 90% within 1 hr and the rest in 4 hrs (use generator) |
| C7 | 11kV distribution spurs | 0-0.5 | Use generator to restore within 4 hrs | Restore in repair time | Use generator to restore within 4 hrs |
| Rural – Orion network | | | | | |
| D1 | Subtransmission feeders | 15-60 | No interruption | Restore within 4hrs (1) | No interruption for 50% and restore rest within 4 hrs (1) |
| D2 | Zone substations and subtransmission feeders | 4-15 | Restore within 4hrs (1) | Restore 50% within 4 hrs and the rest in repair time (1) | Restore within 4 hrs (1) |
| D3 | Small zone substations and 11kV distribution feeders | 1-4 | Restore within 4hrs (1) | Restore in repair time | Restore 75% within 4 hrs and the rest in repair time (1) |
| D4 | 11kV distribution spurs | 0-1 | Restore in repair time | Restore in repair time | Restore in repair time |

(1) Assumes the use of interruptible irrigation load for periods up to 48 hours