

Meeting Date: 12 March 2020

REVIEW OF CIRCUMSTANCES OF MARCH 2019 WELLINGTON N-SECURITY

SECURITY
AND
RELIABILITY
COUNCIL

Note: This paper has been prepared for the purpose of the Security and Reliability Council (SRC). Content should not be interpreted as representing the views or policy of the Electricity Authority.

Review of circumstances of March 2019 Wellington n-security

1. Background

- 1.1. At its 28 March 2019 meeting, the SRC received [brief advice](#) about the then-current situation in which Wellington's CBD and Southern and Eastern suburbs connected with 'N security' to the transmission network. This situation was unplanned and arose because of unforeseen complications with planned transmission circuit reconductoring that emerged in the course of the project.
- 1.2. Subsequent to that meeting, the SRC [advised the Authority on 17 May 2019](#) that "...Wellington's grid security situation in late-March warrants an independent review by the Authority that identifies and promotes any lessons learned."
- 1.3. The Authority Board [responded in a 20 August 2019 letter](#) that "The Board agree that a review into this situation is warranted. However, The Board would appreciate hearing the SRC's perspective on this event and respectfully request that the SRC complete the review instead. We look forward to receiving the SRC's advice from that review."
- 1.4. The SRC's secretariat liaised with Transpower and scheduled this paper to coincide with completion of further review by Transpower and Wellington Electricity and the completion of other papers about [grid security](#) (24 October 2019) and communication of outages (agenda item #14 of this meeting).
- 1.5. The secretariat notes that SRC member Greg Skelton has an interest in this matter, as he is the Chief Executive of Wellington Electricity. The minutes of this meeting will record any restrictions of the member's permission to act in relation to this matter.
- 1.6. Transpower provided the attached report (Appendix A) summarising their review of Wellington's N security situation in March 2019.
- 1.7. Transpower and Wellington Electricity wrote to the Chairs of the Electricity Authority and the Commerce Commission on 3 March 2020 in relation to this topic. That is attached as Appendix B. In that letter, the views of attendees at a Wellington Electricity-facilitated workshop are summarised as:

"...participants were highly engaged over the reduced security situation. They want to be informed about forecast and unplanned N-security situations and use their own discretion as to which events are of sufficient concern to prompt their own electricity outage response plans. Participants expressed interest in a future system which would allow them to register for automated communications and if possible, to filter for the criteria which would trigger a communication to them."

2. Secretariat comments arising from Transpower's report

- 2.1 The secretariat considers that Transpower's report is comprehensive and accurate.
- 2.2 Transpower's report refers to various conductor configurations and types such 'duplex Zebra', 'simplex Chukar' or 'simplex AAAC Sulphur'. The secretariat notes that understanding this jargon is not salient to understanding the issues that arose but can provide explanations to any interested members.
- 2.3 In paragraph 1.2 of its report, Transpower state:
- "Transpower is meeting grid security of supply obligations to Central Park. Further re-enforcement of supply does not strictly meet the relevant regulatory tests. Transpower and [Wellington Electricity] have been working to progress investigations about providing additional supply capacity. Investment would require community consultation by [Wellington Electricity] (as the party who would be responsible for the costs)."
- 2.4 The secretariat infers from the above that one or both of Transpower and Wellington Electricity consider that standard (regulated) processes are failing to enable investment that would be in the best interests of consumers' security and reliability.
- 2.5 As with agenda item #14, communication of reduced grid security (and outages as well in the context of #14) to connected parties and consumers is an important aspect from which lessons can be drawn. Transpower's discussions with various distributors suggest most "do not want to communicate N Security outages to their communities". The secretariat notes that:
- a) Distributors advise retailers of planned outages through a standardised file exchange (the Electricity Information Exchange Protocols, or EIEPs). Distributors are required¹ to provide an EIEP5A to the registry transfer hub² to advise of planned outages, or changes to planned outages. Retailers have access to this data and can use this to advise their affected customers.
 - b) Similarly, distributors can use EIEP5B to advise of unplanned outages, though it has not been mandated.
 - c) The registry transfer hub could provide a conduit for Transpower to advise interested parties of planned outages, unplanned outages and reduced grid security. However, as illustrated by the 24 October 2019 paper about [grid security](#), security is not a binary status and is subject to complex conditions. Once defined, the information could have one or more dedicated EIEP file formats created (eg EIEP5C) and endorsed by the [Standing Data Formats Group](#).
 - d) If the EIEP hub received a comprehensive dataset from Transpower and that were made available, technical solutions exist for innovative parties to

¹ EIEP5A has been regulated as mandatory, but a start-date from which this is effective has not yet been announced.

² The registry transfer hub is a file exchange service provided under contract to the Authority by the registry manager, Jade Software Corporation.

develop systems that provide timely information to the consumers that value it.

3. Questions for the SRC to consider

3.1 The SRC may wish to consider the following questions.

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| Q1. | Does the SRC want to offer Transpower and/or Wellington Electricity the opportunity to present a paper at a future meeting that identifies any undue regulatory barriers to grid security and reliability? |
| Q2. | What further information, if any, does the SRC wish to have provided to it by the secretariat? |
| Q3. | What advice, if any, does the SRC wish to provide to the Authority? |



Wellington Region N Security Review

Purpose

For around three weeks in March and April 2019, parts of Wellington (including parts of the CBD area and Parliamentary precinct) were on N Security as a result of Transpower project work on the Central Park – Wilton B transmission line. Concerns were raised by stakeholders about security of supply in the capital city and Transpower committed to conducting a review of the circumstances that led to this outcome and how the reduction in grid security was managed and communicated. This report documents the findings of this review and identifies what changes Transpower has made as a result of the review and what further changes (if any) are still to be finalised.

Executive Summary

Beginning in November 2018, Transpower undertook a significant programme of reconductoring on the 110 kV double circuit line from Wilton to Central Park. Part-way through the work, a previously unforeseen conductor swing hazard was identified. The hazard arose due to the different behaviour of the new and old conductor during certain wind conditions. On the long conductor spans near Karori this meant the conductors were at risk of flashing over. This presented a significant safety risk and required work to be halted and replanned.

All viable options to complete the reconductoring within the required timeframe required a double circuit outage (or outages), placing Central Park substation on N Security. The stage at which the project was halted meant that N-1 Security could only be maintained to Central Park until the end of April 2019. After this the winter load would increase and full N-1 Security required all three circuits to Central Park in service.

Transpower identified the lowest risk option to deliver the outstanding work and provide N-1 Security to Central Park over winter. The selected option reduced N Security duration, minimised return to service time in the event of a loss of supply, returned all three circuits to service prior to winter and did not require any changes to the existing design or the procurement of additional materials. A new contingency plan was developed that specifically accounted for the various activities to be undertaken and focussed on reducing return to service time should a loss of supply occur. It included additional measures to monitor in-service asset condition and reduce the risk of asset failures and outages.

This was a unique circumstance where an unexpected hazard required a late change to the project delivery plan. Our usual process for advance notification and engagement of customers where N Security works is required was dramatically shortened. As a result, Transpower was not as effective as it could have been in engaging Wellington Electricity (WE*), particularly when developing solutions and assessing impacts.

An initial communications plan was drafted and socialised for comment and input with WE*. The plan assumed a low-key approach to informing key stakeholders. A subsequent meeting with WE*, which also included officials from the Commerce Commission, helped finalise aspects of this plan. Wider communication to media and general public was not undertaken on the basis that it would highlight a vulnerability that could be exploited and cause undue public concern. This decision was reached following consultation with stakeholders including the Wellington City Mayor and WREMO.

Following the successful completion of the parts of the project requiring N Security to Central Park, Transpower reviewed the project to identify opportunities for improvement and learning. This included;

- Transpower and WE* held a workshop to capture learnings from the event and help define how similar situations would be managed in the future.
- Transpower attended a WE* workshop with WE* customers to better understand their needs.
- Transpower revised its External Communications Policy to incorporate learnings from the workshops. This specifically included a new section addressing “Significant Risk to Supply”, which covers instances where major urban areas are placed on N Security together with developing a protocol for communications for such events with WE*.
- Transpower is completing a technical review of the conductor swing hazard. It considers the hazards that can occur when reconductoring with a different conductor to develop strategies and work methods to identify and remove this hazard during future works.

1. Introduction

1.1. Wellington Area and Central Park Supply Arrangement

The Wellington Area is supplied via three GXPs; Wilton (WIL), Kaiwharawhara (KWA) and Central Park (CPK). Central Park is the largest of these supply points, supplying more than 45,000 WE* customers and supplying more than 160 MW of peak load. Central Park supplies the southern and eastern suburbs and much of central Wellington (including parts of the CBD and parliamentary precinct). WE* have limited capacity in their network to transfer load from Central Park to either Wilton or Kaiwharawhara.

The Central Park supply configuration is shown in Appendix A. It provides full N-1 security under a normal (all in-service) grid configuration. There is no 110 kV Bus at Central Park (removing either a circuit or transformer therefore reduces security) and the three transformers are not equally sized, providing different N-1 Security load limits depending on the in-service equipment combination.

During outages (planned or unplanned) of a single circuit or transformer supplying Central Park, a Special Protection Scheme (SPS) is installed to manage post-contingent loading on the remaining transformer. The scheme will trip WE* feeders sequentially until the Central Park load returns back below specified limits, maintaining supply to the majority of customers. With this scheme in place, full N-1 Security is provided where the total load at Central Park is below 112 MVA (in cases where CPK-T3 or T4 is the last remaining supply transformer) or 150 MVA (where CPK-T5 is the last remaining supply transformer).

This equates to the provision of N-2 Security to Central Park for approximately 83% of all half hour trading periods (based upon 2019 load data) and reflects the criticality of this GXP as a supply point. Once supply to Central Park is reduced to a single circuit or transformer, the entire load is placed on N Security.

1.2. Transmission Network Security

Transpower operates the transmission grid in accordance with its regulatory obligations. These obligations include managing grid security, including provision of adequate pre and post-contingent supply capacity.

A paper written for the Electricity Authority's Security and Reliability Council, "[Transmission Security: Introduction to Concepts and Governance](#)" provides a good summary of the regulatory regime under which Transpower operates and how Transpower manages its obligations.

Transpower is meeting grid security of supply obligations to Central Park. Further re-enforcement of supply does not strictly meet the relevant regulatory tests. Transpower and WE* have been working to progress investigations about providing additional supply capacity. Investment would require community consultation by WE* (as the party who would be responsible for the costs).

2. Central Park – Wilton B Reconducting Project

The CPK–WIL–B line is a 12.5km 110 kV double circuit line from Wilton to Central Park. The line crosses some challenging terrain, including the hills and valleys of the western suburb of Karori before it re-enters the urban environment via Zealandia. Some sections of the line are built to a 110 kV construction, while others are built to a 220 kV construction. It was strung with duplex Zebra conductor for all but the final five spans into the Central Park, which are strung with a simplex Chukar conductor.

The line is in a highly corrosive environment due to airborne salts from the nearby coast and a conductor condition assessment determined that the Zebra conductor sections required replacement. An engineering investigation determined the preferred option was to replace the Zebra with simplex AAAC Sulphur.

2.1. Central Park – Wilton B Reconducting Project Planning

Reconducting works involve the removal of the existing conductor and its replacement with new conductor. For worker safety, the circuit must be isolated (disconnected from the energised grid) and earthed (connected to earth).

The need for circuit outages and the network configuration meant that at various times, West Wind would have periods of N Security and Central Park would be on reduced security. Works were planned so that there would always be two circuits and two transformers supplying the Central Park load and works were timed to be completed when the Central Park load would remain below the 112 MVA limit.

Construction and Delivery Planning

Delivery planning for the project divided the reconducting into four viable runs (A, B, C & D), splitting each circuit into two runs at tower 14, as shown in Appendix A.

The spans within these runs all had common outage requirements and allowed the most efficient completion of work on site, allowing Transpower to optimise resourcing and minimise the number and duration of outages. It also allowed for N-1 Security to be maintained to West Wind during runs B and C.

The construction programme was prepared with float days to allow for possible work interruption due to adverse weather. Planned outage durations could be reduced if progress and circumstances allowed.

As part of assessing the constructability of the works, an engineering assessment of conductor swing behaviour was undertaken. This considered steady-state operating conditions (i.e. all conductors moving together in the wind) and did not identify any problems with the different conductors being strung on the same tower. Dissimilar conductor swing behaviour was not considered during project planning. Transpower had previously successfully undertaken very similar works (reconducting double circuit towers with dissimilar conductors, including duplex and simplex arrangements) without incident and this work was expected to be consistent with that past experience.

Supply Risk Management

The reduced grid security to parties connected to the Central Park – Wilton lines meant that detailed project risk management plans were prepared. These covered activities to reduce the probability of a fault (and subsequent tripping) occurring and mitigation of the consequences should one occur.

Preventative activities (to reduce the risk of tripping) undertaken included:

- A review of maintenance and inspection records for both lines and all Central Park transformers, to identify any known defects or incidents.
- A review of any recent Thermography surveys carried out on CPK, WWD and WIL 110 kV substation equipment, and completion of new thermographic inspections as required
- Preparation for the temporary arrangement – T3/T4 supplied from CPK-WIL-1 if required (in the case of T5 permanent fault); including obtaining materials and providing protection setting files.
- Avoiding outages during the period when CPK load could exceed 112 MVA
- A review of the plan for SPS testing – which was arranged as required

Operational measures were also undertaken to minimise risks once works had commenced, including;

- Long range weather forecasts monitored leading up to and during each outage
- Central Park and Wilton temporary hazard board communicated the works being undertaken and the restrictions to all equipment associated with T3, T4, T5 and CPK-WIL-1 and CPK-WIL-2/3 (as required)
- Signs were placed on Central Park and Wilton protection panels indicating “No work to be carried out on in service equipment associated with CPK T5 and T3/T4 and CB152 and Circuit 2 / Circuit 3” (as required)
- Reference to Transpower GP020 Significant Event Operational Contact Guidelines for coordination with WE*
- Project communication plan developed for progress updates and emergency response.
- To minimise the impact of a contingent event, WE* planned to shift 2MW load from CPK to WIL via the 33kV network, with a further 12MW possible subject to network conditions

2.2. Conductor Swing Hazard Identification and Management

The reconducting of run A had been successfully completed, with work having commenced on run B. On 27 February it was identified that the conductor spans between towers 22 and 23 were at risk of clashing or flashing over under particular wind conditions. The grid configuration when the hazard was identified is shown in Appendix B. The two different conductors (the aged Zebra conductor strung on one side of the tower and the new Sulphur conductor on the other) were observed to have a differential swing pattern in certain winds. Instead of swinging in the same direction at the same time (although to different magnitudes due to their different weights, tensions and wind areas) they were observed in some instances to swing dissimilarly (out of phase or one moving prior to the other), compromising clearance between the adjacent circuits. This necessitated work to be halted due to the hazard posed to workers.

Analysis identified this conductor swing hazard would only occur on the long spans of runs B and C. The affected spans had very unique properties making them susceptible to this kind of behaviour, including crossing a valley that channelled wind onto the conductors, the spans are perpendicular to the prevailing

winds so the wind acts upon the largest possible conductor surface area, the conductor spans are very long (871m) when compared to general 110 kV span lengths (closer to 300m) and this section of the line is built to 110 kV construction, with smaller clearance between conductors. The remaining reconductoring on runs B and C could not be completed without a double circuit outage, removing CPK-WWD-WIL-2 and 3 simultaneously, placing Central Park on N Security. The reconducted run A and subsequent reconductoring of run D would not be affected.

2.3. Drivers for Project Continuation

The stage at which the project was halted meant that N-1 Security could only be maintained to Central Park until the end of April. After this time the load would increase above the 112 MVA limit and full N-1 Security could only be maintained through winter with all three circuits in service. This provided a key driver for project continuation prior to the end of April.

A second key driver was resource availability. Work crews capable of completing this reconductoring task are limited in number and are heavily committed by Transpower and other network owners. Should work not be able to recommence and finish as expected, these resources would become unavailable.

2.4. Delivery Optioneering

Delivery optioneering was used to identify alternative ways the reconductoring could be delivered within the new constraints. All options required a double circuit outage (or outages) in various forms to facilitate the reconductoring of runs B and C as shown in Appendix C.

The project team considered eight different options. Each option was assessed against several criteria including outage requirements (specifically how long Central Park would be on N-Security); recall times to restore supply should a fault occur on the CPK-WIL-1 circuit; additional design, engineering and materials requirements; any specific challenges identified with the solution; the advantages of the solution; and the effect on the project programme. All eight options required run D to be deferred beyond the planned June project completion date.

The selected option reduced the time Wellington was on N Security, minimised circuit recall time, returned all three circuits to service prior to the winter load increase, and did not require any changes to the design or require procurement of additional materials. It was the lowest risk option to deliver the outstanding work.

3. Reduced Security Management

3.1. Additional Risk Mitigation

Substantial risk mitigation had already been completed as part of the original project planning. This was reviewed given the changes to project delivery, with particular attention paid to re-developing the contingency plan should the CPK-WIL-1 circuit trip during the double circuit outage.

A new contingency plan was developed that specifically accounted for the various activities to be undertaken during the delivery of runs B and C. It included actions for the various different contingencies, identified resource and material requirements to restore supply and identified likely return to service times. Crucially this plan included detailed resource planning, ensuring that adequate lines resources would remain available throughout the delivery period to respond post-fault. This substantially reduced restoration times. Depending on the fault, restoration times varied between 90 minutes and 6 hours (for a worst-case fault, requiring supply to be restored by one of the outage affected circuits, allowing for the restraining of conductors and installation of jumpers at two locations). Asset condition and risk was again assessed to ensure there were no known defects or hazards leading into the outage.

3.2. Customer and Stakeholder Communication

Once the conductor clashing issue was identified and quantified, it was raised with WE*. This included a conversation at CEO level around the first week of March.

An initial communications plan was drafted by 7 March and this was socialised for comment and input with WE* on 8 March. The plan was drafted assuming a low-key approach to key stakeholders including the Wellington City Council Mayor and CEO; Ministers (State Owned Enterprises, Finance and Energy and Resources) and officials; Wellington Regional Emergency Management Office (WREMO) and communication to key WE* customers.

The basis for this plan was a previous project in Hamilton where a similar load was on N Security for an extended period of time. A meeting with WE*, which also included officials from the Commerce

Commission (11 March), helped finalise aspects of this plan. Importantly the question of a wider communication to media and the general public was discarded on the basis that it would highlight a vulnerability that could be exploited by those seeking to be disruptive. This was informed by the Wellington City Mayor and WREMO who advised against this kind of communication.

By 11 March, Transpower had communicated with the key stakeholders and was working with WE* on their communication to key customers. Communication to customers was sent out on 13 March – which included letters from WE* and Transpower. Transpower responded to a few queries from customers seeking more detail and the likelihood of an outage.

WREMO also sought a more specific briefing on the event and this was undertaken on 15 March. They wanted to understand the planning Transpower had undertaken and the mitigation measures in place to reduce the potential for, and consequence of any outage. They were comfortable that the risks were being managed, and that no further action would be needed in terms of further notification. There was an understanding that Transpower as the grid owner and system operator is well versed in managing outage risk and contingency planning and that it was doing all it could together with WE* to minimise an outage risk and the severity of one should a fault occur.

Their advice at that time was that further notification to organisations like the Police would not be warranted – on the basis they are more operationally focused. Subsequent to the 15 March event in Christchurch, and questions raised around ongoing security threats, Transpower formally notified the Acting District Commander for Wellington.

During this time, Transpower was also contacted the Commerce Commission, Electricity Authority and MBIE around our communications planning which were duly responded to.

4. Outcomes Review

Following the successful completion of this part of the project, Transpower reviewed several elements of the project to identify opportunities for improvement and collaborated with WE* to better understand their needs and those of their customers.

4.1. WE* Workshops

Transpower and WE* facilitated two workshops to capture learnings from the event and help to define how similar situations would be managed in future. One workshop was a lessons learned workshop, focussing on learnings from our interactions and coordination as electricity network operators. The second was a security of supply insights workshop hosted by WE* with key Wellington stakeholders (major or significant customers connected to the WE* network).

Lessons Learnt Workshop with WE*

This workshop was internally focussed, looking at how the N Security challenge was managed between Transpower and WE*. It was a constructive forum allowing each organisation to understand what went well from both perspectives and where improvements could be made. The workshop provided insights as to how the two organisations could work together in the future. Key themes from this workshop were:

- Communication and collaboration at operational levels are good and facilitate positive customer outcomes. Provides a model for other parts of the businesses. Overall collaboration was both forthcoming and valuable
- Involving the customer (WE*) earlier in project risk discussions will allow them to be better informed and prepared should a project risk eventuate.
- Completion of optioneering (to resolve the problem) with WE* involved from the start would both expedite a decision and develop a shared understanding of the problem and solutions
- Distribution Network Providers are the voice of the customer; they better understand their customers' needs and when escalation is required
- Establishing an authority to act, as part of cross-entity risk management plans will expedite the process.

Transpower and WE* were able to take learnings from the workshop that will ensure future events are better managed.

Insights Workshop with WE* and Customers

This workshop was hosted by WE*, with invitation extended to key WE* customers responsible for maintaining essential services, utilities and infrastructure (as defined by the region's emergency management plans) as well as organisations representing residential consumers and businesses. Transpower attended to hear the stakeholder feedback and gain an understanding of consumers' expectations of grid security.

The workshop provided customers with the context related to the security of their electricity supply, how both WE* and Transpower have built redundancy and resiliency into their network, demonstrated the volume of planned and unplanned outages experienced by our collective customers and then gauged the level of information these customers require to help manage and mitigate the loss of supply risk within their own business or organisation.

The workshop was well attended and had a broad range of attendees representing a variety of end consumers. Participants asked a variety of questions throughout the presentation, demonstrating differing levels of understanding of the electricity system, how maintenance and unplanned events are managed, grid security considerations and business resilience. This indicated that future education of some customers and sectors may assist in increasing both understanding and resiliency.

Transpower and WE* also posed participants a series of questions related to how instances of reduced grid security (such as N Security) might be communicated. This was to gauge both the interest in this information generally (i.e. do customers want to know about reduced security), the method by which they would like to receive information (e.g. self-service notifications, opt-in communications, emails) and the types and magnitudes of risks they wished to be informed about. These responses were generally consistent, with the following themes emerging;

- Participants wanted to be able to access information about abnormal risks to their supply
- Participants wanted to be able to self-select the types of events and risks they receive information about, allowing them to tailor information to their specific needs
- Participants favoured an opt-in notification system, driven electronically.

This information will be used to frame future communications in the WE* supply area and inform conversations with other Distribution Network Providers.

4.2. External Communications Policy Review

Transpower revised its External Communications Policy to incorporate learnings from the various workshops and consultation. This specifically included the addition of a new section addressing "Significant Risk to Supply", which covers instances where major urban areas are placed on N Security. It provides a set of criteria that defines when Transpower must collaborate with the Distribution Network Provider over the need for wider community consultation. This inclusion is to reflect stakeholders' increasing desire to understand more in regard to the impact of significant Transpower outages, whilst recognising not all Distribution Network Providers wish to communicate this information for every N-security situation.

The Policy has been written to acknowledge each situation is unique and that the Distribution Network Provider is best placed to determine what their community may want (i.e. to consult or not). This gives flexibility to allow different communications strategies to be applied for different Distribution Networks or different community groups within a Distribution Network, reflecting local customers' needs (for example criticality, resilience) and the regularity with which customers are placed on N Security (both from a distribution and transmission standpoint).

Transpower and WE* have collaborated to develop a specific protocol for outages impacting WE* supply points. The protocol includes trigger points around when it would be activated and roles and responsibilities. These are well advanced and will be finalised imminently.

Since the implementation of the revised Policy, Transpower has held discussions with five Distribution Network Providers when planning N Security outages. Four of the five have indicated they do not want to communicate N Security outages to their communities. The fifth has provided an initial view that aligns with the others, but more internal discussion is required before a final position is taken.

This shows the divergent views of the Distribution Network Providers on the need to communicate instances of reduced network security to their communities. Transpower will continue to engage with Distribution Network Providers as and when required under the revised Policy.

Transpower is also examining ways to make outage information publicly available on our website. Industry outage information is available on POCP, but this tool is not suitable for general consumers. As an interim step, major stakeholders are able to access the POCP tool to obtain any information they require.

4.3. Technical Review

The dissimilar swing behaviour of the conductors was unexpected and had not been experienced by Transpower before. We are unaware of this behaviour being experienced by our international peers. We have posed this question as part of our technical review (including through CIGRE contacts) and all responses have been consistently negative. Peer organisations indicate they are generally able to undertake double circuit reconductoring works with both circuits de-energised, reflecting the higher level of redundancy built into their networks. A technical review is underway investigating this instance and the phenomena in general to develop strategies to identify instances where similar projects may be impacted by this behaviour in future. If this can be identified as a hazard during the project planning phase, the impacts can be communicated and designed for or managed earlier, alleviating many of the challenges that arose in this project.

The review has two components - standard assessment requirements and dissimilar conductor monitoring.

Reconductoring Project Assessment Standard Requirements

Engineering Teams have developed first cut standard assessment parameters that can be applied to future reconductoring projects where stringing of dissimilar conductors is considered. This will allow a high-level assessment of the spans involved to determine if a project is at risk of differential conductor swing. If it is identified, a more detailed engineering assessment will be required to determine if the differential swinging will result in conductor clearance or flashover hazards and what measures can be put in place to manage or eliminate the risk.

Dissimilar Conductor Monitoring (LineVision)

A detailed conductor monitoring system, using Laser Survey technology, has been setup on a conductor span elsewhere on the CPK-WIL-B line. The monitored span has similar characteristics to that where the differential swinging was first observed. This monitoring is intended to inform future modelling. The ability to accurately model conductor behaviour will inform the need for control measures, such as double circuit outages into the future.

5. Conclusions and Observations

The ultimate project outcome was satisfactory, the reconductoring works were completed safely, without an outage to Central Park supply. The path by which it was achieved would benefit from improvement.

Transpower, Service Providers and WE* worked together to resolve an unexpected and significant challenge. A solution was determined, evaluated and communicated to customers and communities effectively. The feedback on the communication was positive, with stakeholders having confidence in Transpower's ability to manage the risk to prevent outages and respond effectively should the worst eventuate. The future challenge is ensuring Transpower engages effectively and early with customers to collaborate with them to manage risks to grid security.

In this instance WE* were not effectively engaged early enough in the process delaying action while Transpower and WE* revisited Transpower's plans to arrive at a common understanding of the problem, its solution and how it would be communicated. Transpower acknowledges this is a priority area for improvement and work is well progressed in improving these areas. Two changes underway will address this, as noted below.

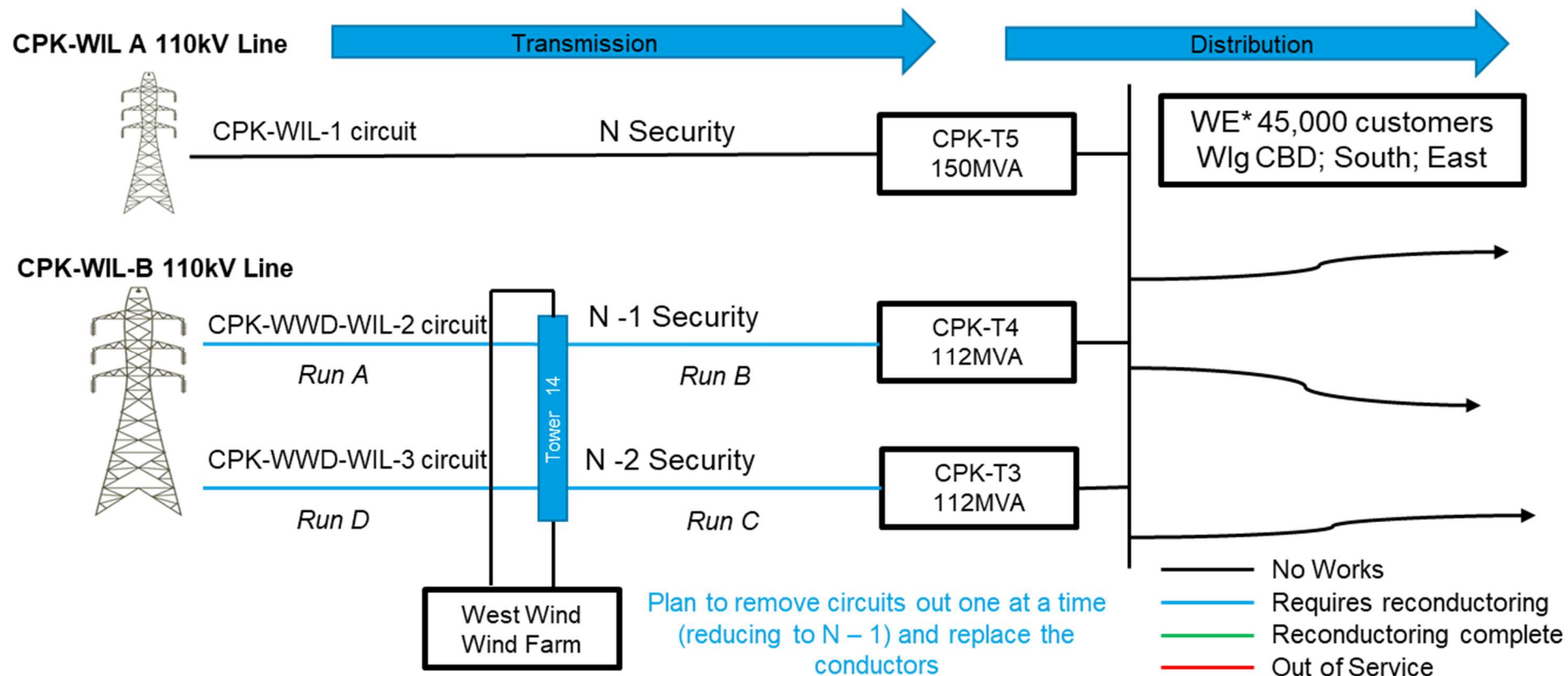
The changes made to the External Communications Policy have placed an obligation on Transpower to engage with Distribution Network Providers when a significant risk to supply will occur. This will ensure Transpower is communicating with customers (at an appropriate level) and collaborating with them to determine what, if any, community communication is required. Transpower will develop protocols with individual Distribution Network Providers (where they wish to do so), which will more explicitly state what is required when significant risk to supply will occur. This allows both parties a clear understanding of the roles, responsibilities, actions and authorities required to manage these events in the future.

Transpower is developing a Customer Engagement Plan which aims to ensure customers are engaged earlier in planning processes (amongst other things) on the need for a project, rather than at the outage

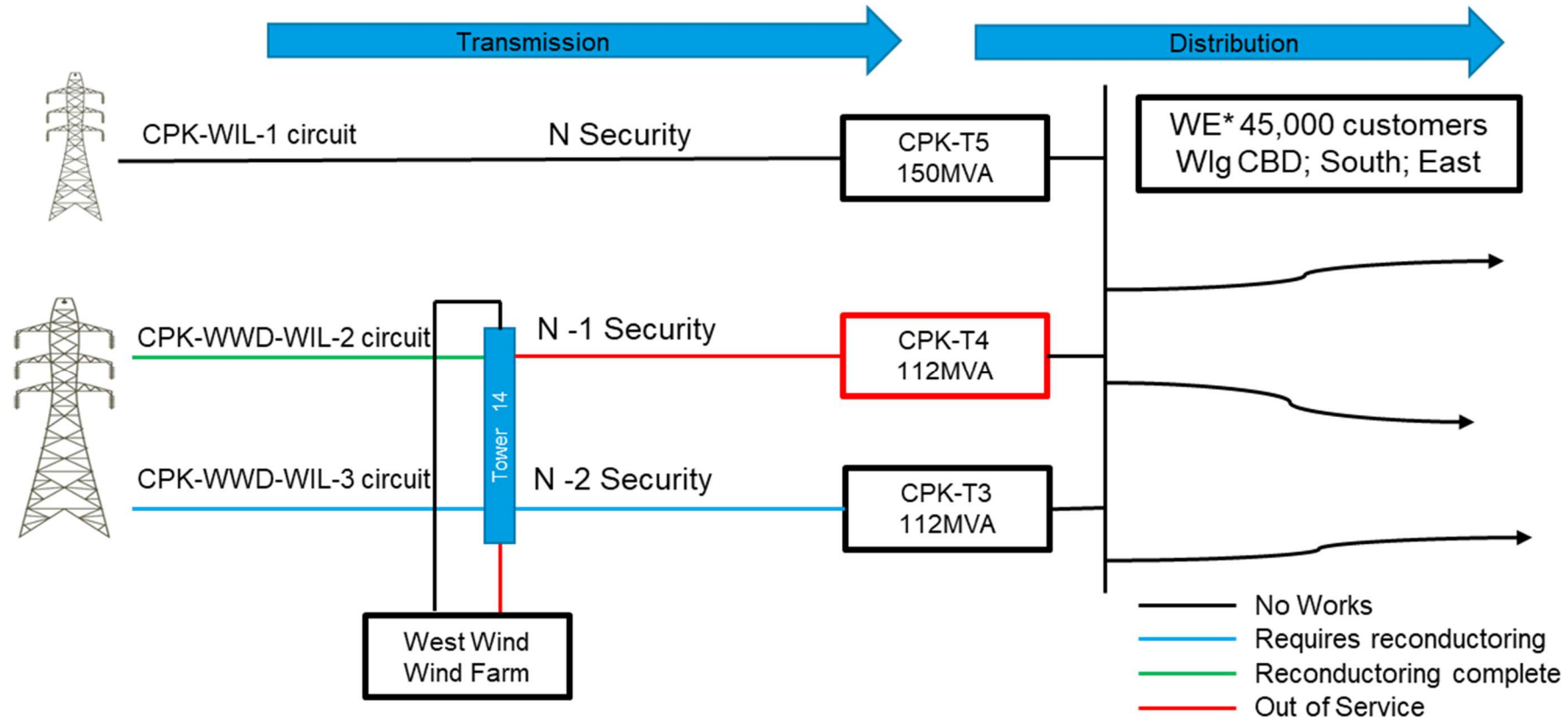
planning stage. It aims to improve engagement at all levels of Transpower, ensuring customers are engaged on matters that impact them early, regularly, meaningfully and as partners.

Finally, a technical review is underway investigating dissimilar conductor swing behaviour to determine the exact causes and develop strategies to identify instances where similar projects may be impacted by this behaviour in the future. If this can be identified as a hazard during the project planning phase, the impacts can be identified, communicated and designed for or managed earlier, alleviating many of the challenges that arose in this project.

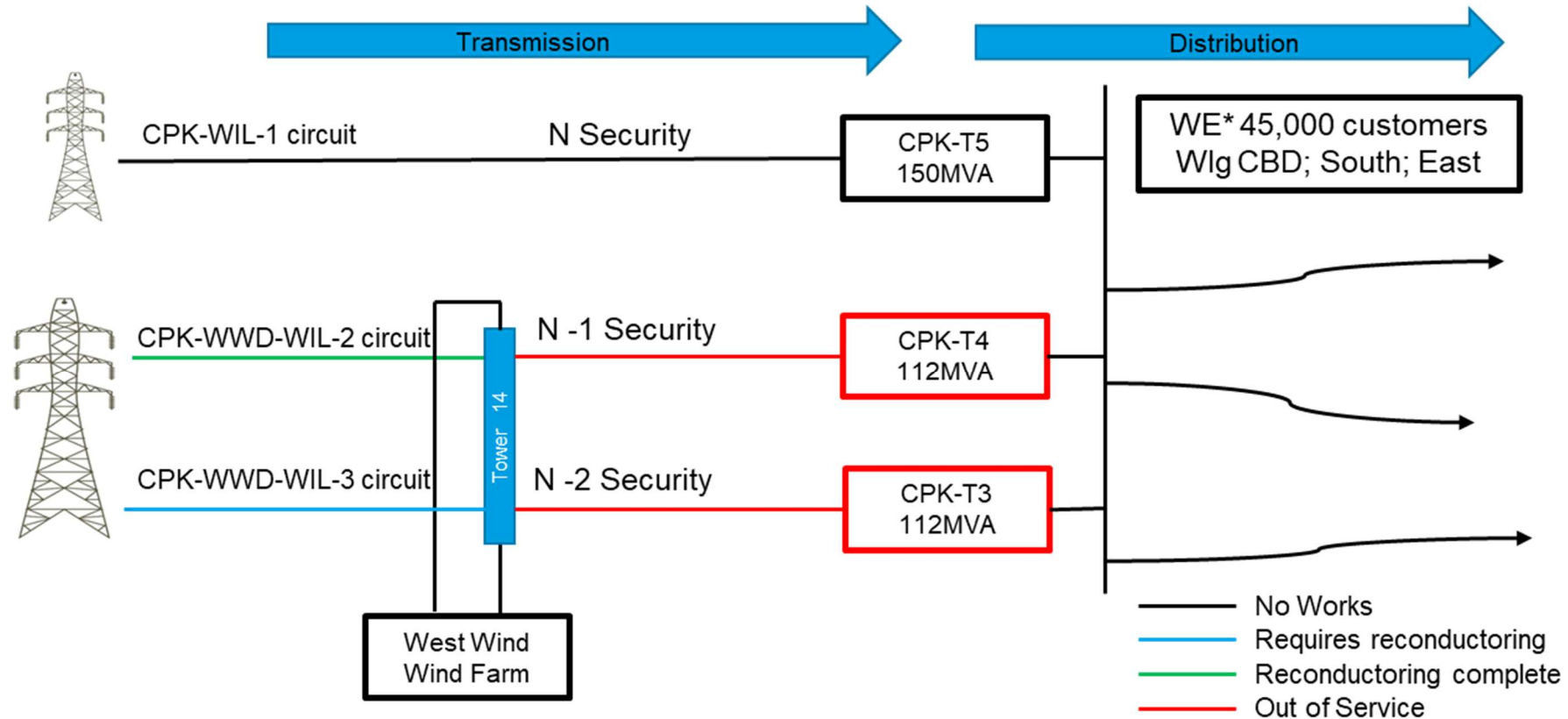
Appendix A: Central Park Supply Configuration



Appendix B: Grid Configuration when Hazard Identified



Appendix C: Grid Configuration required to manage Hazard



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03 March 2020

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Dear Sue and Brent

Update on communications to stakeholders about increased outage risks

In further response to your joint letter dated 26 March 2019 we would like to update you on the review (committed to in our initial response letter dated 11 April 2019) of our communications procedures for prolonged N-Security situations, similar to that which occurred at Central Park Substation during March and April 2019.

Transpower and Wellington Electricity met in September 2019 to discuss current procedures and the need to amend them on the basis of the size, scale, duration and likelihood criteria which might initiate the need for wider communication with stakeholders.

The situation which led to the Central Park event was also reviewed at a technical level so that the risk which at the time was unforeseen could be accounted for in future reconductoring work planning. Therefore prolonged N-security events can be mitigated through better planning, by adopting further risk controls.

Stakeholder Communications Workshop

Wellington Electricity have also facilitated a community workshop in December 2019 with public representatives and key stakeholders so we could engage and discuss the notice periods they would expect and require in order to prepare their businesses ahead of a developing N-security situation. Transpower attended the workshop so they could receive the feedback from consumers on expected security levels.

Invitees to the workshop included organisations responsible for maintaining essential services, utilities and infrastructure (as defined by the region's emergency management plans) as well as organisations representing residential consumers and businesses.

The workshop took stakeholders through:

- an overview of the transmission and distribution networks
- a definition of N-Security and the situation which prompted the need for the workshop
- a forward view of planned transmission network maintenance which may result in N-security situations
- a summary of resilience initiatives planned to improve restoration timeframes in response to major weather and earthquake events; and
- a session where they could discuss and express if, when and how they would like to be communicated with in relation to N-security events.

To summarise feedback from the workshop, participants were highly engaged over the reduced security situation. They want to be informed about forecast and unplanned N-security situations and use their own discretion as to which events are of sufficient concern to prompt their own electricity outage response plans. Participants expressed interest in a future system which would allow them to register for automated communications and if possible, to filter for the criteria which would trigger a communication to them.

Communications Protocol Update

As a result, Wellington Electricity and Transpower have updated the communication protocol for Central Park, which includes escalation processes and how stakeholders will be informed, as follows:

Event Triggers

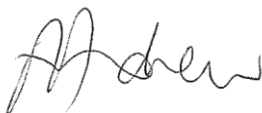
- when Central Park (being significant load >75 MW), is placed on N security for more than 24 hours continuously during weekdays; and
- the Recall time is more than two-hours.

Actions

- awareness of the security situation will be raised to CEO level in our companies;
- a contingency and Risk Mitigation Plan will be put in place; and
- Transpower will summarise the issue via a letter to Wellington Electricity who will forward to critical stakeholders.

We continue to work on ways to improve communications to end consumers.

Yours sincerely



Alison Andrew
Chief Executive
Transpower



Greg Skelton
Chief Executive
Wellington Electricity