

BEFORE THE HEARINGS PANEL

Under the Resource Management Act 1991

In the matter of

The Proposed Waikato District Plan - Hearing 22 Infrastructure

Between

Waikato District Council

And

**Transpower New Zealand Limited (Submission S576 and
FS1350)**

**Statement of Evidence in Chief of Dougall Campbell for
Transpower New Zealand Limited dated 29 September
2020**

Executive Summary

1. Transpower New Zealand Limited (**Transpower**) operates the National Grid, which transmits electricity throughout New Zealand. The National Policy Statement on Electricity Transmission 2008 (**NPSET**) requires the National Grid to be appropriately recognised in the Proposed Waikato District Plan (the “Proposed Plan”). The Proposed Plan must give effect to the NPSET.
2. This means that the Proposed Plan must include provisions to recognise and provide for the national significance of the National Grid, manage the effects of the National Grid, and manage effects of the National Grid. Transpower adopts a thorough and systematic approach to planning for and establishing new National Grid assets. While a resilient National Grid remains at the heart of New Zealand’s energy future, climate change has become a central issue for governments globally and hence for Transpower as a responsible owner and operator of the National Grid on behalf of New Zealanders.
3. With regard to managing the effects of land use and development on the National Grid, corridors around the National Grid are necessary to:
 - a) Ensure the network can be efficiently operated, maintained, developed and upgraded by providing the working and access space to do this;
 - b) Manage reverse sensitivity effects;
 - c) Ensure sensitive activities are generally not provided for in the area directly under lines; and
 - d) Protect the safety of both the National Grid and people working or living close to it.
4. Transpower’s approach to NPSET implementation is to ensure that it only seeks the minimum district plan restrictions necessary to ensure the NPSET is given effect. Under this approach, Transpower seeks different size setbacks depending on the asset type (for example whether it is on poles or towers). Activities are considered very specifically, so that only

those activities which have a real potential to compromise the integrity of the Grid are sought to be non-complying, with everything else permitted (except subdivision and certain earthwork activities).

5. Transpower wishes to see appropriate planning provisions included in the Proposed Plan to ensure that Transpower is able to develop, upgrade, operate, and maintain the National Grid to enable a sustainable, secure and reliable supply of electricity to the Waikato District and nationally.
6. Transpower considers that the amendments and additions set out in **Ms Whitney**'s evidence will best give effect to the objective and policies of the NPSET. **Ms Whitney** supports many of the recommendations within the s42A report but seeks some amendments to give effect to the NPSET and the Regional Policy Statement. I concur with the amendments sought in **Ms Whitney**'s evidence.
7. The provisions Transpower seeks in Waikato District are generally consistent with the provisions Transpower seeks elsewhere around New Zealand to give effect to the NPSET.
8. The corridors sought in the Proposed Plan align with the matters in Policies 10 and 11 of the NPSET. The provisions are not consistent with the corridors Transpower seeks for new build (i.e. a new line and associated assets). For new build, Transpower seeks a much wider and more restrictive corridor – that generally coincides with the maximum swing of the line. A main reason for this is that new builds are typically designated with property rights secured.
9. In addition to the health and safety risks of activities occurring near the National Grid assets, activities can also directly compromise the ability for Transpower to operate, maintain and upgrade its assets through restricting access or adverse effects on the Grid assets themselves. Transpower experiences a range of reverse sensitivity effects from those who carry out activities or wish to develop land near its assets. These complaints are, for instance, about visual or noise effects or effects on agricultural operations. A particular focus is also on restricting sensitive activities within proximity of the assets given the increased exposure and

electrical hazard risk such activities are subject to and increased risk of harm and incidents. Restriction of sensitive and incompatible development near the lines will reduce the likelihood of reverse sensitivity effects, harm to people, as well ensuring security of supply.

10. Subdivision sets the framework for land use going forward, and careful regulation of subdivision can prevent the creation of unusable (or severely constrained) lots. Well-designed subdivision can also ensure:
 - a) sufficient vehicle access to, and working space around, National Grid assets;
 - b) design and orientation of buildings to reduce the likelihood of reverse sensitivity effects;
 - c) landscaping or horticultural plantings planned as part of the subdivision that will not adversely affect the National Grid; and
 - d) the land (new lot) can be developed (i.e. accommodate a dwelling or commercial operation) and used in a way which maintains safe separation distances.
11. Earthworks can have a range of effects on the National Grid and should be regulated by district plans. The New Zealand Electrical Code of Practice for Electrical Safe Distances (**NZEC34:2001**) does not protect working and access space near National Grid assets and cannot be relied upon to give effect to the NPSET.

Introduction

12. My full name is Dougall James Campbell. I am the Environmental Policy and Planning Group Manager at Transpower. My relevant experience, qualifications, and commitment to comply with the code of conduct for expert witnesses are included in **Appendix A**.
13. I confirm that I am authorised to give this evidence on behalf of Transpower.

Scope of Evidence

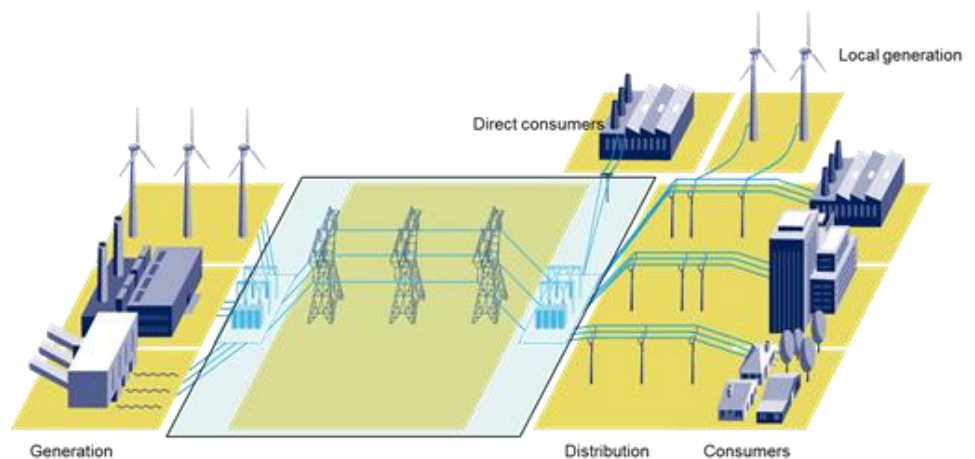
14. My evidence will address the following:
 - a) Transpower and the National Grid;
 - b) Transpower's assets within Waikato District;
 - c) Transpower's process for establishing new National Grid assets;
 - d) Effects of, and on, the National Grid, including earthworks, buildings and structures, sensitive activities, hazardous facilities, mobile plant, and subdivision;
 - e) The New Zealand Electricity Code of Practice for Safe Distances 34:2001 (NZECP34:2001);
 - f) Transpower's approach to National Grid Yards and Corridors;
 - g) Transpower's approach to implementing the NPSET; and
 - h) Conclusions.

Transpower and the National Grid

15. Transpower is a State-Owned Enterprise that plans, builds, maintains, owns and operates New Zealand's high voltage electricity transmission network – the National Grid (or "The Grid"). The Grid links generators to distribution companies and major industrial users. It extends from Kaikohe in the North Island down to Tiwai in the South Island and carries electricity throughout New Zealand.
16. New Zealand has become increasingly dependent on electricity. It is an intrinsic part of living and working in the 21st century. Electricity now accounts for about 25% of all energy used in New Zealand. Each year, \$5 billion worth of electricity is traded on the wholesale electricity market. Transpower, whose main role is to ensure the delivery of a reliable and

secure supply of electricity to New Zealand, has a fundamental role in the industry and in New Zealand's economy.

17. Transpower is not a generator of electricity and has no retail sales of electricity. It can be considered to be a 'freight company' for electricity, in that it carries bulk electrical energy from where it is generated by companies such as Contact Energy, Mighty River Power and Genesis to the local lines distribution companies (e.g. Waipa Networks in Waikato) and some major users of electricity (e.g. Marsden Point Oil Refinery, NZ Steel at Glenbrook and Tiwai Point Aluminium Smelter).
18. Transpower also manages New Zealand's power system in real time. In its role as System Operator, Transpower operates the electricity market to ensure electricity transmitted through the Grid is delivered whenever and wherever it is needed, 24 hours a day, seven days a week.
19. Transpower's main role is to ensure the reliable supply of electricity to the country. Transpower plays a significant part in New Zealand's economy, with all major industries, cities and communities being reliant on a secure and reliable supply of electricity.



Source: Electricity Commission, *Electricity in New Zealand*, 2009

Figure 1: Electricity industry in New Zealand

20. As a State-Owned Enterprise, Transpower's principal objective is to operate as a successful business. It must operate within certain legislative constraints and report regularly to its shareholding Ministers.

Transpower is required to deliver and operate a National Grid that meets the needs of users now and into the future.

21. One of Transpower's key objectives therefore is to maintain and develop the National Grid, which contributes to New Zealand's economic and social aspirations. This objective is reflected in the single objective in the NPSET.
22. Prudent investment in the Grid, long term transmission planning strategies, and developing technologies are crucial to ensure the most can be made from existing infrastructure. Proper maintenance and access to the Grid is essential in order to defer the need for new lines and substations and to create better options for when new build is required; this will, in turn, help to limit the cost and environmental footprint of the National Grid for future generations.

The National Grid

23. The National Grid comprises some 12,000 km of transmission lines and around 166 substations across the country. This is supported by a telecommunications network of some 300 telecommunication sites, which help link together and communicate with the components that make up the National Grid.
24. The Grid comprises a high voltage backbone which runs the length of the country and links major generation (such as the geothermal power stations near Taupō) to major loads in the main cities. The bulk of the Grid backbone was built around 60 years ago and comprises most of the 220 kilovolt (kV) lines throughout New Zealand, along with the High Voltage Direct Current (HVDC) link between the North and South Islands.
25. Connected to this Grid backbone are regional Grid lines (also owned or operated by Transpower) which connect smaller generation stations and supply regional communities. In the Waikato region, transmission lines traverse the countryside and link substation sites in order to get electricity to the main centres (e.g. Cambridge) and to some smaller centres where the electricity load is then transferred to the local distribution networks.

A district map showing National Grid substations and transmission lines is included in **Appendix B** to Transpower's submission and a copy is attached to this evidence.

26. The Grid is an interlinked network. Electricity flows along transmission lines via lines supported by towers (pylons) or poles and can vary in any instant, depending on actual generation at power stations and the demand for electricity across New Zealand. As System Operator, in operating the electricity market, Transpower uses real-time information about electricity use by consumers and electricity generation available from generators to balance electricity demand and supply, ensuring optimum performance of the network.
25. The National Grid provides connectivity between all sources of generation and consumers. Without the National Grid, consumers across New Zealand would be dependent on locally generated electricity which would be more expensive and less reliable. As such, the National Grid plays an important role in the sustainable management of natural and physical resources.

Transmission Tomorrow

27. Transpower's 2016 publication "Transmission Tomorrow" (updated in 2018) sets out Transpower's strategy for the future development of the Grid for the next 30 years and beyond. Transmission Tomorrow documents Transpower's view that there is an enduring role for the National Grid. Transpower's lines and substations will be required for many years into the future to power the economy while enabling New Zealand's continued reliance on renewable forms of electricity generation, including from the power stations along the Waikato River, and the new geothermal stations commissioned near Taupō.

New Zealand's Paris Commitment and Decarbonisation

28. In early 2018 Transpower published its white paper "Te Mauri Hiko – Energy Futures" (Te Mauri Hiko). This project closely examined a range of electricity supply, demand and future technology scenarios and began exploring what will be required for New Zealand to maximise the potential

of the energy opportunity it is facing, including meeting its Paris Climate Accord commitments. Greenhouse gas emission reduction targets were agreed by New Zealand at the 2016 Paris Climate Accord and have been translated into climate policy via the Climate Change Response (Zero Carbon) Amendment Act 2019.

29. An updated strategy underlining the need to decarbonise New Zealand's economy, *Transmission Tomorrow*, was published in 2018. *Transmission Tomorrow* sets out how Transpower will go about planning and the developing the transmission system as demand for electricity increases as the transport and process heat sectors are electrified, and as new renewable generation is added to the system.
30. Since then Transpower has released a further document "Whakamana i Te Mauri Hiko – Empowering our Energy Future" which sets out a blueprint for how New Zealand might get to a zero-carbon future. It is consistent with the findings of both the Interim Climate Change Committee and the Productivity Commission that the greatest opportunities for emissions reductions outside of agriculture lie in the energy sector; specifically around increasing the proportion of renewable electricity in the system and the electrification of emissions intensive transport and process heat sectors.
31. While a resilient National Grid remains at the heart of New Zealand's energy future, climate change has become a central issue for governments globally and hence Transpower as a responsible owner and operator of the National Grid on behalf of New Zealanders. Technology continues to advance rapidly. Electricity is increasingly positioned as an energy source for whole economies, rather than just homes and some business processes.
32. As the economy electrifies in pursuit of the most cost efficient and renewable sources, the Whakamana i Te Mauri Hiko base case predicts that electricity demand is likely to increase around 55% by 2050. Whakamana i Te Mauri Hiko suggests that meeting this projected demand will require significant and frequent investment in New Zealand's electricity generation portfolio over the coming 30 years,

including new sources of resilient and reliable grid connected renewable generation. In addition, new connections and capacity increases will be required across the transmission system to support demand growth driven by the electrification of transport and process heat. Simply put, New Zealand's electricity transmission system is the infrastructure on which our zero-carbon future will be built.

33. This work supports Transpower's view that there will be an enduring role for the National Grid in the future, and the need to build new National Grid lines and substations to connect new, renewable generation sources to the electricity network.
34. In terms of a brief summary, the National Grid:
 - a) Transports electricity across the country (connecting generation to consumers);
 - b) Supports New Zealand's national and regional economic growth;
 - c) Plays an essential role in maintaining reliability and security of supply of energy;
 - d) Provides a basis for investment decisions to be made by both suppliers and consumers of electricity;
 - e) Enables competition among suppliers and retailers of electricity, thereby providing the basis for competitively priced electricity;
 - f) Assists the development of new electricity generation technologies, including renewable energy, by providing access to markets;
 - g) Enables the electrification of transport and process heat, without which there is no way in which our Paris Agreement and net-zero carbon economy commitments can be met; and
 - h) Is predicted to play a key role in the decarbonisation of the economy.

Transpower's assets within Waikato District

35. The National Grid lines that traverse the Waikato District are:

- a) Huntly – Ōtāhuhu A 220kV transmission line (HLY-OTA A);
- b) Bombay – Meremere A 110kV transmission line (BOB-MER A);
- c) Meremere - Takanini A 110kV transmission line (MER-TAK A);
- d) Brownhill – Whakamaru North A 400 kV transmission line (BHL-WHN A) (Designated);
- e) Ōtāhuhu – Whakamaru A 220kV transmission line (OTA-WKM A);
- f) Ōtāhuhu – Whakamaru B 220kV transmission line (OTA-WKM B);
- g) Ōtāhuhu – Whakamaru C 220kV transmission line (OTA-WKM C);
- h) Huntly – Taumarunui A 220kV transmission line (HLY-TMN A);
- i) Hamilton – Meremere A underground 110kV transmission line (HAM-MER A CBL);
- j) Hamilton – Meremere A 110kV transmission line (HAM-MER A);
- k) Hamilton – Meremere B 110kV transmission line (HAM-MER B);
- l) Hamilton – Meremere B underground 110kV transmission line (HAM-MER-B CBL);
- m) Hamilton Deviation A 220kV transmission line (HAM-DEV A);
- n) Hamilton - Waihou A 110kV transmission line (HAM-WHU A);
- o) Huntly Deviation A 220kV transmission line (HLY-DEV A);
- p) Huntly – Ōtāhuhu A 220kV transmission line (HLY-OTA A);
- q) Hamilton – Karāpiro A 110kV transmission line (HAM-KPO A);
- r) Arapuni - Hamilton A 110kV transmission line (ARI-HAM A);
- s) Arapuni - Hamilton B 110kV transmission line (ARI-HAM B); and

- t) Te Kowhai Deviation A 220kV line (Designated).
36. In addition to the transmission lines, Transpower owns and operates the following facilities within the Waikato District, all of which are designated:
- a) Western Road Substation and Training Facility;
 - b) Huntly Outdoor Switchyard;
 - c) Meremere Switching Station;
 - d) Te Kowhai Substation; and
 - e) Ōhinewai Switching Station.
37. These assets are shown on the map in **Appendix A** to my evidence. The National Grid transmission lines cover a total of approximately 1,360km within Waikato District traversing approximately 1700 land parcels.

Transpower's projects in the Waikato District

Waikato and Upper North Island Voltage Management Project

38. Transpower are wanting to install series capacitors on the Brownhill to Whakamaru (BHL-WKN) circuits. This is necessary to support voltage compensation levels of 45% to maximise the reduction of transmission losses between the Central North Island and Auckland.

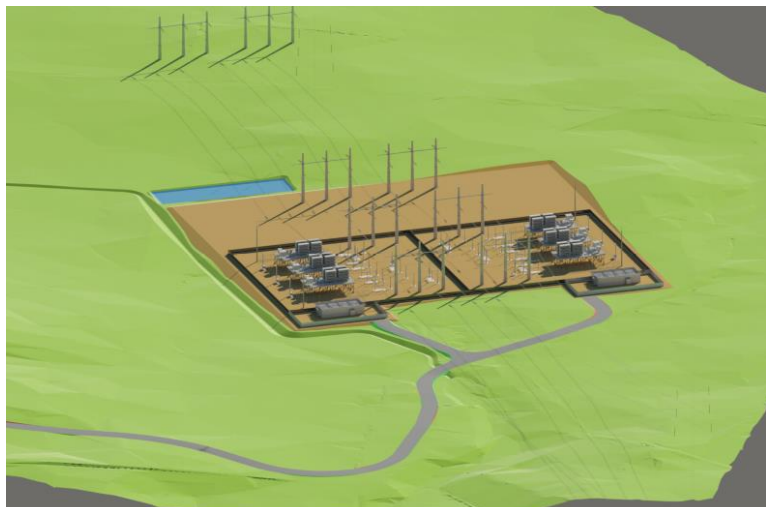


Figure 2: 3D Model of Series Capacitor

39. The BHL-WKN double circuit line is a critical supply link into the Auckland and Northland regions. The overhead line was constructed for 400 kV operation at 3,900 A (2,700 MVA). As part of the Waikato and upper North Island voltage management investigation, Transpower identified the need to install series capacitors on the Brownhill-Whakamaru circuits. The primary purpose of a series capacitor is to allow higher power transfer by reducing the impedance of the line which then reduces the voltage drop along the line, providing an increase in the static and dynamic voltage stability limits.
40. The series capacitor is planned to be installed under existing transmission lines on a new site near Morrinsville no earlier than 2025.

Establishing new National Grid assets

41. Since approximately 2005, when faced with the need to determine an appropriate route for the 400kV National Grid line between Whakamaru in the centre of the North Island and south Auckland, Transpower has applied a systematic methodology called the ACRE process for route identification for major new lines/stations projects. This methodology was developed, taking into account international best practice and the need for the method to be able to demonstrate that Transpower had given “adequate consideration to alternative sites, routes or methods of undertaking” the work proposed when seeking to designate land. It also provided a means of progressively assessing and seeking to limit adverse effects on the environment, consistent with the RMA.
42. The ACRE model is based on a progressive filtering approach, where increasing and more specialised detail is provided on environmental, property and engineering constraints throughout the process to enable the identification of a preferred easement/site. Following identification of the easement centreline and substation sites, Notices of Requirement (NoRs) would then be lodged with the respective Council(s) under the RMA for the purposes of securing designations both for the transmission lines and substations.
43. The generic ACRE process:

- highlights the stages of the NoR process and high-level principles derived from the RMA;
 - outlines the objectives and outputs for each stage; and
 - identifies process (actions to achieve output), internal deliverables (in-house functions), and external deliverables (consultants).
44. The key stages of the ACRE process are summarised as follows (note – these can be modified or combined, depending on the scale and nature of the project):
- A – Area (identification of the wider study area within which the project might occur; undertaking constraints and opportunities mapping);
- C – Corridor (identification and confirmation of alternative corridors, ranking and selection of preferred corridor);
- Ri – Route i (selection and evaluation of a route, or alternative routes, within the preferred corridor, and consultation on one or more routes);
- Rii – Route ii (confirmation of the preferred route, following public consultation); and
- E – Easement (identification and confirmation of the easement centreline – approximately 100m wide). There are two further process steps, referred to as “D” and “S”:
- D – Documentation (preparation of full documentation for lodgement with councils);
- S – Statutory Process (Lodgement of documents for statutory approvals under the RMA, Council Hearings, Environment Court appeal process where relevant).
45. At the end of each stage, the model highlights estimated timeframes to complete each stage of the model process and perceived risk to complete each stage. The generic designation process applies to all future Transpower designation projects.

Operating, upgrading and maintaining the National Grid

46. The National Grid has operational requirements and engineering constraints that both dictate and constrain the way it is managed. The operational requirements relating to the Grid are set out in various legislation, rules and regulations governing the National Grid, including the Electricity Act 1992 and the Electricity Industry Participation Code.
47. The National Policy Statement on Electricity Transmission 2008 (“**NPSET**”) expressly recognises the technical, operational and security requirements associated with the transmission network, and that these can limit the extent to which it is feasible to avoid or mitigate all adverse effects on the environment from the National Grid. The NPSET recognises that the National Grid is a physical resource of national significance. **Ms Whitney’s** evidence discusses the NPSET in more detail.
48. Transpower also undertakes many activities in accordance with the Resource Management (National Environmental Standards for Electricity Transmission Activities) Regulations 2009 (“**NESETA**”). The NESETA applies to National Grid transmission lines existing as at January 2010. It specifies that activities relating to operation, maintenance, upgrading, removal or relocation of existing transmission lines are permitted subject to conditions. It also identifies resource consent requirements for activities that do not meet the conditions. The NESETA prevails over any more stringent rules in a plan.
49. Transpower has a duty to maintain, upgrade and develop the National Grid. To meet that duty, it runs an extensive programme of inspections and maintenance, and actively plans for the future.
50. Clearly, the National Grid has developed over time, and has an aging asset base. However, Transpower's asset strategy is that all transmission lines have (with the right maintenance) a perpetual life, and that all substation sites are required indefinitely. Transpower has a continuous programme of work to maintain and enhance its assets, and the Waikato District is no exception.

51. The NPSET recognises that the efficient transmission of electricity via the Grid plays a vital role in the wellbeing of New Zealand, its people and the environment. In Transpower's view, the amendments set out in **Ms Whitney's** evidence are necessary to ensure the Plan gives effect to the NPSET.

Effects of, and on, the National Grid

52. A number of activities have the potential to compromise the operation, maintenance, upgrade and development of the National Grid. The following are specific risks and activities:

Risks of transmission lines to people and property

53. The main electrical hazard risk associated with high voltage transmission lines is receiving an electric shock. The risk and severity of electric shocks varies depending on the transmission voltage and type of exposure (e.g. direct human contact, mobile plant, or vegetation). Risks are most likely to be highest within 12 metres of a transmission line. However, some associated effects can be transferred further than this.
54. Lethal electric shocks can be caused by:
- a) earth potential rise;
 - b) step and touch voltages;
 - c) induction voltages;
 - d) conductor drop;
 - e) flashovers (coming into contact with the line conductors or where the electricity arcs from a conductor onto an object such as a structure or fence); and
 - f) vegetation growing too close to a line and causing a flashover.
55. There are a number of other risks to people and property including damage due to fire and the risk of structure failure. These hazards can occur as a result of third-party activities (such as mobile plant or

machinery) coming into contact with conductors, and excavations occurring too close to structures or mid-span thereby reducing clearance distances. It is essential that the use and location of this machinery is carefully considered to avoid contact with the conductor. Coming into close proximity to a live conductor and causing a flashover (i.e. the flashover will occur prior to contact) can:

- a) compromise the safety of the machinery operators or workers or members of the public in or near the machinery and result in electric shock;
- b) damage the machinery or the line itself; and
- c) affect the operation of the Grid and the security of supply.

56. **Mr Renton's** evidence describes the risks of transmission lines to people and property in more detail.

Earthworks

57. Uncontrolled earthworks can undermine the support structures or generate dust. This can result in the build-up of material on the National Grid lines and increase the wear on the equipment reducing its useable lifespan. Excavations or mounding mid-span can increase risks by reducing the clearance between the ground and conductors. Excavated areas or piles of earthworks soil can also restrict Transpower's ability to access and locate the heavy machinery required to maintain support structures around the lines, and may lead to potential tower failure and significant constraints on the operation of the lines, such as power outages. For these reasons, Transpower seeks controls on earthworks near the National Grid.

58. Figure 3 shows earthworks that have occurred around a tower as part of development for an urban subdivision in Whitby, Porirua. The earthworks were well within 12m of the support structure.



Figure 3: Earthworks in Porirua

59. As well as possibly undermining the stability of the tower structure, the earthworks in the photograph have also restricted vehicular access to the tower and the area where Transpower can place machinery required to maintain the tower. This compromises Transpower's ability to maintain the existing transmission line.
60. Transpower worked with the developer retrospectively to ensure that the constraints on the line introduced by the developer were mitigated and the long-term stability of the towers is retained. This required the installation of a shot-crete surface on the cut batter. Such works are an example of how earthworks conducted close to the Grid can undermine Transpower's ability to operate and maintain the network effectively and efficiently. Ultimately the manner in which Transpower carries out maintenance at this tower will need to change to address the effects.
61. In determining appropriate setback distances for earthworks from National Grid support structures, a common assumption made is that compliance with NZECP is sufficient to ensure the Grid is not compromised. The examples below illustrate this is not the case and that NZECP34:2001 on its own does not give effect to the NPSET and Policy 10.

Example 1 Earthworks compliant with ECP34



Figure 4: NZECP34 compliant earthworks around a pole on ARI-HAM-A 110kV pole line off Orepunga Road (Karāpiro)

62. Figure 4 illustrates earthworks that have been undertaken on a property that are technically compliant with NZECP34:2001. As a result of the earthworks in vicinity of the pole structure, Transpower's ability to operate and maintain the network has been compromised. The batter slope may become unstable as a result of erosion and slipping. Access to the site is now severely restricted and there is no ability for Transpower to operate heavy plant on the elevated platform. Ongoing engineering checks will be required to monitor the effects of erosion and to check the stability of the foundations.

Example 2 Earthworks Hastings District – Ground clearance violations

63. Another example of earthworks adversely impacting on the operation of existing National Grid assets are earthworks undertaken Hastings. Transpower investigated the clearances from the conductor to ground for two Hastings properties and found the minimum clearance is only 5.3m from the ground to conductor at everyday conditions (instead of 6.5m required under NZECP34). This violation occurred as a result of earthworks – i.e. is due to a build-up of soil under the conductors. The soil had been excavated onsite, spread under the line and has now

reduced the required ground clearance to an unacceptable distance. As a result of the earthworks people and property were at risk.

64. Transpower needed to arrange temporary fencing of the two earthworks sites to prevent any further access under the circuit (wires) and rectification works are completed. Mitigation included installing a new set of cross arms on the poles. The top and bottom crossarms were changed to shorter steel crossarms with new Horizontal Line Posts (HLPs) attached. This lifts the conductor into a clamp on the end of the HLPs on the same pole by approximately 1200mm and prevented the need to replace the poles. Transpower then carried out ground works to cut the edge of the bench/track back to ensure the regulation 6.5m ground clearance at maximum operating temperature was complied with i.e. remediating the site back to original ground level and compliance with NZECP34:2001.



Figure 5: Hastings ground clearance violations



Figure 6: Hastings ground clearance violations

Buildings and structures

65. Buildings and structures pose a risk to the operation of the National Grid, compromise Transpower's ability to maintain the line, and place any residents or workers at those facilities at risk from electrical hazards.
66. In a rural context this includes buildings such as dairy sheds, piggeries, poultry farms, commercial greenhouses, and factories. These buildings and activities either are at greater risk of effects from the transmission lines or put the line itself at greater risk.
67. The cumulative effect of allowing these activities under lines will be further restrictions on Transpower's ability to maintain and upgrade existing lines.
68. I consider that it is common sense to locate activities that cannot be easily shut down to enable work on transmission lines, or are likely to have reverse sensitivity effects, away from the lines so they will not need to be vacated for maintenance work or scheduled upgrade and development work.

Sensitive Activities and Reverse Sensitivity

69. Transpower's lines and substations were traditionally established within rural areas because this typically minimised constraints resulting from neighbour complaints. However, over time, through land rezoning and population growth, some of the lines and substations have had urban development and sensitive activities establish around them. While land use change and development occur at different rates throughout the country, it may only take one or two poor planning decisions to create significant difficulties, and over the lifetime of an enduring asset such as the National Grid, land use change can be dramatic.
70. The nature of lines and substations means that they are required to operate 7 days a week and 24 hours a day. People can become sensitised to the noise emitted from a substation site, or corona discharge from a line, even when they are operated within accepted noise limits. Visual amenity can also become an issue for people living next to lines and substations. Substations and lines can also cause concern or annoyance because of electrical interference and perceived electric and magnetic field ('EMF') health issues.
71. Transpower has experienced reverse sensitivity effects from those who carry out activities or wish to develop land near its assets. Examples of reverse sensitivity effects include requests for:
- a) conductors to be raised, to allow fruit trees to grow higher (and cherry pickers to be used) beneath them;
 - b) lines to be placed underground, to reduce visual impacts;
 - c) a tower to be raised and a new tower erected to allow for commercial bulk building development to occur under a line; and
 - d) poles to be increased in height to allow earthworks and driveway access to a new dwelling;
 - e) Complaints about noise from lines, or their visual impact, because of their effects on new residential development nearby. These complaints can be accompanied by requests to underground or relocate lines.

72. Transpower experiences reverse sensitivity issues or complaints (such as those described above) annually.
73. In addition, people often use consenting processes for upgrading and development works as an opportunity to raise concerns about existing infrastructure.
74. In my view, complaints and attempts to restrict Transpower's activities are inevitable if sensitive and intensive activities are allowed to locate near existing National Grid lines. Transpower's approach is to seek to prevent any instances arising through appropriate plan provisions and controls - a preventative and proactive approach.
75. The area or distance from the lines within which reverse sensitivity effects can arise may vary according to the type of issue raised, but they are most noticeable in the area where the conductor swings out to. Depending on asset type, conductor swing can be out to 37 metres either side of the centreline.

Access

76. In 2014 a grillage refurbishment crew was carrying out a pre-works inspection at Tower 48 on the Henderson to Roskill 110kV transmission line. The crew discovered a dwelling was under construction directly below the line and Transpower had not been consulted on the proposal. This dwelling blocked access to the tower site, meaning that Transpower had to secure alternative access across four separate properties. This required the removal of fencing and vegetation. Figure 7 clearly illustrates the difficulties now arising at the site. Figure 8 shows the original subdivision plan that was not complied with, which envisaged a setback from the tower and transmission line.



Figure 7: Dwelling blocking access to tower

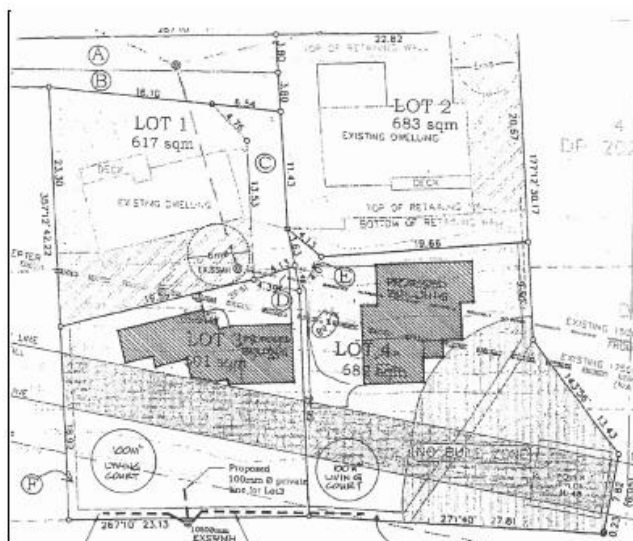


Figure 8: Original subdivision plan providing access to tower

Mobile plant

- 77. Disruption to the National Grid was caused by inappropriate activity under a National Grid line when North Auckland and Northland

experienced an outage in October 2009. This outage was the result of an intensive industrial/commercial activity operating under the line. The disruption was caused by a forklift carrying a container and hitting the 220kV transmission line between Otahuhu and Henderson. The incident significantly impacted power supply into Auckland and caused 280,000 customers to lose electricity, including the entire Far North District. It was lucky no one was killed. This also resulted in reverse sensitivity effects because Transpower had to raise a tower to prevent future similar incidents.

78. Figure 9 shows the outage area—North Auckland and Northland.



Figure 9: North Auckland and Northland outage area

79. Figures 10, 11 and 12 show the forklift, the flat tyre sustained in the incident, and the damage done to the conductor.
80. This risk caused by mobile plant can occur anywhere forklifts, cranes, and heavy machinery is used, including rural areas.



Figure 10: Mobile plant incident



Figure 11: Mobile plant incident flat tyre



Figure 12: Mobile plant incident – conductor damage

81. More recently, an incident occurred when a tractor carrying a crop auger on a local road hit the overhead High Voltage Direct Current ('HVDC') line in Canterbury. The crop auger caught fire, and the HVDC line faulted a number of times. Again, it was fortunate no one was injured. However, this incident, and others like it, are avoidable if activities are restricted within the National Grid corridor.



Figure 13: Site of Canterbury crop auger incident

Subdivision

82. The regulation of subdivision in the vicinity of the National Grid will enable Council to give effect to Policy 10 of the NPSET and to manage the potential effects of a subdivision on the operation/maintenance and upgrading of the network - including retaining an area for access to the network.
83. Subdivision within the Waikato District should be regulated near the transmission lines because:
- a) Transpower is not always recognised by councils or applicants as being affected by subdivision applications;
 - b) Transpower wants to avoid the creation of lots on which it would be difficult or impossible to construct a complying dwelling;

- c) The public has an expectation that at least one dwelling can be constructed on each legal title. The requirement to show a complying building platform is consistent with this;
- d) Subdivision can disrupt access to lines because it often precedes changes to land uses, including fences and driveways (which can prevent or facilitate access to land). Transpower has the legal right under the Electricity Act 1992 to access the lines but the physical ability to access the lines needs to be protected;
- e) Transpower cannot rely on NZECP34:2001 to protect the National Grid from the effects of subdivision, as it does not restrict the subdivision of land near lines or substations, and it allows underbuilding; and
- f) Subdivision also means Transpower will in the future need to manage its operations around a greater number of landowners and their activities.

84. Subdivision provides the framework for future land use and is enduring. Integrated planning at the subdivision stage can avoid land use conflicts later. In particular, restricted discretionary activity status (defaulting to non-complying) at the subdivision stage provides the opportunity for Transpower and the Council to consider whether buildings can be sited in a safe manner and so as to avoid reverse sensitivity effects arising from the visual, noise and other impacts of the National Grid (consistent with Policy 10 of the NPSET).

85. Within the Waikato District the Proposed Plan needs to establish rules to avoid potential future adverse effects on its National Grid infrastructure. Given the significance of the issues involved, and the directives of the NPSET, this is an appropriately proactive approach to pursue.

86. Transpower seeks a restricted discretionary activity subdivision rule, which defaults to non-complying if it is not possible to show a complying building platform on the new lots. This is a simple and effective framework for promoting appropriate outcomes, which is consistent with

the NPSET and the approach adopted by many local authorities around NZ, including those in low growth areas.

Examples of subdivision near the National Grid

Subdivision at Lake Hayes, Queenstown



Figure 14: Subdivision in Queenstown

87. Compatible development of green-field sites is possible, especially if those plans take account of Transpower infrastructure. The subdivision in Figure 14 in Queenstown is an example where Transpower has supported subdivision around the National Grid. The application was approved with “no build” consent notices imposed as conditions on the lots within the corridor.
88. Another example of compatible greenfields subdivision development is the industrial Highbrook Development in South Auckland (shown in the Figures 15 and 16) where the roads and industrial buildings were planned and constructed to minimise the impacts on Transpower's infrastructure, and consequently the road users and owners/occupiers of

the neighbouring land. As can be seen from the photos, the road has been designed around a clear Yard and comparatively clear corridor.



Figure 15: Highbrook Development in South Auckland



Figure 16: Highbrook Development in South Auckland

89. For Highbrook, the lattice towers were replaced with steel towers (monopoles), at the developer's expense in a new location. A more recent industrial development in Christchurch retained the existing structures, but followed a similar approach, with the new road being located in the 12m Yard.



Figure 17: Waterloo Business Park



Figure 18: Waterloo Business Park

Examples of subdivisions Transpower wishes to avoid

90. Transpower is also aware of subdivisions which it would have preferred had not occurred. At 7A Cormack St, Mt Roskill and 362 Blockhouse Bay Road, Blockhouse Bay, Auckland, subdivision consents were granted (prior to the Auckland Unitary Plan process), creating new rear lots

directly beneath a transmission line. Transpower was not involved or identified as an affected party to either of the original subdivision applications.

91. The owners of each site later wished to develop the sites for residential uses. However, because each site is wholly located within the 12m Yard (as shown in Figures 19 and 20), Transpower cannot support new residential dwellings on these sites.



Figure 19 - Site at 7A Cormack St and 12m Yard corridor



Figure 20 - Site at 362 Blockhouse Bay Rd and 12m Yard corridor

***New Zealand Electricity Code of Practice for Safe Distances 34:2001
(NZECP34:2001)***

92. As discussed, NZECP34:2001 seeks to protect persons, property, vehicles and mobile plant from harm or damage from electrical safety hazards by setting out minimum safe electrical distances.
93. Some members of the public and interest groups around the country have asserted that compliance with NZECP34:2001 should be enough to ensure the safe and efficient use of land near the National Grid.
94. However, those assertions are incorrect. This is because they fail to acknowledge the range of electricity transmission issues covered by the NPSET. For example, NZECP34:2001 does not address the other electrical safety hazards and the potential effects of the lines on activities in close proximity to them.
95. Further, NZECP34:2001 does not protect the integrity of the National Grid from the effects of other activities. For example, it does not restrict the subdivision of land near the lines, and it allows underbuilding. In addition, NZECP34:2001 does not distinguish between sensitive and non-sensitive activities, and therefore it does not prevent the types of inappropriate development contemplated by the NPSET from occurring.
96. To emphasise the point, NZECP34:2001 does not consider the environmental effects of activities on the National Grid, or the potential environmental effects of the National Grid on third party activities.
97. Transpower is only made aware of any breaches of NZECP34:2001 when developments are already in place, and when the cost of mitigating the associated risks is usually very high.
98. Developments that comply with NZECP34:2001 can also constrain maintenance activities on the lines and increase the number of people exposed to and potentially at risk of adverse effects.
99. I note however that the National Grid Yard and Corridor sought by Transpower will not replace the requirement to comply with NZECP34:2001; nor will these provisions eliminate all risks. The

provisions sought will reduce risks, but anyone near the National Grid needs to be continually alert to the hazards associated with this infrastructure.

Transpower's Approach to National Grid Yards and Corridors

100. Based on the above identified issues and risks associated with activities in proximity of National Grid assets, Transpower has developed a National Grid corridor approach around transmission lines (as is required by Policy 11 of the NPSET) in the form of a buffer corridor approach comprising National Grid Yards and National Grid Subdivision Corridors. The corridor approach has eight important purposes for the Waikato District:

- a) To ensure that sensitive activities, such as residential development, are generally not provided for near National Grid structures and lines: Sensitive activities include the establishment of dwellings, schools and papakainga close to the Grid. The purpose of Policy 11 of the NPSET is to prevent sensitive activities (including the expansion of existing sensitive activities) such as these from being established near the National Grid.
- b) *To manage reverse sensitivity effects:* These effects occur when people undertake activities close to an existing line or structure. For example, National Grid lines can cause noise (especially in damp weather), reduced visual amenity, radio and television interference, perceived effects of electric and magnetic fields from the lines, and interference with landowners' business activities beneath the lines. These effects often lead to requests by neighbouring land users to impose constraints on existing lines. These complaints and constraints are reverse sensitivity effects and can constrain the operation, maintenance and upgrade of existing National Grid assets.
- c) *To protect the integrity of the National Grid (structures and lines):* Structures, earthworks and other land use activities that are too close to a line can affect the stability of that line and contribute to electricity outages. The presence of these structures and activities can also

increase the need for, and thereby the risk associated with, mobile plant (such as cranes, forestry haulers and excavators) and other equipment. Transpower wishes to ensure that safe distances are maintained so the risk of coming into contact with the lines is minimised.

- d) *To enable efficient and safe maintenance and operations:* National Grid Yards/Corridors provide a relatively clear area for line workers to gain access to the line and structures in order to conduct operational maintenance on high voltage equipment, sometimes at great heights. The Yards also limit the need for costly workarounds (for example, bypass lines), when maintaining and operating the Grid.
- e) *To allow for any future potential upgrade requirements of the asset:* For example, Transpower must be able to control “non-sensitive” large scale buildings and buildings that are intensively used (regardless of scale) under the lines, as these can inhibit upgrade activities. This reflects Policy 10 of the NPSET.
- f) *To provide the residential, rural, commercial and industrial electricity users in the Waikato District with a reliable and secure supply of electricity.*
- g) *To provide the community, Council and Transpower with the knowledge and confidence that the lines are being managed in a safe and sustainable manner.* To provide certainty as to how that management is being achieved within the NPSET framework.
- h) *To minimise safety hazards:* Electricity transported at high voltages can cause serious, or even fatal, injuries to people who come in close contact to lines. Corridor management is therefore of paramount importance as it provides for the wellbeing, health and safety of people.

101. The Proposed Plan will regulate activities for the foreseeable future and Transpower considers it is important to look at possible future activities even if they do not currently exist.

102. Transpower values its relationship with councils, the community and landowners and endeavours to work with them to reach the best outcome for all parties concerned. Transpower works with councils around the country prior to, and after notification of plan changes intended to give effect to the NPSET. Transpower continues to engage with councils once operative plan provisions are in place, including involvement in the resource consent process.

Transpower's Approach to Implementing NPSET

103. Councils were required to implement the NPSET through appropriately recognising the National Grid in a District Plan by 10 April 2012. Transpower's approach to implementing the NPSET across the country has been to require land use setbacks (often referred to as the "National Grid Yard") and subdivision rules and corridors (referred to as the "National Grid Subdivision Corridor") to ensure the safe and sustainable management of the National Grid, third party activities, and landowner usage near the assets. These outcomes have been achieved through the ongoing policy and plan review and plan change processes undertaken by many regional, district and city councils throughout New Zealand.
104. The provisions Transpower seeks in the Waikato are generally consistent with provisions sought elsewhere around the country, including Invercargill, Opotiki, Hurunui, Queenstown, South Taranaki, Porirua, Kāpiti, Far North, Kaipara, Whangārei, Palmerston North, Whanganui, Tauranga, Western Bay of Plenty, Southland, Waimate, and Central Otago Districts and the Christchurch Replacement District Plan.
105. Transpower seeks, and has sought in the Proposed Plan, 12 metre or 10 metre setbacks either side of the centreline and from support structures where sensitive activities would be non-complying.
106. Transpower also seeks a subdivision corridor of varying widths depending on the voltage of the line. Subdivision has restricted discretionary activity status within this corridor provided a complying building platform locates outside the 10 or 12m Yard. The subdivision requires non-complying consent if the building platform is located within

the Yard. Transpower seeks regulation of subdivision within corridors to prevent the creation of unusable or severely constrained lots.

107. The Yard and Corridor provisions Transpower seeks to give effect to Policies 10 and 11 of the NPSET in an integrated manner, taking into account:
- a) Conductor swing calculations. Buildings and land use activities within the 12m Yard are effectively under the conductors in normal wind conditions. Buildings and land use activities in the subdivision corridor could be under the conductors in high wind conditions;
 - b) The maintenance, access and workspace requirements. The 12m Yard will allow the support structures and conductors to be accessed and provide sufficient space for most (but not all) maintenance activities. The 12m yard will not eliminate all inconvenience caused by operation and maintenance activities, nor necessarily ensure full access for maintenance activities is provided in all circumstances - it attempts to strike a reasonable balance;
 - c) An understanding that restrictions on land uses (both the geographical extent of land restricted and the range of uses restricted) need to be justified and allow for continuing reasonable use of the land. Some of Transpower's operation, maintenance, upgrading and development could be carried out more efficiently if a larger National Grid Corridor was provided. However, as day-to-day maintenance is not carried out in high winds, it was considered more reasonable to focus on the 12m Yard for restricting land use;
 - d) Transpower does not consider resource consent should have to be obtained for activities which are unlikely to compromise the National Grid now or in the future. Unnecessarily requiring resource consent will add unnecessary costs, both for the landowner and Transpower (who would be notified of the applications); and
 - e) The need for the District Plan provisions to be clearly understood by Plan users, and enforceable by the District Council.

108. The corridors are based on the operational and maintenance needs of Transpower's existing assets. They have not been sized to provide for major rebuilds or new lines. For new lines projects, Transpower's general approach is to obtain a designated corridor and an easement over the affected properties involved in the project. Both the designation and easement would contain restrictions on the activities within the designated/easement area i.e. Transpower seeks clear corridors to ensure the safe and efficient operation of the line. Transpower seeks a corridor that is clear of buildings and structures (other than fences) and restricts all earthworks unless Transpower agrees. Such a restrictive approach is not considered appropriate for the corridors that are required to implement Policies 10 and 11 of the NPSET – those corridors are the minimum Transpower requires and are a compromised position.
109. The corridor and yard provisions sought by Transpower go beyond compliance with NZECP34:2001. This Code of Practice made under the Electricity Act and Regulations, relates to electrical safe distances - it does not address the resource management matters in Policies 10 and 11 of the NPSET. Transpower does not support simple reliance upon NZECP34:2001. NZECP34:2001 will not ensure the National Grid infrastructure and surrounding land are proactively and sustainably managed for the future.

Conclusions

110. The National Grid is critical to the social and economic wellbeing of the Waikato District and our nation generally. The NPSET requires that the National Grid be recognised and provided for in the Proposed Plan. This includes ensuring that
111. Policies 10 and 11 of the NPSET also require that other activities around the National Grid do not compromise the operation, maintenance, development and upgrading of the infrastructure, that reverse sensitivity effects are managed, and that sensitive activities are generally not provided for around the infrastructure. Transpower has refined its approach to the implementation of the NPSET in districts around the country. For the reasons set out above, Transpower requests that the

Proposed Plan include the provisions appended to **Ms Whitney's** evidence.

112. This relief will ensure integrated management of activities through the District Plan to provide for sustainable development of both the National Grid infrastructure and other natural and physical resources, both of which are critical for the future development of the Waikato.

Dougall Campbell
29 September 2020

Appendix A – Relevant Experience and Qualifications

1. I am the Environmental Policy and Planning Group Manager at Transpower. My Group's responsibilities include:
 - a) Strategic planning. This planning is achieved through the development and implementation of Transpower's approach to the NPSET at a national level and local level.
 - b) Delivering Transpower's policy approach on environmental regulations, legislation and council planning documents.
 - c) Ensuring the on-going and future protection of Transpower's network.
 - d) Ensuring that all environmental approvals are obtained for Transpower's physical works.
 - e) Managing third party interactions to ensure that Transpower's interests are appropriately maintained.

2. I have been employed by Transpower for 16 years, and during this time I have had experience working in various roles; including:
 - a) As a Grid Programme Delivery Specialist. This role involved developing a "lessons learned" and continuous improvement strategy and process for Grid Projects.
 - b) As the Environmental Planning and Stakeholder Manager on the Alliance Management Team of the Transpower Alliance. I was responsible for the environmental planning, strategy and policies, and processes to deliver and monitor all the necessary environmental approvals for the 400kV capable overhead line section of the North Island Grid Upgrade Project (NIGUP). This line traverses 185km from Whakamaru (North Taupo) to Brownhill Road (South Auckland).

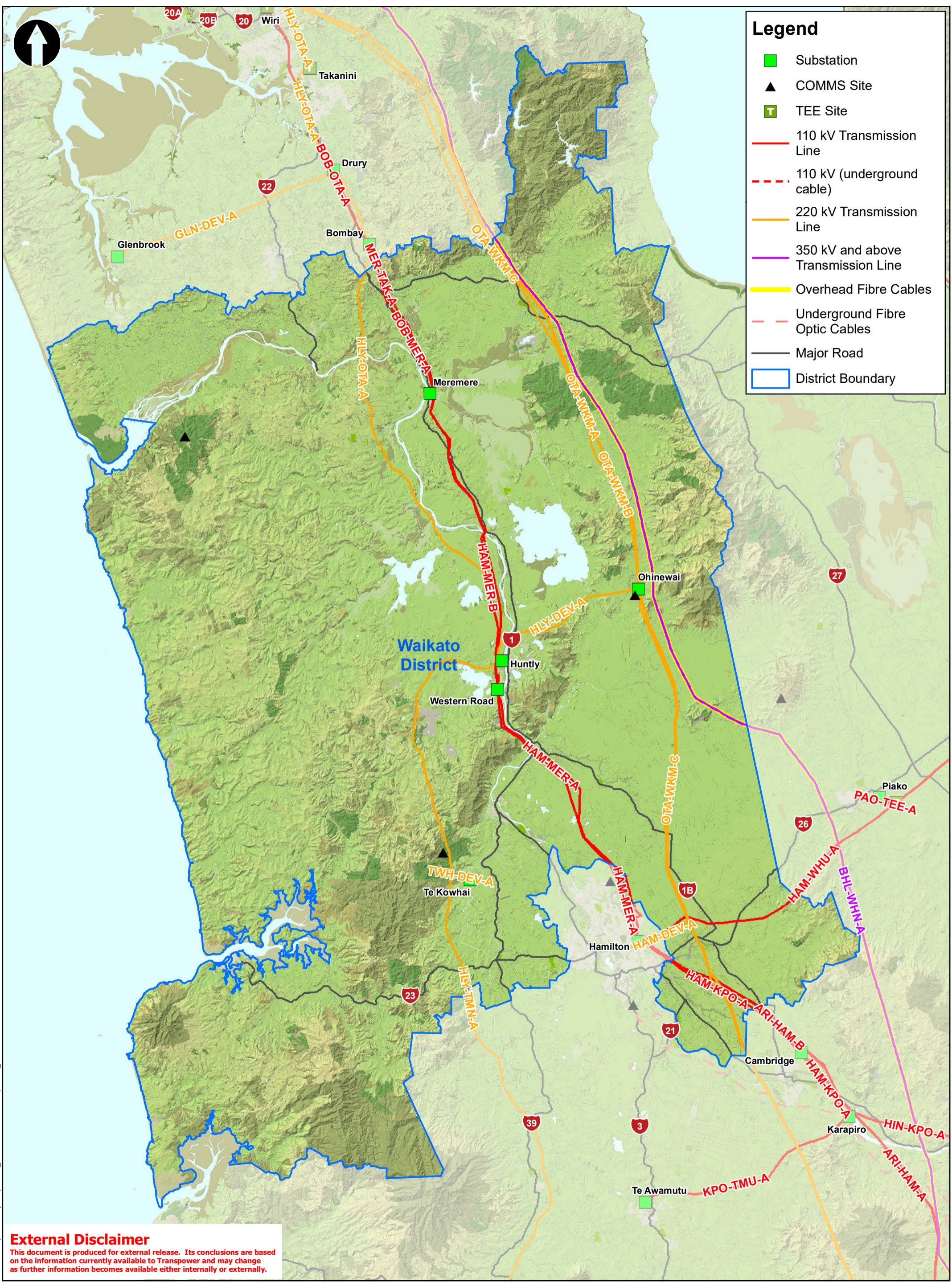
- c) Carrying out stakeholder relationship responsibilities of the Transpower Alliance, ensuring that key stakeholders are informed, risks are identified, and reputations are enhanced.
 - d) As a Senior Environmental Planner/Environmental Project Manager for NIGUP. My responsibilities included developing strategy for consenting major projects, managing the environmental consortium appointed to deliver NIGUP, through to the final Notices of Requirement, managing the resource consent documentation and the Board of Inquiry process.
 - e) Providing planning advice to support the implementation of Transpower's Grid Vision investigations and its System Integration investigations.
3. I have a Bachelor of Regional Planning Degree and a Diploma in Business Studies from Massey University. I have 25 years' experience working as an environmental planner and I am a member (Intermediate) of the New Zealand Planning Institute.
4. I confirm I have read the 'Code of Conduct for Expert Witnesses contained in the Environment Court Consolidated Practice Note 2014. As I am employed by Transpower, I acknowledge I am not independent; however, I have sought to comply with the Code of Conduct. In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Appendix B – National Grid Assets within the Waikato District



Legend

- Substation
- ▲ COMMS Site
- T TEE Site
- 110 kV Transmission Line
- - - 110 kV (underground cable)
- 220 kV Transmission Line
- 350 kV and above Transmission Line
- Overhead Fibre Cables
- - - Underground Fibre Optic Cables
- Major Road
- District Boundary



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TRANSPOWER
 Prepared by: Geospatial & Drawings

**Transpower Assets
 Waikato District**

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Date: 9/10/2018 Drawn by: martino

Projection: NZTM 2000 Scale: 1:320,000 Plan Size: A3P