Applications for Resource Consents and Assessment of Effects on the Environment

Transmission Gully Project: Paekakariki-Takapu Road A 110kV Transmission Line Relocation

8 August 2011

Keeping the energy flowing




TRANSPOWER

Transpower New Zealand Limited The National Grid

APPROVED FOR RELEASE

On behalf of the ESA Group Manager

Transpower NZ Ltd

Report

Application for Resource Consents and Assessment of Effects on the Environment

Prepared for Transpower New Zealand Limited

For submission to the Environmental Protection Authority

By Beca Carter Hollings and Ferner Limited (Beca)

8 August 2011

Revision History

Revision Nº	Prepared By	Description	Date
1.0	LH, NB	First draft for client and legal review.	8 July 2011
2.0	LH, NB	Second draft for client and legal review.	18 July 2011
3.0	LH, NB	Draft for EPA and RATAG review	20 July 2011
4.0	LH, NB	Final draft for client and legal review.	25 July 2011
5.0	LH, NB	Final for lodgement	8 August 2011

Document Acceptance

Action	Name	Date
Prepared by	Lesley Hopkins (Associate – Planning, Beca) Nathan Baker (Associate – Planning, Beca)	8 August 2011
Reviewed by	Ainsley McLeod (Technical Director – Planning, Beca)	8 August 2011
Approved by	Darryl-Lee Wendelborn (Project Director, Beca)	8 August 2011
on behalf of	Beca Carter Hollings & Ferner Ltd	

Table of Contents

Appendices to the Assessment of Effects on the Environment Report

Supporting Technical Reports

List of Figures

List of Tables

Glossary of Terms and Abbreviations

Term	Definition
AEE	Assessment of Effects on the Environment
CEMP	Construction Environmental Management Plan
DOC	Department of Conservation
EPA	Environmental Protection Authority
GWRC	Greater Wellington Regional Council
Hz	Hertz
KCDC	Kapiti Coast District Council
kV	Kilo Volts
Microtesla (μT)	Unit of measurement for magnetic flux density
National Grid	The high voltage electricity network owned and operated by Transpower New Zealand Limited
NESETA	Resource Management (National Environmental Standards for Electricity Transmission Activities) Regulations 2009
NPSET	National Policy Statement for Electricity Transmission
NZECP34	New Zealand Electrical Code of Practice 34:2001
NZTA	NZ Transport Agency
ONL	Outstanding Natural Landscape
PCC	Porirua City Council
PKK-TKR A	Paekakariki to Takapu Road A 110 kV transmission line
RMA	Resource Management Act 1991
RoNS	Roads of National Significance
SH	State Highway
SNA	Significant Natural Areas representing areas in defined ecological districts and/or regions with significant indigenous vegetation and significant habitats of indigenous fauna, as outlined in section 6(c) of the RMA. These areas are identified by district and regional council through surveys and protected in planning documents.
Transmission Gully Project	The proposed State highway from Linden in Wellington City to MacKays Crossing in the Kapiti Coast District
Transmission Line Relocation Project or Line Relocation Project	The relocation and replacement of the Paekakariki-Takapu Road A 110 kV transmission line as part of the NZTA Transmission Gully Project.
Transpower	Transpower New Zealand Limited

1 Introduction

The NZ Transport Agency (NZTA) has identified the need for a new inland state highway from Linden in Wellington City to MacKays Crossing in the Kapiti Coast District. This is known as the Transmission Gully Project and is part of the Wellington Northern Corridor Road of National Significance (RoNS). The NZTA are progressing notices of requirement for designations and applications for resource consents for the Transmission Gully Project as a project of national significance under the Resource Management Act 1991 (RMA). NZTA's documentation that supports the notices of requirement for designations and applications for resource consents is contained in Volumes 1 to 5, and these contain a substantive description of the Transmission Gully Project.

In order to allow for the construction and operation of the Transmission Gully Project, parts of the existing electricity transmission line between MacKays Crossing and the Pauatahanui Substation at State Highway 58 (SH58) will need to be relocated. The Paekakariki-Takapu Road A (PKK-TKR A) 110 kV transmission line is part of the high voltage electricity network (the National Grid) and is owned and operated by Transpower New Zealand Limited (Transpower). Transpower is seeking the majority of the resource consents to enable the line relocation to occur under the regulations included in the Resource Management (National Environmental Standards for Electricity Transmission Activities) Regulations 2009 (NESETA) prior to construction of the Transmission Gully Project. The applications for resource consents are lodged with the Environmental Protection Authority (EPA) under section 145(1)(a) of the RMA as a matter that is part of a proposal of national significance. The regional consents associated with culverts, tracking and earthworks will be sought during detailed design and are discussed in further detail in Sections 1.2.2 and 4.4 of this report.

This report comprises the Assessment of Effects on the Environment (AEE) in support of the resource consent applications sought on behalf of Transpower New Zealand Limited (Transpower) for the relocation of the existing PKK-TKR A 110 kV transmission line located between Tower 1 at MacKays Crossing and Tower 49a at the Pauatahanui substation on SH58 as part of the enabling works for the NZTA Transmission Gully Project. In particular, the works involve relocating and replacing 24 transmission towers, strengthening 10 towers and removing 1 tower entirely. The changes to towers are set out in Appendix B and the works are described in further detail in Section 3 of this report. The line relocation works are collectively referred to as the Transmission Line Relocation Project.

1.1 Transpower New Zealand Limited

Transpower became an independent state owned enterprise on 1 July 1994, having formerly been a subsidiary of the Electricity Corporation of New Zealand. Transpower owns and operates New Zealand's high voltage electricity network (the National Grid) linking generators to distribution companies and major industrial users. Transpower is also the System Operator, responsible for the co-ordination of the transmission of electricity across the National Grid. The National Grid is made up of over 12,000 km of high-voltage transmission lines and more than 170 substations.

Transpower's role and function is constrained by the State Owned Enterprises Act 1986, the company's Statement of Corporate Intent, and the regulatory framework within which it operates. Transpower as a State Owned Enterprise has a very limited statutory role in relation to generation, and no responsibility for local distribution of electricity.

Within Transpower's Statement of Corporate Intent for July 2009 to June 2012, it is stated that:

"The role of the National Grid is to enable New Zealand to achieve its international and local aspirations. It is vital infrastructure of critical importance to all New Zealand. New Zealand needs a reliable supply of electricity, delivered to areas of demand, in order to:

- *Sustain commercial confidence*
- *Enable economic growth and development*
- *Enable New Zealand to effectively participate and be competitive in the global community; and*
- *Maintain and enhance the living standards of all New Zealanders."*

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.

The PKK-TKR A 110 kV transmission line connects the Paekakariki and Takapu Road substations and is part of the essential network of transmission lines servicing the Wellington Region. Along this section, the line also passes through the Pauatahanui Substation.

1.2 Summary of Resource Consent Requirements

1.2.1 Activities Covered by the NESETA

The NESETA came into effect on 14 January 2010 and sets out a national framework of permissions and consent requirements for activities that relate to existing electricity transmission lines. The NESETA only relates to existing transmission lines which were operational (or able to be operational) on 14 January 2010.

The PKK-TKR A transmission line, and its support structures (towers), fall within the definition of "transmission line" contained in the NESETA and is an "existing transmission line" under the definition in the NESETA as the line was operational on 14 January 2010. This is further expanded on in Section 4 of this report.

Regulation 4(1) of the NESETA sets out the activities which are covered by the NESETA and specifically provides for the relocation of an existing transmission line including activities that relate to construction, use of land and an activity relating to an access track to an existing transmission line. The activities associated with the relocation of the PKK-TKR A transmission line involve the relocation and replacement of transmission line support structures (towers) and the conductor (wire), the strengthening of existing towers and foundations, the removal of towers and construction associated activities including temporary structures and formation of access tracks. These activities are detailed in Section 3 of this report.

The proposed activities are covered by regulation 4(1) of the NESETA and have therefore been assessed against the regulations in the NESETA. This assessment is set out in detail in Section 4 of this report.

The line relocation works are located within Kapiti Coast District and Porirua City. No line relocation works will be located in Upper Hutt City or in Wellington City.

The relocation of the towers is assessed in Section 4.2.2 of this report and in summary requires the following resource consents:

- Restricted discretionary land use consent for the relocation of 6 towers in Kapiti Coast District in accordance with Regulation 16(1)(a) and 16(1)(b) of the NESETA; and

- Restricted discretionary land use consent for the relocation of 18 towers in Porirua City in accordance with Regulation 16(1)(a) and 16(1)(b) of the NESETA.

The matters for discretion are set out in regulation 16(4) and are:

"(a) the location and height of the transmission line support structures in relation to—

(i) visual, landscape, and ecological effects; and

(ii) the effects on historic heritage; and

(iii) the effects on sensitive land uses; and

(b) earthworks, clearance of trees and vegetation, and restoration of the land; and

(c) the effects and timing of construction works."

These matters are assessed in Section 7 of this report.

Tower removal, tower strengthening and other ancillary construction activities are permitted activities under the NESETA. This is expanded on in Section 4 of this report.

Earthworks are covered by regulation 33 of the NESETA except to the extent where those earthworks are subject to a regional rule. In this instance, the relevant rules of the Wellington Regional Soil Plan and the Regional Freshwater Plan apply to the extent that they deal with the discharge of sediment to the environment and land stability. Regulation 33 of the NESETA still applies to the earthworks located within a natural area being the Outstanding Natural Landscape at Wainui Saddle as the extent of the regional rules do not address landscape effects. Therefore, the project will require both resource consents from the Wellington Regional Council under the relevant rules of the Regional Soil Plan and the Regional Freshwater Plan and resource consent from the Kapiti Coast District Council for earthworks in a natural area under the NESETA. This is expanded on in Section 4 of this report. Any resource consents for earthworks will be sought during the detailed design phase of the Line Relocation Project.

1.2.2 Activities not Covered by the NESETA

Regulation 4(2) of the NESETA lists activities that the NESETA does not apply to and the relevant district and/or regional plan rules still apply to these activities. In the context of this project, this includes:

- The construction and use of culverts to access an existing transmission line.
- Earthworks for tower construction and access tracks to the extent that they are subject to a regional rule.

The resource consents likely to be required for these activities are set out in Section 4.4 of this report and are matters that fall within the jurisdictional ambit of the regional council. In summary, the following additional resource consents may be required from the Greater Wellington Regional Council:

- A restricted discretionary land use consent in accordance with Rule 47 of the Regional Freshwater Plan to place culverts within the Horokiri Stream;
- A controlled activity land use consent in accordance with Rule 1(2) of the Regional Soil Plan to undertake tracking located in an area of erosion prone land that will have a continuous length of new upslope batter extending for greater than 200 metres, with a height of greater than 2 metres measured vertically; and

- A discretionary land use consent in accordance with Rule 5 of the Regional Freshwater Plan for the discharge of stormwater into surface water where the discharge originates from an area of bulk earthworks greater than 0.3ha.

The regional resource consents for culverts, tracking and earthworks are not being sought at this time as the detailed design of tower sites, access tracks, and the location of culverts, have yet to be finalised. Detailed design will be undertaken once the final location of towers is confirmed to allow for any changes/refinements to track design. Any resource consents required from the Greater Wellington Regional Council will be sought during the detailed design phase of the Line Relocation Project.

Notwithstanding the above, this report contains details of these matters to allow the scale and effects associated with these works to be understood.

1.2.3 Matters that are part of a Proposal of National Significance

Part 6AA of the RMA provides for the consideration of matters which, singularly or collectively, constitute a proposal of national significance. The NZTA have lodged the matters associated with Transmission Gully Project with the EPA as part of a proposal of national significance. As discussed in Section 1.7 of the NZTA Transmission Gully AEE document (Volume 1), on 10 September 2010, the Minister for the Environment made a direction that the NZTA Transmission Gully Project is a proposal of national significance. The Transmission Line Relocation Project represents enabling works for the NZTA Transmission Gully Project, and as such, these matters are being lodged with the EPA under section 145(1)(a) as part of a proposal of national significance (ie the NZTA Transmission Gully Project).

The matters are lodged concurrently with those that relate to the Transmission Gully Project. At the same time as lodging these matters with the EPA, they have also been served on the Kapiti Coast District Council and Porirua City Council as the relevant local authorities in accordance with section 145(10) of the RMA.

1.3 Purpose and Structure of Volume 6: PKK-TKR A Line Relocation Project

Volume 6 constitutes the applications for resource consents and supporting information to authorise the construction, operation and maintenance of the transmission line relocation as part of the Transmission Gully Project under the RMA.

This report has been prepared in accordance with the requirements of Section 88 and Schedule 4 of the RMA and comprises the following information:

- Introduction to the Project and application – The reasons for the applications and relationship to the NZTA's Transmission Gully Project documentation.
- Description of existing environment – A description of the environment along the proposed transmission line route and description of the existing transmission line.
- Description of the Line Relocation Project - Description of the Transmission Gully Project, the route selection process for relocation of the transmission line and a description of the various activities associated with line relocation, operation and maintenance.
- Resource Management (National Environmental Standards for Electricity Transmission Activities) Regulations 2009 – An assessment of the project against the provisions of the NESETA and confirmation of the resource consents required.
- Statutory context – identification of the relevant provisions and documents that form the framework for assessment of the project.

- Consultation – description of the consultation undertaken for the Line Relocation Project and how it has influenced the project.
- Assessment of effects on the environment – An assessment of the effects of the project against the matters to which discretion is restricted in the NESETA and discussion of the mitigation and monitoring proposed to address the effects.
- Proposed conditions – The proposed conditions to manage the effects of the line relocation, operation and maintenance.
- Statutory Assessment - Assessment of the line relocation against the relevant provisions of the RMA including the National Policy Statement on Electricity Transmission.

1.4 Relationship to the Transmission Gully Project Documents

The NZTA has prepared documentation in support of the planning approvals for the Transmission Gully Project. This documentation is contained in Volumes 1-5.

Volume 3: Technical Reports and Supporting Documents contains specialist assessments for the Transmission Gully Project. The transmission line relocation is located largely (with the exception of four towers – 9A, 10A, 11A and 32A) within the proposed Transmission Gully extent of works. Therefore, components of these specialist assessments are directly relevant to the transmission line relocation. The Addendum Technical Reports contained in Volumes 6 have been prepared in support of the Line Relocation Project and do not repeat the relevant parts of the specialist assessments in Volume 3. Rather, the addendum reports focus on identifying the environmental effects specific to the Line Relocation Project and do not therefore repeat detail, such as methodologies, data gathering and baseline studies or description of the environment, apart from where is necessary.

The following Technical Reports have been prepared in support of the applications for resource consents.

Table 1:1: Addendum Technical Reports

Report	Expert
Addendum to Technical Report 5 : Assessment of Landscape and Visual Effects	Gavin Lister, Isthmus Group Ltd
Addendum to Technical Report 11: Assessment of Ecological Effects	Stephen Fuller, Boffa Miskell Ltd
Addendum to Technical Report 16: Land Contamination Assessment and Investigation Report	Terre Maize, Aurecon New Zealand Ltd
Addendum to Technical Report 17: Assessment of Social Impacts	Gary Rae, Incite Ltd and Charlotte Crack, Beca
Addendum to Technical Report 19: Assessment of Built Heritage Effects	Ian Bowman
Addendum to Technical Report 20: Assessment of Archaeological Effects	Mary O'Keeffe, Heritage Solutions Limited

Volume 4: Plan Set contains the drawings and plans for the Transmission Gully Project. The relevant plans for the transmission line relocation are also contained in *Volume 4* and include the following plans:

Table 1:2: Relevant Plans in Volume 4 Plan Set

Description	Plans
Plans of the existing and relocated transmission line	Transmission Line Relocation Project Plans, Sheets TP1 to TP12
Long sections of the transmission line relocation	Transmission Line Relocation Project Plans, Sheets TP13 to TP18
Landscape and visual assessment visual simulations	Landscape Plans, Sheets LA22 to LA46
Landscape plans showing proposed mitigation planting	Landscape Plans, Sheets LA01 to LA12
Individual properties and representative locations for visual assessment	Landscape Plans, Sheets LA121-LA122

1.5 Transmission Line and Tower

To assist the reader in understanding the nature of the Line Relocation Project, the following sets out the basic components of a transmission line and the reasons that the transmission line support structures need to be replaced rather than dismantling and reassembling the existing towers.

The basic components of a transmission tower are shown in Figure 1.1 and in summary consist of:

- Support structures (towers) used to keep the conductors (wires) suspended above the ground;
- Tower foundations to support towers;
- Conductors comprising conductive wires bundled together with three phases per circuit. These span from structure to structure and carry the electricity; and
- Insulator sets which provide insulated support for the live conductors from the earthed support structures so the power can flow along the line.

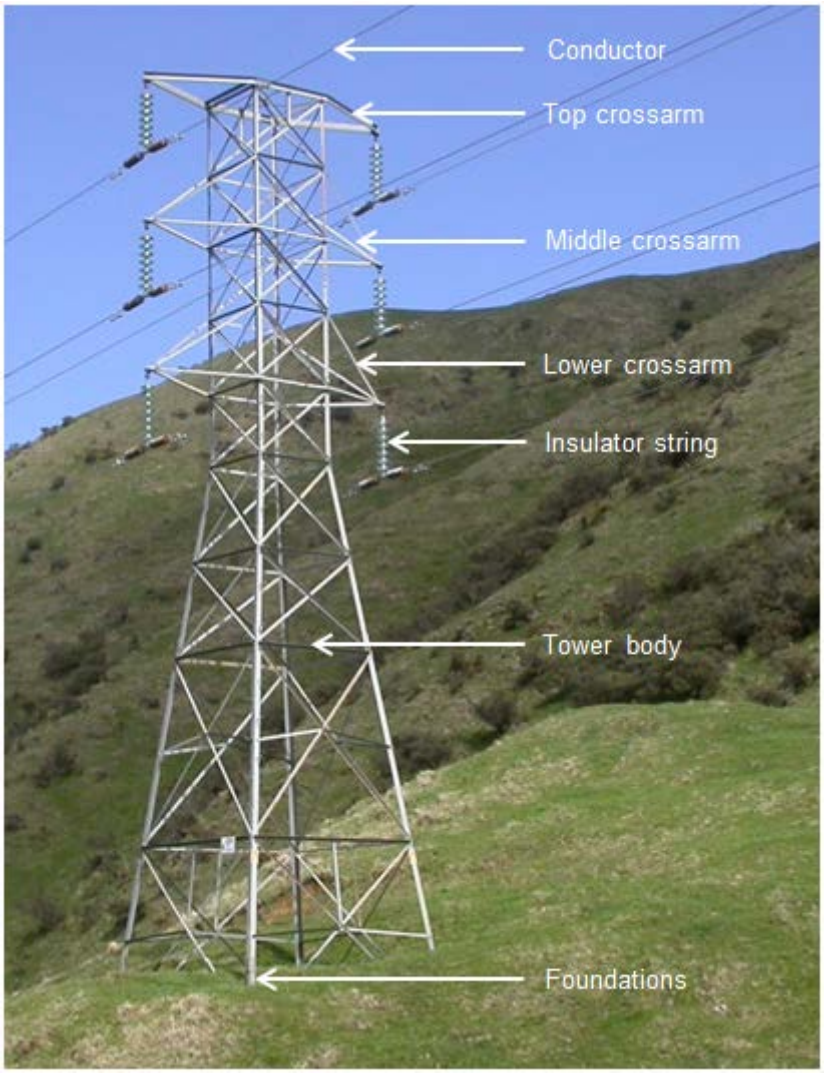


Figure 1.1: Basic Tower Components (Double Circuit Line)

The height and type of transmission line support structure is determined by several factors including, the line span (distance between two towers) and clearance (distance between the line and the ground, the side slope, future road and road cut and fill), line angle and location of adjacent towers. When any of these factors change, the design of the tower needs to respond. For example, shifting a tower from a flat valley floor used for rural land use to a spur above a major transport route may require that the height of the towers is increased so the line can achieve clearance of the road and ground over a longer span. Similarly, if the line is replaced such that it is on an angle, the towers will need to be designed to take different loads and therefore a different type of structure is required. Section 3.4 discusses the structure types proposed for the line relocation.

Transpower has undertaken the preliminary design of the line relocation based on current transmission line design standards and several additional engineering requirements due to the proposed road along the route including:

- Using strain towers on either side of the road crossing;
- Separating towers from the edge of the road;
- Separating towers from the edge of the road works (eg cut or fill batters) in accordance with the New Zealand Electrical Code of Practice 34:2001 (NZECP:34);

- Where lines run parallel to the road, locating towers to minimise conductor blowout (the distance a conductor travels under wind conditions) over the road;
- Maintaining perpendicular crossings of the road.

In addition, best practice landscape principles were developed by the project's landscape and visual team and used by the design team with the aim of integrating the proposed towers into the landscape and mindful of the fact that the NZTA proposes to also construct a road along this route. These principles are set out in *Addendum to Technical Report 5: Assessment of Landscape and Visual Effects.*

The design of the transmission line and support structures is set out in further detail in Section 3.4 of this report.

2 Description of Existing Environment

This chapter describes the existing environment relevant to the Line Relocation Project. The section of transmission line subject to this application starts at Tower 1 near MacKays Crossing and ends at Tower 49a by the Pauatahanui Substation at SH58.

For assessment purposes, the NZTA have split the Transmission Gully Project into nine sections. Sections 1-6 are relevant for the Line Relocation Project and are shown in Figure 2.1. References to these sections (hereafter referred to as route sections) are used throughout the remainder of this report to describe the route, works and the effects on the environment.

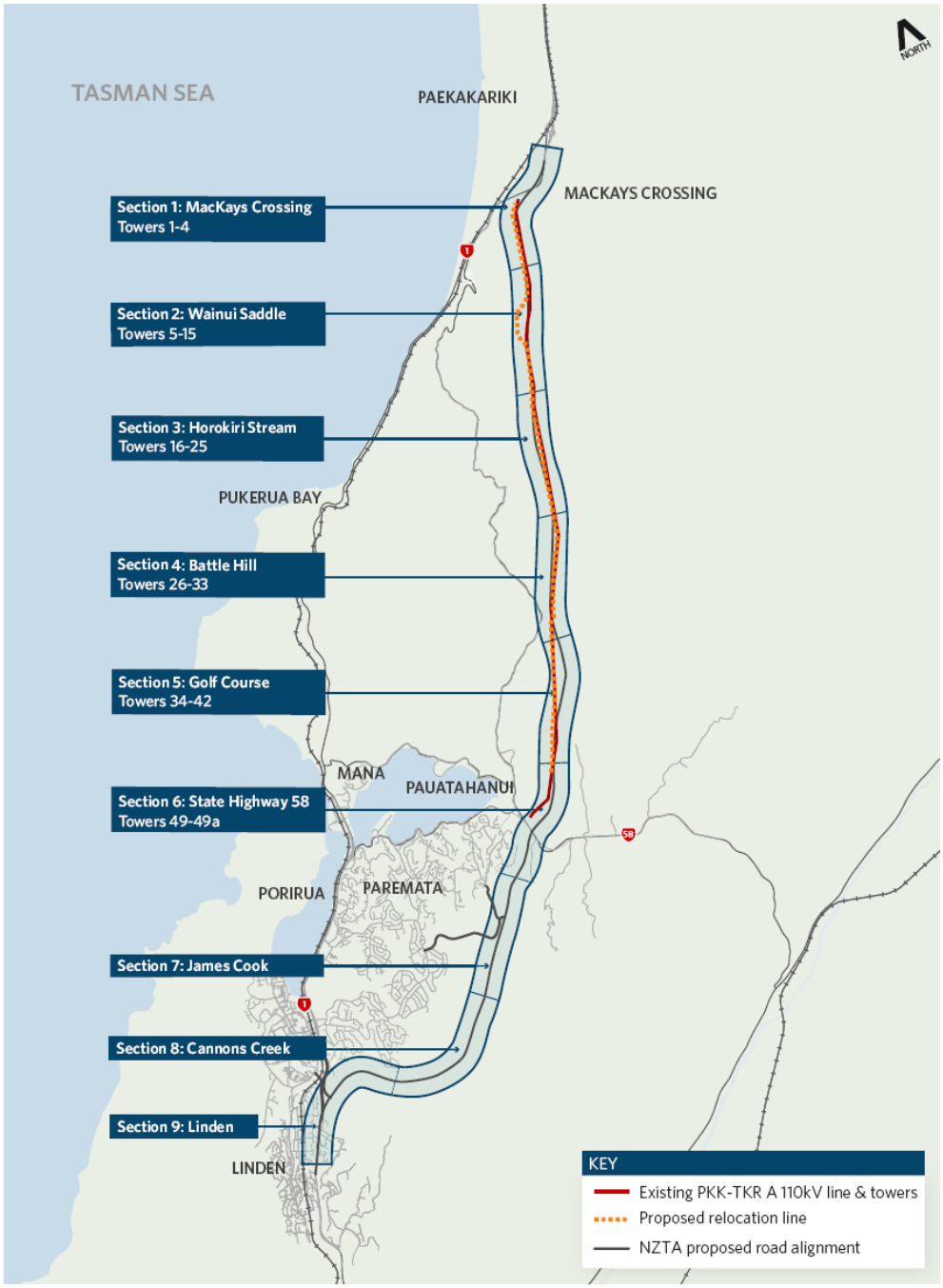


Figure 2.1: Route Sections (with Existing and Relocated Transmission Line)

Part C of *Volume 1: Assessment of Environmental Effects Report* provides a full description of the existing environment for the Transmission Gully Project. More detailed information about the environment is also provided in the relevant chapters on the assessment of environmental effects in Part G of Volume 1 and the associated addendums in this Volume 6. This chapter augments that description of the existing environment, focusing on environmental features that are particularly relevant for the Line Relocation Project. For consistency, the route sections and names (as shown in Figure 2.1) used in the NZTA's application are adopted in this report and in the Addendum Technical Reports.

Particularly relevant to the Line Relocation Project is the existing transmission line. The Transmission Gully Project is named as such because the Main Alignment corridor generally follows the existing electricity transmission line between Paekakariki and Takapu Road. A transmission line was first commissioned through Transmission Gully in 1924 as part of the original 110kV electricity network in the country. The existing support structures along this line consist of predominantly steel lattice towers with some two poles at the Pauatahanui Substation. The poles were added as part of the reconductoring of the line in 2002. Many of the existing towers and poles will remain unchanged as a result of the project, including all the towers south of SH58. The figures in the following sections show the existing transmission line located within Route Sections 1 through 6 in the context of key land use features relevant to the Line Relocation Project. Further detail is shown on the Transmission Line Relocation Plans contained in Volume 4: Plan Set.

There are a number of other existing network utilities as described in *Section 6.1 of Volume 1: Assessment of Environmental Effects Report*, including electricity, gas, water supply, and telecommunications infrastructure located along the entire length of the NZTA's project corridor and notably through Route Sections 1 through to 6. In particular, a high pressure gas transmission pipe runs the length of the corridor, being part of the North Island natural gas transmission network, owned and operated by Vector Gas Limited.

The following sections provide details of specific features and land use in each of the route sections.

2.1 Route Section 1: MacKays Crossing (Towers 1 to 4)

Route section 1 extends from MacKays Crossing (including existing SH1) to the lower part of the Te Puka Stream valley. To the west of SH1, the topography consists of low-lying flat plains comprising peat lands, dune depressions and low dunes, with the highest dunes rising to about 15m above the surrounding flats.

Figure 2.2 shows the key features of this route section relative to the existing and proposed transmission line.

The landscape features of note are the surrounding hills, which are characterised by steep slopes, large plantation forest on hills east of Te Puka Stream, and extensive pastoral land use on hills west of Te Puka Stream. Although largely pastoral in nature, these western slopes are located within an Outstanding Natural Landscape Area as currently identified in the Kapiti Coast District Plan; the Outstanding Natural Landscape Area includes the entire Te Puka Valley and thus encompasses the current location of the transmission towers. The landscape values of this area in relation to the Line Relocation Project are expanded on in the *Addendum to Technical Report 5: Assessment of Landscape and Visual Effects*.

There is a particularly prominent terrace southeast of MacKays Crossing, the edge of which is a former sea cliff. The terrace has been modified by construction works for the existing SH1. In the vicinity of MacKays Crossing, the existing SH1 follows a northeast-southwest alignment along the edge of the coastal plain at the toe of the Ohariu Fault escarpment.

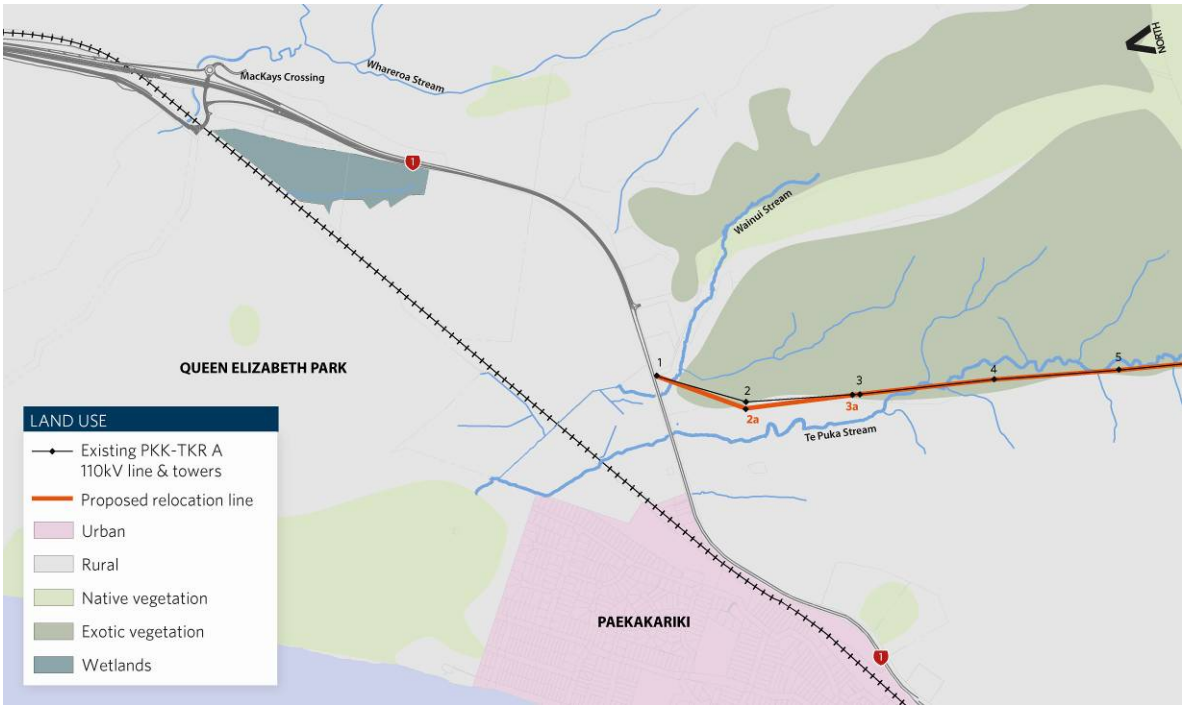


Figure 2.2: Route Section 1

This route section covers the line route between Tower 1 and Tower 4. The PKK-TPR A Line starts at Tower 1, adjacent to SH1. There is no substation at Paekakariki, but Tower 1 does connect to the final pole structures in the Mangahao- Paekakariki A and B single circuit lines. The existing towers on this section are a mixture of strain (Tower 1) and suspension towers (Towers 2, 3 and 4). Tower 4 is the only tower of its type on this line that is on piled foundations.

Figure 2.3 shows the view from between Tower 1 and 2 looking towards Tower 1 and SH1.

Figure 2.3: Looking Towards Tower 1 and SH1

Within the vicinity of MacKays Crossing is a World War II splinter proof blast containment structure referred to as the 'brick fuel storage tank'. The tank is located between Towers 2 and 3 an can be seen on Drawing TP02 within the Volume 4: Plan Set. The tank (shown in Figure 2.4 below) is listed in the Kapiti Coast District Plan as a significant site (structure B87) and it is identified within the *Addendum to Technical Report 19A: Assessment of Built Heritage Effects* as a heritage feature. The structure does not however meet the criteria for an archaeological site set out in the Historic Places Act 1991 due to its construction date being post 1900.

Figure 2.4: Photograph of the Brick Fuel Storage Tank

2.2 Route Section 2: Wainui Saddle (Towers 5 to 15)

Route Section 2 extends from approximately half-way up the Te Puka Stream valley, to the south side of the Wainui Saddle. At approximately 262m above sea level, the Wainui Saddle is the highest point of the corridor. The route section is characterised by the linear valley of the northward flowing Te Puka Stream, north of Wainui Saddle. The Wainui Saddle gorge is steep and narrow in places. The steep greywacke side slopes are forested on the eastern flank and in pasture and regenerating bush on the western slopes. There are a number of alluvial fan deposits at the mouths of main tributary streams. The steep valley generally follows the Ohariu Fault along this section.

Figure 2.5 shows the key features of this route section relative to the existing and proposed transmission line.

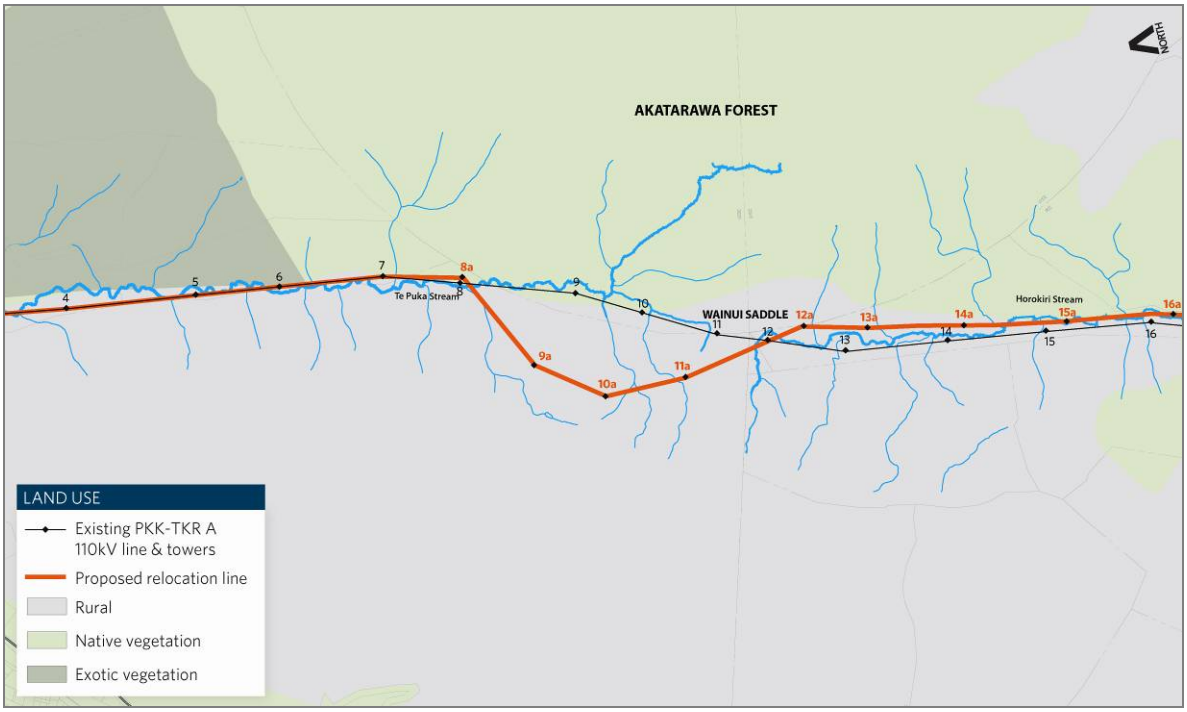


Figure 2.5: Route Section 2

This route section covers the line route between Tower 5 and 15. The existing transmission towers through this section are a mixture of strain and suspension towers. Through this route section, the existing transmission line is located on the eastern side of Wainui Saddle and then crosses into the Horokiri Stream Valley. The existing transmission towers through this section are a mixture of strain and suspension towers. The towers within the Saddle itself experience large loads due to winds from the north, south and northwest. Figure 2.6 shows the Wainui Saddle area with Tower 11 in the foreground and looking towards Tower 10. Figure 2.7: shows the view of Wainui Saddle with Tower 12 on left and Tower 11 on right.

Figure 2.6: Wainui Saddle Looking from Tower 11 towards Tower 10

Figure 2.7: Wainui Saddle looking north-west from near Tower 13

2.3 Route Section 3: Horokiri Stream (Towers 16 to 25)

This route section is approximately 3km long and extends from the southern end of the Wainui Saddle to the northern end of Battle Hill Farm Forest Park. The route descends steeply to the south before flattening to a more moderate grade near Battle Hill. It is characterised by the southward flowing Horokiri Stream eastern branch, south of Wainui Saddle. The steep bedrock slopes are forested on the eastern flank and covered by rough pasture on the western slopes and valley floor. The mouths of steep-sided tributary streams contain alluvial fan deposits. The steep escarpment on the valley's west side has short, steep tributary streams and scree slopes. Rough pasture with extensive areas of regenerating scrub and pockets of remnant indigenous forest are present. On the valley's eastern side there are larger catchments with tributary streams incised in deep valleys with inter-leaved spurs. Some areas of indigenous and second growth bush are located on the valley side, backed by expansive plantation forest. The stream itself is characterised by a gravel bottom meander with limited riparian vegetation.

Figure 2.8 shows the key features of this route section relative to the existing and proposed transmission line.

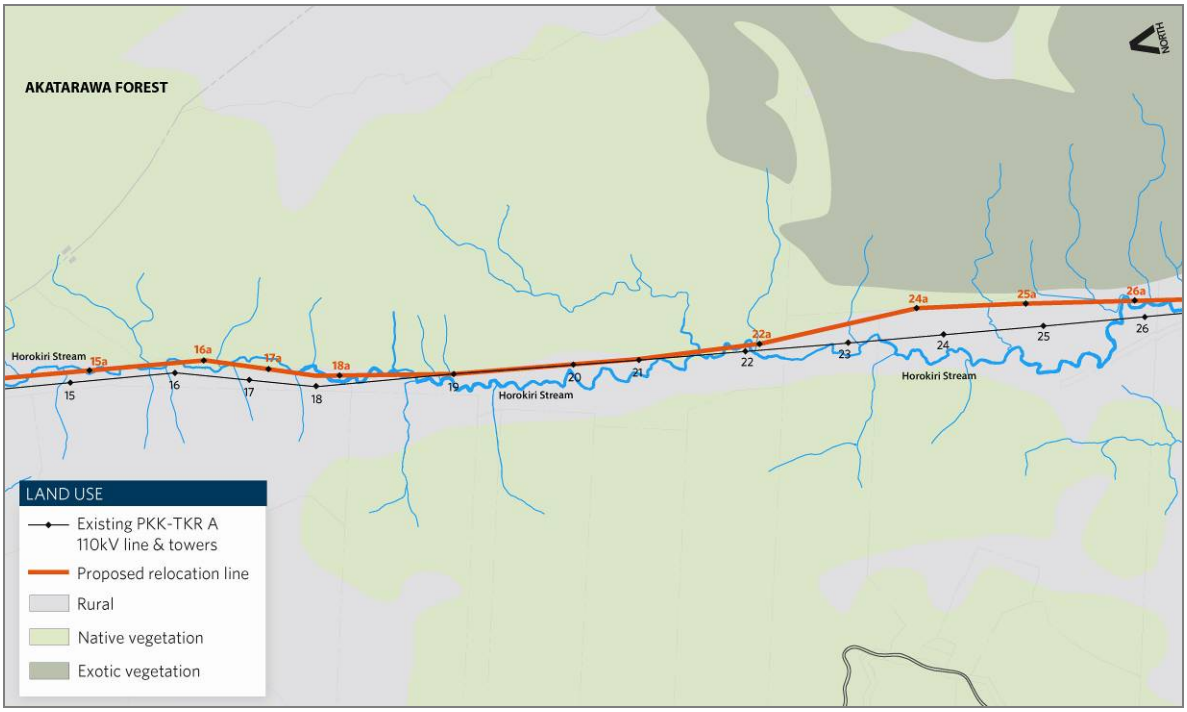


Figure 2.8: Route Section 3

This route section covers the line route between Tower 16 and 25. The existing transmission line generally follows the valley floor and the Horokiri stream. The towers through this route section are predominantly suspension towers. Figure 2.9 shows the Horokiri Valley looking southwards towards Tower 18.

Figure 2.9: Horokiri Valley Looking South Towards Tower 18

2.4 Route Section 4: Battle Hill (Towers 26 to 33)

This route section extends from the northern boundary of the Battle Hill Farm Forest Park, through the Horokiri Valley to the Pauatahanui Golf Course. It is characterised by the wide, sloping alluvial basin of the Horokiri Stream, with steep sided slopes planted in pine forest on the eastern flank (Akatarawa Forest), and pasture on the valley floor and western hills. The valley is characterised by a splinter fault on the north-south alignment, and the Horokiri Stream which meanders across the flood plain. The Horokiri Stream and its eastern tributaries are of high ecological value.

Figure 2.10 shows the key features of this route section relative to the existing and proposed transmission line.

The Battle Hill Farm Forest Park, which is generally accessed from Paekakariki Hill Road (approximately 6km north of SH58 and Pauatahanui), provides for a range of recreational activities, including access to the Akatarawa Ranges. The Battle Hill Farm Forest Park has archaeological and historic sites of significance. It was the site of the last battle in the region between Ngati Toa Rangatira and the Crown in 1846. There are two groups of archaeological sites in the Battle Hill Farm Forest Park; the location of the military camp below the battle site, and the site of the battle on the hill behind. The grave sites and site of the battle itself on the ridge leading up to Battle Hill summit are regarded as waahi tapu by Ngati Toa Rangatira.

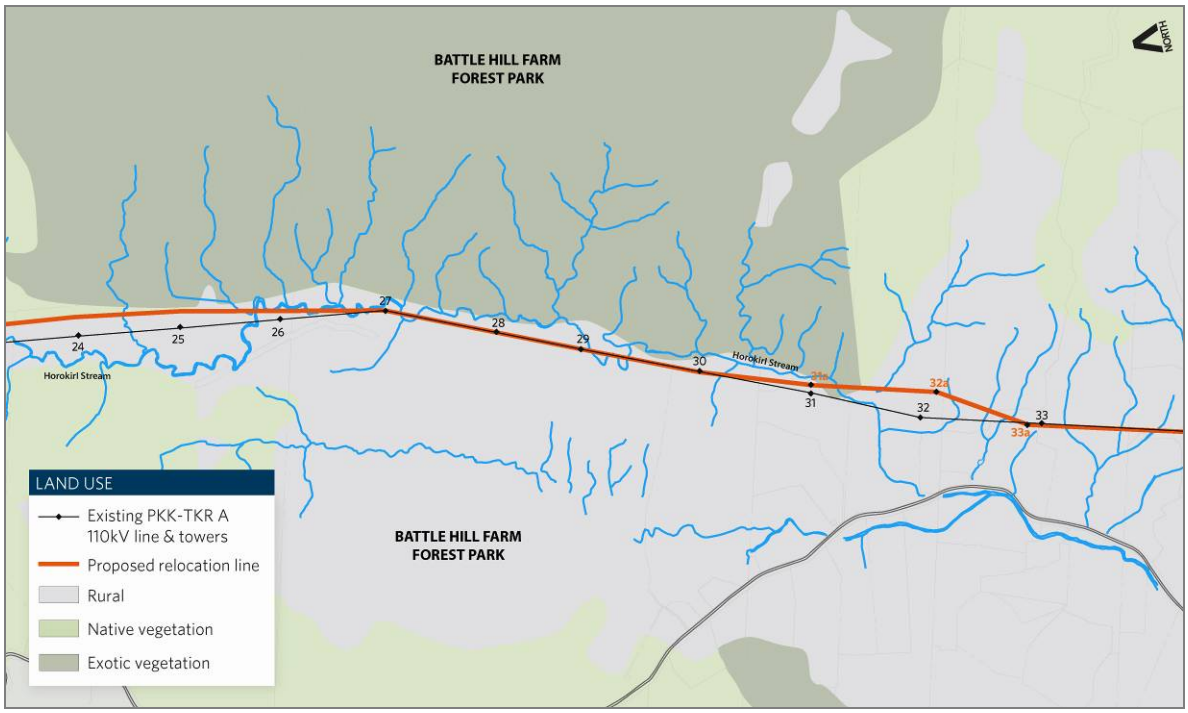


Figure 2.10: Route Section 4

This route section covers the line route between Tower 26 and 33. The section of line between Tower 27 and 33 goes through Battle Hill Regional Park. Through at least half of this section, the ground below the line is flat farmland. From Tower 30 onwards, the typography steepens. The existing vector pipeline is located near the transmission line Towers 32 and 33.

Figure 2.11 shows the view from Tower 31 looking towards Tower 30. The vegetation on the right of the photograph is pine plantation associated with Battle Hill Farm Forest Park.

Figure 2.11: Looking Northwards Towards Tower 30 from Tower 31

2.5 Route Section 5: Golf Course (Towers 34 to 42)

Route Section 5 extends through rural land adjacent to the Pauatahanui Golf Course and Flightys Road. It is characterised by undulating river terraces, gullies and gentle hilltops in pasture and plantation pines, lying between Horokiri Stream and SH58 (in the vicinity of the Pauatahanui Golf Course). The higher hills to the east are characterised by plantation forest and areas of pasture. To the west of the corridor is the Pauatahanui Inlet. To the east of the corridor is Ration Stream bush and Flightys Road. The corridor crosses a number of small tributaries of the Horokiri Stream along this section.

Figure 2.12 shows the key features of this route section relative to the existing and proposed transmission line.

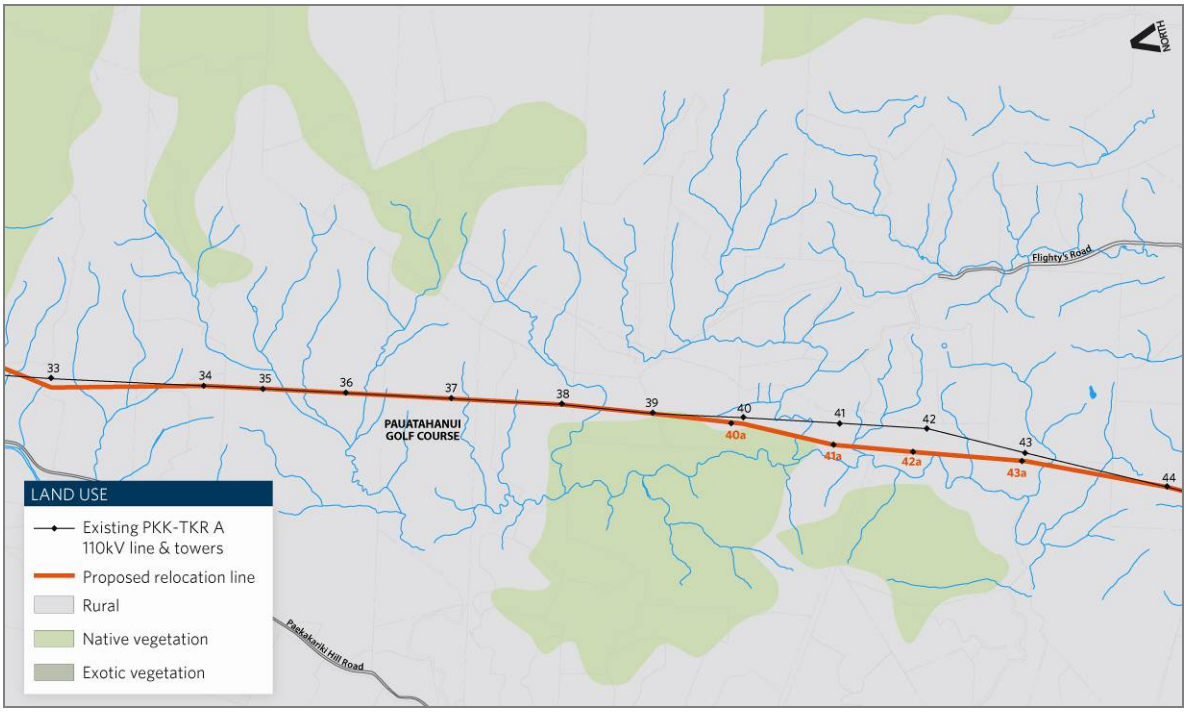


Figure 2.12: Section 5

This route section covers the line route between Tower 34 and 42. This section of transmission line leaves the flat valley floor that characterises the line route further north, to cross hilly farm land. The towers through this route section are generally located on the top of hills. Between Towers 38 and 42, there is a large area of plantation pine located to the west. Figure 2.13 shows the view from near Tower 41(the tower on the far right) looking back (north) towards Towers 38, 39 and 40.

Figure 2.13: View of Towers 38 to 41 from near tower 41 (facing north)

2.6 Route Section 6: State Highway 58 (Towers 43 to 49a)

This route section extends through rolling rural and rural residential land north of SH58, crosses SH58 and a low-lying estuarine plain (Lanes Flat) associated with the Pauatahanui Inlet, and steeper terrain to the south that has been recently cleared of forest. Land to the west of the route is currently being progressively developed as a residential subdivision.

Figure 2.14 shows the key features of this route section relative to the existing and proposed transmission line.

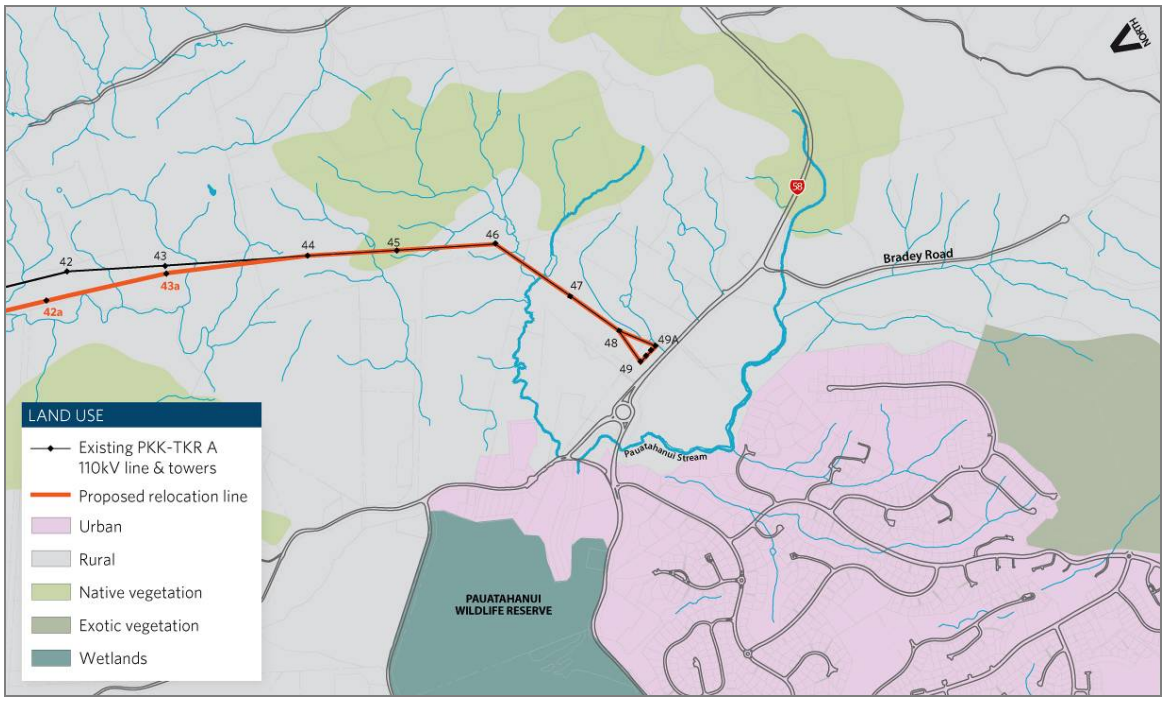


Figure 2.14: Route Section 6

This route section covers the line route between Tower 43 and 49A. The existing transmission line crosses undulating farm land before entering the Pauatahanui substation in the vicinity of SH58.

3 Description of the Project

3.1 Transmission Gully Project

The NZTA Transmission Gully Project is described fully in Part D of *Volume 1: Assessment of Environmental Effects Report* of the NZTA documentation and in summary consists of three components, being the Transmission Gully Main Alignment, the Kenepuru Link Road and Porirua Link Roads. The proposed Main Alignment is the component relevant to the transmission line relocation and involves the construction, operation and maintenance of a State highway formed to an expressway standard from Linden (Wellington City) to MacKays Crossing (Kapiti Coast). The proposed route is approximately 27 kilometres in length and once completed, is intended to become part of SH1.

3.2 Transmission Line Relocation

3.2.1 Rationale

The proposed Transmission Gully Main Alignment generally follows the existing PKK-TKR A transmission line between MacKays Crossing and SH58. In order to construct the road, the transmission line must be relocated. As such, works to the existing electricity transmission line forms enabling works for the Transmission Gully Project. Transpower and the NZTA have investigated the relocation of the line and confirmed a route for the line relocation.

3.2.2 Route Selection Process

Section 88(2)(b) of the RMA outlines that an application for resource consent must include an AEE in accordance with Schedule 4. Schedule 4 (1)(b) requires a description of alternative locations or methods *"where it is likely that an activity will result in any significant adverse effect on the environment".* In this case, the assessment of effects contained in Section 7 confirms that the adverse effects of the activity will not be significant and therefore, a description of alternative locations and methods is not required.

Notwithstanding this, and as part of the process of managing potential effects, Transpower, in partnership with the NZTA, have undertaken a route selection process to determine the most appropriate location for the relocated line. This process was informed by social, environmental, cultural, engineering and other factors. A summary of this route selection process is provided in **Appendix A** to demonstrate how the proposed route was selected.

3.2.3 Transmission Line Route and Tower Locations

The outcome of the route selection process was confirmation of the line relocation route, which generally follows the existing transmission line with a western bypass of the Wainui Saddle where the steep slopes on either side and the proposed highway create a pinch point for the line such that the proposed road and the transmission line cannot both be located within the saddle.

The preferred line route is shown in Figure 3.1 and the route sections are described below. Detailed plans of the route are contained in the *Volume 4: Plan Set* and Appendix B contains details of the changes to towers.

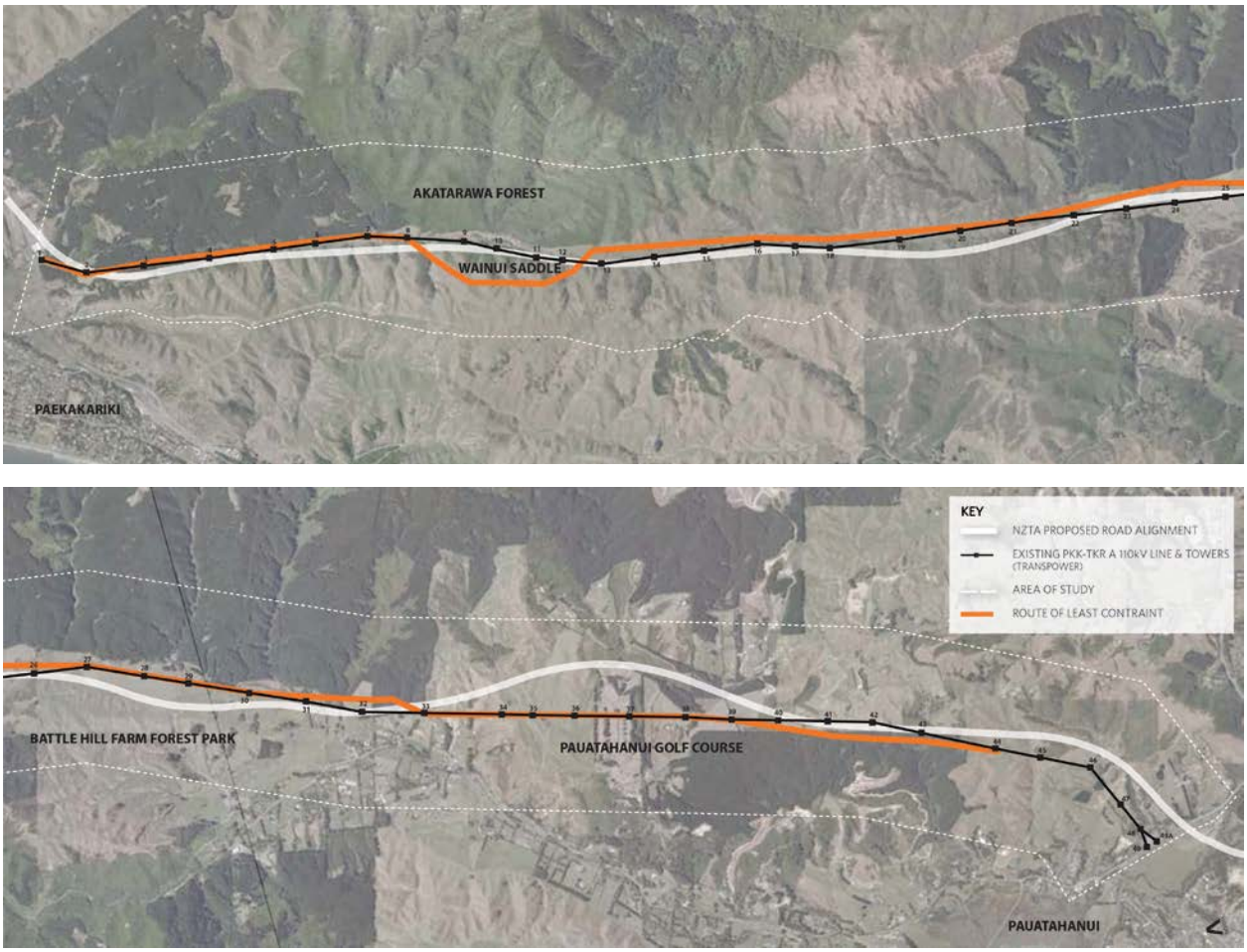


Figure 3.1: Preferred Route (Indicative Representation)

Route Section 1– MacKays Crossing

In order to accommodate the Transmission Gully Main Alignment, the following changes are proposed to towers in this section:

- Towers 1 and 4 will remain in the same location, with some strengthening due to changes in the adjacent towers and angles.
- Tower 2A[1] will be relocated approximately 20m to the west resulting in a small increase to the existing angle, and a strain tower. The new tower will be taller than the existing tower due to the road crossing.
- Tower 3A will be relocated approximately 20m to the north of the existing tower. The new tower will be taller than the existing tower and will be replaced with a strain tower as it is located on one side of the road crossing. The location of this tower is constrained by several factors including; the distance to the road cut, minimising the angle on adjacent Tower 4, a steep bank to the east and maintaining clearance in the span to Tower 4.

[1] The "A" in the tower reference denotes relocated/replaced tower. Existing structures have no suffix, with the exception of Tower 49a, which was installed during part of the reconductoring of the line in 2002/2003.

Route Section 2 - Wainui Saddle

Through this section, the line route runs to west of the proposed road and then from a point roughly two thirds of the way up the Te Puka valley (from tower 8), the line is proposed to be relocated to the west of the Saddle. This is required in order to navigate around the Wainui Saddle, which will be occupied by the Transmission Main Alignment. The specific changes to towers in this section include:

- Towers 5, 6 and 7 will remain in the same location with some likely strengthening of Tower 7 due to the change in adjacent Tower 8.
- Tower 8A will be relocated approximately 15m to the east and 12m higher on the eastern side of the valley than the existing tower and replaced with a strain tower due to the change in line angle and higher wind loads for this area. The line will take a sharp turn-off angle at this location, will cross the road, and will be strung above a tributary gully which contains fill for the proposed road. The tower also needs to be taller to account for these factors.
- Tower 9A will be relocated on a spur 120m above the road. The base of Tower 9A will be approximately 70m below the western ridge. The top of the tower will be approximately 40m below the ridge. The tower will be a strain tower to account for the line angle and the relative height differences between the towers through this section.
- Tower 10A will be relocated to a spur approximately 145m above the road and 30m below the western ridge. The tower will be a strain tower to account for the line angle and higher wind speeds for this area.
- Tower 11A will be relocated to a spur approximately 80m above the road. The base of Tower 11A will be 70m below the western ridge and the top of the tower will be 40m below the ridge. The line will take a sharp angle across the road to Tower 12A. The tower will be a strain tower due to this angle and because it is located on one side of the road crossing. The tower is taller also due to the road crossing.
- Tower 12A at the opposite end of the deviation will also be relocated approximately 35m to the east and 20m higher on the eastern side the valley than the existing tower, replaced with a strain tower due to its location on one side of the road crossing and large span back to Tower 11. The tower height increases due to the road crossing and span length.
- Tower 13A, 14A and 15A will all move to the south of their current location (by approximately 50-60m and in order to vacate space proposed to accommodate the NZTA's new road) and although they will be placed higher than their current location on the eastern hill side, they will end up at a lower elevation than the road. Due to their lower elevation, the heights of the towers need to increase to maintain clearance with the road in the event of conductor blowout.

Route Section 3 - Horokiri Stream

There will be small to moderate changes to this section of the line. Six of the nine towers will be replaced and shifted to the east-in most cases higher on the valley's eastern hill slope to provide greater separation from the highway. The changes to towers in this section include:

- Tower 16A will be a new strain tower located approximately 60m to the south. The tower is taller to maintain clearance with the road in the event of conductor blowout.
- Tower 17A will be a new suspension tower located 40m east of the existing line.
- Tower 18A is approximately 10m to the east of the existing tower will be replaced with a strain tower. The line is angled at this location to maintain the necessary separation between the highway and the new line. Due to its proximity to the road the tower is also taller.
- Towers 19, 20 and 21 will remain in the same location, with some strengthening likely for towers 19 and 21 due to changes at adjacent towers resulting in increased loads on the towers. A small

angle in the line will be introduced at Tower 21 to maintain separation between the highway and the new line to the south.

- Tower 22A will be some 5m higher and 25m to the east of the existing alignment. The ahead span (to Tower 24A) is longest span in the proposed alignment at 500m. The tower is taller to maintain clearance with the road in the event of conductor blowout.
- Tower 23 is removed as it is not required for the relocated line.
- Tower 24A will be some 40m higher on a spur and 100m east of the existing alignment. The location is just within the pine plantation in contrast to other towers in this section which are in pasture. Tower 24A will have a large angle and will therefore be a strain tower.
- Tower 25A is some 70m east of the existing alignment and approximately 5m higher on the slope, adjacent to the edge of the pine plantation. Tower 25A is taller due to the elevation of the adjacent Tower 24A and the need to maintain clearance distances along the span between Tower 24A and 25A.

Route Section 4 - Battle Hill

There will be little change to most of this section of line, the exception being realignment between towers 31A-33A. The changes to towers in this section include:

- Tower 26A remains on the valley floor, but approximately 100m north and 40m east of the existing alignment. The tower is taller due to its proximity to the proposed road and the need to maintain clearance distance in the event of conductor blow out on adjacent spans.
- Towers 27, 28, 29 and 30 will remain in the same locations with likely strengthening of towers 27 and 30 required due to changes at adjacent towers resulting in increased loads on these towers.
- Tower 31A will move 20m to the east of existing tower 31 on a low spur. It will be taller than the existing tower and the highway will cut through the ridge on the 'inland' side so that the tower will now be located on a small hillock but at a similar elevation to its current location.
- Tower 32A will be shifted approximately 80m to the east and 20m higher on the west-facing hill slope. It will be taller that the existing tower due to the road crossing and large adjacent spans. It will be a strain tower and will provide for considerable spans (between 350 and 400m) to the north and south. The tower will be located on the edge of the existing pine plantation and grassed hill face. The existing pine plantation in the vicinity of the line will be cleared to provide access, tower platform and conductor clearance.
- Tower 33A is on the opposite side of the highway. The existing tower will be replaced approximately 10m from current location (towards tower 32A) with a strain tower to connect the deviation to the existing alignment at Tower 34.

Route Section 5 – Golf Course

There will be relatively small changes to this section of line with the relocated line aligned roughly parallel and to the west of the existing line. The changes to towers in this section include:

- Towers 34-39 will remain in the same locations with likely strengthening of Towers 34 and 39 due to changes at adjacent towers resulting in increased loads on these towers.
- Tower 40A will be relocated 40m to the north of the existing alignment. Tower height will increase however the base of the tower will be approximately 5m lower than the existing tower. The increase in height is required to maintain ground clearance.
- Tower 41A will be relocated 70m to the west of the existing alignment. The tower will taller in order to accommodate the proposed commensurate reduction in the height of the base of the tower by approximately 15m (lower than the existing tower).

- Tower 42A will be relocated 110m to the north-west of the existing alignment. Tower height will increase by 19.8m but the base of the tower will be approximately 10-15m lower than existing tower 42. As with the above (tower 41A) the height increase is needed to accommodate the reduction in vertical elevation of the tower, bearing mind the need to achieve relevant line clearances.

Route Section 6 - State Highway 58

There will be only small changes to this section of line. The changes to towers include:

- Tower 43A will be relocated west of the existing alignment. This section will be straight and parallel to the highway. It will be aligned close to the edge of the existing pine plantation and some clearance of pines will be required between towers 42A-44.
- Tower 44 will be in the same location, but will be strengthened due to the changes in adjacent Tower 43A resulting in increased loads on this tower.
- Towers 45, 46, 47, 48 and 49 and 49a will remain in the same locations with no changes to the towers.

Table 3:1 summarises the proposed changes to towers.

Table 3:1: PKK-TKR A Line Towers

Description	Towers	Quantity
Replaced structures	2,3,8,9,10,11,12,13,14,15,16, 17,18,22,24,25,26,31,32,33, 40,41,42,43	24
Structures to be strengthened*	1,4,7,19,21,27,30,34,39,44	10
Structures to be removed entirely	23	1
Unaffected Structures (not moving (replaced) or being strengthened)	5,6,20,28,29,35,36,37,38,45,46, 47,48,49,49a	15
Total		**50**

* Involves foundation and/or tower strengthening.

3.3 Land Affected by the Line Relocation

Table 3.2 is a schedule of the land to which this application for resource consents relates.

Table 3:2: Schedule of Land

Proposed Tower/Line	Legal Description	Certificate of Title	Owners	Address/ Purpose
Line only	LOT 1 DP 87790	WN55C/104	Kapiti Coast District Council (Vesting on deposit for local purpose reserve)	
Line only	LOT 2 DP 87790	WN55C/105	Her Majesty the Queen	330 State Highway 1, Paraparaumu-Paekakariki
2A, 8A, 9A, 10A, 11A	LOT 1 DP 368307	277518	John Hayes Perkins	314 State Highway 1, Paraparaumu-Paekakariki

Proposed Tower/Line	Legal Description	Certificate of Title	Owners	Address/ Purpose
3A	LOT 7 DP 70122	WN38A/630	Her Majesty the Queen	
Line only	LOT 10 DP 70122	WN38A/633	Her Majesty the Queen	370 State Highway 1, Paraparaumu-Paekakariki
Line only	LOT 13 DP 70122	WN38A/636	Wilhelmus Leonardus Marie Van Cruchten	
Line only	PT LOT 1 DP 11960		Acquired for use in connection with a road	
12A, 13A, 14A, 15A, 16A, 17A	PT LOT 1 DP 4268		Acquired for use in connection with a road	
18A, 22A	PT LOT 2 DP 71399		Acquired for use in connection with a road	
Line only	LOT 1 DP 41731	WN13D/1330	Michael Boyd Kenning	874 Paekakariki Hill Road, Pauatahanui
24A	LOT 3 DP 77862	WN44D/367	Ann Ruby Inglis, Ronald George Inglis	
25A	SEC 1 SO 402089	439219	Her Majesty the Queen (Acquired for use in connection with a road State Highway 1)	
Line only	SEC 2 SO 426500	547194	Her Majesty the Queen (Acquired for use in connection with a road)	
26A	SEC 3 SO 426500	547194	Her Majesty the Queen (Acquired for use in connection with a road)	
Line only	LOT 1 DP 8107	WN31C/915	The Wellington Regional Council (Acquired for water supply, recreation and forestry purposes)	610A Paekakariki Hill Road, Pauatahanui
Line only	PT LOT 2 DP 8107	WN31C/915	The Wellington Regional Council (Acquired for water supply, recreation and forestry purposes)	
Line only	LOT 4 DP 87055	WN54D/115	Her Majesty the Queen	
31A	LOT 3 DP 87055	WN54D/114	Her Majesty the Queen	
32A	LOT 2 DP 64048	WN35C/763	Lois Priscilla Ann Reid, Mary Eleanor Hubble, Maureen Joan Collins, Maureen Joan Collins-Lucic, Maureen Joan Lucic, Milos Lucic	528 Paekakariki Hill Road, Pauatahanui

Proposed Tower/Line	Legal Description	Certificate of Title	Owners	Address/ Purpose
Line only	LOT 2 DP 77897	WN44D/328	W P Szeto Limited	
Line only	LOT 1 DP 77897	WN44D/327	Helen Anne Poppe, Philip John Poppe, Stephen David Walsh	504B Paekakariki Hill Road, Pauatahanui
33A	LOT 2 DP 73878	WN40D/764	Eberhard Jurgens Deuss	462 Paekakariki Hill Road, Pauatahanui
Line only	LOT 3 DP 88589	WN56B/233	Her Majesty the Queen	436B Paekakariki Hill Road, Pauatahanui
Line only	LOT 1 DP 88589	WN56B/231	Hart Land Company Limited	406 Paekakariki Hill Road, Pauatahanui
Line only	LOT 1 DP 90101	WN57D/166	Kevin Williams-Elliott, Yvonne Mabel Williams-Elliott	337 Flightys Road, Pauatahanui
Line only	LOT 1 DP 83730	WN50D/616	Her Majesty the Queen	
40A, 41A, 42A	SEC 1 SO 314239	102713	Her Majesty the Queen (Acquired for use in connection with a road)	
43A	PT SEC 66 Pauatahanui District			
Line only	LOT 3 DP 314471	57408	Gloria Mary Welch, William Ian Welch	56 Paekakariki Hill Road, Pauatahanui

Not all line relocation activities are captured by the proposed NZTA Transmission Gully designation and therefore, separate easements will be negotiated with landowners for the line relocation where relevant. This includes the four tower sites located outside the NZTA Transmission Gully Designation.

The discussions undertaken with affected landowners are set out in Section 6.4 of this report.

3.4 Proposed Line Relocation Works

The line relocation project will involve the following works which are detailed in the subsequent sections:

- Relocation, alteration and replacement of transmission towers;
- Steel and foundation strengthening of some existing towers;
- Removal of an existing transmission tower; and
- Upgrading of existing access tracks and construction of new access tracks for construction and maintenance of the line. As noted in Section 1.2 and Section 4.4 any resource consent required for earthworks associated with the access tracks is not being applied for at this time.

3.4.1 Tower Design and Locations

The line relocation works involve the relocation and replacement of 24 transmission towers. **Appendix B** contains the existing and proposed details for each of the towers including location, height, tower type and span lengths.

The tower co-ordinates provided in Appendix B and shown on the plans contained in the *Volume 4: Plan Set*, represent the centre point for each tower. These locations have been selected based on preliminary design informed by site visits and desktop investigations. During detailed design, the tower locations may be re-sited to respond to particular geotechnical conditions or other features at a site. For this reason, a 20 metre tolerance has been provided for each tower location.

The exception is Tower 31A, 32A, 33A and 40A where a reduced tolerance is provided to respond to known constraints including large cuts for the proposed road, areas of native vegetation and the visibility of the towers from nearby dwellings. The visual effects of these towers are discussed in Section 7.3 of this report. The following tolerances are proposed for these four towers:

- For Tower 31A, the tower site may be moved up to 5m west, 20m north, east and south. A large proposed cut face is located to the west of this tower. Locating the tower on the cut face is not viable and should be avoided.
- For Tower 32A, the tower site may be moved up to 10m east, 20m north, west and south. Further movement to the east (uphill) would increase the prominence and degree of visual effect on adjacent properties.
- For Tower 33A, the tower site may be moved up to 5m west and south, 20m north and east. Property owner has indicated that any movement of tower closer to dwelling will be an issue of concern for them.
- For Tower 40A, the tower site may be moved up to 5m north, 10m east, 20m west and south. Directly north of this tower is an area of native vegetation that was introduced as ecological mitigation for the previous NZTA designation. Clearance of this vegetation should be avoided.

Figure 3.2 shows how the proposed tolerances would apply during the final siting of towers. The figure shows the standard tolerance of 20 metres and a reduced tolerance, using tower the proposed tolerance for Tower 40A as an example.

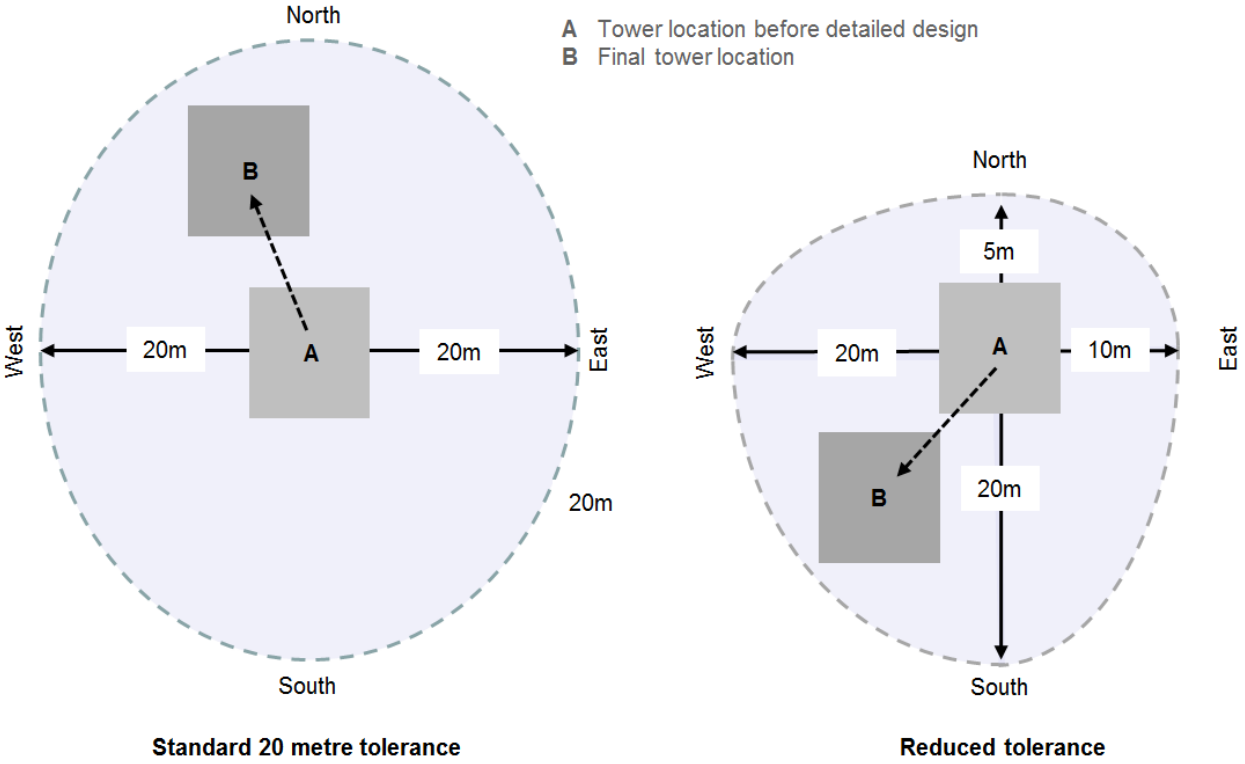


Figure 3.2: Tower Tolerances

The new towers will be a mixture of strain and suspension towers of steel lattice design.

A suspension tower has conductors suspended from the tower, with the mechanical tension being the same on each side. The tower carries the downward and lateral force, but is not designed for a longitudinal force. Suspension towers are used where a transmission line continues in a straight line, or turns through a small angle.

A strain tower is designed for a longitudinal force where the mechanical tension on the line is different on each side. The conductors are attached to the structure through strain insulators. Strain towers are used where the line turns through an angle and on either side of a road crossing. These towers are typically shorter and wider than suspension towers.

Figure 3.3 and Figure 3.4 show examples of an existing strain and a suspension tower on the PKK-TKR A line.

Figure 3.3: Example of a Suspension Tower (PKK-TKR A transmission line).

Figure 3.4: Example of a Strain Tower (PKK-TKR A transmission line).

The relocated towers will be selected from a "family" of support structures with each chosen depending on the design parameters for a particular location. Due to the age of the existing towers, and the changes in design standards since the existing towers were constructed, they cannot be reused for the relocated line. Rather, relocated towers will need to be replaced with towers that are designed and constructed to meet current Transpower design standards. The indicative design for the suspension and strain towers is shown in Figure 3.5 and Figure 3.6. The towers shown in the figures are the general outline of the towers and do not include the cross members (the steel bracing) within the body of the tower. The proposed towers will include such bracing.

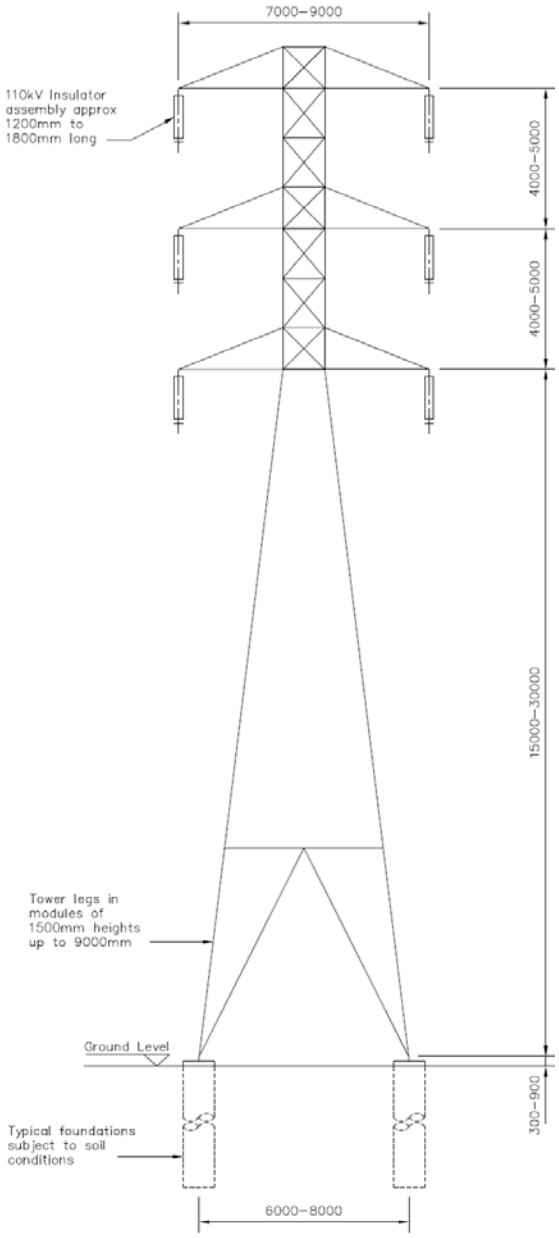


Figure 3.5: Preliminary Outline Geometry for 110kV Suspension Tower

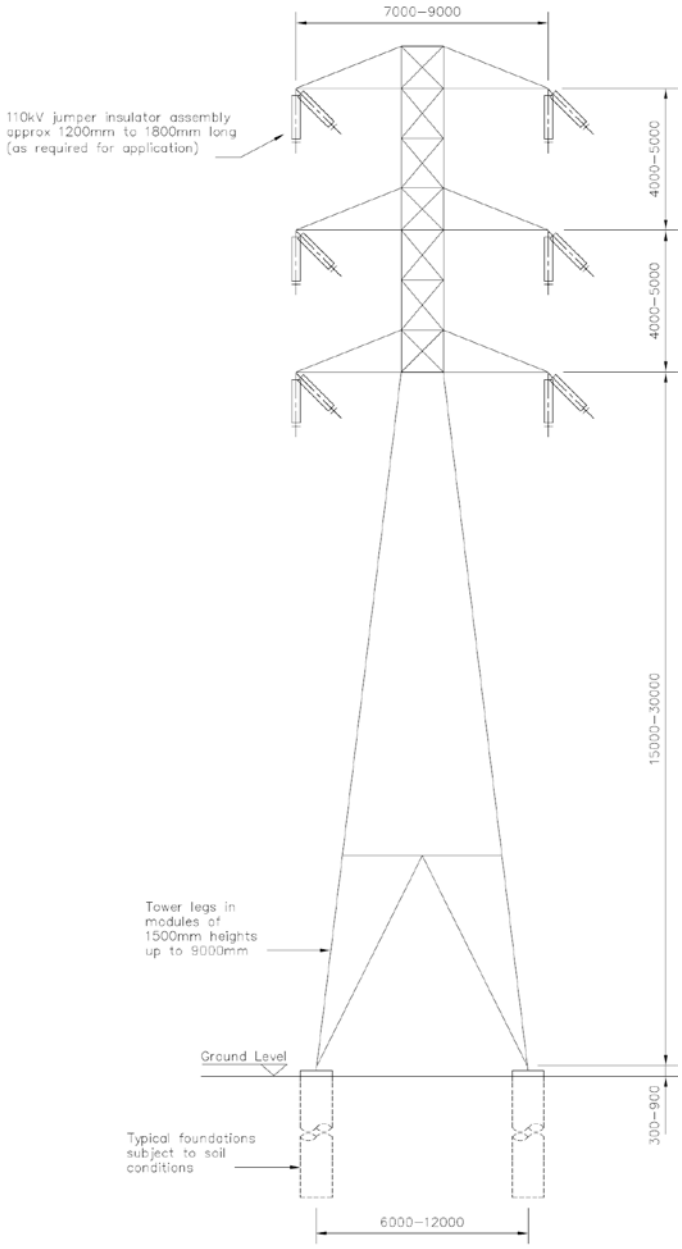


Figure 3.6: Preliminary Outline Geometry for 110kV Strain Tower

The replacement towers will range in height from 29 metres through to 40 metres. The tower height is determined by the surrounding topography and clearance requirements. Typically, shorter towers are located on elevated areas such as hills, with taller towers being used near gullies, on flatter terrain or where additional clearance is required over mid-span obstacles.

The proposed heights for the replacement towers provided in Appendix B include a 5 metre tolerance. This is to account for any height increases needed as identified during detailed design to achieve safe distances between the line and the ground/structures underneath. That is, if the ground conditions require lowering of the base of the tower then this will require a commensurate increase in the height of the tower. These distances are set out in the NZECP34. Therefore, the tower heights represent the maximum anticipated height of towers for the proposed tower locations.

The existing line does not have an earthwire and no earthwire is proposed for the relocated line. The line will use the same or similar type of conductor as the existing, being Wolf ACSR/AC. This conductor has an overall diameter of approximately 18mm. The key features of the existing and relocated PKK-TKR A towers and line are as follows:

Feature	Existing	Proposed
Number of structures	50	49
Tower body	Steel lattice	Steel lattice
Tower type	Mixture of strain and suspension	Mixture of strain and suspension
Insulators	Primarily glass and some composite	Primarily glass and some composite
Earthpeak	None	None
Conductor	Wolf ACSR/AC	Wolf ACSR/AC or similar
Number of circuits	Double	Double
Operating voltage	110kV	110kV
Maximum design operating temperature	75o	75o

3.4.2 Tower Foundations

The size and type of each tower foundation is dependent on tower loading, tower type and soil conditions. The foundation type for each tower will be confirmed during detailed design and could be either concrete piles or pad and pedestal foundations depending on ground condition and terrain. Figure 3.7 shows an example of pile foundations on an existing PKK-TKR A tower. The tower foundations typically cover an area of approximately 6m x 6m for a suspension tower and approximately 8m x 8m for a strain tower.

Figure 3.7: Example of Pile Foundations

3.4.3 Tower and Foundation Strengthening

Transpower have reviewed the existing towers along this section of the PKK-TKR-A transmission line to identify whether any of the remaining towers or their foundations will need to be strengthened as a result of the line relocation works.

This assessment has identified ten towers located adjacent to replacement towers that will require strengthening due to changes in tower loading. These towers are identified in Table 3:1.

Tower structural strengthening typically involves replacing existing steel members with larger steel members, or installing some additional strengthening members and bracing inside the frame of the existing towers.

Foundation strengthening typically involves excavation of the foundation earth backfill, and replacing it with concrete, followed by reinstatement of the surface.

3.4.4 Tower Removal

As a result of the tower replacements, existing tower 23 will no longer be required as the span length through this section does not require the tower. This tower will be dismantled and removed.

Once the towers have been replaced, the old towers will be dismantled using cranes or similar and their foundations partially removed.

3.4.5 Construction and Maintenance Access Tracks

Transpower has access tracks along the length of the existing for the purpose of maintaining the existing line. These tracks are shown on Plans TP 1-12 within the *Volume 4: Plan Set*. Wherever possible this existing track will be used to access the replacement tower locations. Sections of new access track will be constructed off the existing track for the construction of some relocated towers where these cannot be accessed directly from the existing Transpower access track or from existing farm/forestry tracks. At the Wainui Saddle, access to Towers 9A, 10A, 11A is likely to be taken from off the access track that currently serves the farm and the gas pipeline owned by Vector. The track runs along Gasline Ridge and can be seen on Drawing GM04 within the *Volume 4: Plan Set*. Sections of new track are required from this existing track to gain access to tower sites 9A and 10A.

The new tracks range in length from approximately 20 metres to 350 metres. Based on preliminary design, the total combined approximate length of new construction access tracks is 2,860m. The detailed design of these tracks will be undertaken at a later stage once tower locations are confirmed.

Construction of the Transmission Gully Main Alignment will result in the removal of the existing Transpower access track in some locations and so sections of maintenance track will need to be provided off the service tracks that are to be constructed by NZTA. Preliminary design indicates six towers that will require new sections of track for on-going maintenance following the construction of the Main Alignment. Based on preliminary design, the total combined approximate length of new maintenance access tracks is approximately 840m. The location and length of access tracks will be confirmed during detailed design.

Where towers are not relocated and access is not disrupted by the Transmission Gully Main Alignment, then the existing tower access arrangements will continue for line maintenance activities.

3.5 Proposed Construction Methodology

Relocation of the transmission line will involve a series of construction related activities, which are broadly categorised as follows:

- Detailed design including geotechnical investigations and confirmation of tower siting
- Vegetation clearance for access tracks and foundation platforms and vegetation trimming for line clearance
- Construction of access tracks
- Installation of temporary line deviation (where required/if necessary)
- Tower site preparation
- Foundation installation
- Tower erection
- Steel and foundation strengthening of existing towers
- Conductor stringing
- Site reinstatement
- Existing tower and foundation removal
- Commissioning of the relocated line.

The activities above are listed in the general order in which they are undertaken. However, some of the above activities will be undertaken concurrently. There will also be the detailed design phase undertaken prior to construction works commencing. This detailed design work would include detailed site investigations where necessary, such as detailed geotechnical investigations, and pegging out the position of the structures.

3.5.1 Geotechnical Investigations and Confirmation of Tower Positions

On-site geotechnical investigations will be undertaken to identify soil characteristics and water table conditions. The geotechnical investigation programme has not yet been developed, but it is intended to undertake tests at every tower site affected by the proposal.

The geotechnical information will be used to confirm the suitability of the soils for the proposed tower and for the selection of the most suitable tower foundation type. The geotechnical investigations will also provide information to the construction crew on the presence of groundwater and the likely nature and extent of the material to be excavated.

Based on the results of the geotechnical testing, the tower locations and foundation type will be confirmed and earthworks design finalised.

3.5.2 Vegetation Clearance for Towers and Access Tracks

Some vegetation will need to be cleared when forming or upgrading access tracks, clearing sites for support structures and for conductor minimum clearance requirements. The extent and type of clearing required is dependent upon terrain, vegetation type and to some extent landowner and land use requirements. The majority of the vegetation to be affected is pasture. However, in some cases, woody vegetation will need to be removed.

Vegetation clearance is likely to be required for the construction of the following towers:

- Towers 3A, 21 (existing tower to be strengthened) and 22A - Gorse dominated scrub (closed canopy); and
- Towers 24A and 43A – Pine plantation.

Vegetation clearance for these towers may involve clearing the tower footprint and an area for crane and tower assembly located adjacent to the tower.

Vegetation clearance may be required for access tracks to gain access to the following towers outside the Transmission Gully Project construction extent:

- Tower 21 (existing tower to be strengthened) - Gorse dominated scrub (closed canopy); and
- Tower 3A (existing tower to be strengthened), 24A, 43A – Pine plantation.

3.5.3 Access Tracks

Individual construction and maintenance access tracks will be required to each tower site along the line. Where ever possible, the construction access tracks for the Transmission Gully Project will be used to access replacement tower sites. The construction access tracks run the full length of the Transmission Gully Project route from MacKays Crossing to the Main Alignment main site compound located next to the proposed SH58 Interchange. Wherever practical, existing access tracks, such as farm and forestry tracks will be used with the agreement of the respective landowners.

Access tracks will generally require a 3.5m minimum up to 4.5 metre wide carriageway. The access tracks will be constructed to provide all weather access suitable for heavy vehicles to access each tower site.

The construction of new access tracks or significant upgrading of existing farm tracks would generally involve the following activities:

- Survey and peg out limit of earthworks and track centreline
- Fence off any environmentally sensitive areas in close proximity (where necessary)
- Construct sediment controls for fills
- Earthworks to prepare spoil disposal areas including silt and sediment controls
- Construct cut-off drains at tops of cuts to intercept clear water – clean water diversions
- Construct silt fences at the toes of fills
- Remove topsoil from within the earthworks limits
- Carry out earthworks
- Construct side drains, culverts and grit traps
- Close spoil areas, topsoil and re-grass
- Construct road and tower pad pavements
- Topsoil and hydro-seed cut and fill batters
- Decommission sediment control measures when the site is stabilised.

Where existing tracks are used, it is anticipated that some existing tracks will require levelling or regrading during the construction phase to improve access for heavy vehicles.

All access arrangements, including upgrades to existing access tracks or new tracks, will be formalised as part of the easement agreements with landowners. The access arrangements may require changes to other site features and activities, such as realigning farm fences and gates.

The final design and access requirements for each support structure will be determined as part of the detailed design phase. However, some general design principles and standards will be followed for all access tracks. These principles and standards include implementing erosion and sediment control measures to appropriately manage water runoff, particularly in areas of erodible soils. Erosion and sediment control will be undertaken in accordance with the requirements set out in the

Wellington Regional Council, *Erosion and Sediment Control Guidelines for the Wellington Region*, September 2002.

Access tracks are often retained by landowners post-construction as they can provide improved farm, forestry and landowner access. In addition, some form of access track will be required for future maintenance activities, although the access tracks for maintenance purposes may be of a lower standard.

If any additional resource consents are required for access tracks (eg for earthworks or temporary or permanent culverts), these additional consents will be sought following the detailed design phase which would determine the location and alignment of the access tracks. This is discussed further in Section 4.4 of this report.

3.5.4 Tower Site Preparation

The tower construction activities including site preparation earthworks, foundation construction and tower erection will be carried out within a tower construction area. The construction area will be in the immediate vicinity of the tower site. The total construction area will range between approximately 500 to 2,000m^2 depending on site constraints such as typography and vegetation. For example, flatter towers sites in pasture are likely to be larger due to clear available space around the tower with smaller areas used on steeper slopes to reduce the extent of earthworks. Within the construction area, up to approximately 500m^2 of earthworks may be required to establish construction platforms depending on the typography adjacent to the tower site.

Heavy plant (eg crane and drilling rig) is used to construct the tower foundations and towers themselves. This heavy plant requires a reasonably level platform to work from. Where tower sites are located on ridges or sloping ground, earthworks would be carried out to form a necessary level working platform. Depending on the contour of the tower site, there may be one or more platforms formed at different levels. The platforms would typically need to include a 6 metre wide platform for a large drilling rig and a platform of 12 metres wide for a large capacity crane. These areas will be contained within the tower construction area and will be confirmed for each site during detailed design. The construction works sequence for preparing tower sites is similar to the sequence for constructing access tracks as outlined above.

On flat sites with soft ground conditions, hard standing platforms for plant may be formed by spreading and compacting hard fill or by laying of construction matting on the site. It is anticipated that most, if not all, tower site preparation works (excluding access) will be conducted within the tower construction area. It should be noted that extensive benching of sites on steep terrain can effectively take away height from the site that is often required for clearance to the next site and therefore such benching is kept to a minimum.

While it is desirable for the lay-down area to be as close as possible to the tower site, the actual location is controlled to some extent by topography.

Following the completion of the tower site preparation works, the site will be left in a tidy manner by removing materials and stabilising the construction area. The tower site is then ready for the tower foundation to be constructed.

3.5.5 Foundation Installation

Transpower has identified two potential options for tower foundations, these being bored concrete piles or pad and pedestal foundation. The specific foundation type chosen will only be known following detailed analysis based on site-specific geotechnical investigations. The following is a

general description of these two potential tower foundation options and what processes are involved during construction.

Bored Concrete Piles

A cast-in-situ bored concrete pile consists of a vertical or raked hole bored into the ground. Reinforcing steel is placed in the hole which is then filled with concrete. A stub leg by which the tower body is fastened to the top of the concrete foundation pile is fixed into the top of the foundation and encased in the concrete. Generally one pile is installed at each corner of the tower. However, in some instances, it is more cost effective to install multiple piles of smaller dimensions at each corner of the tower and bond these piles together using a concrete raft or pile cap.

The dimensions of bored concrete pile foundations are dependent on the loads the foundations are required to withstand and the physical strength properties of the soil. Typical bored concrete pile foundation dimensions for the project are expected to have diameters ranging between 900mm-1,500mm, but may be up to 2,400mm in diameter. The piles are expected to range in depth from 7 metres to 20 metres. The diameter and depth of the foundations are dependent on whether the piles are vertical or raked, as well as the loads, and the soil strength and other properties.

The typical process for the construction of a bored concrete pile foundation involves:

- Drilling the foundation hole
- Installing the steel reinforcing cage inside the excavation
- Installing the formwork to shape the top of the foundation pile
- Installing the stub leg to accurate dimensions using support frames
- Placing mass concrete
- Sometime later after the concrete has sufficiently cured, the temporary framework used to support the stub leg, and the formwork is removed.

Typically concrete is placed as soon as possible after the foundation has been excavated. Excavation is most commonly carried out using a wheeled or tracked drilling rig using an auger or bucket type drilling head. Typical quantities may range from 30m^3 to 80m^3 per tower site depending on the designed foundation dimensions.

Pad and Pedestal Foundation

The pad and pedestal foundation design provides for a separate foundation structure to be installed at each corner of the tower. The foundation structure consists of site poured reinforced concrete which protrudes above the ground and into which a stub leg is cast at the top of the foundation, as for the bored concrete pile foundation.

The general design provides for a large steel reinforced concrete pad installed below ground with a reinforced concrete column (pedestal) of smaller section, connected to and extending from the centre of the pad to above ground level. The pedestal will be raked in accord with the tower leg rake. Compacted fill is placed around the pedestal and on top of the pad, to become an integral part of the foundation.

The typical process for constructing a pad and chimney foundation involves:

- Excavating the foundation site
- Shoring the excavation
- Installing formwork if required
- Installing reinforcing steel

- Placing concrete for the pad
- Installing formwork for the chimney
- Installing stub leg to accurate dimensions
- Placing concrete for chimney
- Remove formwork
- Backfill the foundation.

Excavations for pad and pedestal foundations would generally be between 4 and 6 metres square and up to 5 metres deep (from 20m^3 to 100m^3 per foundation, which equates to between 80m^3 and 400m^3 per tower site). As one of the main advantages of this type of foundation is decreased depth, one of the main purposes for using it is to avoid penetrating the water table.

3.5.6 Tower Erection

The term 'tower erection' refers to a sequence of activities from delivery of the structure components to the site, pre-assembly, erection, tightening and inspection of each tower structure. Steel for lattice towers is fabricated, galvanised, sorted and bundled ready for delivery at an off-site contractor's facility. Pre-assembly of the tower is usually carried out adjacent to its final site location and involves assembly of a number of sections that will allow convenient erection at the following stage.

Large or heavy towers may require the use of a small mobile crane to move members and sections around the tower construction area. In most instances, a large mobile crane is used to erect the tower with a work crew installing and tightening all bolts, and checking that the structure is complete. Alternatively, where site access is difficult or the site confined, a helicopter may be employed to lift tower sections. In extreme situations, where crane access is not possible and helicopter access is not desirable, the older traditional method of using a floating derrick or Gin Pole may be employed.

3.5.7 Temporary Line Deviation

Temporary line deviations may be established for the period of the works to enable the on-going operation of the line where a replacement tower is located in close proximity to existing towers and create a safety issue during construction (eg Tower 33A which is located close to the existing tower). At these locations a temporary line may be constructed. This would involve installing poles or similar for a short section to carry the existing line while the new tower/s are being constructed. Once the works are complete, the temporary line deviation is removed and the area reinstated.

3.5.8 Conductor Stringing

Conductors will be installed using the "tension stringing" method using specialised wiring equipment including a winch / tensioner and may be assisted by helicopter. Tension stringing is the term used to describe the process by which conductors and earthwires are installed under sufficient tension to be kept clear of the ground and mid-span obstacles. Prior to the conductor stringing operation of a selected section, the suspension insulator strings are fitted to the tower crossarms and running blocks (pulleys) subsequently fitted to the bottom of the insulators in preparation for the conductor being run out. The strain and jumper insulators are then fitted to towers after the conductor has been run out and correctly sagged.

A pilot rope is initially pulled (usually by helicopter) from one end of the section through the running blocks (pulleys) on each tower attached to the towers by insulators and then connected to the winch. The pulling winch then pulls the pilot rope which is connected to the conductors and they are in turn, pulled through the stringing sheaves under tension via the tension winch. This sequence of

work is repeated for each of the six phases (ie two circuits). Stringing is usually carried out in sections of three to six kilometres, depending on the terrain, access and tower types.

Stringing locations will require a working area of to accommodate the tensioner/pullers and conductor and pilot wire drums together with ancillary equipment. These areas can be up to 5,000m^2. The stringing locations will be contained within the Transmission Gully Project construction extent.

In locations where the new conductor crosses the existing conductor or construction access, temporary scaffolding (or hurdles) and netting may be constructed. These hurdles are to protect the existing line and access tracks from a potential conductor fall during the stringing process due to component failure. The hurdles would be installed prior to conductor stringing and removed at completion of conductor stringing.

After the conductors have been installed to the correct tensions, they are “clamped in” by removing the sheaves and installing fixed clamps which hold the conductor in its final position. Tension set insulators are then installed at the same time.

3.5.9 Existing Tower and Partial Foundation Removal

Once the new towers have been constructed, the old towers will be removed using similar equipment including cranes. The tower components will be removed from the site. Tower foundations will be partially removed by cutting them down to a depth of approximately 1 metre where they are not within an area of cut for the proposed road. The area will be reinstated and stabilised. The same method will also be used for Tower 23 which is being removed and will not be replaced.

3.5.10 Site Reinstatement

Construction debris will be removed from site during or on completion of the construction activity that caused it. Any temporary access tracks located outside the Transmission Gully Project construction extent will also be removed on the completion of all works, with excavation of laid base course and other roading material. In some instances the track formation will remain for future maintenance of the line.

Repair of damage to pasture caused by construction traffic and lay-down areas will generally be completed at the earliest opportunity after completion of work at each site.

Repair of any accidental damage to farm infrastructure such as gates and fences, etc, will be completed as soon as possible following the damage and in agreement with the landowner.

3.5.11 Site Office and Storage Areas

It is expected that the construction phase may make use of two of NZTA’s identified construction yards, one at MacKays crossing (to access the northern towers) and the other at Battle Hill Forest Farm Park, which is accessed off Paekakariki Road, for the remaining towers. The use of these yards is dependent on the activities NZTA is undertaking at that time. From these yards, the tower sites will be accessed from the existing access track or existing farm tracks (eg the Vector pipeline track for construction of towers on the western side of Wainui Saddle).

A storage area(s) will be required for storage of bulk materials such as tower steel, conductor and insulators, as these are usually delivered in bulk, and not delivered directly to the tower sites where they are to be installed. At this stage, it is unknown where or how many storage area(s) will be required; however, these will be within the Transmission Gully Project construction extent. The site

office and storage area(s) will be temporary, and will be removed at the end of the construction works.

3.5.12 Construction Traffic

Traffic will be generated by the project to deliver materials to storage depots and then to site, and to deliver construction plant and labour to site. Delivery of materials and plant will involve heavy trucks and truck mounted plant such as drilling rigs. Labour will generally be transported in light four wheel drive vehicles such as utility vehicles.

Construction is expected to involve between 30 to 50 heavy vehicle movements and up to 70 light vehicle movements per tower (excluding any access track formation). As described above, access tracks are yet to be confirmed, and different tracks may provide access to one or more towers.

At conductor stringing (wiring) sites, there will be additional vehicle movements of between 25 to 50 heavy vehicle movements, depending on if it is a winch or tensioner site, and at least 40 light vehicle movements.

In terms of duration, construction traffic will typically be concentrated in certain locations for short periods associated with the sequence of works. The highest level of construction movement would occur during foundation construction and tower construction works. Each replacement tower would take approximately two weeks to construct. Removing the existing towers and tower strengthening works will take approximately one week each. Other vehicle movements would occur on an occasional basis over the entire construction phase.

Below is a list of the heavy vehicles and plant expected to be used during construction activities.

- Heavy plant including bulldozers, excavators, graders and heavy trucks
- Bull winders & Tensioners
- Cranes
- Trucks
- Light 4 wheel drive
- Hiab (truck mounted small crane)
- Tractors
- Piling rigs
- Concrete batch mixers.

3.5.13 Timing

Relocation and strengthening of parts of the existing electricity transmission lines will take approximately 12 to 18 months including site investigations, construction and commissioning. The line relocation will be undertaken before construction of the Transmission Gully Project starts.

It is expected that there will be some efficiencies with Transpower's contractors being able to work with the NZTA's contractors (where appropriate) to coordinate some activities, such as the construction of access tracks and earthworks, and to ensure that they are placed in locations that suit both parties.

3.6 Transmission Line Operation and Maintenance

Transpower has a comprehensive asset management programme for all in-service transmission line assets. This programme provides for planned regular inspections of the transmission line to ensure the safety of the line by identifying environmental changes (such as tree growth or land

development) that may affect the security of the line, and to monitor performance and degradation of the line components.

After the relocation of the line, Transpower will continue its normal maintenance schedule for the line, easement and access tracks. These checks are undertaken on a six monthly basis.

More comprehensive inspections (eg Condition Assessment reviews) check for any signs of wear, corrosion or damage. The inspections are visual and may be carried out by climbing each support structure or by helicopter. On this type of tower line, these inspections are completed every five to eight years.

The normal vehicles used to access the tower sites for maintenance purposes are utility vehicles or quad bikes. Access tracks will be maintained to four wheel drive standards, or such other standards agreed with landowners for this purpose. Maintenance work will require additional plant and vehicles, depending on the tasks being undertaken.

4 Resource Management (National Environmental Standards for Electricity Transmission Activities) Regulations 2009

The NESETA came into effect on 14 January 2010 and apply to activities that relate to the operation, maintenance, upgrading, relocation, and removal of existing transmission lines. The NESETA apply only to the existing high voltage electricity transmission network owned and operated by Transpower. The standards apply to the existing transmission network but not to substations or the construction of new lines. This section provides an assessment of the proposed line relocation activities against the regulations of the NESETA.

4.1 The Legislative Context of the NESETA

Section 43A of the RMA describes what a national environmental standard may do, including establishing whether a particular activity has status as a permitted, controlled, restricted discretionary, discretionary or non-complying activity. The NESETA includes a range of regulations that establish various consent requirements in this manner.

Section 43B of the RMA sets out the relationship between a NES and rules or consents. Section 43A(1) states that a rule or consent that is more stringent than a NES only prevails over the NES if the NES especially says that a rule or consent may be more stringent than it. In this case the NESETA does not provide for more stringent rules or resource consents to prevail over NESETA. Similarly, section 43A(3) states that a rule or resource consent may not be more lenient than a NES.

Together sections 43A and 43B of the RMA have the effect that the Regulations in the NESETA will generally prevail over rules in plans insofar as they relate to the activities provided for in Regulation 4 of the NESETA (existing transmission lines). Local authorities are required to observe and enforce an NES by section 44A of the RMA.

The NESETA does not alter whether the matter would be dealt with by a territorial authority or regional council. These line relocation works are located within the jurisdictions of two territorial authorities the Kapiti Coast District Council and the Porirua City Council. The entire area of the proposed relocation is under the jurisdiction of the Wellington Regional Council. Table 4:1 shows the transmission line sections and the corresponding council jurisdiction.

Table 4:1: Council Jurisdiction for Towers and Line

Tower/Line	Jurisdiction
Towers 1 – 11 (11 existing structures)	Kapiti Coast District Council
Towers 12 to 49a Pauatahanui Substation (39 existing structures)	Porirua City Council

4.2 Applying the NESETA to the Project

4.2.1 Activities Relating to Existing Transmission Lines (regulation 4)

The NESETA only relates to existing transmission lines which were operational (or able to be operational) at the time the standards came into force (ie 14 January 2010).

A *Transmission line* is defined in Regulation 3 as:

"(a) means the facilities and structures used for, or associated with, the overhead or underground transmission of electricity in the national grid; and

(b) includes transmission line support structures, telecommunication cables, and telecommunication devices to which paragraph (a) applies; but

(c) Does not include an electricity substation."

The existing PKK-TKR A 110kV double circuit transmission line falls within the definition of "transmission line" contained in the NESETA and as set out above is an "existing transmission line" in accordance with the definitions because the line was operated or able to be operated on 14 January 2010.

Regulation 4(1) sets out the activities which are covered by the NESETA. Specifically regulation 4(1) states that (emphasis added):

"(1) These regulations apply only to an activity that relates to the operation, maintenance, upgrading, relocation, or removal of an existing transmission line, including any of the following activities that relate to those things:

(a) a construction activity:

(b) a use of land …:

(c) an activity relating to an access track to an existing transmission line:

(d) undergrounding an existing transmission line."

The activities involved in this line are of the type specifically referred to in regulation 4. Each of the relocation activities is assessed in the sections that follow.

Regulation 4(2) lists activities that the NESETA does not apply to and the relevant district and/or regional plan rules will still apply to these activities. In the context of this project, this includes:

"(a) the construction or use of a bridge or culvert to access an existing transmission line;

(f) earthworks to the extent that they are subject to a regional rule."

In regards to (a), the relocation of the existing transmission line may require the construction of temporary culverts to provide for construction access. This activity is not covered by the NESETA and is subject to the rules in the Wellington Regional Freshwater Plan. Section 4.4 summarises the additional approvals required for this activity and confirms that where resource consents are required for the formation of access tracks, these will be sought during detailed design.

In regards to (f), the line relocation will involve earthworks for tower foundations, construction areas and access tracks. If no regional rule exists for the earthworks under the relevant regional plan, then only the district council consent requirements under the NESETA apply. In this instance, the relevant rules of the Wellington Regional Soil Plan and the Regional Freshwater Plan apply to the extent that they deal with the discharge of sediment to the environment and land stability. As set out in Section 4.4, regional resource consents are likely to be required. These earthworks will be the subject of detailed design and separate resource consent applications. Regulation 33 of the NESETA will still apply to earthworks where they are within a natural area and is discussed in further detail in Section 4.2.8. Based on this assessment, the project will require both resource consents from the Wellington Regional Council under the relevant rules of the Regional Soil Plan and the Regional Freshwater Plan and resource consent from the Kapiti Coast District Council for earthworks in a natural area under the NESETA.

4.2.2 Alteration, Relocation and Replacement of Transmission Line Support Structures

Regulation 14, 15 and 16 provide a cascade of regulations for determining consent requirements relating to the alteration, relocation and replacement of transmission line support structures including foundations, foundation strengthening and tower strengthening. The line relocation works involve relocating and replacing 24 towers and strengthening 10 remaining towers (ie altering the structure) and therefore these regulations are relevant. Where the proposed activities cannot meet the permitted activity conditions in regulation 14, they default to a controlled activity under regulation 15 and then a restricted discretionary activity under regulation 16.

Assessment under Regulation 14: Permitted Activities

Regulation 14 of the NESETA permits the alteration, relocation, or replacement of towers subject to compliance with conditions. Regulation 14 reads (underlining added for emphasis):

(1) Altering, relocating, or replacing a tower of an existing transmission line (other than as part of a temporary line deviation or undergrounding) is a permitted activity if all of the applicable conditions in subclauses (3) to (6) are complied with.

(2) Altering, relocating, or replacing a pole of an existing transmission line (other than as part of a temporary line deviation or undergrounding) is a permitted activity if all of the applicable conditions in subclauses (3), (4), (7), and (8) are complied with.

Conditions

(3) If a transmission line support structure is increased in height (including by being replaced with another structure),—

(a) the structure may be made no more than 15% higher than its base height; and

(b) the additional height must comply with any height restrictions for airport purposes, or any public view shafts, specified in a rule.

(4) A transmission line support structure must not be relocated, or replaced with another transmission line support structure, so that any part of the structure at ground level is—

(a) within 12 metres of an occupied building (measured horizontally); or

(b) any closer to an occupied building, if the existing structure is within 12 metres of the building (measured horizontally).

(5) If a tower is widened (including by being replaced with another tower), each side of the tower's footprint may be made no longer than the total of—

(a) the length of that side of the tower's base footprint; and

(b) 25% of the tower's base width.

(6) A tower must not be relocated, or replaced with another tower, so that any part of the tower at ground level falls outside the tower's envelope for permitted activities.

(7) A pole must not be replaced with a tower.

(8) A pole must not be relocated, or replaced with another pole, more than 5 metres from the pole's base position (measured horizontally).

Therefore, the tower relocation and tower strengthening is permitted if all of the applicable conditions in subclauses (3) to (6) are complied with. The following section assesses compliance with regulation 14.

Increase in structure height (subclause 3)

Within the NESETA, height means *"in relation to a transmission line support structure, means the height of the structure measured vertically from the ground level at the centre of the structure to the highest point of the structure (including conductors, but excluding telecommunication devices, earth peaks, and lightning rods)."*

In regards to subclause (3)(a), 24 towers will be relocated/replaced as part of the transmission line works. The existing and proposed heights of these towers are shown in Table 4:2.

Table 4:2: Existing and Proposed Heights of Relocated and Replaced Towers

Proposed tower	Existing height (m)	Proposed Height (m) *	Height difference (m)	% Change
2A	23.4	33.0	9.6	41%
3A	30.7	33.0	2.3	7%
8A	24.8	30.0	5.2	21%
9A	28.8	30.0	1.2	4%
10A	28	30.0	2.0	7%
11A	28.8	30.0	1.2	4%
12A	15.7	32.0	16.3	104%
13A	23.5	32.0	8.5	36%
14A	21.9	36.0	14.1	64%
15A	28	36.0	8.0	29%
16A	17.3	32.0	14.7	85%
17A	18.7	36.0	17.3	93%
18A	17.6	30.0	12.4	70%
22A	28.2	35.0	6.8	24%
24A	22	33.0	11.0	50%
25A	24.7	39.0	14.3	58%
26A	28.2	40.0	11.8	42%
31A	16	30.0	14.0	88%
32A	23.3	30.0	6.7	29%
33A	31	29	- 2.0	- 6%
40A	15.7	31.0	15.3	97%
41A	15.7	30.0	14.3	91%
42A	17.2	37.0	19.8	115%
43A	21.7	33.0	11.3	52%

* Tower heights are measured from the middle of the tower. The change in height does not take into account a change in tower elevation.

All except one of the relocated towers will be taller however, 19 of the 24 towers are increasing in height by more than 15% of their existing base height. This increase in height is to ensure that the line continues to comply with the statutory clearance requirements in the New Zealand Electrical Code for Practice for Electrical Safe Distances 2001 (NZECP 34:2001). Therefore, the replacement towers do not comply with subclause (3)(a) and the activity defaults to regulation 15 and then regulation 16 respectively (see discussion at the end of this section).

In regards to sub clause (3)(b), the additional heights of the towers do not contravene any rule in the District Plans with regards to height restrictions for airport purposes or public view shafts.

Replacement structures within 12 metres of an occupied building (subclause 4)

None of the relocated towers will be located within 12 metres of an occupied building under subclause (4)(a) and no existing towers are currently located within 12 metres of a building so subclause (4)(b) does not apply.

Therefore, the replacement towers comply with subclause 4.

Widening of a tower (subclause 5)

Footprint is defined in the NESETA (regulation 3) as:

> *"means the outline of the land occupied by a tower, formed by drawing straight lines between the outermost edges of the outermost parts of the tower at ground level."*

The existing towers foot prints are approximately 6m by 6m for the suspension towers and 8m x 8m for the strain towers. For a 6m wide suspension tower, the tower can be widened to 7.5m and for an 8m wide strain tower, it can be widened to 10m. Some suspension towers are being replaced with strain towers and will increase by more than the distance set out in subclause 5.

At high risk tower sites (those with large loads or difficult ground conditions), heavily engineered foundations may be required which will exceed these dimensions. The identification of these sites will follow geotechnical investigations during detailed design.

The final tower footprint is dependent on the local ground conditions, towers loads and tower type. The final tower footprints will be confirmed during the detailed design phase, however, at this stage is expected that some towers will not meet this regulation and therefore subclause 5 cannot be met.

Tower envelope for permitted and controlled activities (subclause 6 and regulation 15(1)(c))

The tower envelope for permitted activities means the quadrangle formed by moving each side of a tower's base footprint outwards by 60% of the tower's base width and joining the sides. Where a tower cannot meet the envelope for permitted activities in subclause 6 it defaults to the envelope for controlled activities set out in regulation 15(1)(c)). The permitted and controlled tower envelope for the PKK-TKR A line is shown in Figure 4.1.

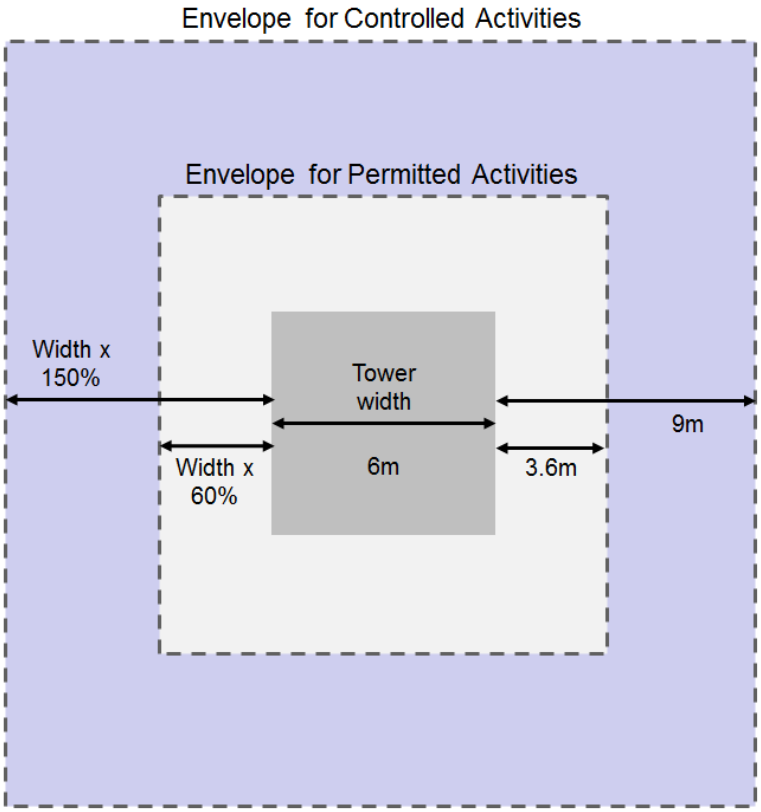


Figure 4.1: Permitted and Controlled Tower Envelopes

The 24 tower relocations will all fall outside of the permitted tower envelope of 3.6m and the controlled tower envelope of 9m in regulation 14(6) and regulation 15(1)(c)). Therefore, regulation 16 applies (see assessment below).

Pole replacement more than 5 metres from the pole's base position (Sub clause 8)

No poles will be relocated or replaced more than 5 metres from the pole's base position. Generally, poles are replaced within approximately 1 metre of their existing base position.

Summary of Assessment under Regulation 14

The change in height of the proposed towers does not comply with regulation 14(3), the widening of the tower footprints does not comply with regulation 14(5) and the tower locations fall outside the permitted and controlled tower envelopes in regulation 14(6). These activities therefore default to regulation 15 (controlled activities).

The strengthening of towers is likely to be a permitted activity under regulation 14 as the changes to the towers should meet the conditions set out in the regulation. In the event that during detailed design, any changes as a result of tower strengthening trigger consent under the NESETA, then these resource consents will be sought at that stage.

Assessment under Regulation 15: Restricted Discretionary Activities

Regulation 15 provides that:

> *(1) Altering, relocating, or replacing a tower of an existing transmission line (other than as part of a temporary line deviation or undergrounding) is a controlled activity if—*
>
> *(a) all of the applicable conditions in regulation 14(3) to (5) are complied with; and*
>
> *(b) the condition in regulation 14(6) is breached; but*
>
> *(c) the tower is not relocated, or replaced with another tower, so that any part of the tower at ground level falls outside the tower's envelope for controlled activities.*

In regards to subclause (a), the replacement towers do not meet regulation 14(3) and 14(5), but meet regulation 14(4). In regards to (b), the replacement towers breach regulation 14(6). They also fall outside the tower's envelope for controlled activities set out in (c). Therefore, the activities default to regulation 16.

Assessment under Regulation 16

Regulation 16 provides that:

> *(1) Altering, relocating, or replacing a tower of an existing transmission line (other than as part of a temporary line deviation or undergrounding) is a restricted discretionary activity if—*
>
> *(a) 1 or more of the conditions in regulation 14(3) to (5) are breached; or*
>
> *(b) both of the following apply:*
>
> *(i) the requirement described in regulation 15(1)(c) is breached; but*
>
> *(ii) all of the applicable conditions in regulation 10(2) to (8) are complied with.*

In regards to (a), the replacement towers breach 1 or more of the conditions set out in regulation 14(3) to (5).

In regards to (b), the towers lie outside the envelope for controlled activities in regulation 15(1)(c) but all of the applicable conditions in regulation 10(2) to (8) are complied with. Regulation 10(2) to (8) relate to electric field strength, magnetic flux density, density of electric current and static electric field strength. Section 4.2.10 sets out compliance with regulation 10(2) to (8).

Based on the above, the tower relocations require a restricted discretionary land use consent in accordance with regulation 16(1)(a) and 16(1)(b).

4.2.3 Tower Removal (regulation 19)

As part of the line relocation, Tower 23 will be removed as it is not required for the relocated line.

Regulation 19 of the NESETA states that:

> *"(1) Removing an existing transmission line, or part of an existing transmission line, is a permitted activity if both of the conditions in subclauses (2) and (3) are complied with.*
>
> *Conditions*

(2) The transmission line, or the part of the transmission line, and any associated construction or demolition material must be removed from the land.

(3) Any ground that is disturbed from the removal must be restored in a way that minimises the risk of soil erosion, sediment run-off, and weed invasion."

It is noted that regulation 19 allows for the removal of the whole existing transmission line or part of the line (as is the case with Tower 23). The tower will be removed and the foundation will be partially removed.

Based on the above, the removal of Tower 23 is a permitted activity in accordance with Regulation 19.

4.2.4 Replacing Overhead Conductors (regulation 6)

The line relocation works will involve the replacement and restringing of the overhead conductor.

Regulation 6 of the NESETA states that:

"(2) Replacing an overhead conductor, or part of an overhead conductor, on an existing transmission line is a permitted activity if the condition in subclause (6) is complied with.

Conditions

(6) The diameter of a replacement conductor, or a replacement part of a conductor, must not exceed—

(a) the diameter of the existing conductor or part; or

(b) 50 mm, if the diameter of the existing conductor or part is less than 50 mm."

The line will use the same or similar type of conductor as the existing, being Wolf ACSR/AC. The size of the conductor will remain similar to the existing at approximately 18 mm: well below the 50mm provided in subclause (6)(b). Therefore, the replacement conductor meets both (a) and (b) above.

It is considered that the replacement and restringing of the overhead conductor complies with Regulation 6 and is a permitted activity.

4.2.5 Temporary Structures (regulation 17(1))

The transmission line route does not cross any local road but crosses several tracks used to access and manage land and the Transmission Gully Main Alignment Route. The line relocation works may involve the use of hurdles or similar temporary structures to protect these features during the line relocation works. The requirement for hurdles or similar will be confirmed during detailed design.

Temporary structures are defined in the NESETA (regulation 3) as:

"(a) a non-permanent structure, and any associated lighting, erected only for a specific maintenance or upgrading task; but

(b) does not include a transmission line that is part of a temporary line deviation."

Regulation 17of the NESETA states that:

> *"(1) Erecting or using a temporary structure in relation to an existing transmission line (other than as part of a temporary line deviation) is a permitted activity if the condition in subclause (3) is complied with.*
>
> *Conditions*
>
> *(3) Any temporary structures must be—*
>
> *(a) erected no earlier than 20 working days before the start of the relevant maintenance or upgrading; and*
>
> *(b) removed no later than 20 working days after the end of the maintenance or upgrading."*

It is considered that the erection and removal of the temporary structures can be managed to comply with conditions 37(2) and 37(3) such that they are a permitted activity.

4.2.6 Temporary Line Deviations (regulation 17(2))

The PKK-TKR A line is a vital part of the transmission network in the Wellington Region and therefore, the existing line needs to remain operational during the relocation works. Temporary line deviations may be established for the period of the works to enable the on-going operation of the line where a replacement tower is located in close proximity to an existing tower and create a safety issue during construction (eg Tower 33A). At these locations a temporary line may be constructed and these will be confirmed during detailed design.

Regulation 17 of the NESETA states that:

> *"(2) Carrying out a temporary line deviation of an existing transmission line is a permitted activity if the condition in subclause (4) is complied with.*
>
> *Conditions*
>
> *(4) Any structures involved in a temporary line deviation must be—*
>
> *(a) erected no earlier than 60 working days before the start of the relevant maintenance or upgrading; and*
>
> *(b) removed no later than 60 working days after the end of the maintenance or upgrading."*

It is considered that the erection and removal of the temporary line deviation can be managed to comply with conditions 37(2) and 37(3) such that it would be a permitted activity.

4.2.7 Trimming, felling and removing trees and vegetation (regulation 30)

Vegetation trimming and removal is required for the construction of towers and access tracks during construction and operation of the line.

Regulation 30 of the NESETA states that:

> *(1) Trimming, felling, or removing any tree or vegetation, in relation to an existing transmission line, is a permitted activity if all of the applicable conditions in subclauses (2) to (6) are complied with.*
>
> *Conditions*
>
> *(2) Any tree or vegetation must not be trimmed, felled, or removed if—*

(a) a rule prohibits or restricts its trimming, felling, or removal (as the case may be); or

(b) it is in a natural area.

(3) Any tree or vegetation located on any land must not be felled or removed if a regional plan controls the use of the land for the purpose of—

(a) soil conservation; or

(b) avoiding or mitigating flooding.

(4) Any tree or vegetation must not be trimmed, felled, or removed if it is on land administered by the Department of Conservation under the Conservation Act 1987 or an Act specified in Schedule 1 of that Act.

(5) The felling or removal of any tree or vegetation must not create or contribute to—

(a) instability of a slope or another land surface; or

(b) erosion of the bed or bank of a water body or the coastal marine area.

(6) Debris resulting from the trimming, felling, or removal must not enter a water body or the coastal marine area.

Condition (2) – Vegetation Rule and Natural Areas

In regards to condition (2)(a), Rule D2.1.1 of the Kapiti Coast District Plan provides for the following as a permitted activity:

"The disturbance, removal, damage or destruction ("modification") of naturally occurring indigenous vegetation, where such modification is in accordance with the Permitted Activity Standards."

The permitted activity standards accompanying the rule require that:

(i) The disturbance, removal, damage or destruction ("modification") of naturally occurring indigenous vegetation shall be a permitted activity where such modification is limited to:

- *The removal of trees less than 4 metres in height, or which have a trunk circumference less than 95cm measured at a point no higher than 1.4 metres above the ground. Trees listed in the Heritage Register are excluded from this provision.*

Provided that in (i) above, modification of vegetation is not permitted where it is:

(a) Forms a contiguous area of more than 100m^2; or

(b) Within 20 metres of a waterbody (including within the waterbody itself) or the coastal marine area; or is

(c) Nationally or regionally rare or threatened.

(iii) The modification of no more than 2 hectares of naturally occurring indigenous vegetation in any 12 month period is a permitted activity where:

(a) The vegetation is predominantly Manuka (Leptospermum scoparium) or kanuka (Kunzea ericoides); and

(b) The vegetation has a canopy less than 4 metres tall.

Provided that in (iii) above, modification of vegetation is not permitted where it is:

(a) Manuka or kanuka within 20 metres of a waterbody (including the waterbody itself) or the coastal marine area; or

(b) Nationally or regionally rare or threatened.

In relation to the above, the vegetation to be removed for tower locations consists of plantation pine (two towers), gorse dominated scrub (three towers) and pasture (the remaining 19 towers). The vegetation to be removed for access tracks consists of plantation pine (four tracks), gorse dominated scrub (two tracks) and pasture (the remaining tracks). The extent of vegetation clearance will be confirmed during detailed design.

In regards to condition (2), the definition of "natural area" in the NESETA is "*an area that is protected by a rule because it has outstanding natural features or landscapes, significant indigenous vegetation, or significant habitats of indigenous fauna*". The pine plantation is not naturally occurring indigenous vegetation and the gorse dominated scrub is less than 4m in height. In addition, the towers and tracks within gorse dominated scrub do not involve the removal of more than 2 hectares of vegetation. In addition, the areas do not contain any trees listed on the Kapiti Coast District Plan Heritage Register. Therefore, the vegetation removal is not protected by a rule in the plan.

In regards to significant indigenous vegetation or significant habitats of indigenous fauna, a short section of transmission line is located within ecological area E17: Tararua Ranges in the Kapiti Coast District Plan. No native vegetation removal is proposed within this area however so the condition in regulation 30 (2)(b) does not apply.

Based on the above, the vegetation removal associated with the line relocation complies with Condition 2. If, during detailed design, the area of vegetation removal/trimming changes, compliance with this condition will need to be confirmed. If vegetation removal/trimming does not meet this condition resource consent will be required and will need to be sought at that time.

Condition (3) – Vegetation removal controlled by a regional plan

In regards to condition (3), the vegetation to be trimmed or removed will be undertaken in a manner to avoid instability of a slope or another land surface and any erosion of the bed of streams.

Condition (4) – Vegetation on land administered by the Department of Conservation

In regards to condition (4), no vegetation removal will be undertaken on land administered by the Department of Conservation under the Conservation Act 1987 or an Act specified in Schedule 1 of that Act.

Condition (5) – Vegetation and land stability

In regards to condition (5), the vegetation to be trimmed or removed is not on land controlled by the Wellington Regional Plan for the purpose of soil conservation or avoiding or mitigating flooding.

Condition (6) – Vegetation and waterbodies

In regards to condition (6), vegetation trimming or removal will be undertaken in a manner that controls debris entering streams.

Summary of Assessment under Regulation 30

In accordance with the assessment set out in this section, the proposed vegetation removal and trimming associated with the transmission line support structures and access tracks comply with the conditions in regulation 30(2) through (6) and are therefore a permitted activity.

4.2.8 Earthworks (regulation 33)

Earthworks will be required for tower construction and access tracks. As set out in Section 4.4, resource consent is likely to be required from the Wellington Regional Council for earthworks and tracking in accordance with the relevant rules in the Regional Soil Plan and the Regional Freshwater Plan. This section assesses whether any district consents are also required for earthworks under regulation 33 of the NESETA.

Earthworks are defined in the NESETA (regulation 3) as:

> *"the disturbance of the surface of land by activities including blading, tracking, boring, contouring, ripping, moving, removing, stockpiling, placing, replacing, recompacting, excavating, cutting, and filling earth (or any other matter constituting the land, such as soil, clay, sand, or rock)".*

Regulation 33 of the NESETA states that:

> *"(1) Earthworks relating to an existing transmission line are a permitted activity if all of the conditions in subclauses (2) to (9) are complied with.*
>
> *Conditions*
>
> *(2) Earthworks in a natural area must not, in a calendar year, exceed—*
>
> *(a) 50 m³ per transmission line support structure; or*
>
> *(b) 100 m³ per access track.*
>
> *(3) Erosion sediment control must be applied and maintained at the site of earthworks, during and after the earthworks, to avoid the adverse effects of sediment on water bodies and the coastal marine area.*
>
> *(4) All areas of soil exposed by the earthworks must be stabilised against erosion as soon as practicable after the earthworks end to avoid the adverse effects of sediment on water bodies and the coastal marine area.*
>
> *(5) The earthworks must not create or contribute to—*
>
> *(a) instability or subsidence of a slope or another land surface; or*
>
> *(b) erosion of the bed or bank of a water body or the coastal marine area; or*
>
> *(c) drainage problems or flooding of overland flow paths.*
>
> *(6) Soil or debris from the earthworks must not be placed where it can enter a water body or the coastal marine area.*
>
> *(7) Earthworks must not be carried out on the bed of a lake or river or in the coastal marine area.*
>
> *(8) Earthworks must not be carried out in a historic heritage area unless they are carried out on an archaeological site in accordance with the Historic Places Act 1993.*

(9) Earthworks must not be carried out on land that a local authority has identified as containing, or possibly containing, contaminants that pose a risk to the environment."

The following assesses compliance with the conditions in regulation 33.

Condition (2) – Earthworks in a Natural Area

In regards to condition (2), the definition of "natural area" in the NESETA is "*an area that is protected by a rule because it has outstanding natural features or landscapes, significant indigenous vegetation, or significant habitats of indigenous fauna*".

In regards to outstanding natural features or landscapes, the section of transmission line between Towers 1 to 11 is located within an area of Outstanding Natural Landscape (ONL) in the Kapiti Coast District Plan. The earthworks associated with some towers and access tracks in this area may exceed the volumes set out in Regulation 33(2)(a) and (b). The volume of earthworks required for the towers will be confirmed during detailed design, and in the event they exceed 50m^3, resource consent will be required from the Kapiti District Council. Regulation 34 (1) will apply and provides that:

"(1) Earthworks relating to an existing transmission line are a controlled activity if—

(a) 1 or more of the conditions in regulation 33(2) to (7) are breached; but

(b) both of the conditions in regulation 33(8) and (9) are complied with."

In accordance with the assessment set out in this section, the earthworks within the ONL breach regulation 33(2) but comply with all other conditions including regulation 33(8) (historic heritage area) and 33(9) (contaminated land). The earthworks for all other towers comply with regulation 33.

Therefore, the earthworks associated with towers 8A, 9A, 10A and 11A will be a controlled activity in accordance with regulation 34(1) of the NESETA subject to detailed design. This resource consent will be sought during detailed design.

Condition (3) to (6) – Erosion and Sediment Control

Conditions (3) through (6) deal with the management of earthworks to avoid the adverse effects of sediment on the environment including: the implementation of erosion and sediment control; stabilising areas of earthworks; minimising instability, erosion and drainage problems as a result of earthworks; and the placement of soil and debris such that it does not enter a water body.

Condition (7) – Work in or near a watercourse

Condition (7) requires that earthworks must not be carried out on the bed of a lake or river or in the coastal marine area. No towers and foundations are located within waterways. Therefore, the earthworks can meet condition (7). Separate resource consents may be required for works in a watercourse for the construction of culverts in accordance with the Regional Freshwater Plan and these are detailed in Section 4.4.1 of this report.

Condition (8) – Historic Heritage Area

Condition (8) requires that earthworks must not be carried out in a historic heritage area unless they are carried out on an archaeological site in accordance with the Historic Places Act 1993.

Historic heritage area is defined in the NESETA (regulation 3) as:

"(a) means an area that is protected by a rule because of its historic heritage; and

(b) to avoid doubt, includes an area that is protected by a rule because it is a site of significance to Māori."

The New Zealand Historic Places Trust (NZHPT) Register, New Zealand Archaeological Association, Porirua City District Plan and Kapiti Coast District Plan identify a number of archaeological and historic heritage sites in the general vicinity of the transmission line route. These sites are associated with maori occupation and subsistence, military activities, and European settlement. No earthworks for transmission line support structures and access tracks are carried out near these sites.

Therefore, the earthworks can meet condition (8).

Condition (9) – Contaminated Land

None of the sites for towers or access tracks are identified by either the Wellington Regional Council or Porirua City Council as containing contaminants.

Therefore, the earthworks meet condition (9).

Summary of Assessment under Regulation 33

In accordance with the assessment set out in this section, the proposed earthworks associated with the transmission line support structures and access tracks breach regulation 33(2) but comply with all other conditions including regulation 33(8) (historic heritage area) and 33(9) (contaminated land). The earthworks for tower sites and access tracks associated with the Wainui Saddle deviation are located within an ONL. Therefore, these earthworks are a controlled activity in accordance with regulation 34(1) of the NESETA. The earthwork design for the project is to be undertaken during detailed design and any resource consents required for earthworks will be sought at that stage.

4.2.9 Construction Noise and Vibration (regulation 37)

Regulation 37 of the NESETA states that construction noise and vibration relating to an existing transmission line is permitted if the construction noise complies with New Zealand Standard NZS 6803:1999 Acoustics—Construction Noise (condition 37(2)) and construction vibration complies with the peak particle velocity limits in table 1 of German Standard DIN 4150 3:1999 Structural Vibration—Effects of Vibration on Structures (condition 37(3)).

It is considered that construction noise and vibration can be managed to comply with conditions 37(2) and 37(3). This may include restricting the hours when removal activities occur adjacent to existing residential dwellings. Therefore, the noise and vibration experienced during construction will be a permitted activity under regulation 37. Noise and vibration effects are discussed further in Section 7.8.2 of this report.

4.2.10 Electric and Magnetic Fields (regulation 10)

Conditions (2) to (8) in Regulation 10 of the NESETA relate to electric field strength, magnetic flux density, density of electric current and static electric field strength for above and below ground transmission lines. Electric and magnetic fields for this line and their effects are described in further detail in Section 7.10 of this report.

Regulation 10(2) of the NESETA requires that:

"(2) The electric and magnetic fields produced by the transmission of electricity at 50 Hz through overhead or underground alternating current transmission lines must, after being modelled in accordance with subclauses (4) to (7), be demonstrated to either—

(a) not exceed the following reference levels for public exposure:

(i) electric field strength of 5 kV/m; and

(ii) magnetic flux density of 100 microteslas; or

(b) not exceed the basic restriction level of 2 mA/m² for the density of electric current induced in the body."

Subclauses (4), (5), (6), and (9) provide direction on how electric and magnetic fields are to be modelled for the line. Subclauses (3) and (7) are not relevant for this line as they relate to underground transmission lines.

The proposed line has been modelled in accordance with the requirements set out in regulation 10. The results of the modelling are summarised in Table 4:3 and contained within **Appendix C.** Appendix C also contains information on EMFs to assist the reader in understanding how they relate to electricity transmission.

Table 4:3: Calculated EMF Levels under Normal Operating Conditions[2]

	PKK-TPR A Line levels	Reference levels for 50Hz a.c. transmission line – NESETA Reg 10(2)
Calculated Electric Field (kV/m)	0.6	5
Calculated Magnetic Field Level (microteslas)	2.5	100

The proposed line relocation does not result in any changes to voltage or current. Due to this, the EMF levels for the line will not change but the location of the fields will change relative to the existing line. Section 7.10 of this report contains further assessment of the EMF for the relocated line.

Based on the results of the modelling, compliance with electric and magnetic field levels in regulation 10 is achieved.

4.3 Summary of Consent Requirements

Table 4:4 provides a summary of the NESETA assessment for each of the towers.

Based on the above assessment, it has been determined that resource consent is required for a Restricted Discretionary Activity in accordance with regulation 16(1)(a) and 16(1)(b) of the NESETA. The matters over which discretion is restricted are set out in regulation 16(4) and are assessed in Section 6 of this report.

[2] Normal operating conditions –means the conditions associated with the highest load current but does not include conditions in which short-term increase in voltage or current is caused by a fault such as switching, a lightning, a short circuit, or an abnormal operating state of a direct current transmission line. For the PKK-TPR A Line, the normal operating conditions assumes that both circuits run at 60% load.

Table 4:4: Summary of NESETA Assessment

Structure number	Council area	Existing or Proposed	Foundation and/or tower strengthening	NESETA Regulation													Status
				6	10	14(3)	14(4)	14(5)	14(6)	15(1)	16(1)	17(1)	17(2)	19	30(1)	33	
1	Kapiti Coast District	Existing	Yes	√	√	√	√	X	√								Permitted
2A	Kapiti Coast District	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
3A	Kapiti Coast District	Proposed	-	√	√	√	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
4	Kapiti Coast District	Existing	Yes	√	√	√	√	X	√								Permitted
5	Kapiti Coast District	Existing	No change	√	√												-
6	Kapiti Coast District	Existing	No change	√	√												-
7	Kapiti Coast District	Existing	Yes	√	√	√	√	X	√								Permitted
8A	Kapiti Coast District	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	X	Restricted Discretionary
9A	Kapiti Coast District	Proposed	-	√	√	√	√	X	X	X	√	√	√	√	√	X	Restricted Discretionary
10A	Kapiti Coast District	Proposed	-	√	√	√	√	X	X	X	√	√	√	√	√	X	Restricted Discretionary
11A	Kapiti Coast District	Proposed	-	√	√	√	√	X	X	X	√	√	√	√	√	X	Restricted Discretionary
12A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
13A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
14A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
15A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
16A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
17A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
18A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
19	Porirua City	Existing	Yes	√	√	√	√	X	√								Permitted
20	Porirua City	Existing	No change	√	√		√										-
21	Porirua City	Existing	Yes	√	√	√	√	X	√								Permitted
22A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√		√	√	Restricted Discretionary
23	Porirua City	To be removed	-	√	√		√							√			Permitted
24A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
25A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
26A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
27	Porirua City	Existing	Yes	√	√	√	√	X	√								Permitted
28	Porirua City	Existing	No change	√	√												-
29	Porirua City	Existing	No change	√	√												-
30	Porirua City	Existing	Yes	√	√	√	√	X	√								Permitted
31A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
32A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
33A	Porirua City	Proposed	-	√	√	√	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
34	Porirua City	Existing	Yes	√	√	√	√	X	√								Permitted
35	Porirua City	Existing	No change	√	√												-
36	Porirua City	Existing	No change	√	√												-
37	Porirua City	Existing	No change	√	√												-
38	Porirua City	Existing	No change	√	√												-
39	Porirua City	Existing	Yes	√	√	√	√	X	√								Permitted
40A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
41A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
42A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
43A	Porirua City	Proposed	-	√	√	X	√	X	X	X	√	√	√	√	√	√	Restricted Discretionary
44	Porirua City	Existing	Yes	√	√	√	√	X	√								Permitted
45	Porirua City	Existing	No change	√	√												-
46	Porirua City	Existing	No change	√	√												-
47	Porirua City	Existing	No change	√	√												-
48	Porirua City	Existing	No change	√	√												-
49	Porirua City	Existing	No change	√	√												-

√ Complies
X Does not comply

49a	Porirua City	Existing	No change	√	√											-

4.4 Other Consents / Approvals Required

As noted in Section 4.2.1, regulation 4(2) specifically excludes certain activities from the NESETA. These are:

> *(c) The construction or use of a bridge or culvert to access an existing transmission line; and*
>
> *(f) Earthworks to the extent that they are subject to a regional rule.*

Additional regional consents may be required for these activities. The details of these are set out below.

4.4.1 Culverts

Based on investigation of access track locations, culverts may be required to gain access to some towers. All other new towers, apart from towers 9A to 11A lie in close proximity to existing access tracks, or can be accessed over pasture without crossing streams. Initial assessment indicates that the culverts may be located within the headwaters of the Horokiri Stream. The construction of culverts is subject to the provisions of the Wellington Regional Freshwater Plan.

Any resource consents required for the construction of these culverts will be applied for following detailed design of the access tracks.

4.4.2 Earthworks

The Wellington Regional Soil Plan (October 2000), applies to soil disturbance and vegetation disturbance on erosion prone land. The line route is within an area identified as subject to erosion and therefore, earthworks for the Line Relocation Project are subject to the relevant rules within the Plan.

In relation to earthworks for access tracks, Rule 1(2) (Roading and tracking) provides for the following restricted discretionary activity:

> *"Any roading or tracking activity that is: located in Area 2 and, during any 12 month period, will result in a road or track having a continuous length of new upslope batter extending for greater than 200 metres, with a height of greater than 2 metres measured vertically."*

Some access tracks on steeper areas around Wainui Saddle may require resource consent under this Rule. The design of the tracks will be undertaken during the detailed design phase.

In relation to earthworks for towers, Rule 2(1) (Soil disturbance on erosion prone land) provides for the following restricted discretionary activity:

> *"Any soil disturbance on erosion prone land that: involves the disturbance of greater than or equal to 1,000 m^3 of soil, within any 10,000 m^2 area (calculated using a minimum width of 10 m) and within any continuous 12 month period."*

Based on design to date, no tower or access track is likely to involve the disturbance of more than 1,000 m^3 of soil, within any 10,000 m^2 area and therefore, these earthworks are a permitted activity.

The Regional Freshwater Plan applies to the management of freshwater throughout the Region. In relation to the discharge of sediment from earthworks, Rule 2 of the Plan provides for the discharge of stormwater into surface water provided the discharge complies with the conditions set out in that rule. Condition (3a) requires that *"the discharge does not originate from an area of bulk earthworks greater than 0.3 ha".* Within this rule, bulk earthworks means the cut to fill, excavation, and blading required to regrade an area. The area of earthwork relates to any unstablised earthworks open at

any one time. Discharges that do not comply with this rule are discretionary activities in accordance with Rule 5 of the Plan. The detailed design of earthwork for the project has yet to be undertaken, however, based on design to date it is likely that more than 0.3 ha of earthwork will be undertaken. Therefore, resource consent will be required and will be assessed as a discretionary activity.

4.4.3 Summary of Other Resource Consents Required

In summary, the following additional resource consents may be required from the Wellington Regional Council for the Line Relocation Project:

- A restricted discretionary land use consent in accordance with Rule 47 of the Regional Freshwater Plan to place culverts within the Horokiri Stream;
- A controlled activity land use consent in accordance with Rule 1(2) of the Regional Soil Plan to undertake tracking located in an area of erosion prone land that will have a continuous length of new upslope batter extending for greater than 200 metres, with a height of greater than 2 metres measured vertically; and
- A discretionary activity land use consent in accordance with Rule 5 of the Regional Freshwater Plan to discharge stormwater originating from an area of bulk earthworks greater than 0.3 ha.

These regional resource consents will be sought during the detailed design phase of the Line Relocation Project to allow for any changes/refinements to tower and track design.

5 Statutory Context

This chapter sets out the statutory matters that are relevant to assessment of the applications for resource consent. An assessment of the line relocation against these matters is provided in Section 9 of this report.

5.1 Resource Management Act 1991

The resource consent applications for the line relocation are required to be prepared, processed and considered in accordance with the relevant provisions of the RMA. The relevant statutory matters and the criteria under which the applications will be considered are;

- the purpose and principles of the RMA (Part 2);
- consideration of proposals of national significance (Part 6AA); and
- applications for resource consent (Part 6).

5.1.1 Section 104 - Consideration of Applications

Section 104(1) of the RMA requires that when considering an application for consent and submissions, regard must be had, subject to Part 2, to the following:

> *"(a) any actual and potential effects on the environment of allowing the activity; and*
>
> *(b) any relevant provisions of—*
>
> *(i) a national environmental standard:*
>
> *(ii) other regulations:*
>
> *(iii) a national policy statement:*
>
> *(iv) a New Zealand coastal policy statement:*
>
> *(v) a regional policy statement or proposed regional policy statement:*
>
> *(vi) a plan or proposed plan; and*
>
> *(c) any other matter the consent authority considers relevant and reasonably necessary to determine the application."*

In regards to section 104(1)(a), Section 7 of this report provides an assessment of the actual and potential effects on the environment.

In regards to section 104(1)(b), the relevant documents for the line relocation are the NESETA and the National Policy Statement on Electricity Transmission. Section 4 provides an assessment of the project against the NESETA regulations and Section 9 provides an assessment against the National Policy Statement on Electricity Transmission.

5.1.2 Section 104C - Determination of applications for restricted discretionary activities

As set out in Section 4, the line relocation will require restricted discretionary land use consents in accordance with Regulation 16(1)(a) and 16(1)(b) of the NESETA. The applications for resource consent will be assessed in terms of the statutory approach in section 104C of the RMA that serves as a framework for the consideration of an application for resource consent for a restricted discretionary activity.

Section 104C of the RMA states that;

"(1) When considering an application for a resource consent for a restricted discretionary activity, a consent authority must consider only those matters over which—

(a) a discretion is restricted in national environmental standards or other regulations:

(b) it has restricted the exercise of its discretion in its plan or proposed plan.

(2) The consent authority may grant or refuse the application.

(3) However, if it grants the application, the consent authority may impose conditions under section 108 only for those matters over which—

(a) a discretion is restricted in national environmental standards or other regulations:

(b) it has restricted the exercise of its discretion in its plan or proposed plan."

In this case, the NESETA has restricted discretion and an assessment against the matters over which the Board should restrict its discretion is provided in Section 7 of this application.

Section 8.2 contains consent conditions in regards to the matters where discretion is restricted in the NESETA.

6 Consultation

6.1 Consultation Overview

The NZTA have undertaken widespread consultation on the Transmission Gully Project and this has shown a level of community support for the project, including a general understanding that the relocation of the existing transmission lines is a necessary consequence of the road project. A description of consultation and engagement for the Transmission Gully Project is set out in Volume 3, Technical Report 22.

An indicative transmission line relocation route was shown on the NZTA highway plans released for public consultation during October 2010. There was no public concern raised specifically in relation to the relocation of transmission lines, however it was understood at that time that directly affected landowners would require further consultation once the relocation route had been refined following further investigation. Since that time, Transpower and NZTA have been working together to further refine and confirm the line relocation route, including undertaking recent stakeholder and land owner consultation as set out below.

Transpower has sought to minimise the impact of the realignment of towers by accommodating the towers within the NZTA Transmission Gully Main Alignment extent of works wherever possible. As result, only four towers will not be accommodated within the proposed designation, including the three new towers that provide for a bypass of Wainui Saddle on land to be acquired in full by the NZTA.

More recent consultation has focussed on ensuring key stakeholders and directly affected landowners are informed of the Line Relocation Project and their interests have been adequately addressed.

The following sections summarise the feedback received and correspondence with the various stakeholders and landowners specific to the Line Relocation Project.

6.2 Key Stakeholder Consultation

In addition to consultation on the wider Transmission Gully Project, the stakeholders set out in Table 6:1 have been engaged with specific regard to the Line Relocation Project.

Table 6:1: Key Stakeholder Consultation

Stakeholder	Key issues/ interest	Consultation Summary and Outcome
Kapiti Coast District Council (KCDC)	Consent authority – for the relocation of 6 towers in Kapiti Coast District in accordance with Regulation 16(1)(a) and 16(1)(b) of the NESETA. Existing towers 1 – 11 are located within the Kapiti Coast District. Managing the effects on the environment.	KCDC has been involved throughout the wider Transmission Gully Project and more recently with the Line Relocation Project. Paul Jones (Planning Manager – KCDC) attended a workshop on 13 July 2011 to be briefed on the NESETA framework in relation to the Transmission Line Relocation Project. KCDC are interested in the relocation of 6 towers in Kapiti Coast District and the means to avoid, remedy or mitigate any potential adverse environmental effects generated as a consequence.

Stakeholder	Key issues/ interest	Consultation Summary and Outcome
Porirua City Council (PCC)	Consent authority – for the relocation of 18 towers in Porirua City in accordance with Regulation 16(1)(a) and 16(1)(b) of the NESETA. Existing towers 12 to 49a (Pauatahanui Substation) are located within Porirua City. Managing the effects on the environment.	PCC has been involved throughout the wider Transmission Gully Project and more recently with the Line Relocation Project. Richard Watkins (Principal Resource Consent Planner – PCC) attended a workshop on 13 July 2011 to be briefed on the NESETA framework in relation to the Transmission Line Relocation Project. PCC are interested in the relocation of 18 towers in Porirua City and means to avoid, remedy or mitigate any potential adverse environmental effects generated as a consequence.
Wellington Regional Council (GWRC)	Managing the effects on the natural environment. Access requirements.	Although no regional consents are being sought at this stage, GWRC is a key stakeholder and landowner for the Battle Hill land block. GWRC has been involved throughout the wider Transmission Gully Project and more recently with the Line Relocation Project. A meeting was held with Murray Waitati (Manager Parks) and Luke Troy (Corporate Planning Manager) on 13 July 2011. Discussion focussed particularly on access requirements. No significant issues were raised in relation to the Line Relocation Project. GWRC has an on-going interest and role in managing the effects on the natural environment throughout the duration of the Line Relocation Project. GWRC will be the consent authority for any future regional consent applications at detailed design stage.
Department of Conservation (DOC)	Managing the effects on the natural environment.	There are no areas of DOC-protected land directly affected by the line relocation, however DOC are a key stakeholder for the wider Transmission Gully project. Officers from the DOC Wellington Regional Office have been involved throughout the wider Transmission Gully Project and more recently with the Line Relocation Project. No significant concerns have been raised in relation to the Line Relocation Project, however DOC maintain an interest and role in managing the effects on the natural environment. In that regard, DOC will continue to have an on-going stakeholder role, particularly for any future r consent applications at detailed design stage.

6.3 Iwi Consultation

Te Runanga o Toa Rangatira (Ngati Toa) has been involved throughout the wider Transmission Gully Project and more recently with the Line Relocation Project. In particular, Jennie Smeaton represented Ngati Toa at the route selection workshop on 22 February 2011 to assess the possible line route options.

Ngati Toa has identified that cultural values in relation to water quality and sites of significance are the key areas of interest for the Transmission Line Relocation Project. There are no sites of cultural significance adversely affected by the Transmission Line Relocation Project. Matters of water quality will be addressed as part of any required regional consent applied for during detailed design stage.

Ngati Toa commissioned a Cultural Impact Assessment report (Technical Report 18), which includes an assessment of the Line Relocation Project. The report is contained in Volume 3.

6.4 Landowner Consultation

The landowners set out in Table 6:2 have been consulted regarding the Line Relocation Project.

Table 6:2: Landowners Consulted

Party	Property	Relevant Towers	Consultation Summary and Outcome
John Perkins	LOT 1 DP 368307	Towers 9A, 10A and 11A.	On-going correspondence as NZTA is in the process of acquiring the land in its entirety – the three towers will traverse the upper paddocks of the land, however given the farm block is to be acquired in full there are no significant issues in relation to the Line Relocation Project for the landowner.
Michael Kenning	LOT 1 DP 41731	Line Span 22A and 24A	Contact made through email correspondence and telephone conversation. NZTA is in the process of acquiring the land.
Inglis & Pauatahanui Forest Partnership	LOT 3 DP 77862	Towers 24A, 25A and 26A.	Meeting held on 13 July 2011. The on-going access of the forestry block was the main issue raised. Access will be addressed separately through easement negotiations. No significant issues were raised in relation to the Line Relocation Project.
Wellington Regional Council (GWRC)	PT LOT 2 DP 8107	Towers 27-30.	Meeting held with Murray Waitati (Manager Parks) and Luke Troy (Corporate Planning Manager) on 13 July 2011. Discussion focussed on access and easement requirements. Access will be addressed separately through easement negotiations. No significant issues were raised in relation to the Line Relocation Project. GWRC has an on-going interest and role in managing the effects on the natural environment throughout the duration of the Line Relocation Project. GWRC will be the consent authority for any future regional consent applications at detailed design stage.

Party	Property	Relevant Towers	Consultation Summary and Outcome
Maureen Lucic	LOT 2 DP 64048	Towers 31A and 32A.	Meeting held on 2 August 2011. The proposed highway was the main point of discussion. Key area of interest for the Line Relocation Project relates to property access. Access will be addressed separately through easement negotiations. No significant issues were raised in relation to the Line Relocation Project.
Walter Szeto	LOT 2 DP 77897 PT LOT 1 DP 11960	Tower 32B	Meeting held on 11 July 2011. Key area of interest relates to property and plantation access and any impact on future subdivision plans for the property. Access will be addressed separately through easement negotiations. No significant issues were raised in relation to the Line Relocation Project.
Philip and Helen Poppe	LOT 1 DP 77897	Tower 33A	Meeting held on 1 August 2011. Key area of interest relates to Tower 33A, and specifically whether that tower could be relocated further east than currently proposed, including shifting it to the opposite side of the proposed road.
Eberhard Deuss	LOT 2 DP 73878	Tower 33A	Meeting held on 12 July 2011. The proposed highway alignment was the main point of discussion. Key area of interest for the Line Relocation Project relates to property access. Access will be addressed separately through easement negotiations. No significant issues were raised in relation to the Line Relocation Project.
Ron Woodrow and Peter Searle	Lot 5 DP 79125	Towers 41A and 42A	Meeting held on 2 August 2011. Key area of interest relates to the easement width at the edge of the forestry block and associated effects in terms of harvesting and access.
Gloria and William Welch	LOT 3 DP 314471	Towers 43A to 46	Meeting held on 12 July 2011. Key area of interest relates to property access. Access will be addressed separately through easement negotiations. No significant issues were raised in relation to the Line Relocation Project.

6.5 Outcomes of Consultation

Based on the consultation undertaken to date, there has been little concern raised by either stakeholders or landowners in relation to the Line Relocation Project. The key topics of discussion raised by landowners related to the wider NZTA Transmission Gully project in terms of highway alignment and secondly property access and Transpower requirements for on-going access to towers and lines for maintenance. Matters of access will also be addressed separately through property and easement negotiations between Transpower and relevant landowners. The matters raised regarding the location of Tower 33A, particularly by Mr and Mrs Poppe, have been carefully considered and after assessing a range of engineering, environmental (including visual), and economic factors the proposed location of Tower 33A is considered to be the most appropriate siting.

6.6 Future Consultation and Engagement

On-going consultation and stakeholder engagement will be welcomed by Transpower throughout the statutory approvals phase and post-lodgement during construction and beyond. In particular, Transpower will require on-going relationships with those landowners whose properties accommodate relocated towers in terms of long-term corridor management and maintenance access. Those landowners will have on-going engagement with Transpower's property team in that regard.

7 Assessment of Effects on the Environment

7.1 Introduction

In accordance with Regulation 16(4) of the NESETA, discretion is restricted to the following matters in relation to a restricted discretionary activity:

"(a) the location and height of the transmission line support structures in relation to—

(i) visual, landscape, and ecological effects; and

(ii) the effects on historic heritage; and

(iii) the effects on sensitive land uses; and

(b) earthworks, clearance of trees and vegetation, and restoration of the land; and

(c) the effects and timing of construction works."

In addition to these matters, regulation 16(1)(b)(ii) requires that the line relocation demonstrates compliance with the EMF levels set out regulation 10(2) to (8). While this is not a matter for discretion for these resource consent applications, compliance with these conditions is discussed in Section 7.10 of this report.

The above matters are assessed in the following sections.

7.2 Summary of Key Effects

The assessment of effects provided in the following sections demonstrates that overall, the adverse effects of the line relocation are no more than minor.

With regard to landscape and visual effects (**regulation 16(4)(a)(i)**), for the most part only small modifications will be made to the existing line resulting in minor landscape effects relative to the existing environment.

The main exception is the four-span deviation around Wainui Saddle (Towers 8-12) which will result in three towers on spurs above the saddle. The deviation is within an area classified as an Outstanding Natural Landscape (ONL) however in this instance the deviation is considered appropriate because the existing line already traverses the ONL and the landscape and visual effects of the relocated and replaced towers will be modest in degree. Several other towers have also been identified as having modest visual effects when viewed from existing dwellings and visual mitigation is proposed for these towers.

The line will be visible from the proposed highway however this is an inevitable consequence of the alignment of the highway along the valley occupied by the transmission line from which Transmission Gully takes its name. The line relocation has been designed to minimise these effects by reducing the number of road crossings and angle changes, and increasing the separation distance between new road and line wherever possible.

With regard to ecological effects (**regulation 16(4)(a)(i)**), of the 24 towers to be relocated, two are located in plantation pine, three in gorse scrub, and the remainder in pasture. No significant regenerating native bush or native forest will be affected by the line relocation and is unlikely to be necessary for the foreseeable future for line operation.

With regard to the effects on historic heritage (**regulation 16(4)(a)(ii)**), no archaeological sites are affected by the line relocation and for built heritage, the only site within proximity to the line relocation is a World War II brick fuel storage tank which, due to its distance from proposed Towers 2A and 3A it will not be physically impacted and the towers will have negligible visual impact on the heritage values of the tank as the views to and from the tank are currently obscured.

With regard to the effects on sensitive land uses (**regulation 16(4)(a)(iii)**), there are no childcare facilities, school, or hospitals in the vicinity of the line relocation. No towers will be located in close proximity to dwellings and the adverse effects will be minor and arise due to views of the towers. Visual mitigation is proposed for four towers to minimise the impact of these on existing dwellings. In some cases the effects of the line relocation on existing dwellings will be positive, with the towers shifting further away from the dwellings.

With regards to the matters in **regulation 16(4)(b) and (c),** several of these matters can be addressed by adopting good construction management practices as set out in Section 7.7 and Section 7.8. A Construction Environmental Management Plan is proposed to manage construction activities and mitigate construction impacts. Details of the CEMP are contained in Section 8.1 of this report.

7.3 Visual and Landscape Effects

The visual and landscape effects of the Line Relocation Project have been assessed in *Addendum to Technical Report 5: Assessment of Landscape and Visual Effects.* The following section sets out the potential landscape and visual effects from the construction and operation of the relocated line.

The assessment of landscape and visual effects distinguishes between the effects of the project on the existing environment (including dwellings) and effects on future users of the road once the Transmission Gully Main Alignment has been constructed. In providing an overall assessment, the effects on the existing environment including dwellings have been accorded greater weight than those for the road user as the effects on the road users are of a short duration and road users have a choice of route.

The landscape and visual assessment for the six route sections is provided below.

7.3.1 Route Section 1 – MacKays Crossing

Changes to the existing line in this route section will be small and involve the relocation of two towers and strengthening of two other towers. The effects on the existing environment of the changes will be minor.

The line will be visible from the proposed new highway. The most significant element in this section will be tower 2A which is in the centre of a view from a vehicle when on the outside of a bend where views in a northbound direction begin to open up to the coastal plain.

The overall landscape and visual effects from the line relocation in Route Section 1 are considered minor.

7.3.1 Route Section 2 – Wainui Saddle

The changes to towers through this route section represent the most significant change to the existing transmission line route. These result from a deviation of the line through the Wainui Saddle area. The deviation is required because of the space constraints within the saddle imposed by the saddle's narrowness and steep sides, and the native bush on the eastern slopes. The line and the road cannot both be located within the Saddle and therefore the line needs to be relocated. The deviation involves relocating three towers to spurs above the saddle, and using heavier angle

towers for adjacent towers. The western slopes were favoured over the eastern slopes of the valley due to the significant ecological values in combination with similar landscape values for the eastern slopes. The route selection process that resulted in the selection of the proposed tower locations is set out in Appendix C and the landscape and visual consideration discussed in further detail in Section 4 of the *Technical Report 5: Assessment of Landscape and Visual Effects.*

Te Puka valley and the hills on either side are mapped in the Kapiti Coast District Plan as part of "the foothills of the Tararua Ranges" which is classified as an 'outstanding natural landscape' (ONL). This area includes the Wainui Saddle and the location of Towers 8 to12. The District Plan does not outline the reasons for the area being classified as an ONL. In the absence of such information, *Technical Report 5: Landscape and Visual Assessment* (paragraph 8.1.142) assessed the main value of the hills as their boldness and sharp escarpment backdrop to the coastal plains. Contributing values include the expressiveness of the Ohariu Fault, historical and tangata whenua values associated with the toe of the hills in the Whareroa /MacKays Crossing area, and the natural science values of the bush and streams. As this area is part of an ONL, consideration needs to be given to whether the changes to the transmission line are 'appropriate' in terms of s6(b) of the RMA.

Within its immediate environs the Wainui Saddle line deviation will be more obtrusive than the existing alignment as it is will be located higher on the hills, and will contain sharp horizontal and vertical angles. Although three of the towers will be located on the skyline and will therefore be more prominent, the visual effects of these changes are reduced by the following:

- The deviation is a long way (up to 4km) inland from the coastal plain and relatively distant from key public viewpoints such as Queen Elizabeth Park and MacKays Crossing. Lattice towers tend to fade in prominence relatively quickly at such a distance.
- The landscape effects of earthworks will be limited because access can be provided by the existing gas pipeline road along the main ridge. No clearance of native vegetation will be required.

A photomontage from Queen Elizabeth Park has been prepared and is contained in *Volume 4: Plan Set* (Viewpoint 14)**.** This shows that parts of Tower 9A and 10A can be seen on the skyline when viewed from parts of the coastal plain to the north, although they will be distant in such views. This illustrates that the deviation will have low prominence from the coastal plains primarily due to distance inland and location on the shoulders of spurs below the main ridge. The towers south of Tower 10A will not be visible from the north. Conversely, towers to the north of Towers 10A will not be visible from the south.

The visual effects of earthworks for access and tower sites will be relatively minor because access will largely be provided by the existing access track that runs alongside the gas pipeline on Gas Line Ridge.

In this instance the deviation of the line on the western slopes of the Wainui Saddle is considered appropriate because the existing transmission line already traverses the ONL and the landscape and visual effects will be modest in degree. Apart from towers in the deviation, the remainder of this section will mostly have a backdrop of hills and the proposed changes have been assessed as having a minor effect compared with the existing transmission line.

7.3.2 Route Section 3 – Horokiri Stream

There will be small to moderate changes to this section of the line. Six of the nine towers (16A, 17A, 18A, 22A, 24A and 25A) will be replaced and shifted to the east - in most cases higher on the valley's eastern hill slope to provide greater separation from the highway.

The proposed changes will have less than minor adverse effects on the existing environment compared with the existing line. A number of towers are proposed to be relocated to higher land and on the hill toe slopes. Some towers will be taller and will be 'heavier' than existing towers, and some earthworks may be required to create access and tower platforms. The majority of changes in alignment are modest, and there will be one less tower (Tower 23) along this section. The proposed alignment is fairly linear and does not cross the proposed road.

The most significant change is to Tower to 24A which will be relocated some 100m to the east in order to avoid crossing the new highway. It will be located on a locally prominent spur above a 30m side cut of the proposed road. This location is visible from Gas Line Ridge in Battle Hill Farm Forest Park as illustrated on Plans LA29-LA34 contained in the *Volume 4: Plan Set*. Earthworks and clearance of established pine trees will be required to provide a building platform for tower 24A. These factors increase the overall visibility of the tower and therefore mitigation planting is proposed for areas adjacent to the tower to reduce the visual effects whilst providing for required line clearance under NZECP34. The proposed mitigation planting for this tower combined with the planting to also be undertaken for the Main Alignment is shown on Plan LA07 within the Volume 4: Plan Set. The earthworks required for this tower will require careful design to integrate the tower platform with the earthworks for the road. In this regards, best practice earthwork design principles have been attached as Appendix 5G to the *Addendum to Technical Report 5: Assessment of Landscape and Visual Effects* and these will be used *to* guide earthworks design for this, and other towers, during the detailed design phase.

The line will be visible from the proposed road due to the increase in tower heights. Mitigating factors for the height increases include the line being viewed mainly against a backdrop of hills, and the separation distance between the road and transmission line. In any event, this part of the expressway is likely to be known as Transmission Gully because of the very transmission lines that will be visible to motorists.

7.3.3 Route Section 4 – Battle Hill

There will be little change to most of this section of line which traverses the southern end of Battle Hill Farm Forest Park, the exception being realignment between towers 31A-33A.

Towers 31A-33A will have moderate adverse visual effects from a small number of properties and dwellings west of the line and accessed off Paekakariki Hill Road. These are the properties at 528, 510 and 504 Paekakariki Hill Road. The housing inventory attached as Appendix 5D to the Transmission Gully Project *Technical Report 11: Assessment of Landscape and Visual Effects* includes appraisal of the effects on these properties (including cumulative effects from the line relocation and road).

The most prominent visual element through this route section will be Tower 31A which will be elevated on what will become a small knoll above the highway cutting. Recommended measures to mitigate the appearance of the tower for existing dwellings include:

- Integrating the edge of the platform to tie in with the adjacent road cutting;
- Tying the remaining platform edges into the natural landform; and
- Planting the north-west and south-west slopes of the knoll to reduce the tower's prominence.

Tower 32A will be located higher on the hill slope and will be a strain tower. The visual impact of this tower will be moderated by the fact the line will have a significant hill backdrop. Mitigation planting is proposed on the gully slope adjacent to existing vegetation to reduce the visual effects of this tower. Off-site mitigation is also proposed on land to the north of this tower if acceptable to the landowner.

Tower 33A will be a strain tower and at this location the line will have an angle compared with the existing straight alignment. The existing pine plantation between towers 32A and 33A will need to be removed to allow for line clearance (and in the future for construction of the road) allowing parallel views along the line south of this tower. Consultation with the closest affected landowner (504 Paekakariki Hill Road) has identified that the key concern is the proximity of the replacement tower to their dwelling and in particular a desire that the line and tower does not move any closer. In response to this, the proposed tower location is located approximately 10m along the existing line, but no closer to the dwelling. The location of this property can be seen on the Road Layout Plans GM contained in the Volume 4: Plan Set. To further reduce the visual effects of this tower, mitigation planting is proposed adjacent to existing vegetation to intercept views along the line.

The location and extent of the mitigation planting proposed for these towers, combined with the planting to also be undertaken for the Main Alignment, is illustrated on Plan LA09 in the *Volume 4: Plan Set.*

During the final siting of these towers, a reduced tolerance is proposed to take account of the large cuts for the proposed road, areas of native vegetation and the visibility of the towers from nearby dwellings. The tolerances for each of the towers are discussed in further detail in Section 3.4.1 of this report.

7.3.4 Route Section 5 – Golf Course

There will be relatively small changes to this route section of line and the line will be relatively straight and parallel to the highway. It will be aligned close to the edge of the existing pine plantation and some clearance of pines will be required to the south of Tower 42A to provide for line clearance between Towers 42A, 43A and 44. The adverse effects of these changes will be less than minor when compared to the existing line because:

- The line will be moved further away from the nearest houses.
- Although towers increase in height they will be located lower down and behind intervening landform.
- The new alignment will be closer to the backdrop hill and pine plantation.
- The line crosses easy rolling terrain mostly in pasture so that the adverse visual effects of earthworks should also be minor.

For the majority of houses on Flightys Road that have views of the existing towers, the proposed realignment will have positive effects. The exception are the two properties located at 317 and 247C Flightys Road, where the 27m shift of Tower 40A will increase the elevation of the tower resulting in moderate visual effects for these properties. The location of these properties can be seen on the Road Layout Plans GM contained in the Volume 4: Plan Set. The tower will be located directly adjacent to an area of native vegetation that was introduced as ecological mitigation as part of the previous NZTA Transmission Gully designation process, but any clearance of this vegetation will be minimal (see *Addendum Technical Report 11A*). During the final siting of this tower, a reduced tolerance is proposed to take avoid any further increase in elevation of the tower and avoid the removal of native vegetation (See Section 3.4.1).

The line through this section will be visible from the proposed highway however views will be restricted by the succession of box cuts and the line will be seen against a back-drop of rising land that is currently in pine plantation.

7.3.5 Route Section 6 – SH58

Through this route section, the visual effects associated with Tower 43A will be positive and adverse effects of other changes to this section of the line will be negligible. The only changes in alignment are between Towers 43A and 44, with Tower 43A shifting further from the nearest houses and closer to the backdrop hill and pine plantation. Some minor clearance will be required on the edge of the pine plantation. Otherwise the line will remain in its current configuration through to the Pauatahanui Substation.

The line will be visible from the proposed highway however, the views of the line will be restricted by the succession of box cuts, and the line will be seen against a back-drop of rising land that is currently in pine plantation.

7.3.6 Summary of Landscape and Visual Effects

For the most part only small modifications will be made to the existing line resulting in minor landscape effects relative to the existing environment.

The main exception is the four-span deviation around Wainui Saddle (Towers 8-12) which will result in three towers on spurs above the saddle. The deviation is within an area classified as an ONL and therefore additional consideration needs to be given as to whether the deviation is 'appropriate' in terms of section 6(b) of the RMA. In this instance the deviation is considered appropriate because the existing line already traverses the ONL, the proposed route is was selected as the best option to achieve a balance with other constraints, and the landscape and visual effects will be modest in degree.

Several other towers have also been identified as having moderate impacts for existing dwellings and of a lesser weight, the users of the proposed road. Visual mitigation is proposed for these towers both within the proposed designation for the Main Alignment and off-site if acceptable to the landowner. This visual mitigation has been addressed in the proposed conditions of consent contained in Appendix D and includes the preparation of a landscape plan. With the implementation and maintenance of this mitigation, the adverse effects of the towers are reduced such that the effects are no more than minor.

The design of earthworks for towers sites and access require careful design. Best practice earthworks design principles need to be adhered to during detailed design. Suggested principles are contained as Appendix 5G to the *Addendum to Technical Report 5: Assessment of Landscape and Visual Effects.* The use of these principles during detailed design is included in the proposed conditions of consent contained in Appendix D.

7.4 Ecological Effects

The ecological effects of the Line Relocation Project have been assessed in *Addendum to Technical Report 11A: Assessment of Ecological Effects.* The ecological effects of the project arise as direct and indirect impacts of construction and operation of the line.

7.4.1 Vegetation Removal during Construction

During construction, vegetation clearance may be required for the construction of new tower foundations, the upgrading of existing towers, the formation of access roading including culverts for construction access, and vegetation clearance needed to maintain line clearance. The vegetation clearance required for the line relocation is set out in Section 3.5.2 of this report.

All but four of the proposed tower relocations lie within the extent of works for the Main Alignment. The tower locations outside the Transmission Gully Main Alignment construction extent, being

Towers 9A, 10A, 11A and 32A, all lie on improved pasture and are accessible by existing farm or forestry access tracks.

Of the 24 towers to be relocated, two are located in plantation pine, three in gorse scrub, and the remainder in pasture. No significant regenerating native bush or native forest will be affected by the works. Some areas of scrub and shrubland dominated by gorse will be cleared to provide access roads to three towers. The *Addendum to Technical Report 11A: Assessment of Ecological Effects* concludes that the clearance of pioneer shrublands will have negligible ecological effects. In addition, none of the species of conservation concern recorded during the Transmission Gully ecological assessment were found in these plant communities. The ecological assessment concludes that there will be no measurable adverse ecological effects associated with the clearance of vegetation for the formation of new tower pads or from works associated with strengthening existing towers. Almost all vegetation is pasture or plantation pine, which does not contain rare or threatened plants or plant communities, and does not provide habitat for identified fauna of conservation concern. The ecological assessment has recommended that resource consent conditions require best endeavors to minimise clearance of other native vegetation, in particular riparian vegetation. This matter has been addressed in the proposed conditions of consent contained in Appendix D.

Several sites of ecological value identified as Significant Natural Areas (SNA) in the Kapiti Coast District Plan and the Porirua City District Plan are located along the line route. These areas are detailed in the *Addendum to Technical Report 11A: Assessment of Ecological Effects*. No towers or their associated access tracks are located within the SNA. Ecological sites K224, K228, P172, and P199 are traversed by the line. In the case of K224 and P199 these sites are currently traversed by the existing line route in generally the same locations. There will therefore be no new effects. In the case of K228 and P172 the proposed line route will traverse sites that currently lie outside the existing line route. These areas will not be directly affected by the line relocation works. The ecological assessment has recommended that the ecological areas are identified prior to earthworks commencing and protection mechanisms identified. This matter has been addressed in the proposed conditions of consent contained in Appendix D.

Several areas of native vegetation will be traversed by the line locations, and future vegetation trimming may be required to achieve line clearance distances. Twelve spans traverse regenerating native bush, two of which are advanced mitigation planting. However, in all situations the bush is low in stature and lies within gullies. A number of lines will also cross pine plantation. Only the line between Tower 3A and 4 crosses mature native forest near the Te Puka stream. Kohekohe forest lies in the bed and slopes of this incised gorge, turning to pasture on the terraces. The forest will not need to be trimmed or cleared to provide for the line installation. Overall, no vegetation clearance is required for the installation of the proposed line relocation, and is unlikely to be necessary for the foreseeable future for line operation.

7.4.2 Ecological Effects During Operation

During operation, the only potential ecological effects are vegetation removal to maintain line clearance and potential effects on avifauna.

As a result of the Transmission Gully Project, the Te Puka valley and Upper Horokiri valleys will be retired from grazing and revegetated as mitigation. Ultimately this will mean that native forest will develop beneath the line route from Tower 1 to Tower 22. Due to the current age, low structure and successional status of the vegetation, no trimming of regenerating forest is likely to be necessary along the line route for a number of decades.

The ecological assessment has identified a potential but undefined risk of bird strike on transmission lines and towers. However, given this is not a new route, but the relocation of towers

along an existing line, any effects associated with the line relocation will be neutral. In particular, the existing towers at Wainui Saddle and in the upper Te Puka Valley will be moved away from the Akatarawa forest, which has been identified as the most important bird habitat along the Transmission Gully alignment. Therefore, there could be positive avifauna outcomes from the relocation of transmission towers and lines.

7.4.3 Summary of Ecological Effects

No regenerating native bush or native forest will be affected by the line relocation works, and no vegetation trimming for line clearance during operation is likely to be necessary for the foreseeable. Only two access tracks will involve the clearance of vegetation, being gorse dominated scrub. The clearance of these small areas will have negligible ecological effects.

Most towers and associated access roads lie on flat ground (river terraces or downland) and there are unlikely to be any issues around the prevention of erosion or management of sediment control discharge to streams. Any towers located in close proximity to streams will require care during construction to minimise erosion and the resultant effects on in-stream ecology.

Three towers will be moved from Wainui Saddle and the valley floor of upper Te Puka Stream to the adjacent western slopes, and away from the Akatarawa forest. The effects on wildlife will be neutral or potentially this shift could provide a minor benefit.

Overall, the line relocation can be undertaken without adverse effects on ecological values or indigenous biodiversity.

7.5 Effects on Historic Heritage

The effects of the Line Relocation Project on historic heritage has been assessed with regards to archaeological sites and impacts on built heritage in the *Addendum to Technical Report 19A: Assessment of Built Heritage Effects* and *Addendum to Technical Report 20A: Assessment of Archaeological Effects.*

7.5.1 Archaeological Effects

As described in Section 2 of this AEE, There are known archaeological and heritage sites in the wider environs of the Project area, which remain from Maori occupation and subsistence and also past military presence in the area. These are located within the vicinity of MacKays Crossing, Paekakariki Hill Rd and Pauatahanui Inlet. However, none of the sites are physically affected by the transmission towers and associated construction activities.

Within Route Section 1 - MacKays Crossing, the recorded sites include a combination of pre-European Maori and European sites. They include storage pits, midden, terraces and an urupa. The European sites are of military origin and are associated with the US Marines' camps at Paekakariki. None of the sites will be affected by the relocation of the transmission line. The nearest site is a circular brick fuel storage tank located on the edge of the stream immediately south of the Transmission Gully Main Alignment. This site is discussed further in Section 7.5.2 below.

Within Route Section 4 - Battle Hill, the recorded sites in this route section are associated with Battle Hill, the scene of conflict in the 1840s. Sites include the battle site itself and graves of people killed in the battle. There is also an historic woolshed, a goldmining site and an historic quarry. The transmission towers are at the base of the adjacent ridge, and thus are not near these sites.

Within Route Section 6 - State Highway 58, the recorded sites near the Pauatahanui inlet are a mixture of pre-European Maori – middens, pits and a pa, and European – historic cottages and

churches. The transmission towers are located between the two clusters of archaeological sites and do not impact on them.

7.5.2 Built Heritage Effects

The assessment of built heritage effects area set out in *Technical Report 19: Assessment of Built Heritage Effects* confirms that only two heritage structures are located within proximity of the Transmission Gully Main Alignment. These are the St Joseph's Church located near SH58 and the brick fuel storage tank located near MacKays Crossing. Of these two structures, only the tank is located close to the line relocation. The tank (as shown in Figure 2.4) is identified as structure B87 in the Kapiti Coast District Plan and was built in World War II, and is one of three in New Zealand. It has been identified as a heritage feature, but does not meet the criteria as an archaeological site set out in the Historic Places Act 1991.

Towers 2 and 3 are located nearest to the tank, with Tower 2 the closest at approximately 145m away and Tower 3 further away still. Replacement Tower 2A will be located approximately 20m to the west of its existing location and Tower 3A will be located approximately 18m to the west of its existing location. *Addendum Technical Report 19: Assessment of Built Heritage Effects* concludes that both of the replacement towers will remain sufficient distance away from the tank that their construction will have no physical effects on the tank.

The visibility of the towers is relevant as depending on their height and locations they may detract from the heritage values of the structure. The tank can currently be viewed from an access road on and within the tank itself. The tank is partially buried and vegetation around the tank further obscures views of the tank and also makes access difficult. The tank cannot be seen from the existing or proposed tower locations as it is partially buried and existing vegetation obstructs views. The 9.6m height increase for Tower 2A and the 2.3m increase for Tower 3A will not impact on views from the tank as views will only be possible if the vegetation is removed and even then they are only from the top perimeter of the tank.

While Towers 2A and 3A will be located closer to the tank and will be taller than the existing towers, these changes will have little visual impact on the tank and therefore minimal impact on its heritage values.

7.5.3 Summary of Effects on Historic Heritage

In relation to archaeological sites, the transmission line relocation will not have any impact on recorded archaeological sites. In relation to the effects on built heritage, the only site within proximity to the line relocation is a World War II brick fuel storage tank which, due to its distance from proposed Towers 2A and 3A, will not be physically impacted by tower construction or operation. In addition, the proposed Towers will have negligible visual impact on the heritage values of the tank as the views to and from the tank are currently obscured.

Based on the above, the overall effects on historic heritage in relation to the location and height of the transmission line support structures are considered negligible.

Given that the effects on historic heritage are negligible, no mitigation is considered necessary for either archaeological or built heritage features.

Although no heritage sites are located within the vicinity of the line relocation, it is recognised that vegetation removal and earthworks associated with the works could encounter heritage sites that have not yet been discovered. If there is the accidental discovery of potential archaeological material, measures will need to be in place to ensure that the correct protocol is followed. In this regard, a condition of consent is proposed setting out the procedures that will apply should any

archaeological sites, including human remains, be exposed during site works. The proposed condition is set out in Section 8.2. It is anticipated that, if any resource consent is required for earthworks during the detailed design phase, that it would include a similar condition.

The NZTA has developed and agreed an accidental discovery procedures protocol for the Transmission Gully Project with the NZHPT and Ngati Toa Rangatira. A copy of this protocol is contained in Appendix C of the NZTA Transmission Gully CEMP in *Volume 5: Management Plans*. This protocol will be adopted for the Line Relocation Project and included within a separate CEMP specific to the Line Relocation Project (See Section 8.1 for further discussion regarding the CEMP).

7.6 Effects on Sensitive Land Uses

Sensitive land use is defined in regulation 3 of the NESETA and *"includes the use of land for a childcare facility, school, residential building, or hospital".*

There are no schools or childcare facilities within the line relocation route. The closest school is the Pauatahanui Primary School on Paekakariki Hill Road, and is located at least 350m to the north of the Paekakariki substation. None of the transmission towers in vicinity of the school are to be relocated, replaced or strengthened as part of the Line Relocation Project. The nearest tower to be relocated is Tower 43A, located over 1.2km from the school. This tower is increasing in height by 10.3m and is shifting approximately 26m north-east from its existing location. A large area of pine plantation and undulating terrain mean that neither the existing or proposed tower are visible from the school. Therefore there will be no effects on Pauatahanui Primary School in relation to the location and height of the relocated and replaced towers.

There are no hospitals within the vicinity of the line relocation.

There are a number of residential buildings located in the vicinity of the existing transmission line. The Transmission Line Relocation Plans (TP01-TP12) contained in the Volume 4: Plan Set show the location of dwellings near the line route. These are associated with rural activity and rural residential development and occur in greatest concentration in Section 1 - MacKays Crossing, Section 5 – Golf Course and Section 6 – State Highway 58. As part of the route selection process (See Section 3.2.2), the proximity of the relocated line and towers to existing residential buildings was a contributing factor in the consideration of potential tower locations.

The *Addendum to Technical Report 17: Assessment of Social Impacts* concludes that the majority of tower relocations some distance from any residential properties. In this regard, it is noted that the closest relocated tower to a residential building is Tower 33A, located approximately 120m away from the nearest residential building. This tower is shifting approximately 10m to the north from the existing tower but is not located any closer to the residential building. Tower 3A is shifting approximately 20m to the north and 5m to the east from the existing tower but is not located any closer to the nearest residential building about 140m away. The next closest is Tower 32A, located 220m from the nearest residential building. The distances for the remaining towers are considerably greater than these.

In several locations the relocated towers will be located further away from residential buildings than the existing towers. This is particularly the case for the following towers:

- Tower 31A, shifting approximately 20m further away from the dwelling at 528 Paekakariki Hill Road;
- Tower 32A, shifting approximately 80m further away from the dwellings at 515 and 510 Paekakariki Hill;
- Tower 40A, shifting approximately 40m further away from the dwelling at 247C Flightys Road and no closer to the dwelling at 317 Flightys Road;

- Tower 41A, shifting approximately 70m further away from the dwelling at 247C Flightys Road; and
- Tower 43A, shifting approximately 25m further away from the dwelling at 207 Flightys Road.

The location of these properties can be seen on the Road Layout Plans GM contained in the Volume 4: Plan Set.

Shifting these towers further away from residential buildings needs to be balanced against the increase in towers heights, with the height increases ranging from 6.7m to 14m. The visual effects from residential buildings is considered in Section 7.3 and includes discussion of proposed mitigation measures for those towers (including Towers 31A and 40A) where the adverse effects are assessed to be more than minor.

There are not considered to be any other land uses that might be sensitive to the relocation of the line.

7.7 Earthworks, Clearance of Trees and Vegetation and Restoration of the Land

7.7.1 Earthworks, Land Contamination and Dust

Earthworks for the project include establishing tower sites (foundation area and construction working area) and access tracks for construction and maintenance. Section 3.3 details the earthworks associated with the Project. The nature of earthworks associated with each tower and access track differ depending on tower location, typography and geotechnical conditions.

Land disturbance activities that expose bare earth surfaces, including earthworks, can increase the potential for the generation and discharge of elevated levels of sediment, and consequently have an adverse effect on the quality of waterbodies. Earthworks can also give rise to visual effects and these are assessed in Section 7.3.

The factors affecting sediment generation for the Line Relocation project include the following:

- The amount of exposed bare earth;
- The proximity of the operation to the receiving environment;
- The length of time during which the bare earth surface is exposed; and
- The measures used to restrict or control sediment being transported from the site.

The typography of the areas within which the earthworks are being undertaken will have a direct relationship to the concentration and volume of sediment that may be discharged from a site. The steeper the slope, the greater the potential for increased sediment discharge. Table 7:1 provides a summary of the landforms for the towers being relocated or existing towers with foundation strengthening.

Table 7:1: Summary of Landform for Towers

Landform	Relocated towers	Towers for foundation strengthening
Flat to rolling river terrace	2A, 3A, 14A, 15A, 17A, 18A, 22A, 25A, 26A, 32A	4, 19, 21, 27, 30
Flat to rolling downland	33A, 40A, 41A, 42A, 43A	34, 39, 44
Gentle spurs	9A, 10A, 11A, 31A, 32A	
Moderately steep slopes	8A, 12A, 13A, 24A,	21
Steep spurs	16A	7
Other – established industrial		1

The majority of relocated towers are on flat ground, either river terraces or downland, and most of these sites have existing access tracks to them. Works in these areas have less risk of erosion and sediment discharge than areas located on steeper terrain.

Five sites are located on broad gentle spurs. Four of the sites are on slopes above streams but with the implementation of erosion and sediment control measures, the risk of significant sediment discharge to streams from these sites is considered low.

Five of the relocated towers will be located on steeper slopes. Of these, one sites lies on a steep spur (16A), and four sites (8A, 12A, 13A, 24A), lie on moderately steep toe slopes above stream terraces. Additional care is needed for these sites during construction to minimise erosion.

Managing earthworks for the project involves minimising sedimentation and then capturing sediment that has been eroded and entrained in overland flow before it enters the receiving environment.

Erosion and sediment control for the site will be managed in accordance with the Erosion and Sediment Control Guidelines for the Wellington Region (reprinted June 2006). The measures to be adopted for the works include the following:

- Areas of disturbance shall be kept to a minimum.
- Cut off drains installed around all open earthwork areas.
- Run-off from disturbed areas is to be diverted using suitable run-off controls, to minimise the volume of sediment discharged to the adjacent watercourses.
- Erosion and sediment control measures consisting of sediment retention ponds (which will be treated with flocculant (if necessary) to intercept any discharge of sediment to ground or to watercourses. Where topography and sites are constrained then sediment ponds may need to comprise containers or other similar type devices.
- Silt fencing shall be installed to detain sediment laden run-off at the ends of cut faces.
- On completion of each section of construction, exposed areas of soil are to be stabilised against erosion by re-vegetating by means of topsoil and grass seeding or planting of native bush.

The erosion and sediment controls will be put in place prior to any construction works commencing or topsoil being stripped for tower platforms, construction areas or access tracks.

During earthworks for the line relocation, the risk of encountering land which has contaminants present above background or risk-based values is considered low. The *Addendum to Technical Report 16A: Land Contamination Assessment and Investigation Report* has identified two tower sites that may contain contaminants due to their previous land uses.

The site for Tower 1 is located in an area with a minor to medium contamination risk from past chemical use and asbestos in building material at adjacent former Golden Coast Nurseries. The southern side of the site had higher contaminant levels present. This tower is to be strengthened and tower strengthening activities will not result in the significant disturbance of potentially contaminated soils in this location. In addition, the tower site is located on the northern side of the site.

The site for Tower 25A is located in an area with minor ecological risk from past DDT usage at a former livestock yard. The concentrations of contaminants were below human health guideline values. The earthworks at the site are associated with tower foundations and construction of a short maintenance track.

Measures to manage any potentially contaminated soil/material during land disturbance activities at these two towers sites include:

- Erosion and sediment control measures to minimise the discharge of contaminants through sediment laden run-off;
- Dust management to minimise the discharge of contaminants to air;
- Visual inspections prior to works commencing to confirm that site conditions have not changed;
- Management of excavated material; and
- Making the contractor aware of potential contamination and procedures should contaminated soil/material be encountered during works.

These measures will be included a Line Relocation Project Construction Environmental Management Plan (CEMP) prepared for the Project. The CEMP will be prepared prior to any works commencing and will be certified by the Kapiti Coast District Council and Porirua City Council. A condition of consent has been proposed to require the development of a CEMP and is contained in Appendix D. The CEMP is discussed in further detail in Section 8.1 of this report.

The *Addendum to Technical Report 16: Land Contamination Assessment and Investigation Report* has also considered the risk of encountering elevated levels of zinc and lead at existing towers resulting from construction and maintenance activities (eg painting and cleaning activities involving lead based paint and galvanised structures). Drawing on international studies, the assessment confirms that zinc and lead are not highly mobile in the soil and contamination (if any) around structures is typically found in surface soils directly adjacent to the structure. Therefore, if zinc and lead concentrations are present at any existing tower sites, they are likely to only be present within surface soil samples and drop of rapidly with depth and distance. Tower sites 1 and 25A were both investigated for the NZTA Transmission Gully Project and in both instances, the nearby transmission towers do not appear to have contributed to contamination found at these sites. The assessment concludes that the likelihood of contamination at tower sites is judged to be possible and the consequences minor. The overall risk is ranked as low.

Dust arising from earthwork activities can affect plant life along the edge of the earthworks area, can be a nuisance to the surrounding public, and can contribute to sediment loads discharged to streams and other water bodies by depositing in areas without sediment control measures in place. Sediment deposited in sealed public roads can also result in a dust nuisance. Rainfall, evaporation and wind speed are meteorological conditions having the greatest effect on dust mobilisation. Dust control will be initiated during construction and may include minimising the extent of work and dust suppression (eg dampening exposed areas when high wind is anticipated).

The measures proposed to manage earthworks, potentially contaminated sites and dust for the Project will be set out in the CEMP. In addition, it is noted that earthworks will require separate resource consent from the Wellington Regional Council in accordance with the Wellington Regional

Soil Plan and Regional Freshwater Plan. Any consents will be sought during the detailed design phase and will include specific measures, including consent conditions, to manage land disturbance in these areas.

With the implementation of the measures set out in this section, the adverse effects of earthworks are expected to be no more than minor and have been appropriately avoided, remedied or mitigated.

7.7.2 Clearance of Trees and Vegetation

The clearance of trees and vegetation is required to establish tower platforms and access tracks and to maintain line clearance. Section 3.3 details the earthworks associated with the Project. The majority of towers and access tracks are located in pasture. However for tower construction, three towers are located within gorse dominated scrub (Tower 3A, 21 and 22A) and two towers within plantation pine (24A and 43A). In addition, for the construction of access tracks, one involves the clearance of gorse dominated scrub ((to Tower 21) and three involve the clearance of plantation pine (to Tower 3A, 24A, and 43A). The ecological effects associated with vegetation clearance and trimming are set out in Section 7.4 and in summary, no clearance of significant native vegetation is required and the ecological effects of clearance of gorse dominated scrub and plantation pine are considered negligible.

Vegetation trimming may be required for line clearance between some towers. Where trimming is required, this will be undertaken prior to the relocation of towers. Vegetation trimming may also be required from time to time during the operation of the line to maintain line clearance in accordance with NZECP:34. Transpower uses contractors to carry out regular maintenance and to carry out routine inspections of all its lines every six months. These inspections include checking to see that vegetation is not growing too close to, or endangering, overhead lines.

Measures proposed to minimise the effects of vegetation removal and trimming during construction include the following:

- Areas of native vegetation removal shall be kept to a minimum.
- The removal of riparian vegetation shall be avoided to minimise the risk of stream bank erosion.
- Removed vegetation shall be kept clear of watercourses to avoid debris entering these.

The measures proposed to manage vegetation clearance and trimming for the Project will be set out in the CEMP.

The route selection process has resulted in towers and access tracks being sited to avoid areas of significant indigenous vegetation. The implementation of the above measures will further ensure that adverse effects of vegetation clearance are appropriately avoided, remedied or mitigated.

7.7.3 Restoration of the Land

Following construction, all equipment and materials will be removed from the site and the tower platforms and construction yards not required for the Transmission Gully Main Alignment works reinstated by means of topsoil and grass seeding or planting of native bush. Any access tracks not required for line maintenance will be removed and the affected areas reinstated. Remaining tracks will be established to permanent standard for maintenance access.

7.7.4 Summary of Effects from Earthworks, Clearance of Trees and Vegetation and Restoration of the Land

The potential adverse effects from earthworks, clearance of trees and vegetation can be managed through the implementation of the measures set out above. These will ensure that adverse effects of earthworks and clearance of trees and vegetation on the environment are appropriately avoided, remedied or mitigated.

7.8 Effects and Timing of Construction Works

The construction methodology for the works is set out in Section 3.5. The entire works are expected to take approximately one year to one and a half years involving site investigations, construction and commissioning. The line relocation will take place prior the substantial works for the road.

During construction, a number of activities may be occurring simultaneously within different areas. The timing of each of the works will be determined during detailed design and is dependent of the availability of access, materials and equipment.

The key effects arising from construction works relate to:

- traffic and access effects;
- construction noise effects;
- effects on recreational activity; and
- landscape and visual effects from earthworks and other construction activities.

7.8.1 Traffic and Access Effects

Two of NZTA's proposed construction yards will be used for the line relocation works; one at MacKays crossing to access the northern towers and the other at Battle Hill Forest Farm Park, which is accessed off Paekakariki Road, for the remaining towers. The use of these yards is dependent on the activities NZTA is undertaking at that time. The use of these sites will minimise the number of construction yards and site access points. The NZTA is seeking planning approvals for the use of these sites for the Transmission Gully Project.

Traffic associated with the line relocation works will include articulated trucks, concrete delivery trucks, crane trucks and four wheel drive vehicles. Trucks using local roads will include those delivering and removing tower/foundation components and delivering concrete for foundations (in the event that an on-site concrete batching plant to be used for the NZTA Transmission Gully project will not be available for use during the line relocation and therefore concrete will therefore need to be transported in). In terms of duration, construction traffic will typically be concentrated in certain locations for short periods associated with the sequence of works. The highest level of construction movement would occur during foundation construction and tower construction works. Each replacement tower would take approximately two weeks to construct. Removing the existing towers and tower strengthening works will take approximately one week each. Other vehicle movements would occur on an occasional basis over the entire construction phase.

7.8.2 Construction Noise and Vibration Effects

Construction noise and vibration will result from tower construction and removal. Construction will be undertaken in a manner that construction noise complies with New Zealand Standard NZS 6803:1999 Acoustics—Construction Noise. This includes limiting night time works. Construction will also be undertaken in a manner that complies with German Standard DIN 4150 3:1999 Structural Vibrations—Effects of Vibration on Structures. Effects from vibration are expected to be minor given that blasting and other high vibration causing construction techniques

are not proposed for the line relocation. In addition, the works are well removed from dwellings and other sensitive land uses, thereby minimising disruption caused by construction noise and vibration.

7.8.3 Effects on Recreational Activity

The line relocation works will not adversely affect parks and reserves or other recreational activities, as the existing accesses and tracks will be used during construction and the volume of construction related traffic will not be substantial. Any effects are of a short duration.

7.8.4 Landscape and Visual Effects from Construction Activities

The landscape and visual effects from the construction of towers and access tracks have been considered in *Addendum to Technical Report 5: Assessment of Landscape and Visual Effects* and are assessed in Section 7.3 of this report. In summary, for the majority of tower sites and for all access tracks, the visual effects of construction will be minor. For those towers sites where visual effects during construction (and operation) are more than minor, visual mitigation is proposed. For all tower sites and access tracks, best practice earthwork design principles are recommended as set out in Appendix 5G to the *Addendum to Technical Report 5: Assessment of Landscape and Visual Effects.* The use of the best practice earthwork design principles during the design of towers and access tracks has been included in the proposed conditions of consent contained in Appendix D of this report.

7.8.5 Summary of Effects from Construction Works

The effects of construction are considered to be minor and of short term duration.

7.9 Effects from Operation and Maintenance of the Line

Following the relocation of the line, Transpower will undertake maintenance in accordance with their existing asset management programme. This will involve regular inspections of the line to ensure the safety of the line by identifying environmental changes (such as tree growth or land development) that may affect the security of the line, and to monitor performance and degradation of the line components. Transpower already undertakes maintenance of this line, and following relocation will continue its normal maintenance schedule for the line, easement and access tracks. Therefore, no additional effects, above those already associated with existing maintenance activities (which are themselves minor), are anticipated as a result of the line relocation. The operation and maintenance of the line is a permitted activity in accordance with the NESETA and are not matters currently requiring consent.

7.10 Compliance with the Electric Field and Magnetic Flux Density Reference Levels

Electric and magnetic fields (EMFs) are present wherever there is electricity. Electric fields are determined by the voltage and are not influenced by the current, and, as transmission systems are held at a stable voltage, the electric field at any given location around transmission equipment will be largely constant. Electric fields are easily screened by vegetation, buildings and the ground. Magnetic fields on the other hand are determined by the current. The current flowing (amps) is directly proportional to the strength of the magnetic field as measured in terms of the magnetic flux density (microtesla - μT) and so this level fluctuates with current load. The current and therefore the magnetic field will change in strength over time as the demand for electricity fluctuates.

Regulation 10 of the NESETA sets the reference levels for public exposure for EMF associated with transmission lines. The reference levels in regulation 10 are based on guidelines published by the International Commission on Non-Ionising Radiation Protection (ICNIRP). The guidelines,

published in 1988, have been adopted by the New Zealand Ministry of Health and are generally and widely accepted as providing useful and evidence based thresholds for public health protection.

Electricity mains systems in New Zealand use alternating electric current which reverses in direction of flow (oscillates) at a frequency of 50 times per second at 50 Hz. The electrical conductors which carry mains current are surrounded by electric and magnetic fields, which also oscillate at the same frequency of 50 Hz.

Regulation 10(2) sets the following reference levels for public exposure for a 50Hz alternating current transmission line:

- Electric Field Strength - 5 kV/m
- Magnetic Flux density - 100 microteslas.

Table 4:3 in Chapter 4 confirms that the EMF for the existing and relocated line are well within the reference levels for public exposure when operating under normal operating conditions. The modelled electric field is 0.6kV/m and the calculated magnetic flux density is 2.5 microteslas. The transmission line is designed so that it will always be compliant with the international guideline and thus the NESETA, even under highest operational loads (under normal operating conditions).

The proposed line relocation does not result in changes to voltage or current and therefore, the electric and magnetic fields for the line will also not change. The location of the fields will however change relative to the existing line. EMF are strongest close to the source of the field and become rapidly weaker further away from them. Figure 7.1 and Figure 7.2 show the electric and magnetic field strength and the distance from the centreline. This shows that the field drop off rapidly between the line and approximately 20m out.

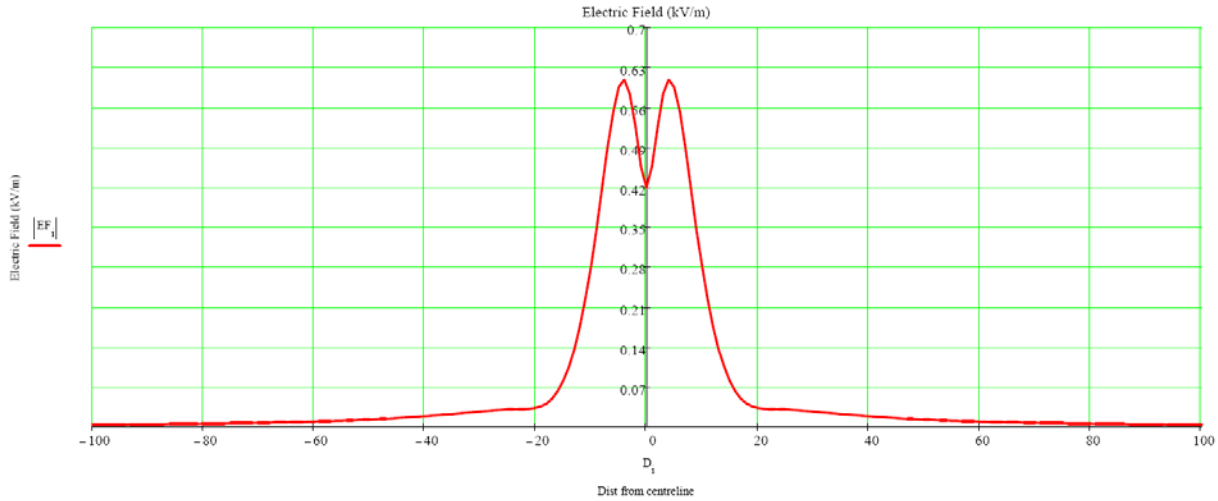


Figure 7.1: Electric Field Strength

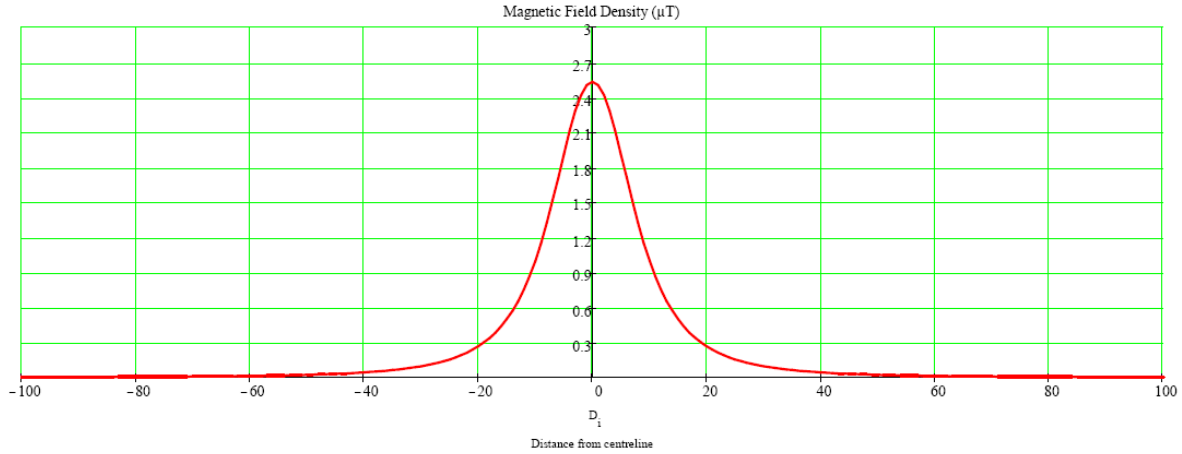


Figure 7.2: Magnetic Flux Density

As noted in Section 7.6, the closest relocated tower to a residential building is Tower 3A, located approximately 120m away from the nearest residential building.

Based on the above, the relocated line does not exceed the reference levels for public exposure set in regulation 10(2).

7.11 Summary of Effects on the Environment and Proposed Mitigation

Table 7:2 provides a summary of the actual or potential effects on the environment and the mitigation proposed to address the identified effects. The proposed conditions identified in the Table are discussed in further detail in Section 8.

Table 7:2: Summary of Actual or Potential Effects and Mitigation Recommended

Actual or potential environmental effect identified	Mitigation recommended	Condition proposed
The location and height of the transmission line support structures in relation to visual and landscape		
Relocation of towers (and associated construction and maintenance tracks) within an area of ONL at Wainui Saddle (Towers 8A, 9A, 10A and 11A) such that towers are visible from parts of the coastal plain to the north.	■ Adoption of the Best Practice Transmission Line Design Principles contained in Appendix 5G of the *Addendum to Technical Report 5: Landscape and Visual Assessment* during the detailed design of towers ■ Adoption of earthworks guidelines for earthworks associated with the towers and access tracks.	■ Identify zone for the final location of towers. ■ Adoption of the Best Practice Transmission Line Design Principles contained in Appendix 5G of the *Addendum to Technical Report 5: Landscape and Visual Assessment* during the detailed design of towers
Visibility of Tower 24A from Gas Line Ridge and Battle Hill Farm Forest Park due to earthworks and vegetation clearance to provide the tower site and line clearance.	■ Adoption of earthworks guidelines for earthworks associated with the tower. ■ Planting adjacent to the tower whilst still providing for the required line clearance in accordance with Plan LA07, *Volume 4: Plan Set*.	■ Mitigation planting as shown on Plan LA09, Volume 4: Plan Set. ■ Adoption of the Best Practice Transmission Line Design Principles contained in Appendix 5G of the *Addendum to Technical Report 5: Landscape and Visual Assessment* during the detailed design of towers
Visibility of Towers 31A, 32A and 33A from adjacent properties and dwellings accessed off Paekakariki Hill Road.	■ Adoption of the Best Practice Transmission Line Design Principles contained in Appendix 5G of the *Addendum to Technical Report 5: Landscape and Visual Assessment* during the detailed design of towers ■ Adoption of earthworks guidelines for earthworks associated with the towers and access tracks. Specific mitigation proposed for Tower 31A: ■ Integrating the edge of the platform for the tower to tie in with the adjacent road cutting and tying the remaining platform edges into the natural landform. ■ Plant the north-west and south-west slopes of the knoll at to reduce the tower's prominence in accordance with Plan LA08, *Volume 4: Plan Set*. Specific mitigation proposed for Tower 32A: ■ Planting on the adjacent gully slope to reduce the tower's prominence in accordance with Plan LA09, *Volume 4: Plan Set*. Specific mitigation proposed for Tower 32A: ■ Planting north of the tower to intercept views along the line. This planting is already proposed as mitigation planting associated with the proposed road as shown on Plan LA09, *Volume 4: Plan Set*.	■ Preparation of a Landscape Management Plan. ■ Mitigation planting as shown on Plan LA09, Volume 4: Plan Set. ■ Adoption of the Best Practice Transmission Line Design Principles contained in Appendix 5G of the *Addendum to Technical Report 5: Landscape and Visual Assessment* during the detailed design of towers. ■ Identify a reduced zone for the final location of the towers – 10 metres for Towers 31A and 32A and 5 metres for Tower 33A.
Visibility of Tower 40A from two dwellings located to the east of the proposed tower due to the increased height of the tower by 5-10 m compared to the current base of the tower.	■ During construction of the tower, minimise the clearance of ecological mitigation planting introduced as part of the previous Transmission Gully designation process. ■ Detailed design must not result in any increase in elevation of the tower.	■ Identify a reduced zone of 5 metres for the final location of tower. ■ Adoption of the Best Practice Transmission Line Design Principles contained in Appendix 5G of the Addendum to *Technical Report 5: Landscape and Visual Assessment* during the detailed design of towers
Landscape and visual effects of other towers to be relocated/replaced.	■ Adoption of the Best Practice Transmission Line Design Principles contained in Appendix 5G of the *Addendum to Technical Report 5: Landscape and Visual Assessment* during the detailed design of towers ■ Adoption of earthworks guidelines for earthworks associated with the towers and access tracks.	■ Identify a 20 metres zone for the final location of towers. ■ Adoption of the Best Practice Transmission Line Design Principles contained in Appendix 5G of the Addendum to *Technical Report 5: Landscape and Visual Assessment* during the detailed design of towers
The location and height of the transmission line support structures in relation to ecological effects		
Vegetation removal or trimming for tower sites, access tracks and line clearance.	■ No mitigation considered necessary.	■ Methods for vegetation clearance, trimming and disposal set out in the CEMP.
Transmission line traversing sites of ecological value (Significant Natural Areas identified in district plans) K224, K228, P172, and P199.	■ Ecological areas are identified prior to earthworks commencing and protection mechanisms identified.	■ Confirm the extent of ecological areas K224, K228, P 172 and P199 prior to the commencement of works.
The effects on historic heritage		
Damage or destruction of archaeological and heritage sites during construction of towers and access tracks. Both known site and not known.	■ No mitigation considered necessary for archaeological sites. ■ Establish accidental discovery procedures protocol and process in the event archaeological site or human remains are encountered during construction.	■ Condition setting out the process to be followed should an accidental discovery be made during construction. ■ Cultural protocols and archaeological requirements set out in the CEMP

Actual or potential environmental effect identified	Mitigation recommended	Condition proposed
Effects on built heritage – brick fuel storage tank near MacKays Crossing.	■ No mitigation considered necessary.	■ Nil
The effects on sensitive land uses		
Childcare facilities, schools and hospitals	■ No mitigation considered necessary.	■ Nil
Proximity of the line to residential buildings	■ Visual mitigation measures as set out above.	■ Visual mitigation as set out above. ■ Nomination of a community contact person for the duration of the works with details contained in the CEMP and provided to affected residents.
Earthworks, clearance of trees and vegetation, and restoration of the land;		
Earthworks for towers sites, construction areas, access tracks.	■ Erosion and sediment control measures to minimise sediment laden run-off. ■ Adoption of earthworks guidelines for earthworks associated with the towers and access tracks.	■ Erosion and sediment control measures to be adopted during earthworks and set out in the CEMP.
Potentially contaminated soil/material from historic land use at Tower sites 1 (asbestos) and 25A (DDT).	■ Erosion and sediment control measures to minimise the discharge of contaminants through sediment laden run-off. ■ Dust management to minimise the discharge of contaminants to air. ■ Visual inspections prior to works commencing to confirm that site conditions have not changed. ■ Management of excavated material. ■ Making the contractor aware of potential contamination and procedures should contaminated soil/material be encountered during works.	■ Processes and procedures for potentially contaminated material set out in the CEMP.
Dust arising from earthwork activities.	■ Dust control measures including minimising the extent of work and dust suppression	■ Methods for controlling dust set out in the CEMP.
Clearance of trees and vegetation for towers sites, construction areas, access tracks and line clearance.	■ Areas of native vegetation removal shall be kept to a minimum during the preparation of towers sites and access tracks. ■ The removal of riparian vegetation shall be avoided to minimise the risk of stream bank erosion. ■ Any removed vegetation shall be kept clear of watercourses to avoid debris entering them	■ Methods for vegetation clearance, trimming and disposal set out in the CEMP.
Restoration of the land following construction	■ All equipment and materials will be removed from the site. ■ All areas not required for the Transmission Gully Main Alignment works are reinstated by means of topsoil and grass seeding or planting of native bush. ■ Any access tracks not required for line maintenance will be removed and the affected areas reinstated. ■ Remaining tracks established to permanent standard for maintenance access.	■ Measures to be adopted to maintain and restore the land affected by the works set out in the CEMP.
The effects and timing of construction works		
Traffic and access for construction activities	■ Use of proposed NZTA construction yards and access points at MacKays Crossing and Battle Hill.	■ Procedures for managing construction traffic and access on public roads and methods to stabilise ingress and egress points to construction sites set out in the CEMP.
Traffic and access for maintenance activities	■ No mitigation considered necessary.	■ Nil
Construction noise and vibration	■ Construction undertaken in a manner that construction noise complies with NZS 6803:1999 Acoustics – Construction Noise. ■ Construction undertaken in a manner that construction vibration complies with the peak particle velocity limits in table 1 of German Standard DIN 4150 3:1999 Structural Vibration—Effects of Vibration on Structures	■ Compliance with NZS 6803:1999 Acoustics – Construction Noise. ■ Compliance with German Standard DIN 4150 3:1999 Structural Vibrations—Effects of Vibration on Structures.
Landscape and visual effects from construction activities	■ Minimise vegetation clearance and earthworks to those necessary for the works. ■ Keeping the land affected by the works in a tidy condition and restore the land once works completed.	■ Minimise vegetation clearance. ■ Adopt erosion and sediment control during construction as set out in the CEMP. ■ Measures to be adopted to maintain the land affected by the works in a tidy condition set out in the CEMP.

8 Proposed Conditions of Consent

8.1 Construction Environmental Management Plan

Transpower will develop and implement a comprehensive set of management processes, systems and tools to ensure that the commitments given in obtaining approvals (including the conditions of this consent) are carried out during construction and that appropriate operational and environmental management practices are followed.

The CEMP is the key document which comprehensively details all project control measures, including environmental controls and measures for mitigating construction impacts. The CMP provides a "tool box" of measures to address resource consent conditions, and to address or mitigate potential adverse environmental effects.

The CEMP will be implemented by the contractor for the duration of construction.

The CEMP will include the following matters:

- Details of the site supervisor and the community contact person, including their contact details (phone, facsimile, postal address, email address);
- An outline construction programme of the work (including staging if appropriate) indicating key activities and their duration;
- The hours of work;
- Location of site offices, areas for equipment storage and conveniences (eg portaloos);
- Measures to manage construction noise and vibration;
- Methods to stabilise ingress and egress points to construction sites;
- Procedures for managing construction traffic and access on public roads;
- Means of ensuring the safety of the general public;
- Methods for vegetation clearance, trimming and disposal;
- Procedures to be followed to ensure that those working in the vicinity of areas with ecological value are aware of the values of these features and the steps which need to be taken to protect these areas during construction;
- The erosion and sediment control measures to be adopted during earthworks;
- Methods to manage the storage, reuse and disposal of excavated material during earthworks;
- Procedures to manage potentially contaminated material encountered during land disturbance activities;
- Procedures for controlling dust. Dust mitigation measures should include use of water sprays to control dust nuisance on dry or windy days;
- Measures to be adopted to maintain the land affected by the works in a tidy condition in terms of disposal/ storage of rubbish, storage, unloading and removal of materials and similar construction activities;
- Procedures to receive and respond to complaints about construction activities, including noise, dust and odour from the works;
- Other specific conditions, cultural protocols and archaeological requirements.

Also, the CEMP would detail the process for addressing any site specific issues that may arise (eg drainage, agricultural, and services issues). The specific details of the CEMP are outlined in proposed conditions of consent contained in Appendix D.

In addition to the CEMP, Transpower will have Access and Construction Agreements with landowners on which the relocated line is located. These agreements take into account the requirements and concerns of each landowner and detail to all parties where and how the access would be formed and used.

8.2 Proposed Conditions of Consent

Section 104C(3) provides that a consent authority may impose conditions under section 108 only for those matters over which discretion is restricted in national environmental standards or other regulations. The proposed conditions set out in Appendix D respond to the matters raised in Sections 4 and 7 of this report, particularly measures to avoid or mitigate the actual or potential environmental effects.

9 Statutory Assessment

This chapter provides an assessment against the relevant matters set out in Section 5 including Part II of the RMA and the objective and policies of the National Policy Statement on Electricity Transmission (NPSET). In summary, the line relocation is consistent with Part II of the RMA and the objective and policies of the NPSET.

9.1 Resource Management Act – Part 2 Purpose and Principles

The purpose and principles of the RMA are set out in Part 2 (sections 5, 6, 7 and 8) of the RMA. The consideration of effects of the Line Relocation Project is subject to Part 2 of the RMA.

Section 5 – Purpose

Section 5 states that the purpose of the RMA is to promote the sustainable management of natural and physical resources which means:

> *"(2) managing the use, development, and protection of natural and physical resources in a way or at a rate, which enables people and communities to provide for their social, economic and cultural wellbeing and for their health and safety while –*
>
> *a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
>
> *b) safeguarding the life-supporting capacity of air, water, soil and ecosystems; and*
>
> *c) avoiding, remedying, or mitigating any adverse effects of activities on the environment."*

With regard to section 5(2):

- The relocation of the transmission line is required to enable the construction of the Transmission Gully Project, part of the Wellington Northern Corridor RoNS which will enable people and communities to provide for their social, economic and cultural wellbeing and for their health and safety by providing for the economic growth of the Wellington Region and providing significant community, social and transport benefits. Without the relocation of the line, these benefits cannot be realised.
- The relocation of the transmission line enables the on-going operation of a nationally significant physical resource; being part of the National Grid. The transmission line provides national, regional and local benefits from the sustainable, secure and efficient transmission of electricity which in-turn enables the well-being of New Zealand, it's people and environment.
- The actual and potential effects of the Project have been identified and evaluated in Section 7 of this report. This concludes that any adverse effects on the environment from the relocation of the line are no more than minor and can be either avoided, remedied or mitigated.

Section 5 must be read in conjunction with Sections 6, 7 and 8 of the Act.

Section 6 – Matters of National Importance

Section 6 of the RMA sets out the matters of national importance that must be recognised and provided for. These are:

> *"(a) the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development:*

(b) the protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development:

(c) the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna:

(d) the maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers:

(e) the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga:

(f) the protection of historic heritage from inappropriate subdivision, use, and development:

(g) the protection of protected customary rights."

With regard to **6(a),** natural character of the coastal environment, wetlands, and lakes and rivers and their margins;

- The effects of construction and the relocated towers on existing streams have been considered in Section 7.8 of this report. The proposed works do not affect any such sites.
- None of the relocated towers are within close proximity to watercourses and erosion and sediment control measures during construction will ensure so that the natural character of rivers is maintained; and
- Construction effects will be managed so that water quality is not compromised and the risk of effects from sediment discharge is assessed as low.

With regard to **6(b)**, outstanding natural features and landscapes;

- The effects of construction and the relocated towers on outstanding natural features and landscapes have been considered in Section 7.3 of this report and are considered minor.
- The only relevant outstanding natural features or landscapes in terms of the meaning under Section 6(b) of the RMA, is the area of ONL around MacKays Crossing and the Wainui Saddle. The three proposed towers located on the spur above Wainui Saddle are assessed as having moderate visual effects due to their location on the skyline and increased visibility. These towers are considered appropriate because the existing line already traverses the ONL and the landscape and visual effects of the relocated and replaced towers will be modest in degree. In addition, the line route on the western side of the valley was selected based on consideration of the landscape, ecological and engineering constraints present in this area. On balance, the western route minimises effects on ecological values which are also present for a route on the eastern side. The proposed route balances two matters of national significance, the continued operation of the National Grid and the protection of an outstanding natural landscape.
- Mitigation measures have been considered and include the adoption of best practice transmission line design principles during the detailed design of towers, managing earthworks for towers and access tracks and limiting the relocation of towers during detailed design.

With regard to **6(c)**, significant indigenous vegetation and significant habitats;

- The effects of construction and the relocated towers on significant indigenous vegetation and significant habitats have been considered in Section 7.4 of this report.
- The tower relocations and construction and maintenance tracks do not affect any areas of significant indigenous vegetation or significant habitats of indigenous flora.

With regard to **6(d)**, public access to and along the coastal marine area, lakes and rivers;

- The line relocation will not affect public access to rivers with tower locations located clear of waterways.

With regard to **6(e)**, the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga;

- The relationship between Maori, their culture and traditions and their ancestral lands, water, sites, waahi tapu and other taonga has been considered in the *Technical Report 18: Assessment of Cultural Impacts* contained in Volume 3. The matters of concern raised by iwi primarily relate to the proximity of works to waterways and this has been considered in the selection of towers sites.
- Consultation has been undertaken with Iwi to confirm that there are no known sites of significance that are affected by the line relocation.

With regard to **6(f),** protection of historic heritage;

- The effects of construction and the relocated towers on historic heritage have been considered in Section 7.5 of this report.
- Several items of historic heritage have been identified within the vicinity of the line relocation including, however no sites are directly affected.
- An accidental discovery protocol is proposed in the event that unknown sites are encountered during construction.

With regard to **6(g),** protected customary rights;

- There are no areas of protected customary rights that are affected by the line relocation.

Section 7 – Other Matters

When exercising functions and powers under the Act, decision makers must have particular regard to the matters set out in Section 7. These are:

(a) kaitiakitanga:

(aa) the ethic of stewardship:

(b) the efficient use and development of natural and physical resources:

(ba) the efficiency of the end use of energy:

(c) the maintenance and enhancement of amenity values:

(d) intrinsic values of ecosystems:

(e) [Repealed]

(f) maintenance and enhancement of the quality of the environment:

(g) any finite characteristics of natural and physical resources:

(h) the protection of the habitat of trout and salmon:

(i) the effects of climate change:

(j) the benefits to be derived from the use and development of renewable energy.

The following provides an assessment of those Section 7 matters relevant to this project:

With regard to **Section 7 (a) and (aa),** Kaitiakitanga and the ethic of stewardship;

- Consultation has been undertaken with iwi/hapu to understand areas of significance and those values of importance to local iwi. This has confirmed that there are no sites of significance which are directly affected by the line relocation works.

With regard to **Section 7(b),** Efficient use and development of natural and physical resources;

- The National Grid is a significant physical resource. The relocation of the line provides for the on-going efficient use and development of that resource whilst enabling the construction of the Transmission Gully Main Alignment.

With regard to **Section 7(c),** Maintenance and enhancement of amenity values;

- The route selection process sought to maintain and enhance amenity values while at the same time considering other constraints and effects and achieving technical and operational requirements. The proposed line route and towers site has achieved the maintenance and enhancement of amenity values for all but a small number of dwellings, where, following the proposed mitigation, the relocation will have a minor adverse effect on visual amenity.
- Any adverse construction effects will be temporary and will be mitigated through the implementation of a project specific CEMP to maintain amenity values as far as practicable during construction. Details of the CEMP are contained in Section 8.1 of this report.

With regard to **Section 7(d),** Intrinsic values of ecosystems;

- The location of the towers and access tracks and the implementation of mitigation measures will avoid or mitigate any significant effects on the existing and future values of ecosystems.

With regard to **Section 7(f)**, Maintenance and enhancement of the quality of the environment, it is considered that quality of the environment will be maintained and enhanced because:

- There will be no significant effects resulting from the project.
- The route is located primarily within the road designation and as discussed in Section 3.2.2, towers have been sited to avoid areas of significant ecological value within the Wainui Saddle.
- A suite of mitigation measures are proposed in this report to maintain environmental quality as far as practicable during construction, and remedy or mitigate effects after construction is completed.

With regard to **Sections 7(g)**, Finite characteristics of natural and physical resources;

- There will be no effects of the line relocation on finite characteristics of natural and physical resources.

Section 8 - Treaty of Waitangi

Section 8 requires those exercising powers or functions under the RMA to take into account the principles of the Treaty of Waitangi. Consultation with tangata whenua has been undertaken, is on-going and will continue through all stages of planning and construction. Discussions with Ngati Toa Rangatira have resulted in the development and agreement of accidental discovery procedures for the Transmission Gully Project which it is envisaged will also be adopted for these enabling works. The line relocation is therefore considered to be consistent with the principles of the Treaty of Waitangi.

Summary in Relation to Part 2 of the RMA

Based on the assessment above, the relocation of the transmission line is consistent with the purpose and principles of the RMA. It will promote the sustainable management of natural and physical resources by enabling a route for the construction of the Transmission Gully Main Alignment in a way that avoids, remedies or mitigates adverse effects on the natural and physical environment and provides for the on-going operation of a national significant physical resource; the National Grid.

9.2 National Policy Statement on Electricity Transmission (NPSET)

The efficient transmission of electricity on the National Grid plays a vital role in the well-being of the New Zealand economy and environment. However its unique characteristics can create challenges for its management under the RMA. In recognition of this, the Government has prepared a National Policy Statement on Electricity Transmission. The National Policy Statement on Electricity Transmission under the RMA (NPSET) sets out the objectives and policies to enable the management of the effects of, and on, the electricity transmission network under the RMA. The objective of the NPSET is:

> *"To recognise the national significance of the electricity transmission network by facilitating the operation, maintenance and upgrade of the existing transmission network and the establishment of new transmission resources to meet the needs of present and future generations, while:*
>
> - *managing the adverse environmental effects of the network; and*
> - *managing the adverse effects of other activities on the network."*

The NPSET is intended to guide decision makers in considering resource consent applications for transmission activities. An assessment of the Line Relocation Project against the objective and relevant policies of the NPSET is provided below.

Policy 1: Recognition of the national benefits of transmission

Policy 1 requires decision-makers to recognise and provide for the national, regional and local benefits of sustainable, secure and efficient electricity transmission.

The relocation of the transmission line provides for the sustainable, secure and efficient transmission of electricity and the continued realisation of the benefits of this line following the construction of the Transmission Gully Project.

Policies 2 – 8: Managing the Environmental Effects of Transmission

Policy 2 requires that in achieving the purpose of the Act, decision-makers must recognise and provide for the effective operation, maintenance, upgrading and development of the electricity transmission network.

The relocation of the transmission line is part of the maintenance and upgrading of this line and is necessary to enable a route for the construction of the Transmission Gully Main Alignment. The road cannot be constructed without the transmission line first being relocated.

Policy 3 requires decision-makers to consider the likely constraints imposed on the technical and operational requirements of the network by any measures to avoid, remedy or mitigate adverse environmental effects.

There are several technical and operational considerations for the relocation of the transmission line. These relate to the nature of transmission lines in general (eg tower angles, span distance and ground clearance) and factors relating to this specific location (eg foundation type based on geotechnical conditions). These considerations have been taken into account during the selection of tower locations.

Policy 4 requires decision-makers to have regard to adverse effects that have been avoided, remedied or mitigated through the route, site and method selection process when considering environmental effects of new or upgraded infrastructure.

The environmental effects of the line relocation have been considered during the route selection process as summarised in Appendix A. This process considered the technical and operational requirements of the line as well as the potential adverse effects on environmental, property and other features. In particular, the landscape, ecological, heritage, cultural, engineering and property constraints were identified by relevant experts during the route selection process, with a view to avoiding or minimising adverse effects on significant features. The selected line relocation route balances these matters.

Policy 5 requires when considering the environmental effects of transmission activities that decision-makers must enable the reasonable operational and maintenance requirements of established electricity transmission assets.

The maintenance and operation of the PKK-TKR A transmission line is provided for by the NESETA, being an established electricity transmission asset. The regulations address the line relocation activities and on-going operation and maintenance of the line.

Policy 6 states that upgrades of infrastructure should be used as an opportunity to reduce existing adverse effects of transmission including such effects on sensitive activities (schools, residential buildings, hospitals).

A transmission line has been present along this route since 1924 is therefore a long-established part of the existing environment. As set out in Section 3.2.2, the route selection process for the line relocation has considered opportunities to reduce existing adverse effects on sensitive activities (dwellings). The identification of potential tower locations included consideration of the proximity of the line and towers to existing residential buildings. In no cases will any new towers be located closer than 120 metres (in the case of Tower 33A) of any residential dwelling, and in most cases the distances are considerably greater than this.

Policy 7 is not directly relevant to the line relocation project due to the rural location.

Policy 8 states that in rural environments, the planning and development of the transmission system should seek to avoid adverse effects on outstanding natural landscapes, areas of high natural character and areas of high recreational value and amenity and existing sensitive activities. The transmission line relocation will occur within a rural environment. Within the area is the ONL near MacKays Crossing, areas of significant vegetation, the recreational area of Battle Hill Farm Forest Park and other features of significance. The route selection process identified and considered these features. The confirmed route avoids as far as practicable these features taking into account the technical and operational requirements of the line. The detailed design of towers, foundations and access tracks will take into account best practice design principles to further minimise effects on the ONL.

10 Conclusion

Transpower proposes to relocate parts of the existing PKK-TKR A transmission line between Tower 1 at MacKays Crossing and Tower 49a at the Pauatahanui Substation near SH58 to enable works for the construction NZTA's Transmission Gully Project, a project of national significance under the RMA. The line relocation will involve relocating and replacing 24 towers, strengthening 10 existing towers and/or their foundations, and removing one tower in its entirety. 15 of the existing towers will not require any relocation or strengthening.

The PKK-TKR A transmission line is part of the National Grid and provides national, regional and local benefits from the sustainable, secure and efficient transmission of electricity which enables the well-being of New Zealand, its people and environment.

Transpower, in partnership with the NZTA, have undertaken a route selection process to determine the most appropriate alignment for the relocated line. This process identified opportunities and constraints in the area and was informed by social, environmental, cultural, engineering and other factors. The outcome of the route selection process was confirmation of the line relocation route, which generally follows the existing transmission line with a western bypass of the Wainui Saddle where the steep slopes on either side, areas of native vegetation, and construction of the proposed highway create a pinch point for the line. The proposed route achieves a balance between the natural and physical constraints and the technical and operational requirements of the line. It has presented an opportunity to consider and reduce existing adverse effects.

Transpower is seeking the majority of the resource consents to enable the line relocation to occur under the regulations included in the NESETA, which came into effect on 14 January 2010 and set out a national framework of permissions and consent requirements for activities that relate to existing electricity transmission lines. The PKK-TKR A line is an existing transmission line under the definition in the NESETA having been first commissioned in 1924 and therefore the operation, maintenance and upgrading of the line is addressed by the NESETA regulations.

The line relocation requires a restricted discretionary land use consent for the relocation of 6 towers in Kapiti Coast District and 18 towers in Porirua City in accordance with Regulation 16(1)(a) and 16(1)(b) of the NESETA. The applications for resource consents are lodged with the EPA under section 145(1)(a) of the RMA as a matter that is part of a proposal of national significance, being the Transmission Gully Project. Resource consent will also be required for earthworks, tracking and culverts associated with the project and these will be sought during detailed design.

The relocated line has been designed based on Transpower design standards and takes into account the local conditions including typography, clearance of the proposed road, construction and maintenance access and effects on the environment.

This report demonstrates that the proposed line relocation avoids, remedies or mitigates any adverse effects on the environment. Mitigation measures are proposed to minimise the adverse effects of the line relocation and associated works. A key mitigation measure is the preparation and implementation of a CEMP to cover all works associated with construction activities and address the actual and potential construction effects in an integrated manner. Landscape mitigation is proposed in specific locations to minimise the potential visual effects of the relocated towers and line when viewed from nearby dwellings. These matters are addressed in the proposed conditions of consent.

Overall, the line relocation is considered to achieve the purpose and principles of the RMA in promoting sustainable management of natural and physical resources In particular it will:

- Enable a route for the Transmission Gully Main Alignment which is part of the Wellington Northern Corridor Road of National Significance; and
- Provide for the on-going operation and maintenance of a national significant physical resource; the National Grid, which provides for the sustainable, secure and efficient transmission of electricity.

Appendix A

Summary of the Route Selection Process

Route Selection Summary

Transpower has developed a generic methodology for identifying new, replacement or relocated transmission lines. This methodology is described as the ACRE model – an acronym for Area-Corridor-Route-Easement investigations. The ACRE process involves a progressive filtering approach, where increasing detail is provided on technical, environmental and property constraints and features throughout the process to enable the identification of a preferred easement for the line. The purpose of undertaking the ACRE process is to provide a robust methodology for identifying a transmission line path.

The generic ACRE process is summarised in Figure 1.

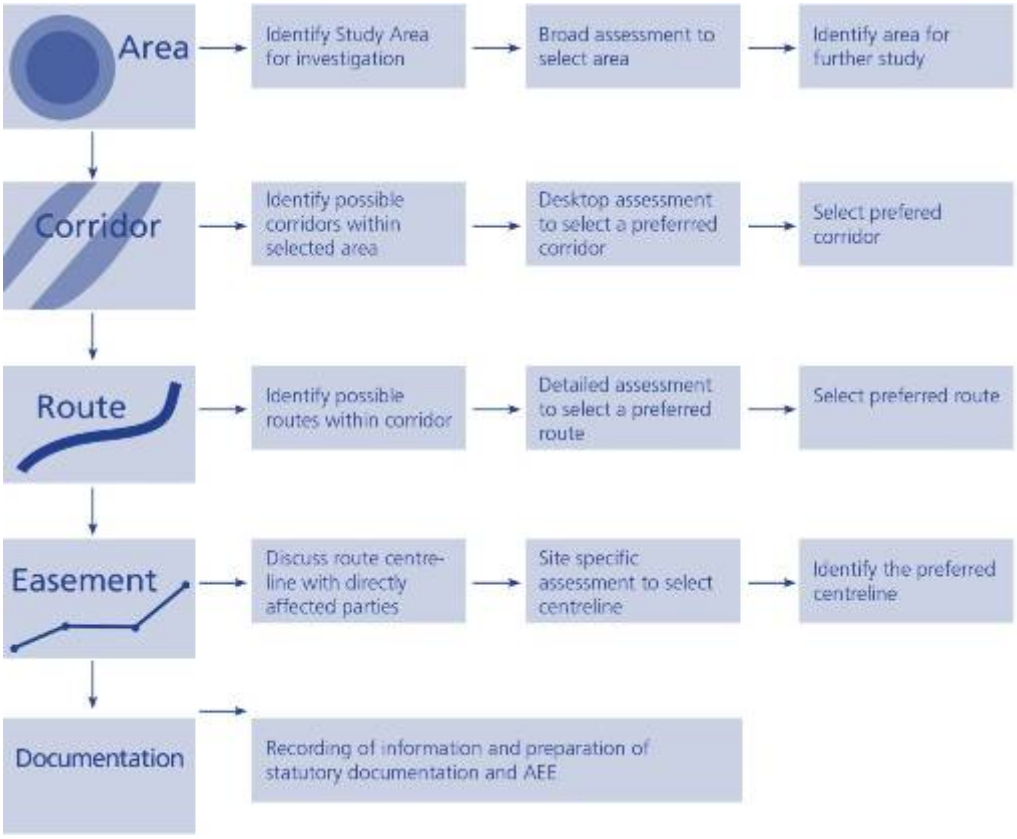


Figure 1: The ACRE Process

The application of the ACRE process differs for each project. While the full ACRE process is appropriate to apply where new lines are to be constructed over long distances involving a wide area of investigation, a more refined ACRE process is appropriate for smaller scale and relocation projects. In terms of this line relocation project, the ACRE process was refined to provide for the specific relocation of the transmission line within the context of Transmission Gully and the NZTA highway project.

The approach for the Line Relocation Project was to try to keep within the Transmission Gully catchment if feasible to avoid crossing prominent ridgelines and potentially adversely affecting other areas and properties that currently do not have transmission lines within them.

The “Area" and “Corridor" steps of the ACRE process were therefore refined to identify an indicative Area of Study that represented the Transmission Gully corridor itself. This focused further investigations on identifying feasible route options – being the next step to the ACRE process.

Given the long history of the NZTA Transmission Gully Project, there were already several route options identified from past investigations, which helped to inform route option assessment. These route options generally followed the existing alignment to various degrees, all located within the Transmission Gully

corridor. The northern extent of the route in particular had several options, in terms of entry points from MacKays Crossing and options passing through Wainui Saddle versus bypassing this narrow gorge to the east and west of the saddle. These route options were presented at a multi-disciplinary workshop on 14 October 2010 to a number of NZTA and Transpower specialists (including landscape/visual, ecological, engineering and planning) to assist discussion on constraints and opportunities using a 'fly-through' of the area.

Following that workshop, a range of engineering, environmental and property constraints and opportunities were mapped to search for routes of least constraint within Transmission Gully. The relevant experts assigned ratings to each of the features as a method for assessing the relative importance, significance or extent of an issue. The ratings ranged from no constraint through to major constraint.

The findings were presented at a workshop on 26 November 2010 with Transpower and NZTA planners, engineers and specialists to discuss the initial constraints assessment, constraints ratings and mapping of features. This workshop confirmed the Wainui Saddle as the area of greatest constraint for the line relocation route, being a narrow gully potentially unable to accommodate both a highway and a transmission line through it.

Following that workshop, further refinement of specialist assessments for landscape/visual, ecological values and geotechnical/ geology was undertaken and associated refinement to the constraints maps made. Several site visits to Wainui Saddle were undertaken by NZTA and Transpower experts to assess the feasibility of a transmission route relocation in that area.

This detailed investigation culminated in a Multi-Criteria Assessment (MCA) workshop on 22 February 2011 to assess the merits of identified route options through Transmission Gully. A range of Transpower and NZTA planners, engineers and specialists presented the detailed constraints investigation and considered the route options within the Area of Study, looking for opportunities to streamline routes

Figure 2 summarises the route options identified for assessment at the Workshop. These route options were based on a combination of constraints analysis and options already identified as part of previous investigations on relocating the existing transmission line within Transmission Gully. In particular, the physical constraints identified within the confines of Transmission Gully, compounded by the constraints of the proposed highway alignment, resulted in only a few viable and practical line relocation routes within the area of study.

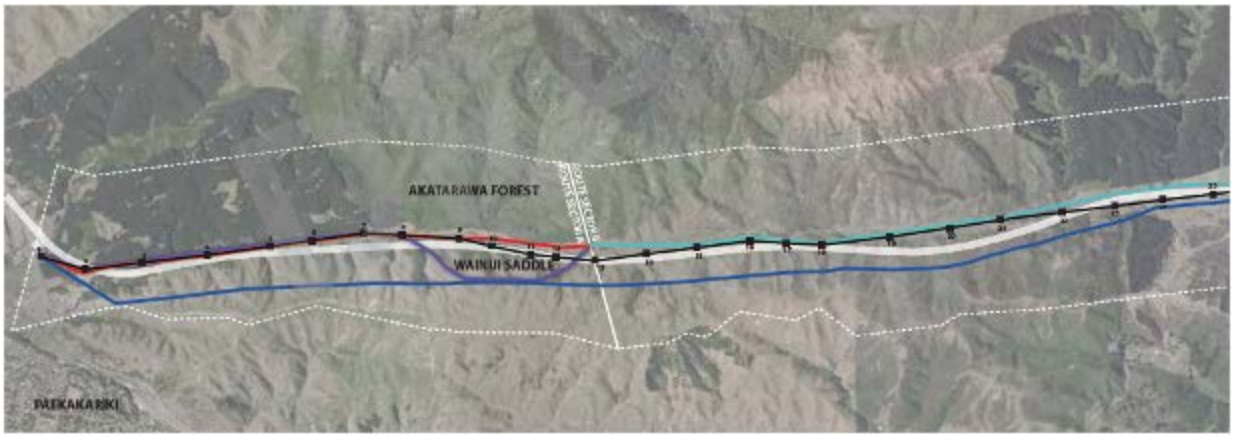


Figure 2: Route Options

The Wainui Saddle between existing towers T8 to T12 was reconfirmed as the most significant constraint along the route, being constrained by the narrow gully at this location such that the transmission lines unable to be relocated within the saddle itself. The integrity of the transmission system could be compromised by locating the structures of the transmission line in close proximity to the proposed road, both during the construction phases and operation of the road. Locating the transmission line within the Saddle itself would not satisfy Transpower's design requirement that a transmission line support structure is located a minimum of 20 m from a road (the edge of the seal), or a minimum of 12 m from the edge of a cut or batter slope. The towers would also need to be temporarily moved and part constructed at the same time as the major earthworks to form the road, which raises serious safety concerns.

As a result, the line could be relocated via either an eastern or a western bypass of the saddle. The two bypass options had a range of environmental and engineering challenges. In particular, the eastern bypass crossed an area of native bush and would require three structures to be constructed within an ecologically sensitive area resulting in effects on remnant native forest and habitat for threatened wildlife. This area also has difficult terrain for construction access, and lacks of existing access tracks through the bush area to possible tower locations. The western bypass would potentially have adverse effects on an outstanding landscape feature.

Table 1 summarises the investigated route options and the preferred route for the line relocation.

Table 1: Route Options and Preferred Route

Section	Summary of Route Options and MCA Workshop Outcome
Towers 1-13 (called Section A for the route selection process)	**Bypass Route preferred** There are three route options through this section – an option generally following the existing line through Wainui Saddle; a western ridge option; and a 'bypass' option. Overall, all route options score similarly – however each option has key constraint differentiators as follows: Existing: Significant engineering/economic constraint through the Wainui Saddle with associated cost constraint. Western: Significant visual/ social constraint as route passes through prominent ridgeline identified as Outstanding Natural Landscape. Bypass: has an element of both options in terms of some engineering/economic and visual/ ecological constraint. However, the degree of the significant constraints identified for the other options are of a lesser degree. For that reason, the Bypass option is the most logical route option through this section.

Section	Summary of Route Options and MCA Workshop Outcome
Towers 13-30 (called Section B for the route selection process)	**Eastern Route preferred** There are two route options through this section – an option generally west and east of the proposed highway. The eastern option has the least constraint and is the most logical route option through this section. Under a variety of weighting scenarios, the eastern option was always identified as the route of least constraint
Towers 30-49a (called Section C for the route selection process)	**Route generally following the existing line preferred** There is only one logical route option through this section which generally follows the existing line.

The Multi-Criteria Assessment workshop identified the preferred line route as that which generally follows the existing transmission line, with a western bypass of the Wainui Saddle. Further site visits and investigations by a full range of specialists confirmed the feasibility of this preferred route, including the refinement of tower siting and design. The technical assessments presented in Volume 6 further describe the process of route selection.

Appendix B

Schedule of Changes to Transmission Line Support Structures

Schedule of Changes to Transmission Line Support Structures

Existing tower	Proposed tower	Existing/ proposed	Strengthening	Existing		Proposed		Plan distance	Type	Span (m)	Existing height (m)	Proposed Height (m)	Height diff (m)	Proposed location tolerance
				Northing (m)	Easting (m)	Northing (m)	Easting (m)							
1	-	Existing	Yes	5461376	1765624				Strain	308	17.3	No change	-	-
2	2A	Proposed		5461117	1765471	5461122	1765451	20	Strain	361	23.4	33.0	9.6	20 m
3	3A	Proposed		5460749	1765416	5460764	1765405	18	Strain	440	30.7	33.0	2.3	20 m
4	-	Existing	Yes	5460327	1765353				Suspension	421	41.5	No change	-	-
5	-	Existing		5459909	1765300				Suspension	273	31.3	No change	-	-
6	-	Existing		5459638	1765266				Suspension	337	24.2	No change	-	-
7	-	Existing	Yes	5459304	1765223				Strain	252	17.5	No change	-	-
8	8A	Proposed		5459058	1765145	5459057	1765172	27	Strain	381	24.8	30.0	5.2	20 m
9	9A	Proposed		5458709	1765030	5458899	1764826	279	Strain	239	28.8	30.0	1.2	20 m
10	10A	Proposed		5458518	1764925	5458714	1764675	319	Strain	280	28.0	30.0	2.0	20 m
11	11A	Proposed		5458294	1764805	5458436	1764713	170	Strain	401	28.8	30.0	1.2	20 m
12	12A	Proposed		5458142	1764748	5458038	1764762	104	Strain	234	15.7	32.0	16.3	20 m
13	13A	Proposed		5457906	1764660	5457817	1764687	92	Strain	355	23.5	32.0	8.5	20 m
14	14A	Proposed		5457575	1764615	5457466	1764633	109	Suspension	349	21.9	36.0	14.1	20 m
15	15A	Proposed		5457260	1764571	5457121	1764580	138	Suspension	319	28.0	36.0	8.0	20 m
16	16A	Proposed		5456923	1764525	5456807	1764528	116	Strain	229	17.3	32.0	14.7	20 m
17	17A	Proposed		5456694	1764449	5456590	1764455	104	Suspension	253	18.7	36.0	17.3	20 m
18	18A	Proposed		5456488	1764380	5456350	1764374	136	Strain	307	17.6	30.0	12.4	20 m
19	-	Existing	Yes	5456049	1764316				Suspension	387	28.2	No change	-	-
20	-	Existing		5455666	1764260				Suspension	213	28.2	No change	-	-
21	-	Existing	Yes	5455455	1764229				Suspension	405	18.6	No change	-	-
22	22A	Proposed		5455113	1764178	5455051	1764195	63	Strain	503	28.2	35.0	6.8	20 m
23	-	Removed		5454783	1764131						24.8	Removed	-	-
24	24A	Proposed		5454478	1764087	5454548	1764211	143	Strain	324	22.0	33.0	11.0	20 m
25	25A	Proposed		5454158	1764040	5454234	1764131	119	Suspension	314	24.7	39.0	14.3	20 m
26	26A	Proposed		5453834	1763993	5453929	1764056	116	Suspension	445	28.2	40.0	11.8	20 m
27	-	Existing	Yes	5453498	1763943				Strain	367	23.5	No change	-	-
28	-	Existing		5453164	1763794				Suspension	280	28.1	No change	-	-
29	-	Existing		5452909	1763678				Suspension	387	22.0	No change	-	-
30	-	Existing	Yes	5452555	1763521				Suspension	369	28.1	No change	-	-
31	31A	Proposed		5452218	1763370	5452213	1763384	14	Strain	399	16.0	30.0	14.0	5m W, 20m N,E &S
32	32A	Proposed		5451893	1763216	5451828	1763278	89	Strain	347	23.3	30.0	6.7	10m E, 20m N,W &S
33	33A	Proposed		5451516	1763106	5451525	1763109	10	Strain	490	31.0	29.0	-2.0	5m W&S, 30m N&E
34	-	Existing	Yes	5451045	1762969				Suspension	197	21.9	No change	-	-
35	-	Existing		5450856	1762915				Suspension	267	15.8	No change	-	-
36	-	Existing		5450600	1762842				Suspension	344	16.2	No change	-	-
37	-	Existing		5450269	1762748				Suspension	355	28.0	No change	-	-
38	-	Existing		5449927	1762650				Suspension	290	21.9	No change	-	-
39	-	Existing	Yes	5449651	1762561				Suspension	270	21.8	No change	-	-
40	40A	Proposed		5449368	1762479	5449396	1762474	27	Strain	317	15.7	31.0	15.3	5 m N, 10m E, 20m W&S
41	41A	Proposed		5449067	1762392	5449113	1762328	79	Strain	224	15.7	30.0	14.3	20 m
42	42A	Proposed		5448798	1762311	5448900	1762259	114	Suspension	400	17.2	37.0	19.8	20 m
43	43A	Proposed		5448514	1762166	5448518	1762140	26	Strain	469	21.7	33.0	11.3	20 m
44	-	Existing	Yes	5448089	1761949				Strain	291	21.9	No change	-	-
45	-	Existing		5447829	1761820				Suspension	323	27.7	No change	-	-
46	-	Existing		5447540	1761675				Strain	299	17.1	No change	-	-
47	-	Existing		5447416	1761404				Suspension	199	18.4	No change	-	-
48	-	Existing		5447336	1761221				Suspension	130	15.7	No change	-	-
49	-	Existing		5447325	1761099				Strain	25	18.5	No change	-	-
49a	-	Existing		5447256	1761118				Strain	21	16.5	No change	-	-

Appendix C

Electric and Magnetic Fields Modelling and Information

Radio Frequency Interference, Electric Field, Magnetic Field & Audible Noise

Double-Circuit three-phase transmission line

Note that the effect of earthwires is considered negligible at ground level and hence earthwires have not been modelled

Calculations for:
RFI are based on CISPR 18-1, Appendix A, and CISPR 18-3, Appendix A.
Electric Field, Magnetic Field & Audible Noise are based on EPRI Transmission Line Reference Book (345 kV and above)

All Yellow Cells are Inputs

1. Line Data

(Note: All dimensions in metres except Conductor/Earthwire diameter which is in centimetres)

Transmission Line name: PKK-TKR A (Proposed Line) - Pre-Contingency

	Circuit 1	Circuit 2
Conductor:	Copper 19/2.57 Hyena ACSR Coyote ACSR **Wolf ACSR** Goat ACSR Zebra A	Copper 19/2.57 Hyena ACSR Coyote ACSR **Wolf ACSR** Goat ACSR
Diameter of conductor (cm)	$d1 := \frac{cond\_1_i}{10}$ $r1 := \frac{d1}{2}$ d1 = 1.813	$d2 := \frac{cond\_2_j}{10}$ $r2 := \frac{d2}{2}$ d2 = 1.813
Line Voltage (kV)	Voltage1 := 110	Voltage2 := 110
Line Current (Amps)	I1 := 300.4	I2 := 300.4
No. of sub-conductors	n1 := 1	n2 := 1
Sub-conductor bundle dimension (cm)	b1 := 46 Not applicable if n1 = 1	b2 := 46 Not applicable if n2 = 1

Conductor Co-ordinates (+ or -)

R1 – Phase	R1x := -2.68	R1y := 2.8
Y1 – Phase	Y1x := -2.68	Y1y := 0
B1 – Phase	B1x := -2.68	B1y := 6.6
R2 – Phase	R2x := 2.68	R2y := 2.8
Y2 – Phase	Y2x := 2.68	Y2y := 6.6
B2 – Phase	B2x := 2.68	B2y := 0

x values are horizontal distance from the tower centreline (m)
y values are vertical height above the lowest conductor (m)

Structural Dimensions:

Height of lowest conductor above ground at attachment point on structure (m): h := 16.6

Height of lowest ground clearance point (m): s := 8.9

Average height of lowest conductor above ground (m): $G := h - \left[\frac{2}{3}\cdot(h - s)\right]$ G = 11.47

Position of point of measurement (Aerial)

Lateral Distance of *RFI Aerial* from Outer Conductor (m)

Height of *Aerial for RFI* Calculations (m)

Lateral Aerial Distance from outer conductor for EMF (m): dc := 15 *(Do not change this value)*

Height of *Aerial for Electric & Magnetic Field* calculations (m): yaRFI := 2 *(Do not change this value)*

dcEMF := 0 *(Do not change this value)*

Lateral Aerial Distance from outer conductor for *Audible Noise*: yaEMF := 1 *(Do not change this value)*

Height of Aerial for *Audible Noise* Calculations (m): Aud := 1 *(Set to edge of Easement)*

Plot Maximum Distance from Centreline required (m): yaAud := 1 *(Do not change this value)*

Frequency of measurement for RFI (MHz) (*Freq > 1MHz only*)

range := 100 *(Do not change this value)*

Freq := 2 (This value is not reqd)

Limits for EMF, RFI and AN

Calculated values are checked for OK/No Good against these

EFLimit := 5 MFLimit := 1·gauss

RFILimit := if(Voltage1 < 220, 50, 59)

ANLimit :=

MFLimitmG := 1000

In accordance with ICNIRP - 1998
In accordance with NZS 6869: 2004
In accordance with NZS 6802: 1991/1999 or relevant council limit

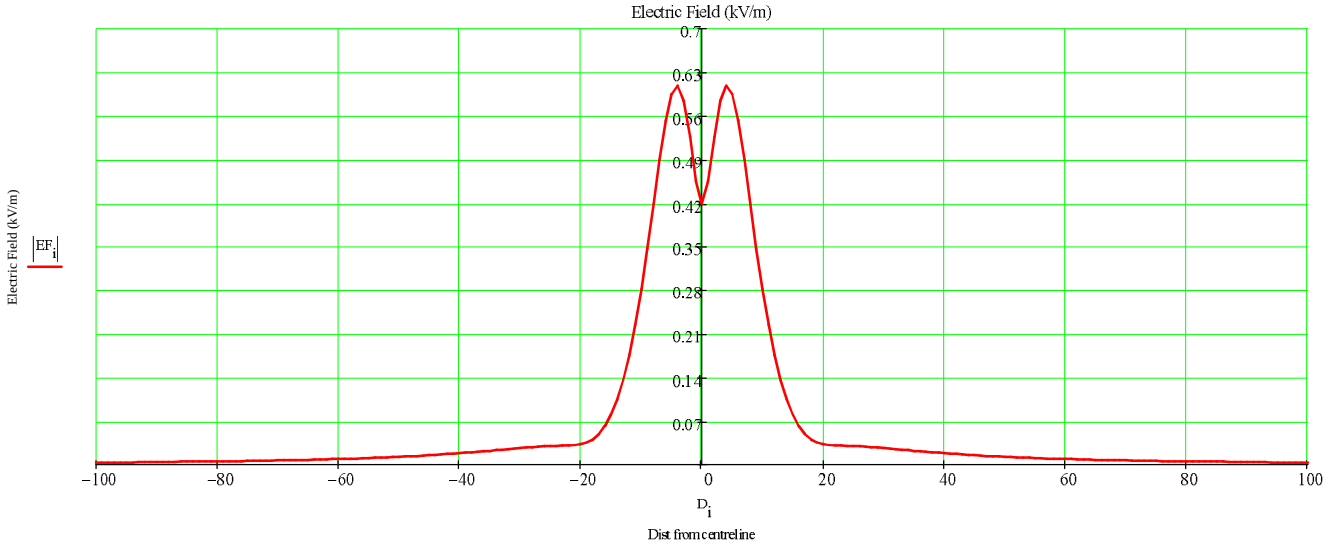
(Audible Noise calculations are set to "wet conductor" conditions with a rain rate of 0.75mm/hr)

Electric Field Strength

max(EF) = 0.608

CheckEF = "OK"

Max Allowable limit for Electric Field Strength
is 5 kV/m as per the National Radiation Laboratory.

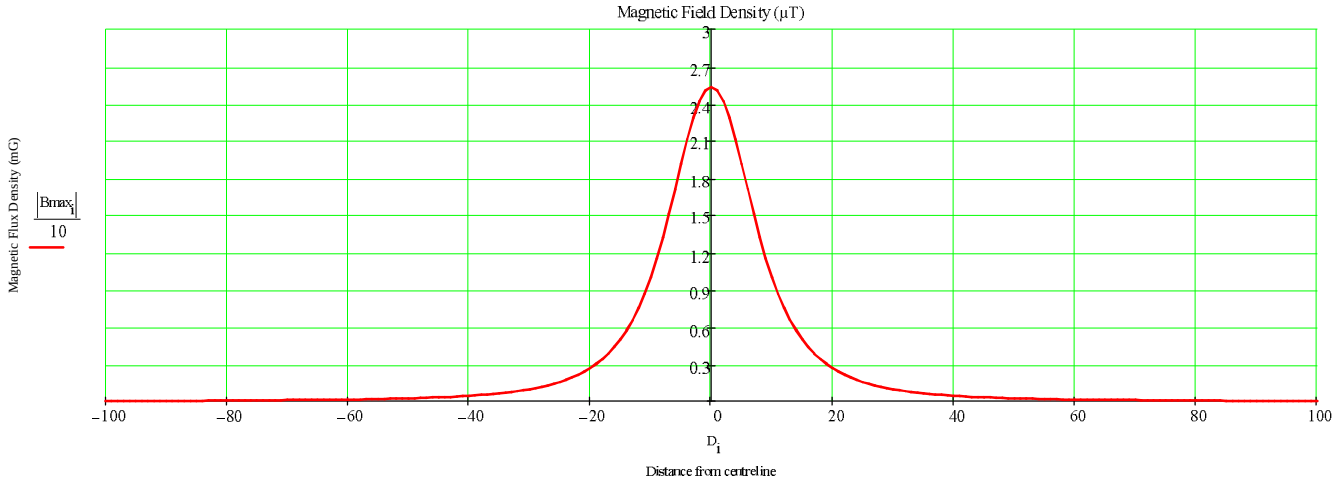


Magnetic Field Flux Density (µT)

$\frac{\max(Bmax)}{10} = 2.535$

CheckMF = "OK"

Max Allowable limit for Magnetic Field Flux Density
is 100 µT as per the National Radiation Laboratory.



Appendix D

Proposed Conditions of Consent

Proposed Conditions of Consent

General

TL1. Except as modified by the conditions below, the works shall be undertaken in general accordance with the information provided by Transpower New Zealand Ltd (Transpower) in the resource consent applications and the supporting documents. This information is summarised as follows:

(a) Transmission Gully Project Volume 6: Transmission Line Relocation Project. Applications for Resource Consents and Assessment of Effects on the Environment, Appendices and Technical Reports (Dated 8 August 2011).

(b) The Transmission Line Relocation plans contained in Transmission Gully Project Volume 4: Plan Set (Dated 8 August 2011.

(c) Schedule 1: Changes to Transmission Line Support Structures attached to these conditions.

TL2. These conditions may be reviewed by the Consents Manager, *[Kapiti District Council/Porirua City Council],* pursuant to Section 128 of the Resource Management Act 1991 (the Act), by the giving of notice pursuant to Section 129 of the Act, on the one year anniversary of the commencement of the consents and every year thereafter in order:

(a) To deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage; or

(b) To deal with any other adverse effect on the environment on which the exercise of the consent may have an influence.

TL3. The period within which this resource consent shall lapse if not given effect to shall be 15 years from the date on which it is granted.

TL4. Pursuant to Section 36(1)(d) of the RMA, Transpower is required to pay to *[Kapiti District Council/Porirua City Council],* any administrative charge for the carrying out by the local authority of its functions in relation to the administration, monitoring, and supervision of consent conditions.

TL5. The servants of agents of *[Kapiti District Council/Porirua City Council]* shall be permitted to have access to relevant parts of the Project at all reasonable times for the purpose of carrying out inspections, investigations, tests, measurements and/or to take samples.

Tower and Access Track Design

TL6. Design of towers shall be undertaken in accordance with the Best Practice Transmission Line Design Principles contained as Appendix 5G of Addendum Technical Report 5: Landscape and Visual Effects Assessment.

TL7. Design of tower foundations, access tracks and other land disturbance activities shall be undertaken in accordance with the Best Practice Earthworks Design Principles contained as Appendix 5H of Addendum Technical Report 5: Landscape and Visual effects Assessment.

Location and Height of the Transmission Line Support Structures

TL8. Tower heights and locations shall be generally in accordance with attached Schedule 1 and the plans contained in Volume 4: Plan Set, except that:

(a) With the exception of Towers 31A, 32A, 33A and 40A, tower sites may be moved up to 20 metres in any direction;

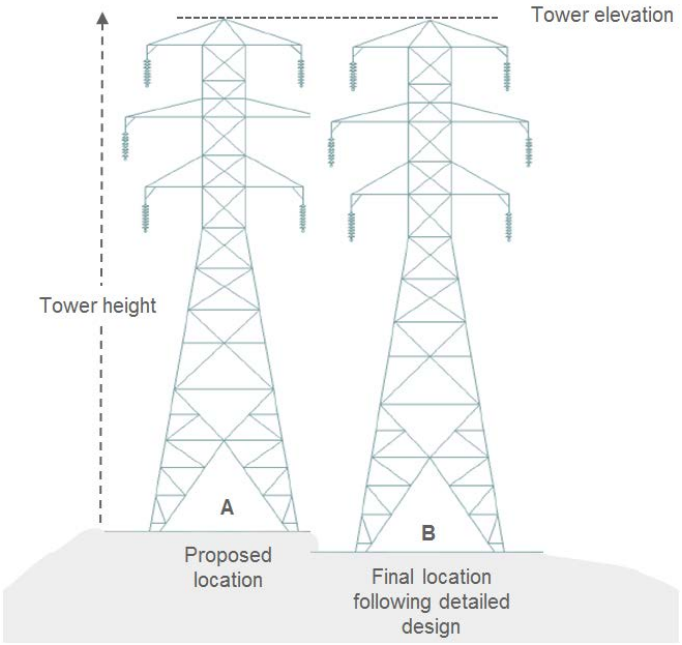
(b) For Tower 31A, 5m west, 20m north, east and south;

(c) For Tower 32A, 10m east, 20m north, west and south;

(d) For Tower 33A, the tower site may be moved up to 5 metres west and south, 30 metres north and east;

(e) For Tower 40A, the tower site may be moved up to 5 metres north, 10m east, 20m west and south;

(f) Where tower locations are moved in accordance with (a) through (e), tower heights can exceed the heights set out in Schedule 1, provided the overall tower elevation as depicted in the figure below does not increase.



Visual Mitigation

TL9. Transpower shall undertake visual mitigation for the following towers/sites:

- Planting adjacent to Tower 24A as shown on *Plan LA07, Volume 4: Plan Set*;
- Planting the north-west and south-west slops of the knoll adjacent to Tower 31A as shown on *Plan LA08, Volume 4: Plan Set*;
- Design and construct the platform for Tower 31A to integrate the edge of the platform with the adjacent proposed road cutting and tie the remaining platform edges into the natural landform; and
- Planting on the gully slope adjacent to Tower 32A as shown on *Plan LA09, Volume 4: Plan Set*.

The objective of the visual mitigation is to mitigate as far as practicable the visual effects of the nearby towers when viewed from existing residential dwellings.

TL10. Transpower shall engage a suitably qualified person to prepare a landscape mitigation plan detailing the visual mitigation measures set out in Condition 9 prior to construction commencing. The landscape mitigation plan shall include the following information (as a minimum):

- The location and pattern of all screen and/or amenity planting proposed
- Plant species, planting densities, bag size and/or minimum heights at time of planting, and approximate minimum heights to be achieved
- Timing for implementation of all landscape mitigation measures including planting.

TL11. Transpower shall submit the landscape mitigation plan to the Consents Manager, Porirua City Council, for certification at least 20 working days prior to the commencement of works. As a guide, the Council will review and respond within 10 working days following receipt of the plan either certifying that the plan achieves the objective in Condition 9 or detailing whether any additional information is necessary.

TL12. Transpower shall implement the landscape mitigation plan required by Condition 10 within the first planting season following completion of the works, depending on the following circumstances:

(a) In areas subject to line relocation construction works, following completion of all construction activities; or

(b) In areas not subject to construction works, following certification by *[Kapiti District Council/Porirua City Council]*; or

(c) In areas subject to construction works for the Transmission Gully Project, following completion of relevant works, or

(d) The landowner consent to carry out the landscape mitigation.

Ecological

TL13. Transpower shall engage a suitably qualified person to confirm the extent of Natural Areas K224, K228, P172, and P199 prior to the commencement of works and shall develop mechanisms for the protection of these areas during earthworks, vegetation removal and trimming activities. The protection mechanisms for these areas shall be set out in the CEMP.

Historic Heritage

TL14. An accidental discovery protocol shall be developed between Ngati Toa and Transpower to clearly outline the process to be followed in the event of a site or any material of cultural significance being encountered during construction. As a minimum, the protocol shall address the matters set out in Condition TL15.

TL15A. If any urupā, traditional sites, taonga (significant artefacts) or kōiwi (human remains) are exposed during site works, then the following procedures shall apply:

(a) Immediately it becomes apparent that a possible archaeological or traditional site has been exposed, all site works in the immediate vicinity of the site shall cease;

(b) The site supervisor shall immediately secure the area in a way that ensures that any remains or artefacts are untouched;

(c) The site supervisor shall notify representatives of Ngati Toa Rangatira in accordance with the protocol developed under condition TL14 and the New Zealand Historic Places Trust, *[Kapiti District Council/Porirua City Council]* and, in the case of human remains, the New Zealand Police.

The notification in (c) above shall allow such persons being given a reasonable time to record and resolve archaeological features discovered before work may recommence.

TL15B If any features or artefacts associated with WW2 are exposed during site work, then the following procedures shall apply:

(a) Immediately it becomes apparent that a possible feature or artefact has been exposed, all site works in the immediate vicinity of the site shall cease;

(b) The site supervisor shall immediately secure the area in a way that ensures that any remains or artefacts are untouched;

(c) The site supervisor shall notify the New Zealand Historic Places Trust, *[Kapiti District Council/Porirua City Council*] and the Project Archaeologist. The Project Archaeologist in turn shall contact a specialist military historian.

The notification in (c) above shall allow such persons being given a reasonable time to record and resolve heritage features discovered before work may recommence.

Construction Environmental Management Plan

TL16. Transpower shall update and finalise the draft Construction Environmental Management Plan (CEMP). The CEMP shall be provided to the Consents Manager, *[Kapiti District Council/Porirua City Council*], for review at least 20 working days prior to the commencement of works to certify compliance and consistency with the conditions. Approval shall not be unreasonably withheld. Construction shall not commence until certification is obtained.

TL17. The finalised CEMP shall include specific details on the construction and management of all works authorised by this resource consent. The certification process of the CEMP shall confirm that the CEMP includes details of the following:

(a) Details of the site supervisor and the community contact person, including their contact details (phone, facsimile, postal address, email address);

(b) An outline construction programme of the work (including staging if appropriate) indicating key activities and their duration;

(c) The hours of work;

(d) Location of site offices, areas for equipment storage and conveniences (eg portaloos);

(e) Measures to manage construction noise and vibration (as set out in condition TL22 and TL24;

(f) Methods to stabilise ingress and egress points to construction sites;

(g) Procedures for managing construction traffic and access on public roads;

(h) Means of ensuring the safety of the general public;

(i) Methods for vegetation clearance, trimming and disposal;

(j) Procedures to be followed to ensure that those working in the vicinity of Natural Areas are aware of the values of these features and the steps which need to be taken to protect these areas during construction;

(k) The erosion and sediment control measures to be adopted during earthworks;

(l) Methods to manage the storage, reuse and disposal of excavated material during earthworks;

(m) Procedures to manage potentially contaminated material encountered during land disturbance activities;

(n) Procedures for controlling dust. Dust mitigation measures could include use of water sprays to control dust nuisance on dry or windy days;

(o) Measures to be adopted to maintain the land affected by the works in a tidy condition in terms of disposal/ storage of rubbish, storage, unloading and removal of materials and similar construction activities;

(p) Procedures to receive and respond to complaints about construction activities, including noise and dust from the works;

(q) Other specific conditions, cultural protocols and archaeological requirements;

Nothing in this condition allows the Council, or any other party, to require more onerous controls than contained in these consent conditions.

TL18. The CEMP shall be implemented and maintained throughout the entire construction period.

TL19. A copy of the CEMP shall be held at the construction site office at all times and be available for inspection on request by the *[Kapiti District Council/Porirua City Council].*

TL20. The CEMP shall be reviewed by Transpower at least annually or as a result of a material change to the Project. Any material change proposed to the CEMP shall be submitted for approval to the Consents Manager, *[Kapiti District Council/Porirua City Council]*, at least 10 working days prior to the proposed changes taking effect.

TL21. A community contact person shall be nominated by Transpower for the duration of construction to be the main and readily accessible point of contact for persons affected by the Project. The contact person's name and contact details shall be made available in the CEMP and provided to affected persons by Transpower. This person must be reasonably available for on-going consultation on all matters of concern to affected parties arising from the Project.

Noise and Vibration

TL22. All construction work shall be designed, managed and conducted to ensure that construction noise does not exceed the limits in NZS6803:1999 Acoustics–Construction Noise at locations set out in section 6.2 of that standard.

TL23. The noise limits required by condition TL22 shall not apply to emergency work required to re-establish continuity of supply, urgently required to prevent loss of life or other personal injury or commissioning works, but all practicable steps shall be undertaken to control noise and to avoid adverse noise effects particularly at times when the stricter noise limits apply (eg at night time).

TL24. Vibration from all construction activities must comply with the peak particle velocity limits in table 1 of German Standard DIN 4150-3 (1999-02) Structural Vibration – Effects of Vibration on Structures.

Clearance of Trees and Vegetation

TL25. Transpower shall minimise the amount of native vegetation and riparian vegetation which is to be removed during the preparation of towers sites. All vegetation clearance shall be undertaken in accordance with the measures set out in the CEMP.

TL26. Any removed/trimmed vegetation shall be kept clear of watercourses.

Erosion and Sediment Control

TL27. Erosion and sediment control must be applied and maintained at the site of earthworks, during and after the earthworks, to avoid the adverse effects of sediment on water bodies.

Note: Additional erosion and sediment control measures may apply to areas which are subject to separate resource consent in accordance with regulation 34 of the NESETA and/or the relevant rules of the Wellington Regional Soil Plan, October 2001.

TL28. Erosion and sediment control measures shall be constructed and maintained in general accordance with the Wellington Regional Council document titled 'Erosion and Sediment Control Guidelines for the Wellington Region' dated September 2002

TL29. All areas of soil exposed by earthworks shall be stabilised against erosion as soon as practicable after the earthworks end to avoid the adverse effects of sediment on water bodies.

Stabilised means inherently resistant to erosion or rendered resistant, such as by using indurated rock or by the application of basecourse, grassing, mulch, or another method to the reasonable satisfaction of the Manager. Where seeding or grassing is used on a surface that is not otherwise resistant to erosion, the surface is considered stabilised once, on reasonable visual inspection by the Manager 80% vegetative ground cover has been established.

Restoration of the Land

TL30. Following completion of the works, all components and material associated with the construction activities and removal of parts of the existing transmission line shall be removed from the land. Any ground that is disturbed from construction or removal activities must be restored in a way that minimises the risk of soil erosion, sediment run-off, and weed invasion.

Electric and Magnetic Fields (EMF)

TL31. The works shall be designed and constructed to limit the electric and magnetic field exposure in accordance with regulation 10(2)(a) of the Resource Management (National Environmental Standards for Electricity Transmission Activities) Regulations 2009 (NESETA). In particular public reference levels of 5 kV/m for electric field strength and 100 μT for magnetic flux density at one metre above the ground under normal operating conditions (ie when there are no faults in the transmission system).