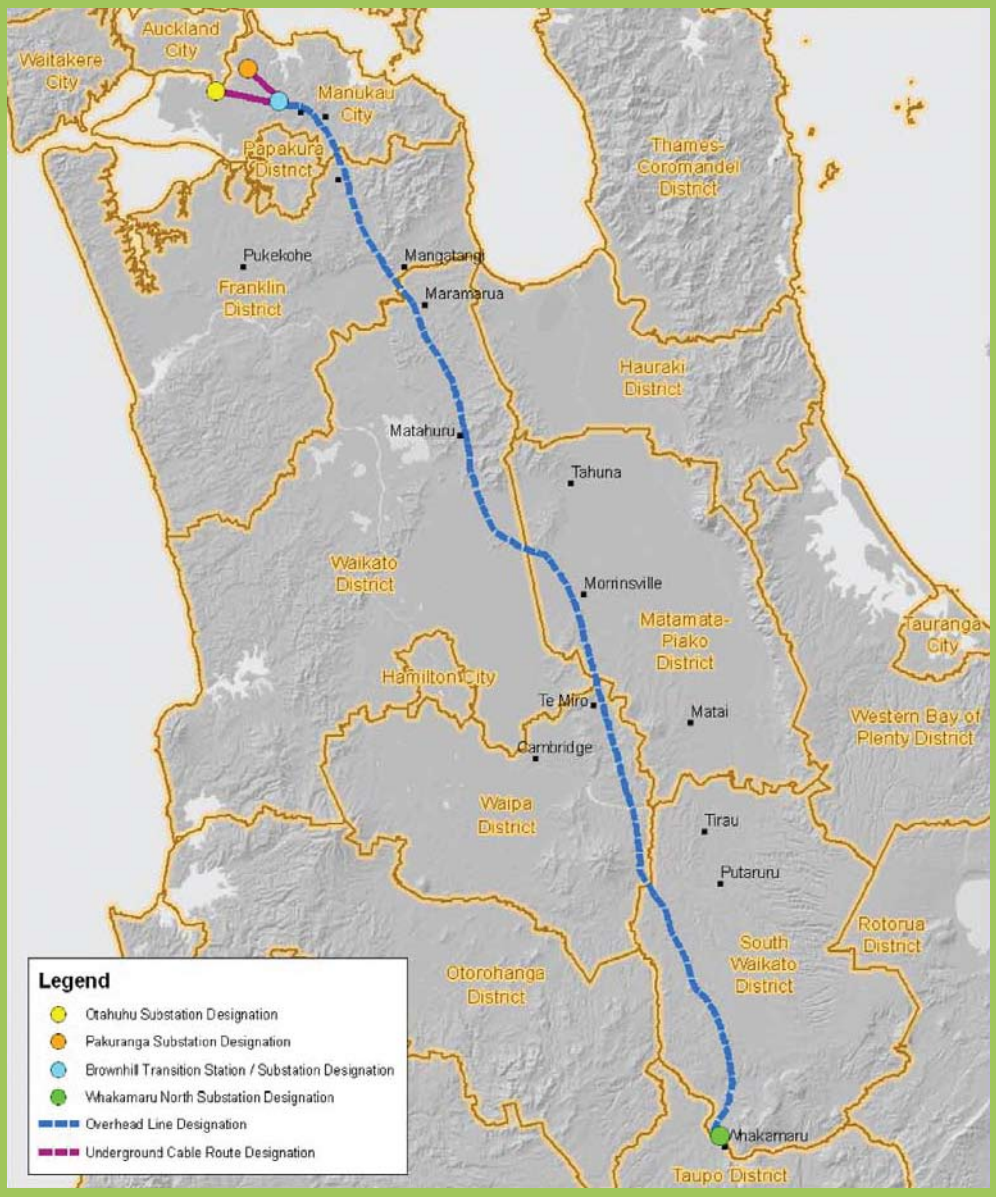
Transpower New Zealand Ltd
North Island Grid Upgrade Project

Notices of Requirement Documentation

Part IX



National Grid Upgrade

TRANSPOWER

KEEPING THE ENERGY FLOWING

PART IX

INFORMATION, DESCRIPTION AND ASSESSMENT OF EFFECTS ON THE ENVIRONMENT

WHAKAMARU AND WHAKAMARU NORTH SUBSTATION

Transpower NZ Ltd

North Island Grid Upgrade Project
Whakamaru and Whakamaru North Substation

Contents

1. Introduction

1.1 General

Part IX has been prepared to support Transpower's Notice of Requirement to Taupo District Council to designate the Whakamaru and Whakamaru North Substation site, shown in Figure 1. Part of the area is already designated as Whakamaru Outdoor Switchyards within the Taupo District Plan and contains the existing substation. As the two sites are contiguous, both are to be included within a single designated area. The designation is required to provide for the extension and upgrade of the existing Whakamaru Substation and the installation of new 400kV and 220kV substations at the Whakamaru North Substation site, and for their continued operation, maintenance and upgrading. The Notice of Requirement also encompasses land for the connection of the new substation to the existing substation by way of new 220kV towers and conductors, as well as a tower, gantry structures and conductors which are part of the new transmission line. These works are part of the North Island Grid Upgrade Project involving the construction of a new transmission line and associated facilities, from Whakamaru to Otahuhu in south Auckland. Also included within the designation are the existing 220kV lines which cross the site of the Notice of Requirement, and provisions for future connections to other parts of the National Grid.

This document has been prepared in accordance with section 168 of the RMA. It includes a description of the Whakamaru and Whakamaru North Substation and the works associated with them, sets out the statutory framework and explains the alternatives considered. It describes the existing environment and the changes to the environment that will result from the proposed new substation and associated works. It also includes measures to avoid, remedy or mitigate adverse effects on the environment and an evaluation of alternatives.

The existing Whakamaru Substation is on land owned by Transpower, and the site has been used for transmission since the early 1950s.

The site on which the new substation is proposed to be located is also owned by Transpower. Mighty River Power owns a small area between the two substations and adjacent to the existing substation onto which the Whakamaru Substation is intended to expand. While the substations proper occupy a relatively small part of the total area, much of the remainder of the site isoccupied by existing transmission lines, or proposed new lines. Thus the two complete areas of Transpower-owned land are included in the Notice of Requirement, along with the small strip of land which lies between them. The total area covered by the Notice of Requirement is 6.44 hectares. As both substation areas will require works associated with the North Island Grid Upgrade Project, it is considered most effective to address the site as one entity for the purposes of the Notice of Requirement. The designation that currently applies will be withdrawn once the new designation is fully in place.

The description of works proposed in the requirement for designation for the Whakamaru and Whakamaru North Substation do not contain the necessary information for an outline plan, and this will be the subject of outline plans at a later date.

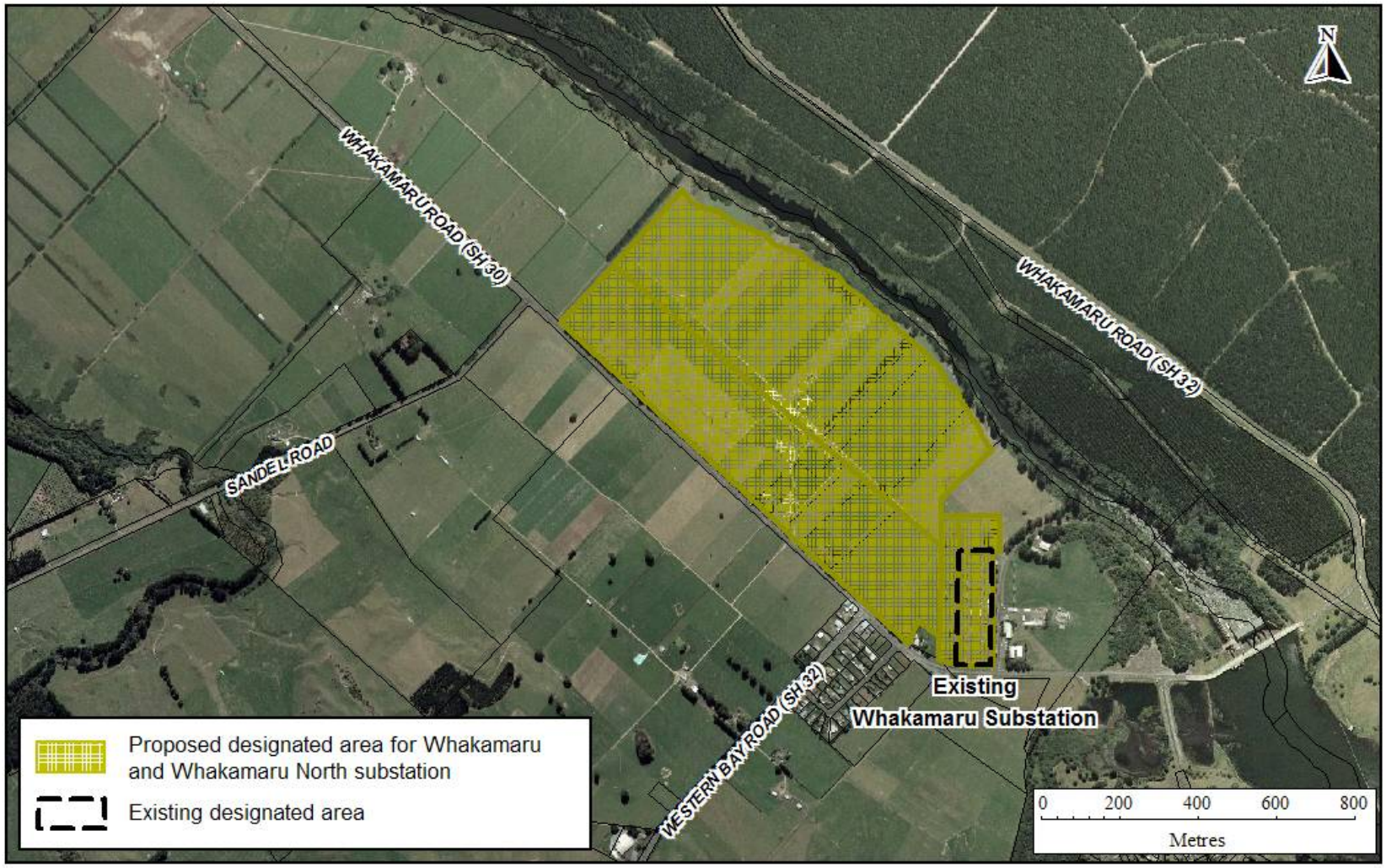


Figure 1. Whakamaru and Whakamaru North Substation Location and Area included in the Notice of Requirement

1.2 Transpower's objectives

Within Transpower's broader common objective for the whole of the North Island Grid Upgrade Project,

> "*To ensure the continued security and certainty of electricity supply for Auckland, Northland, and parts of the Coromandel and Waikato, by constructing and operating a new transmission link (including substations and ancillary facilities) and to upgrade existing assets in a manner that is safe, efficient and consistent with maintaining current grid reliability standards and which provides flexibility to address future changes in supply*",

the following specific objectives for the Notice of Requirement for the Whakamaru and Whakamaru North Substation are provided:

> "*To provide for the development, expansion and operation of a secure facility which enables the transformation and transmission of electricity within the Waikato region and beyond.*
>
> *To facilitate secure and efficient connections to existing electricity transmission and generation infrastructure in order to support electricity transmission to, from, and through the central North Island.*
>
> *To ensure operational flexibility of the facility and associated works to meet growing demand for electricity and requirements for diversity and security of electricity supply".*

These objectives are self-explanatory and cover the variety of activities existing or proposed to be undertaken on the site. The work and designation is considered by Transpower to be reasonably necessary for achieving its objectives, for the following reasons:

- The new substations, being the southern termination point, form an integral part of the North Island Grid Upgrade Project and cannot be considered in isolation from the remainder of the project, therefore assisting with meeting the common objective;
- The work is reasonably necessary to provide a secure and efficient connection between the existing electricity generation and transmission infrastructure to enable electricity, some of it generated in the Waikato, to be transformed and transmitted both north and south from Whakamaru;
- The use of the designation technique is reasonably necessary to ensure that Transpower has the flexibility to undertake the proposed works and to connect to existing infrastructure in the vicinity, while at the same time allowing for sufficient separation from the existing substation to meet its requirements for diversity and security of supply at grid nodal points; and
- The size of the designation will provide sufficient land and separation distances from adjoining activities to enable future connections and upgrades to be undertaken in response to the growing demand for electricity.

It is intended that the objectives also apply to the area currently designated as "Whakamaru Outdoor Switchyards" in the Taupo District Plan. While this area is already designated, the two substations are closely operationally and physically integrated and a single designation, subject to the same description and any restrictions and conditions as the new substation, is considered more appropriate than two separate designated areas.

As noted earlier, once the designation which is the subject of the current Notices of Requirement is in place, the existing designation will be withdrawn in terms of section 182 of the Resource Management Act (RMA).

2. Project description

This section describes the nature of the project and works involved in the area of the Notice of Requirement for the Whakamaru and Whakamaru North Substation as part of the North Island Grid Upgrade Project.

Part of the designated area is already developed and covered by an existing substation. This is described in general terms below, along with a general description of the intended upgrades. The Whakamaru North Substation is entirely a new development.

The new substation components within the designated area have not yet been subject to detailed design, as that will be part of the design-build contract. However, a reasonably comprehensive description of the equipment, likely appearance and functions of the proposed developments can be provided.

2.1 Whakamaru Substation

This substation is more correctly described as a switchyard, as it does not include any transformers, and is not in future intended to include such equipment. However, for simplicity it is described as a substation.

The existing substation site is a major node in the national electricity transmission network in the central North Island and currently links major national grid lines to the north, south and east. Its present development comprises:

- A 220kV outdoor air-insulated substation including fourteen separate bays which connect to 220kV overhead lines, and the four 25MW generators at the nearby hydro power station.
- 220kV circuit breakers and associated air break switches, earthing switches and instrument transformers.
- 220kV high-level buswork.
- An underground earth mat.
- A switchyard perimeter security fence.
- A control/relay building to house control, relay monitoring and protection equipment.

This substation will be extended in a north-easterly direction (towards the Waikato River) to include:

- Two additional 220kV connection bays with circuit breakers and associated disconnectors and instrument transformers;
- Low level bus work (or high level buswork similar to the existing); and
- Reinforced concrete foundation pad/piles to support the above equipment.

This development is expected to involve earthworks, possibly including imported fill and retaining walls.

The construction of the 400kV/220kV Whakamaru North Substation may also require some of the existing 220kV electrical equipment at the Whakamaru Substation to be replaced with similar equipment but with a higher rating.

These changes will not all occur together, but will be staged as described in section 2.3 of this report.

2.2 Whakamaru North Substation

The new Whakamaru North Substation will connect the new overhead 400kV - capable transmission line to the existing Whakamaru 220kV substation. Initially, while the line is operated at 220kV, the new substation will provide 220kV switching facilities only. When the line is required to be operated at 400kV (expected to be about year 2034), the substation will be extended to enable transformation of electricity from 220kV to 400kV. The substation may also be extended to connect other future 220kV and 400kV lines.

To provide diversity of supply and security between the existing and new substations, the new Whakamaru North Substation is physically separate from the existing Whakamaru Substation, being located about one kilometre to the northwest. It will be larger than the existing substation.

Initially, the Whakamaru North Substation will comprise an outdoor 220kV air insulated switchyard, as follows:

- Six 220kV circuit breakers and associated air break switches and instrument transformers. Low level buswork will be about 9 metres high, and;
- Approximately twenty metre high support structures for terminating the incoming 220kV lines, overhead buswork and lightning protection shield wires.
- Approximately twenty metre high lightning protection poles.
- Twenty-five metre high support structures for terminating the conductors and lightning shield wires of the new transmission line.
- Reinforced concrete foundation pads/piles to support the above equipment.

The 400kV Whakamaru North Substation will include:

- Five 400kV outdoor circuit breakers and associated switchgear and instrument transformers. Low level buswork will be about 11.5 metres high;
- Additional 220kV outdoor circuit breakers and associated air break switches, instrument transformers, buswork and buswork support structures;
- Six 400kV/220kV power transformers;
- Support structures some 25 to 28 metres high for terminating the 400kV-capable incoming lines, overhead buswork and lightning protection shield wires;
- Acoustic barriers/firewalls for the power transformers;
- Oil/stormwater separation facilities for minor leakage of transformer oil; and
- Oil containment facilities.

The dimensions of the 400kV/220kV AIS substation platform will be about 320 metres by 200 metres. The 220kV electrical equipment initially installed will utilise only a small part of this area.

In addition, the Whakamaru North Substation will include:

- A security fence, some 2.5 to 3 metres high
- A substation perimeter 7-8 wire stock fence, to protect the security fence from stock damage
- An underground earth mat
- A ground surface layer of crushed rock or asphalt inside the security fence
- A building to house control, relay monitoring and protection equipment
- An emergency standby generator
- A 8 to 10 metre wide access road connecting the substation to SH30
- Communications systems including microwave, optic cables (part of the overhead line system) and buried fibre optic cables
- Sanitary facilities, including a single toilet and handwash facilities, in the control building
- Water tanks and a septic tank
- Site lighting
- Lightning protection poles and/or aerial shield wires
- Two small transformer boxes for local electricity supply
- Miscellaneous control boxes and cable ducts

During the construction stage there will be the need for temporary power supply, temporary facilities such as on-site sanitation and temporary construction lighting.

2.3 Designated Site as a Whole

The area to be included within the designation contains existing transmission lines and steel lattice towers.

In addition, new towers and conductors will be located within the area covered by the designation, including:

- New tie line towers, conductors and lightning shield wires connecting between the existing Whakamaru Substation and the new Whakamaru North Substation; and
- A new tower (tower 429 of the overhead line), gantry structure, conductors and lightning shield wires connecting to the new overhead line to the north.

The Whakamaru and Whakamaru North Substations will be connected via a double-circuit 220kV tie-line. The two tie-line circuits will be connected into the two new 220kV bays constructed at the Whakamaru Substation. A second double circuit tie line may be required in the future.

The tallest item within the designation area will be the termination tower of the overhead line (tower 429), at about 55 metres in height.

The site also contains five existing 220kV lines approximately paralleling State Highway 30. These are to be covered by the designation, as are the small parts of the existing four lines connecting to the southwest and southeast.

A new access road from State Highway 30 will be required. This will need to be of sufficient dimensions to allow access for the heavy transporters needed to bring the new 400/220kV power transformers to the site, and will be up to 10 metres wide.

Figure 2 shows the indicative layout of the proposed substations and associated works, viewed from the south-east. In the future, the site may be further connected into the electricity network, involving additional connections.

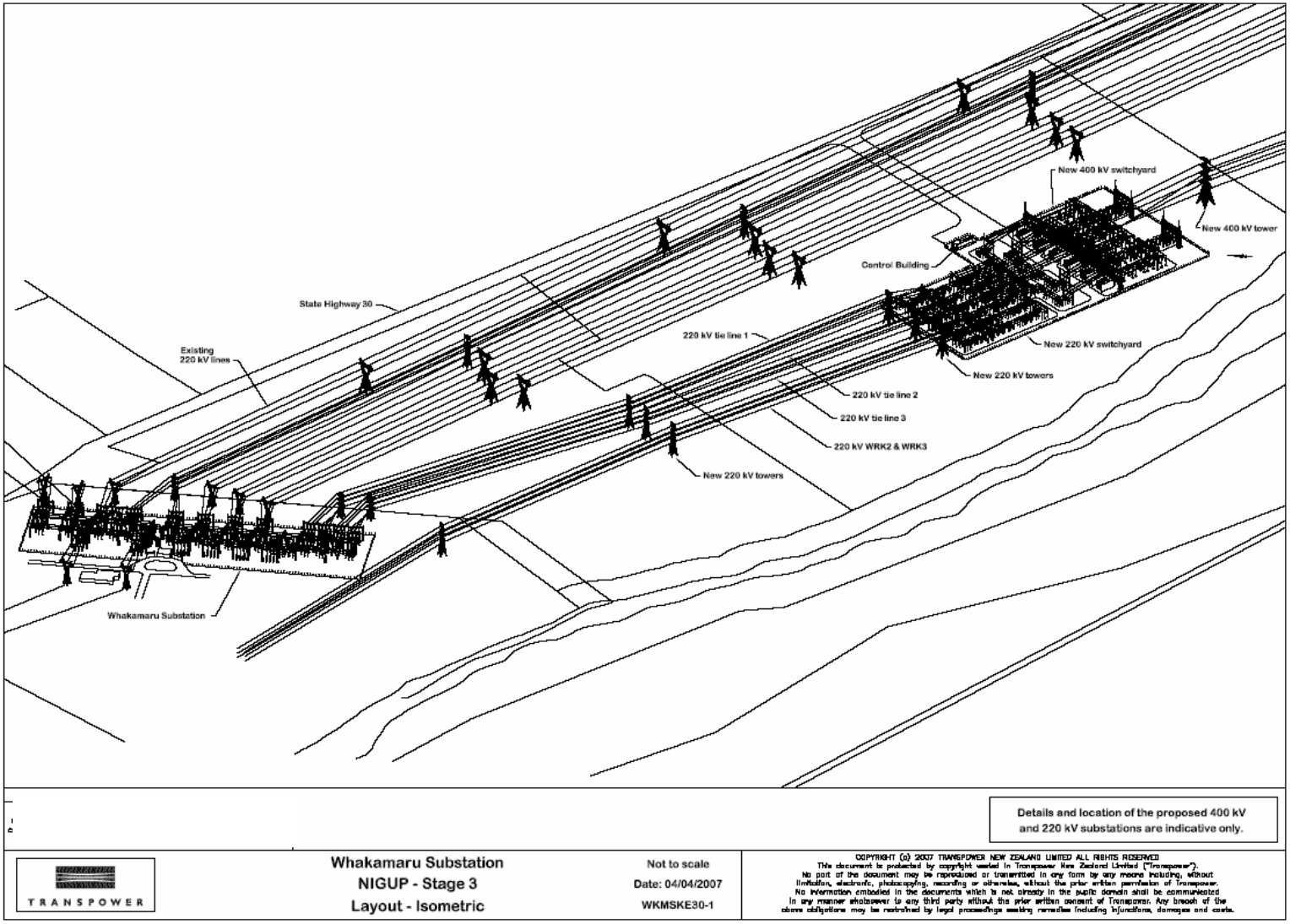


Figure 2. Indicative Isometric View of the Proposed Whakamaru North Substation

2.4 Staging

The Whakamaru and Whakamaru North Substations will be subject to staged development as part of the North Island Grid Upgrade Project. In general terms, this is as follows;

Stage 1, to be completed by 2011, consists of two additional substation bays at the Whakamaru Substation along with civil works for the Stage 2 development, a 220kV Whakamaru North Substation, the tower and gantry for the overhead line connection and the double circuit tie-line between the two substations.

Stage 2, expected to be completed in 2022 to 2024, involves two further substation bays at the Whakamaru Substation and two additional bays at the Whakamaru North Substation with a second double-circuit tie line between the two substations.

Stage 3, expected to be completed by 2034, involves the addition of a 400kV/220kV substation at the Whakamaru North Substation.

As noted above, all stages may involve improvements to or changes of equipment at the existing Whakamaru Substation.

This staging can be seen as part of the staging for the Grid Upgrade Project as a whole, as described in Section 5.2 of Part II of the Notices of Requirement documentation.

2.5 Construction Stages

2.5.1 General

It is expected that each of the three stages of new major development at Whakamaru and Whakamaru North Substations will be constructed under separate design and construction contracts (which is Transpower's usual contracting methodology for substation works). This will require the design contractor to carry out the detailed design of the substation to the preliminary designs that Transpower has completed, including all site works. A separate contractor would then construct the works. The detailed design will then be included in outline plans submitted to the Taupo District Council. A possible alternative methodology is a single design-build form of contract.

Each of the construction periods at Whakamaru is anticipated to be approximately 18 months.

Onsite preparation will include access formation (as necessary) and formation of vehicle parking areas, and provision of temporary facilities for site workers.

Site levelling and earthworks will take place prior to the construction of the concrete foundations for the substation equipment items. This will include some excavation and/or consolidation of the ground. Surplus fill will be disposed of on site as far as practicable, but some may need to be removed to an alternative clean fill site elsewhere. For the extension of the Whakamaru Substation, clean fill may need to be imported.

Following the installation of the substation equipment items on to their foundations and making off of electrical connections, including the new tie lines between the two areas, the new substations will be progressively commissioned.

It will be the construction contractor's responsibility to source the labour and construction plant for constructing the new substations and/or substation components and to develop the detailed programme of works to complete the construction, and to develop appropriate construction management plans to address construction effects. A community liaison plan will also be required so that local residents are kept informed during the construction phase.

2.5.2 Construction management

Mitigation of most construction impacts will be achieved through a construction management plan which will be submitted to Taupo District Council at outline plan stage, for each of the stages.

Transpower will include contractual requirements in the construction contract for the contractor to manage construction impacts.

Construction management plans will be required to be implemented by the contractor covering:

- Storage and reuse of topsoil
- On and off site disposal of spoil
- Silt and dust control during the site levelling and earthworks stages
- Traffic management for the road movement of the transformers from port of importation to the site
- Traffic management for delivery to site of remaining substation equipment items and materials
- Temporary equipment storage on the site in specified areas
- Contractor car parking on the site in specified areas
- Site security and lighting during construction
- Handling of insulation oil
- Construction noise
- Hours of work
- Community information and liaison

It is proposed that noise levels during construction will comply with the requirements of NZS 6803:1999 Acoustics – Construction Noise. Earthworks will comply with the relevant regional plan provisions or consents will be obtained, once detailed plans have been prepared.

The construction contractor will be required to comply with all designation and resource consent conditions relevant to its scope of work.

2.6 Operational Requirements

2.6.1 Access

The Whakamaru Substation is not permanently staffed, and is not intended to be. Whakamaru North Substation similarly will not be permanently staffed. The substations will generate few traffic movements. Visits will occur on a monthly basis for inspections and periodically for equipment maintenance.

Vehicle parking will be accommodated on site.

While the Whakamaru Substation makes use of a shared access way with other utilities, for the Whakamaru North Substation, a new access road will be developed and retained for all stages of construction, operation and maintenance.

2.6.2 Maintenance and Repairs

The substation assets will be maintained at regular intervals to ensure they are in a serviceable condition. Routine maintenance intervals vary depending on the equipment type and could range from every four years to every 10 years. Non routine maintenance would be carried out to undertake minor repairs. This is normally scheduled to be carried out in conjunction with routine (scheduled) maintenance but additional trips may be needed in cases of equipment failure, or for security reasons.

3. Statutory Context

3.1 Introduction

The statutory context of the Resource Management Act is set out in Part II of the documentation for the Notices of Requirement. Notices of Requirement are subject to consideration under Part 2 of the Resource Management Act. Other considerations are the effects on the environment of allowing the requirement, having particular regard to relevant statutory policy statements and plans, whether adequate consideration of alternatives has been undertaken, whether the work is reasonably necessary in terms of Transpower's objectives, and any other matter which is necessary to take into account in making a recommendation to the requiring authority.

This section outlines policy statements and plans prepared under the Resource Management Act that provide the planning context for consideration of the designation.

The area of the Notice of Requirement lies within Waikato Region and Taupo District, and is subject to the provisions of the Waikato Regional Policy Statement, the proposed Waikato Regional Plan, and proposed Taupo District Plan.

3.2 Waikato Regional Policy Statement

The general provisions of the Waikato Regional Policy Statement that apply to the area and may be relevant to the requirement are set out in Part X section 4 of the Notices of Requirement documentation.

The substations which are the subject of the Notice of Requirement can be seen in the context of objectives and policies relating to energy and regionally significant infrastructure. The designation will enhance the region's infrastructure by providing for progressive upgrading of the national grid facilities of the region and the continuation of existing facilities. As part of an efficient system of transmission, the substations will contribute to the improved efficiency of transmission, which is a regional policy.

3.3 Taupo District Plan

While it is intended to provide for the development, operation, maintenance and other activities associated with the Whakamaru North Substation by way of the designation process, the provisions of the proposed Taupo District Plan provide useful guidelines and assist in assessing the anticipated environmental effects and outcomes when considering the Notice of Requirement.

The proposed Taupo District Plan has passed through most of its processes, but is not yet operative. Recently, Taupo District withdrew the Rural Environment section of its Plan and replaced it with Variation 19, which is not yet the subject of Council hearings or decisions. Accordingly, it is considered that both the operative and the proposed Taupo District Plan are of relevance in terms of the Notice of Requirement.

In the proposed Plan, the existing substation site is designated (Designation D89) as Whakamaru Outdoor Switchyards, with the designated purpose being "outdoor switchyard". The adjacent part of the area within the Notice of Requirement which is not owned by Transpower (ie to the west of its designation) is within an area shown as "Power Station Core Site" on the Plan Maps. The whole area of the designation is within the Rural Environment.

There is a separate set of objectives and policies for utilities in the proposed Plan, but the relevant rules for utilities are incorporated along with those for other activities within the Rural Environment. The objectives and policies are included in Part X, section 5, of the Notices of Requirement documentation.

A permitted activity in the Rural A Zone is "any public work or utility which is for the purpose of providing a rural service, or supporting the rural community". It is unlikely that the substations would come within this catergory, therefore they would be non-complying activities.

Much of the land in the designated area will continue to be used for rural activities in compliance with the underlying Rural A Zone provisions.

Performance standards for permitted activities (which are also stated to be a guide for conditional uses) include a maximum structure height of 10 metres (if the site is over 4 hectares), and other requirements, including:

- A 25 metre front boundary setback and 15 metre setback from all other boundaries
- Noise levels, to be measured at the notional boundary of a dwelling, of:
  Daytime/Evening (7am to 10pm) – 55dBA Leq

Night time (10pm to 6am) – 40 dBA Leq

There are no assessment criteria in the Rural A Zone as it now stands.

In the proposed Plan, the activity would be a discretionary (restricted) activity and the standards that provide guidance are the same as in the Rural A Zone in the transitional Plan.

The following assessment criteria apply to consideration of all applications for network utilities as restricted discretionary activities:

- The size and scale of proposed new masts, poles, lines, antennae and support structures and whether they are in keeping with the size and scale of any existing overhead reticulation or facilities. (This is discussed in sections 2.1 and 7.6 of this report).
- Any technological or topographical reasons why the new lines and/or structures cannot be placed underground. (This is not addressed in this report, but it is noted that a new substation could not be placed underground and it would be uneconomic and generally undesirable for maintenance and security reasons to place existing and proposed lines underground).
- Whether the location of new or additional overhead lines, antennae and/or structures will have an impact, in the following ways:
  - Whether the placement of any new structures, antennae and/or lines will have an adverse affect on other users of the road.
  - On amenity values, including public views and streetscape.
  - On areas of significant Tangata Whenua cultural value, landscape, natural, or historic value
  - In a way that requires reconstruction or reinstatement of any natural ground surface, including the replacement of any vegetation removed.

  (These matters are variously addressed in section 7 of this report).

Other assessment criteria relating to building height and earthworks may also be relevant. These are:

"BUILDING HEIGHT

- The extent to which the extra height will:
  - Adversely affect the character and visual amenity of the area in the surrounding Rural Environment, particularly in terms of the dominance of open space over built form.
  - Reduce the privacy or outlook of adjoining allotments.
  - Adversely affect Outstanding Landscape Management Areas and Landscape Amenity Management Areas.
- Proposed methods for the avoidance, remedying or mitigation of potential adverse effect, and the degree to which they would be successful including:
  - The extent to which topography, alternative design, planting or setbacks can mitigate the adverse effects of the extra height.

  (These matters are variously addressed in section 7.6 of this report).

EARTHWORKS

- Detraction from the amenity of adjoining allotments in terms of such matters as noise and dust occurring as a result of the earthworks, and the resulting impact on the use of these allotments.
- Potential for the creation of a nuisance effect for residents within the area.
- Time period for which soil will be exposed.

- Proposed methods for the avoidance, remedying or mitigation of potential adverse effects and the degree to which they would be successful, including:
  - Planned rehabilitation, recontouring and revegetation or the retention of existing vegetation.
  - Identification of alteration to catchment drainage including diversions and stormwater management during earthworks construction.
  - Whether there are any archaeological sites, and the potential effect of the earthworks on these sites".

  (These matters are variously addressed in section 7.6 of this report).

The Taupo District Plan offers some protection to existing overhead lines, making any building within 20 metres from the centreline of a high voltage transmission line shown on the Planning Maps a restricted discretionary activity.

The objectives and policies for network utilities, the Rural Environment and Tangata Whenua values in the Taupo District Plan are included in Section 5 of Part X of this documentation.

As noted above, the transitional District Plan (the former Taupo Country District Scheme, operative December 1985) is still of some relevance to the area. This plan has similar policies in respect of the rural area (Rural A Zone). An existing designation over that part of the Notice of Requirement area which is outside the land owned by Transpower, "Reserved for Electricity Department Purposes – Underlying Zone Rural", will remain in place until the proposed Plan is operative.

The Notice of Requirement is considered to be consistent with objectives and policies in the parts of the plans that relate to network utilities, particularly policies that relate to co-location of such facilities. It is also considered to be consistent with policy for the Rural Environment, the Rural A Zone and tangata whenua cultural values.

4. Alternatives Considered

Alternatives to the project as a whole have been discussed in Part II of this documentation. Alternatives to the Whakamaru location generally have been considered by Transpower, as well as specific locations for the Whakamaru North Substation within the Whakamaru area. These are described below.

4.1 Substation Alternatives

As part of the North Island Grid Upgrade Project, a connection was required to the remainder of the national grid.

Transpower in its report entitled "Security of Supply into Auckland, Assessment of Alternative Solutions" dated October 2004,[1] initially considered a number of locations for the southern and northern terminal stations for the new transmission link. Key factors in the evaluations were:

- System Security

[1] See references in Part II, section 16.

- Technical Feasibility
- Economics
- Environmental Impact

From a system security perspective, it was considered that the southern terminal station for the project must have a strong electrical connection with the transmission system from the south to support the bulk transmission power flows experienced through the central North Island. It was also preferable to have a strong connection to the Waikato River generation stations, which are a major source of bulk injection into the national grid. Substantial power flows would be expected through the new transmission line and therefore it was considered critical to select a highly interconnected substation as the starting point in order to maximise the benefits of the new line.

Of all the substations in the Waikato, only Whakamaru met the criteria of having a strong connection to the transmission grid from the south and the connections into the Waikato River stations. Additionally, the existing constraints on transmission into Auckland are between Whakamaru and Otahuhu. For that reason as well, Whakamaru was seen as a logical termination point in terms of relieving the existing constraints.

The only other practical site option in the area is Wairakei. If Wairakei was chosen as a southern termination point, additional 220kV transmission reinforcement would be required into Wairakei to enable power flowing from the south of the North Island to be transferred into Auckland.

Thus, Whakamaru was identified as being clearly preferred from a system security perspective due to the fact that it is the central transmission hub in the Waikato region.

In addition, a site within the vicinity of the existing Whakamaru substation was preferred on grounds of technical feasibility, economic benefit and least environmental impact, the latter two criteria largely relating to the need for some 30 kilometres less of overhead line and its costs and the associated environmental and social impacts.

However, from a grid planning and risk management perspective it was noted that it is desirable to limit the concentration of transmission capacity at grid nodal points wherever possible. The design of the new terminal stations should take common mode failure risks into consideration. This resulted in a preference to have the main proposed southern terminal station physically separated from the existing 220kV substation at Whakamaru. Thus, as described below, from approximately July 2005[2] it was decided to locate the new substations approximately 1 kilometre to the north west of the existing substation.

4.2 Location Alternatives

At the time that the investigations to identify a possible route commenced, Whakamaru had been identified as the preferred location for a new substation from a systems point of view. This limited the extent to which site options needed to be considered.

[2] See MWH August 2005, "Report on Underground Cable Section, Transition Station and Substations", Vol 1

The Whakamaru area was fully assessed during the Area investigations[3]. Initially, a site was identified in close proximity to the existing Transpower substation which appeared suitable for the purpose. All other potential site options were considered less desirable because they were closer to dwellings, more visible and/or would require complex structures or cables to span the existing lines to connect to the existing substation.

Further investigations at a later date indicated that the site first identified was too small for the purpose, and that Transpower considered there were benefits from a separation, as described above. A suitable location within the area initially identified as part of the 500 metre wide route for the overhead line was found, lying approximately one kilometre north-west of the existing Whakamaru Substation. This site was purchased by Transpower in October 2005.

Investigations undertaken as part of Transpower's Amended Proposal (in the period May 2006 to February 2007) indicated the need for an extended area associated with the existing Whakamaru Substation, to facilitate the staged development. This extension will take place on part of the area first identified for the new substation (as noted above). The limited extent of the development makes the initial site suitable, as well as appropriate (as indicated in the initial Area stage investigations).

5. Description of the Environment

5.1 Overview

The general area is largely pastoral farmland but encompasses the Waikato River to the east of the existing and proposed substation site, State Highway 30 to the west, the small settlement of Whakamaru to the south and west along with the dam and electricity generating and transmission infrastructure, and Lakes Maraetai and Mangakino further to the north. Across the Waikato River and to the north is extensive planted forest.

The area is topographically diverse and presents a complex landscape. The Waikato River is deeply incised in the vicinity of the site.

5.2 Landuses

The existing substation and its small extension is an area of some 3.5 hectares. The proposed new substation site involves an area of approximately 7 hectares, although it is set in a large buffer of Transpower-owned land. Together the designated area would therefore comprise some 64.4 hectares. The area not already in substation use is currently in pastoral farming and also contains a house and large shed, understood to be used for animal breeding. Part of the land towards the south end of the designation, adjacent to the existing Whakamaru Substation, is owned by Mighty River Power and is part of a wider operational area used for electricity generation.

[3] See description of ACRE process in Part II, section 7

To the north and across the State highway the land is largely in dairying. The nearest dwellings are to the south west and north west of the designated area, and are at distances of approximately 700 metres and 800 metres respectively from the proposed Whakamaru North Substation.
Towards the south end, the land adjoins two houses on the frontage of State Highway 30. In this vicinity State Highway 32 meets State Highway 30 from the west, and there is a small settlement including two cafe/shops and a service station.

To the east of the designated area an esplanade reserve separates much of the site from the Waikato River. The existing substation site and its extension adjoin an open paddock area to the north. To the south-east the existing substation adjoins an access and circulation area associated with existing electricity generation and transmission activities, including workshops, depots and parking areas.

5.3 Landscape and Special Features

The area is largely adjacent to the incised Waikato River banks and channel, and the wider area contains a number of distinctive features including two significant volcanic peaks at some distance to the south – Kaahu and Whakaahu.

The river banks and channel are picturesque and have high natural character values. However, the existing and proposed new substation sites are located where there is a low degree of natural character and sit within an area of working rural landscape, which is considerably affected by existing transmission lines and adjacent infrastructure. This development is a long-standing element of the local landscape.

5.4 Land Stability

The designated area is located near the western margin of the Taupo Volcanic Zone (TVZ). The TVZ is oriented northeast/southwest between Mt Ruapehu in the south and White Island in the north. Basement rock in the area is welded columnar-jointed ignimbrite that belongs to the Whakamaru group of ignimbrites. The ignimbrite sheet is overlain by a cover of mixed airfall tephra (volcanic ash), unwelded pumice ignimbrite and alluvium. The most recent addition was the Taupo Ignimbrite, which is a loose pumiceous sandy gravel. Groundwater level is close to the cover material–rock interface. It is possible that tunnel erosion is occurring near the base of the Taupo Ignimbrite at the interface with the less permeable weathered volcanic ash.

The site for the new substation is bordered by 35 metre high cliffs on the left bank of Waikato River. To ensure stability of the substation[4], all components will be set back from the cliffs by at least 20 metres and generally substantially more. The extension of the existing substation is even further from the river.

No major faults were identified in the area of the Notice of Requirement and it is considered that there is negligible risk of the proposed site being affected by surface rupture due to fault displacement. The nearest active faults are located in the Taupo Fault Belt to the east.

The materials at the proposed new substation site which are potentially liquefiable are loose silts and sands of the Taupo Ignimbrite and the thin sand bed above the Whakamaru Ignimbrite. The Taupo Ignimbrite materials are considerably above the groundwater table and the likelihood of those materials liquefying is considered

[4] And to meet district plan setback requirements, as well as for land ownership reasons.

remote. The lower thin sand bed is closer to groundwater level but is free draining, medium dense and intermittent in its distribution. If seismic shaking were to occur when water levels were within this layer some liquefaction may occur, however the potential effects are considered minimal and would not significantly affect operation of the substation.

The possibility of lateral spreading during earthquake shaking is considered negligible.

The small area for the extension of the existing substation falls to a lower level than the existing site and consequently requires some filling and possibly a retaining wall at the northern end. Geotechnical investigations of this area have not yet been undertaken, but it is anticipated that conditions would be similar to those for the Whakamaru North Substation.

5.5 Hydrology

The site is not crossed by streams and there are no known springs. Subsurface detailed geology is complex, so there may be some complexity in groundwater movement. There is a gentle slope to the north, and the land drains in this direction, towards the Waikato River.

5.6 Tourism and Recreational Values

The Whakamaru area is valued for its fishing and other water-based recreational activities. The addition of equipment at the exisiting substation, and a further substation and overhead line, must however be seen in a context of existing long-standing electricity development and infrastructure which appears not to affect recreational use. The river is deeply incised near the site.

5.7 Tangata Whenua Values

The site of the proposed substation is adjacent to the Waikato River, which has cultural significance to Maori. The area is already affected by transmission lines.

The Whakamaru and Whakamaru North Substation site is located in a “border” area between Ngati Raukawa and Ngati Tuwharetoa. No cultural issues have been identified in relation to this site during consultation, although as a precautionary consideration, care has been taken to ensure that any construction and future operational activities will not impact on the river.

5.8 Heritage Values

No heritage values have been associated with the site. As reported in the archaeological assessment in Part X, section 9, it is unlikely that any significant archaeological evidence will be found.

5.9 Ecological Values

The site is in largely pasture and there is a significant exotic shelterbelt next to the road. The adjacent esplanade reserve area contains mixed exotic and indigenous vegetation of no significant values. No vegetation removal is proposed as part of the proposal, with the possible exception of a small number of mature exotic trees affected by the extension of the existing substation.

5.10 Roading network and access

The site of the new Whakamaru North Substation is adjacent to State Highway 30 and at present there is a single access to the house, sheds and property which is off-set from the State Highway 32 junction.

Transit New Zealand's approval will be needed for a new crossing place on State Highway 30.

The existing substation has existing access off a private access-way off State Highway 30, and it is not intended to alter this arrangement.

5.11 Existing utilities

Existing utilities at the existing Whakamaru Substation include:

Utility	Equipment	Location
Telecom	Communications cable	To village and along SH32
Mighty River Power	200kV switchgear	Switchyard
	Protection relays	Relay room
	Cables	Various buried outdoor, switchyard and relay room
Tuaropaki Power Company	Cables	Relay room

There are no existing utilities in the vicinity of the proposed Whakamaru North Substation area.

As discussed later in this report, measures will be implemented to ensure that the impact of Earth Potential Rise on other utilities is adequately mitigated.

6. Assessment of Construction Effects

The three stages involving construction are likely to be more obvious in terms of activity than the intervening or any subsequent period. The effects of the activity associated with construction works will be generally managed through the construction management plan.

6.1 Noise

Description
During the construction of the new substation components there will be noise generated from construction activities. This will be primarily associated with excavation, ground consolidation and construction traffic movements.

Potential Effects
All dwellings are at considerable distance from the main area of construction. Closest dwellings may experience distant noise, but the assessment of noise issues in section 13 of Part X of the Notices of Requirement documentation has established that this is likely to be within the permitted activity standard in the Taupo District Plan due to distance and the intermittent nature of the construction activities.

Works at the existing substation will be audible for part of the time, but should not cause particular adverse effects. The nearest dwelling is some 250 metres away and set adjacent to a relatively busy road frontage. Other dwellings in the Whakamaru Village cluster are further away and are subject to noise from two State highways.

It is anticipated that the construction period will be 18 months at most, and considerably less at the existing substation. Normal working hours are most likely and will be addressed in the construction management plan.

Mitigation Measures
Distance from the construction area will mitigate effects on most people.

Despite the distance, it would be good practice for Transpower to require its design-build contractor to ensure that construction noise remains within the limits specified in New Zealand Standard 6803:1999 Acoustics – Construction Work, and a condition relating to construction noise is proposed to be applied to the designation.

A community liaison programme involving local residents and residents at Whakamaru Village should ensure that people are aware of the construction programme and any periods of work that are likely to be particularly noisy.

6.2 Vibration

Description
Any compaction of the ground for the new or extended substation and other earthworks may cause localised vibration. In particular, if blasting is required in creating a level site for the new substation, and additional compaction at either site is required (see 6.5), these activities may cause some vibration.

Potential Effects
Because the new substation is distant from housing, no adverse effects are anticipated from normal excavation and ground compaction processes. However, blasting (which may occur at the new site) may be noticeable. Compaction at either site is likely to use heavy vehicles, and is unlikely to cause vibration effects.

Mitigation Measures
Generally, vibration effects will be mitigated by distance.

Mitigation measures are considered necessary for any blasting, and should involve advice to the nearby community (including electricity operators) of times of blasting through a community liaison programme as part of the construction management plan. Any blasting needed is likely to take place only as part of Stage 1 of the staged development, to avoid subsequent effects on existing site installations.

6.3 Dust

Description
Dust is a potential effect during the construction phase, from site excavation and earthworks.

Potential Effects
Dust has the potential to cause a nuisance if not properly managed.

Mitigation
Any effects should be readily confined within the relatively large site, and normal construction management practices should mitigate any adverse effects. Excavated material will be reused on site if possible, but otherwise removed from site to an approved area. Fill being brought in (e.g. to the Whakamaru Substation extension area), and any material temporarily stored on site, will be managed to avoid dust effects beyond site boundaries. Particular effort will be needed to manage dust as part of earthworks associated with the extensions of the existing substation, due to the proximity to sensitive existing equipment.

Truck wheel washing will be required prior to leaving the site and any potentially dusty loads will be covered.

6.4 Visual Impacts

Description
The project and work associated with the Whakamaru North Substation involves a change from a pastoral farming activity to a developed electricity substation over part of the site. The construction phase will be when the change is most manifest, although there will be more permanent visual effects after the substations and associated works are constructed and commissioned.

The site is largely screened by existing shelterbelts, although construction activity will be visible when approaching the locality from the north west. In this area, the lines in the foreground will be obvious and there is a backdrop of hills. The substation will be visible from a number of dwellings, but the visual impact of the substation in these locations will be moderated by the existing lines, and the presence of other electricity infrastructure in the vicinity.

Changes at the existing substation site are relatively minor in terms of the existing substation context. They are further limited by the location of the main working area being away from the road, river and existing dwellings.

Potential Effects
Visual effects are considered to be generally minor. The area has long experienced major visual change due to hydro-electric and transmission development, and periodic forest clearing.

Mitigation Measures
Additional screen planting for the new Whakamaru North Substation could be achieved along gaps in the existing solid roadside planting, within the constraints provided by existing overhead lines. The entrance to the site should be designed and planted as attractively as possible because of its likely width, which is necessary to accommodate turning of very large vehicles off the road, particularly during the Stage 3 construction period. Such planting will be addressed as part of the Stage 1 outline plan process. By the later stages of construction, this should provide an effective screen to construction activities.

No other mitigation measures are considered necessary.

6.5 Earthworks

Description
Earthworks will be required to improve and form the new substation site, as well as being necessary to provide a suitable platform to extend the existing substation area.

Potential Effects
Earthworks will be largely confined to the substation footprints, the road construction, and temporary hardstanding and other areas used during construction phase. Disturbance will be limited to areas of currently grazed land. Generally earthworks will be undertaken as part of the Stage 1 development.

The extent of the earthworks will depend on underlying soil conditions and the acceptable gradient for the substation building platforms.

Ground conditions at the Whakamaru North Substation site comprise up to 6 metres of cover deposits overlying ignimbrite. In general the ignimbrite is slightly weathered and moderately strong and its surface dips towards the river, generally in conformity with ground surface. The building platform for the substation, if entirely in cut, may require a maximum excavation depth in the order of 4 to 6 metres along the substation southwestern boundary (ie, away from the river). At that depth the excavation is likely to be into rock over a significant part of the site. Blasting may be required to excavate the rock.

At the Whakamaru North substation site it is possible that tunnel erosion is occurring near the base of the Taupo Ignimbrite at the interface with the less permeable weathered volcanic ash.

Removing the Taupo Ignimbrite as a result of excavation to construct the substation platform would also address the potential tunnel erosion issue identified in section 5.4 of this report. Specific foundation design will be required in areas where the ignimbrite is not removed. This will be addressed during detailed design.

It is envisaged that part of the excavated materials, with the exception of Whakamaru Ignimbrite, is unlikely to be suitable for construction of structural fills and these materials will be disposed of off site. Additional details will not be available until detailed design is completed.

A geotechnical investigation carried out for the extensions of the existing Whakamaru Substation indicates that conditions are expected to be similar to those at the Whakamaru North Substation. As well as possible works to address existing site conditions, this site needs to be filled in part to make it level with the existing site. The estimated fill requirement is 5,000m³ and the maximum fill height will be in the order of 1.5 metres at the northeast corner. Fill batters will be required along the northern and eastern edges of the extended platform which will be approximately 75 metres by 90 metres in plan dimension. It may be expedient to import the fill from the Whakamaru North Substation site.

The earthworks required for the construction of the tower foundations for the new overhead line tower (tower 429), the intermediate gantry, and the 220kV double-circuit tie line connecting Whakamaru North Substation to the existing Whakamaru Substation, will not be substantial.

Mitigation Measures
The earthworks undertaken will be the minimum necessary to achieve a stable and secure building platform and to address any internal erosion issues.

Earthworked areas will be reinstated in topsoil and grassed, except where gravel, rock or asphalt surfaces are required.

Spoil removed from the site may involve frequent return trips of heavy vehicles over several weeks. This will be managed in accordance with the construction management plan. A suitable site, or sites, will need to be found for off-site disposal of spoil in advance of excavation commencing and any necessary approvals obtained.

The fill batters will be of modest height and may be planted with suitable low-growing species.

6.6 Groundwater and Stormwater

Description
Groundwater flow paths may be identified during detailed site investigations for Whakamaru North Substation development. During earthworks and construction, site stormwater will concentrate on exposed areas.

Potential Effects
Groundwater patterns may be modified by site excavation and consolidation, and any erosion on site or closer to the river would need to be addressed. This may be a beneficial effect, avoiding long-term potential for localised collapse of the land surface. Stormwater from the exposed construction areas may carry sediment to the nearby Waikato River, or affect onsite pasture.

Mitigation Measures
As part of a site construction plan, stormwater runoff will be addressed. This is most likely to involve construction and management of sediment retention ponds so that any stormwater reaching the river meets Regional Plan standards.

6.7 Existing Utilities

There are no existing utilities in the vicinity of the Whakamaru North Substation that could be affected by the construction stage. There may however be risks with regard to other utilities associated with Earth Potential Rise, which are discussed in section 7.3 of this report.

It is most unlikely that existing utilities in the vicinity of the Whakamaru Substation will be disturbed. Further detailed work is required to determine this, which will be undertaken during the detailed design.

6.8 Construction Traffic and Access

Description
The substation's equipment items will, in the main, be manufactured overseas. The largest equipment items will be the 220/400kV transformers for the Whakamaru North Substation, estimated to have a transportation weight of approximately 250 tonnes each. A special "beam set" transporter will be required for moving the transformers from the port of importation (likely to be Auckland) to the site. Other equipment including the various 400kV and 220kV plant may involve large and heavy loads.

Transportation of the transformers will be a major logistical exercise, as described in the report in section 17 of Part X of this documentation and outlined below.

A new access is to be formed to State Highway 30 for the Whakamaru North Substation to provide a site access for construction as well as operation and maintenance, separate to the site entrance for the existing Whakamaru Substation which will continue to be used for existing purposes, and for the extension of that substation.

The construction process will involve numerous heavy vehicle trips to the site per day at times, particularly during removal of spoil, major concrete pours and delivery of equipment as well as regular trips of private workers' vehicles.

Potential Effects
Particular items of equipment will be very heavy and will be moved slowly from their port of arrival on designated routes over periods of several weeks. Bridge and road strengthening may be required and discussions were commenced with Transit NZ on this aspect. These trips will involve night-time movements and specific traffic management. Other transport will be able to be managed readily on State Highway 30, which has adequate capacity. The staging of the project has resulted in the need for transport of the very heavy loads being delayed for some considerable time. However, it is expected that a similar management regime will be required at the appropriate time in the future.

Mitigation Measures
A special plan will need to be developed to cover heavy equipment transport to the site in association with Transit NZ. Special permits for this transport will be needed.

The new access point will also need crossing place approval from Transit NZ. The access will achieve all access requirements in terms of the Taupo District Plan. Meeting these requirements will mitigate effects.

The access to the Whakamaru Substation is suitable for the additions to that substation. Management of access will ensure that the needs of the present users are not affected.

All construction traffic will be managed in accordance with a site construction management plan, and it is noted there is more than adequate space on site at each of the substations for parking and construction vehicles.

6.9 Social impacts

Description
During the main construction phases, there will be considerable additional activity in and around Whakamaru. The substation site is likely to involve a considerable and varying workforce. Details of the management of the project and the workforce will be the responsibility of the contractor.

Potential Effects
Whakamaru township and nearby Mangakino may host a number of additional workers during the construction period, and there may be additional business for local service businesses. Recognition of the relatively short duration of the main construction phases, and the need to source many of the workers from further afield (including other towns such as Tokoroa, Putararu and Tirau) should avoid any "boom-bust" effect on the local economy. Some local employment may be available in skilled and unskilled jobs.

The site area where the major construction will occur is at some distance from local dwellings, so any nuisance effects of the construction on the local community will be minimal. Construction of the extensions to the Whakamaru Substation is a smaller project and is likely to have more confined localised effects.

Mitigation Measures
It is not considered that mitigation of social effects during the construction period is required.

6.10 Summary of Mitigation Measures during Construction

Mitigation measures during construction will be largely within the scope of the construction management plan which will include provisions to minimise temporary adverse effects on people and the environment, including effects of dust, noise, traffic, and safety. Because of the location, social effects associated with the construction phase are considered to be very minor.

Section 2.5.2 lists the aspects which will be included in the construction management plan. A draft construction management plan can be provided to the Council for review at the time that an outline plan is provided. This plan will also cover any aspects of the proposal for which a Regional Council resource consent is required.

7. Assessment of Operational Effects

The operational effects of the extensions to the Whakamaru Substation are expected to be de minimis within the context of the operating substation and other generation and transmission facilities in the nearby area.

The operational effects of the proposed Whakamaru North Substation are anticipated to be very minor, due to the site location, its size, and existing electricity development in the vicinity.

Existing lines that cross the site also have existing effects which will be associated with the designated area, once the designation is in place, and there will be some minor additions to these.

7.1 Electric and magnetic fields

Description
As described in section 13 of Part II and section 12 of Part X of this documentation, electric and magnetic fields (EMF) are a component of the North Island Grid Upgrade Project, as they are an unavoidable part of all systems involving the transmission, transformation and use of electricity.

Potential Effects
At the Whakamaru North Substation, the overhead lines are brought to lower heights, and electricity will ultimately be transformed from 220kV to 400kV. Such areas and activities may involve higher EMF levels due to the range of equipment and connecting lines.

Mitigation Measures

The ICNIRP guidelines recommend a limit of 100 microtesla for magnetic flux density and 5kV/m for electric field strength respectively in areas accessible to the public. The guidelines have specific provisions relating to occupational exposure for those working at the substations.

Predicted EMF levels at the security fences of both substations meet the requirements of the ICNIRP guidelines for public access. The existing lines within the designated area meet these guidelines and the proposed lines will be designed to meet the guidelines. As explained in Part II, and in section 12 of Part X, health and safety is safeguarded by compliance with these guidelines.

7.2 Radio Frequency Interference

Description
Radio Frequency Interference (RFI) is the generation of unwanted radio signals that can interfere with the correct operation of electrical, electronic, mobile and wireless devices.

Potential Effects and Mitigation
The four potential sources of RFI from within substations are corona, disconnector operation, gap discharge and tracking.

Gap discharge and tracking are identified by their disturbance characteristic and are commonly attributed to incipient faults. Transpower's policy is to correct these events quickly before they can cause an equipment failure. Disconnector operation emissions cannot be corrected or prevented by design but they are irregular (few times per year) and short duration events (seconds only).

Corona discharge (corona) is the only source of continuous RFI emission and is the principal source of RFI in substations. Corona is only a significant issue on networks where the operating voltage exceeds 300kV and needs to be controlled by design. A 15kV/cm voltage gradient design generally limits the occurrence of corona even during damp weather conditions.

Mitigation Measures

The voltage gradients have been modelled within the preliminary design of the 400kV air insulated switchgear to be used at Whakamaru North Substation, and the results show that the preliminary busbar design will have voltage gradients of less than 15kV/cm.

NZS 6869:2004 sets out compliance criteria for RFI emissions from High Voltage Electrical Installations (HVEI) within New Zealand. NZS 6869 requires the RFI strength to be less than 62 dB/1 μV/m, 20 metres outside the security fence of 400kV substations.

Calculations for the proposed Whakamaru North Substation equipment indicate RFI will be below the NZS 6869 limits at 20 metres outside the security fence. The security fence will be well within the total area owned by Transpower and included within the Notice of Requirement.

The Whakamaru North Substation site boundary lies approximately 200 metres from the live conductors. As RFI attenuates with distance all RFI effects from the substation will be contained within the site.

Further mitigation is not considered necessary.

7.3 Earth Potential Rise (EPR)

For a detailed description of earth potential rise and its potential effects refer to Part II, section 14 of the Notices of Requirement documentation.

All substation components will be designed to comply with the requirements of regulations 58 and 60 of the NZ Electricity Regulations 2002, using the formulae and methods detailed in IEEE 80 (2000), "*IEEE Guide for safety in AC substation grounding*". The design procedure will follow established industry best practice and will ensure that step, touch, and transferred voltages are controlled to prevent any danger to the public.

7.3.1 EPR Effects on Other Utilities

Design work will be carried out as necessary to ensure compliance with the above regulations and industry recognised guidelines in relation to infrastructure services located in close proximity to high voltage overhead lines and underground cables within the Whakamaru substations.

Where specific circumstances require, Transpower will work with the utility owners to modify or improve conductive telecommunications, pipeline, or power utility services, in order to avoid any EPR issues. Any works would be designed and agreed upon between Transpower and the utility owner, to minimise any service or safety issues for customers.

7.4 Noise

Description

The existing Whakamaru Substation and lines in the designated area produce very little noise, as transformers are not part of the present substation, and the lines result in little noise.

The new Whakamaru North Substation will emit noise from transformers, and minor additional noise will be associated with the new lines within the site.

Potential Effects
The new transformers will be sources of noise and this noise has been modelled to assess its effects. The results of the modelling are given in the report in section 13 of Part X of this documentation. This shows that the Taupo District Plan standards of 40dBA_{Leq} (including an allowance for tonal penalty) are met at the site boundary at all times.

The new 400kV-capable line will be designed to meet noise levels of 40dBA_{L10} at a distance of 32.5 metres from the centre line for both the initial 220kV and final 400kV operational situations. It is likely that the existing 220kV lines on the site achieve similar noise levels. This means that noise from lines will meet the Taupo District Plan standards at most places on the designation boundary, except possibly for very short boundary lengths where the lines enter and leave the site. As most of the lines are already in existence, they have existing use rights in any case. The new 400kV – capable line will meet the requirement for almost all of the time (including all the time before it operates at 400kV).

Mitigation Measures
Effects are mitigated by choice of equipment, size of site, location of the substation, and location of plant within the substation layout.

It is proposed that the 40dBA_{Leq} level becomes the noise standard for the site for consistency with the overhead line, to be assessed at the designation boundary. The transformer noise will readily achieve this standard, including an allowance for tonal characteristics.

7.5 Safety and Security

Description
A substation site is a hazardous site due to the electrical and other equipment.

Potential Effects
Unauthorised entry and contact with substation equipment may result in serious injury or death.

Mitigation
The two substations will be enclosed by security fences approximately 2.5 to 3 metres tall. In addition, electronic security will ensure that access to the substations is only available to authorised and competent persons or persons under supervision.

Elsewhere on the site, towers and the gantry structures will be designed, protected, and provided with safety signage as for other overhead transmission line structures on farm land.

7.6 Visual

Description
The area which is already designated includes an existing substation which will be subject to minor expansion. The new substation with which it is linked will be approximately one kilometre to the northwest.

As can be seen from Figure 2, the likely visual appearance of the new substation will be typical of medium sized substations around New Zealand in terms of type of components, scale and spacing density of the components. This is due to the range of equipment and the numerous overhead and ground-level connections between them, and to the remainder of the system.

Lighting for the Whakamaru North Substation will be designed to achieve an average level of 15 lux throughout the substation area in accordance with Transpower's Policy for Outdoor Switchyard Lighting (2003). However, these lights will only be on if night work is occurring, which is expected to be a very rare occurrence.

The new access to the Whakamaru North substation will be designed in accordance with Council and Transit requirements and will be planted to ensure it blends comfortably into the existing rural environment. It will also be planted to provide additional screening of the site.

Potential Effects

The existing substation will change very little in visual terms as a result of its slight extension. The new equipment and possible retaining wall are to the rear of the site and away from public view.

The Whakamaru North Substation site already has five lines crossing it parallel to the State highway. All are closer to the road and therefore more visible than the proposed new substation and the lines associated with it.

The site location is reasonably distant from the road and is partly screened by existing vegetation. The new access will open up the area, but neither the access, the substation, the towers and gantry supporting the new overhead line, or the structures supporting the new tie line between the substations will have a visual effect that is significant. This assessment takes into account the context of use and development in the general area which has resulted in a considerable amount of other electricity infrastructure which has been in place for a number of years.

Night lighting will be confined to the substation areas only and designed to avoid glare and not to exceed reasonable levels at the site boundary. Its use will be limited to the rare occurrences when night work is occurring on site.

Mitigation
Mitigation will be provided by maintaining or planting new vegetation along the State Highway 30 frontage, and additional planting at the new site entrance.

Other elements, such as lighting and onsite landscaping will be addressed during the outline plan process.

7.7 Hazardous Substances

Description
Substations utilise insulating oil in their transformers, circuit breakers and other transmission equipment. The Whakamaru North Substation site will contain approximately 625,000 litres, although initially only 375,000 litres, within this equipment.

Potential Effects
Oil escaping from the site could enter pasture, groundwater and surface water, resulting in site contamination.

Mitigation Measures
Transpower's policy document 'Oil Spill Management, TP:GS.54.01' will be observed in order to avoid, remedy or mitigate any adverse effects which may occur in the unlikely event of an accident occurring. This document provides design guidelines, including requirements for bunding and requires the preparation of an oil spill management and contingency plan.

The likelihood of leakage or spillage is considered to be low as the equipment is sealed or self contained; however, the transformers will be bunded. Any oil and/or stormwater within the bunded areas will be contained and will pass through an oil interceptor before being discharged to ground soakage. The bunded areas and drainage will be regularly inspected, and any oil found will be removed and disposed of in compliance with the above document.

7.8 Greenhouse Gas Effects

Description
Sulphur hexafluoride (SF_6) is an inert, non-flammable, non-toxic, odourless and colourless gas that is five times heavier than air. The global warming potential (GWP) of SF_6 is extremely high. It is a synthetic gas and is exceptionally stable once released into the atmosphere. SF_6 has excellent insulating properties which makes it the preferred insulator for high voltage equipment among the electrical supply industry.

At the Whakamaru North Substation, SF_6 will be used in circuit-breakers (20 kg per current breaker for the 220kV substation equipment, and 60kg per circuit breaker for the 400kV equipment, or 520 kg in total). SF_6 is subject to some leakage even from the best-maintained equipment, and may lose up to 0.5% per annum (manufacturers guarantee) but more likely only 0.1 to 0.2% per annum. This also applies to the two new 220kV circuit breakers to be installed at the Whakamaru Substation.

Potential Effects
To recognise the high GWP of SF_6, a MOU has been signed between Transpower, other SF_6 users and the government. This provides an appropriate mechanism for monitoring SF_6 use nationally and ensuring that emissions are minimised, without placing undue costs or restrictions on the electricity supply industry.

The proposed use of SF_6 will comply with all requirements of the MOU.

Mitigation
A slight loss of SF_6 is an unavoidable effect from switchgear. It is dealt with at national policy level through the MOU, and implemented through a rigorous monitoring and maintenance programme.

7.9 Stormwater and Wastewater

Description
The sealed area of the substations will result in stormwater runoff.

New ablution facilities will be required at the Whakamaru North Substation site for visiting staff and contractors. These will be very low-use. Similar facilities exist at the Whakamaru Substation.

Potential Effects
Effects of these activities are anticipated to be very minor, given the relatively small scale of stormwater and wastewater involved on a site of this size, and the pastoral use of the surrounding land. Nevertheless, both stormwater and wastewater require management and will be addressed during detailed design.

Mitigation
It is expected that stormwater would be collected and passed through interceptors prior to disposal into properly constructed soak pits.

An on-site septic tank or other acceptable system will be provided for wastewater, with discharge meeting the Environment Waikato's permitted activity discharge standards in its proposed Regional Plan.

Design for long-term stormwater management will be part of the outline plan submitted to Taupo District Council prior to commencement of work.

7.10 Social Impacts

Description
Social impacts can arise from changes to the environment which affect a community or individuals.

Potential Effects

There will be no social impacts arising from the relatively minor extension to the Whakamaru Substation.

The proposed Whakamaru North Substation involves land which is owned by Transpower, for a project and work which is largely sited at some distance from local residents. The land which is not directly used for the substation will continue to be used for pastoral farming and other existing rural purposes, including the land below the overhead transmission lines. In addition, there is a longstanding history of the land in the immediate vicinity being associated with electricity infrastructure, and there appear to be no adverse social effects associated with such activities in this area.

There is not anticipated to be any adverse social impact from the operational stage of the project.

Mitigation Measures
No mitigation measures are considered necessary.

7.11 Summary of Mitigation Measures

Mitigation of the potential effects associated with the designation of the Whakamaru and Whakamaru North Substation is achieved through the general choice of the Whakamaru area, and the specific choice of site for the Whakamaru North Substation (which is a new facility) to the north of the Whakamaru area. This site is in an area already affected by transmission facilities and is part of the area investigated for the overhead line. The site is sufficiently large that most effects (other than visual and construction traffic) are readily contained within it. Visual impacts are moderated by the working rural character of the area, the transmission facilities already crossing the site, and the proposal to undertake site planting around the new entrance and further boundary screening.

Mitigation through the construction phase at both substations is provided for through contract specifications which will include a range of requirements including a construction management plan. This will address and seek to avoid or minimise construction noise, dust, sediment, traffic and any community effects. These are temporary, but potentially significant effects if not well-managed.

Long-term potential effects relating to hazards such as oil storage and SF_6 release involve appropriate maintenance and best practice in compliance with Transpower's existing standards and policies. Any potential effect of EPR will be addressed through ongoing investigations and negotiations as design proceeds, and any necessary solutions will be incorporated into final designs.

Any long-term adverse effects of the use and maintenance of the Whakamaru and Whakamaru North Substation are minor and no specific ongoing mitigation is required beyond that which is an integral part of the project design and operation.

8. Other Effects

The Whakamaru and Whakamaru North Substation designation will have the following additional effects.

8.1 Cumulative Effects

The Whakamaru area, including the immediate vicinity of the Whakamaru Substation and the site proposed for the Whakamaru North Substation, is already considerably modified and visually affected by the presence of electricity generation and transmission facilities.

The proposed new substation within the designated area will extend these effects further along the river (although this will not be visible from the river, or particularly obvious from the road). Any cumulative effects on amenity values in the area are considered to be marginal, given the wider context.

The separation between the two substations is achieved across land already affected by existing overhead lines, and ensures that other potential effects such as stormwater and traffic, do not become cumulative effects.

8.2 Positive Effects

The positive effects of the designation are part of those that relate to the whole of the North Island Grid Upgrade Project in terms of ensuring adequate delivery of electricity to the upper part of the North Island.

The Whakamaru and Whakamaru North Substation are both essential components of the enhanced capability of the 220kV system in the shorter to medium term. In the longer term (into the 2030s) the Whakamaru North Substation has a specific role in the transformation of electricity into appropriate voltage for transmission between the 400kV and 220kV transmission systems. As described in Part II of the Notices of Requirement documentation, the North Island Grid Upgrade Project is a nationally significant project and will have a range of benefits and positive effects for both the regional and national economy and, as a consequence, for the social and economic well being of the country.

In addition, the project will provide local jobs on a temporary basis and provide stimulus to the local economy through the purchase of goods and services during the various construction stages.

9. Consultation

The possibility of a new substation at Whakamaru North has been the subject of consultation processes as part of the 400kV overhead lines section of the Original Proposal.[5] The staged development which is part of the Amended Proposal also involves changes at the Whakamaru Substation. This area is within the original site chosen for the new substation and was also the subject of early consultation.

Three information days were held in the vicinity of Whakamaru and Mangakino between November 2004 and September 2005. These demonstrated relatively little concern, other than from residents immediately adjacent to the original site who expressed concern about noise and potential visual impacts. These concerns related to development of a 400kV substation immediately adjacent to the existing substation, whereas the proposed additions in this area are considerably more modest and do not include transformers. The shift in location of the preferred site for the proposed new substation part-way through the consultation process resolved those concerns and the new site has also caused little apparent concern. Residents have however wished to be assured that noise levels will be reasonable and all that the tall vegetation along the State highway will be maintained. A reasonable noise limit is proposed as a condition on the designation as set out in section 13 of this report, and it is intended that vegetation along the Sate highway be retained as far as practicable, and new plantings take place as part of the development of the new access, and be incorporated in the outline plan.

Consultation with iwi for this site has taken place through the Raukawa Trust Board, and no specific issues have been identified.

Transpower has formally approached Mighty River Power identifying and signalling its intent to designate a strip of land they administer, and invited comment, following up with phone calls to discuss. Mighty River Power have not advised of any issues or concerns.

Stakeholders such as Transit New Zealand have also been kept informed as investigations have proceeded.

[5] Details are given in section 2, Part VIII of the Notices of Requirement documentation.

10. Section 171(1) of the RMA

Section 171(1) of the RMA requires particular regard to be had to a number of matters when considering a notice of requirement, submissions received, and the effects on the environment of allowing the requirement. These considerations are subject to Part 2 of the RMA, which sets out the RMA's purpose and principles. A commentary on the section 171 matters is set out below.

It is noted that part of the total area subject to the Notice of Requirement (approximately 2.5 hectares) is already included as a designation in the Taupo District Plan. This area will be subject to a change of designated name and a clarification of purpose. It will also become subject to the restrictions and conditions suggested in this report, whereas at present none apply. The existing designation will be withdrawn following the conclusion of this Notice of Requirement.

10.1 Relevant provisions of plans and policy statements

There are no relevant national policy statements. The relevant provisions of the Waikato Regional Policy Statement are set out in section 4 of Part X of the Notice of Requirement documentation, and it is considered that the proposal is consistent with the overall policy thrust of the Regional Policy Statement in relation to energy and the provision of infrastructure. This report provides an analysis of the proposal in terms relevant provisions of the proposed Taupo District Plan, with the conclusion that the Notice of Requirement for the Substation on the whole is generally consistent with the objectives and policies of the relevant parts of the proposed Plan.

10.2 Consideration of alternatives

It is arguable that Transpower is not required to consider alternatives in terms of section 171(1)(b) of the RMA as Transpower has an interest in the majority of the land required for the project which is sufficient for undertaking the work, and because it is considered that the work associated with the new substation is unlikely to have a significant adverse effect on the environment.

Regardless of whether Transpower is obliged to give adequate consideration to alternative sites, routes and methods by virtue of section 171(1)(b) of the RMA, for the reasons set out in section 4 of this report, it is considered that Transpower's consideration of alternative sites and methods has been adequate in the circumstances. Transpower has considered both location and substation alternatives in considerable detail and taking into account a range of relevant factors, including environmental effects.

10.3 Work and designation reasonably necessary to achieve objectives

This matter is addressed in section 1 of this report, with the conclusion that for a range of reasons, both the work and designation is reasonably necessary for achieving Transpower's objectives.

10.4 Other relevant matters

There are no other matters which are considered reasonably necessary to take into account in terms of the notice of requirement, other than to emphasise that while the separate components of the North Island Grid Upgrade Project are addressed in separate documents because of the legal requirements of the RMA, the entire project is an integrated one. The project cannot proceed without all necessary consents and approvals being obtained, and one part of the project will not proceed in isolation from another.

11. Part 2 of the RMA

The purpose and principles of the RMA are set out in Part 2 (sections 5, 6, 7 and 8) of the RMA. The notice of requirement is ultimately required to be consistent with Part 2 of the RMA.

Section 6 of the RMA identifies matters of national importance which must be recognised and provided for in achieving the purpose of the RMA. Section 6(a) - the preservation of the natural character of the coastal environment, wetlands, lakes and rivers is potentially relevant to this Notice of Requirement. It is considered that the site, while close to the Waikato River, does not have particularly high natural character values, and any effects on the natural character of the river and its margins is addressed by setting the substation site back well beyond the required setback area. It is considered that no issues are raised with regard to section 6(b) – the protection of outstanding natural features and landscapes from inappropriate subdivision, use and development, in that, the site and its surrounds have been assessed as not being outstanding, and are not identified in any regional or district planning documents as being so. The proposal is consistent with section 6(c) – the protection of areas of significant indigenous vegetation, as its locations avoids such areas and involves no removal of vegetation. The proposal does not impact on public access to the Waikato River in terms of section 6(d), and the choice of location away from any known archaeological or cultural heritage features ensures that section 6(e) is met. Sections 6(f) and (g) are not considered relevant.

The proposal is not inconsistent with other relevant matters in section 7 of the RMA to which particular regard must be had. The proposed archaeological protocol ensures consistency with sections 7(a) and (aa) kaitiakitanga and the ethic of stewardship. The ethic of stewardship is also relevant in terms of the approach to construction management, which will reduce liaison with the local community, and with the regional council in terms of any consent requirements. Section 7(b) refers to the efficient use and development of natural and physical resources. The Whakamaru and Whakamaru North Substation designation and the transmission infrastructure it encompasses forms an integral part of the transmission link between Whakamaru and Otahuhu and it is Transpower's objective that the link is safe, efficient and consistent with grid reliability standards. In addition, the location of the new substation in close proximity to the existing substation and generation infrastructure is considered to contribute to an efficient use of the land and existing physical resources in the vicinity. The inclusion of both substations within a single designation provides for efficiency in terms of administration.

The efficiency of the end use of energy in section 7(ba) is not considered particularly relevant, as the substation, while part of a transmission project that has reduced transmission losses compared to other alternative technologies, and which facilitates the effective and efficient transmission of energy from more distant renewable resources, is not in itself an end user of energy.

Due to careful site selection, the nature of the existing environment, and the proposed mitigation measures, it is considered that amenity values and the quality of the environment in the area will be maintained, consistent with sections 7(c) and (f). Section 7(d), the recognition of the intrinsic value of ecosystems is respected, as no ecosystems are to be adversely affected. Section 7(g) is not considered relevant, as there are no issues in terms of finite resources. Although the substation site is close to the Waikato river which is a recognised trout spawning and fishing river, in terms of section 7(h) there will be no effect on the trout habitat.

The effects of climate change (including the potential for higher temperatures and increased storminess) will be integrated into the design of the substation, thereby addressing section 7(I). Finally, in terms of section 7(j) the North Island Grid Upgrade Project will provide for the efficient transfer of renewable energy and will support generation in more remote areas, thereby contributing to the benefits to be derived from the use and development of renewable energy.

Section 8 requires the principles of the Treaty of Waitangi to be taken into account in decision making under the RMA. Known sites of significance to Maori have been avoided through careful site selection and a protocol for accidental discovery of archaeological remains is proposed. Transpower has also engaged in consultation with tangata whenua, such that it is considered that the requirements of section 8 of the RMA have been met.

Section 5 of the RMA states that the purpose of the RMA is to promote the sustainable management of natural and physical resources. The works proposed to be undertaken within the area of the Whakamaru and Whakamaru North Substation designation are part of a project of national significance, both in terms of its breadth and the critical role that secure electricity transmission plays in the day to day life of New Zealanders and the functioning of the New Zealand economy. It is considered that the project will promote the sustainable management of natural and physical resources in a way that enables people and communities to provide for their social, economic and cultural wellbeing and for their health and safety. The new transmission link and associated facilities, of which the upgrade at the Whakamaru Substation and the new Whakamaru North Substation are part, will sustain the potential of natural and physical resources to meet the reasonably foreseeable electricity supply and social and economic needs of future generations in the central and northern part of the North Island, and will not affect the life-supporting capacity of air, water, soil and ecosystems. Finally, the environmental effects of the proposal will be avoided, remedied and mitigated to appropriate levels in a practicable and responsible manner. Accordingly, it is considered that the proposal is consistent with the promotion of sustainable management under the RMA.

12. Conclusion

The proposed designation for the Whakamaru and Whakamaru North Substation as part of the North Island Grid Upgrade Project involves the use of areas of largely rural land adjacent to the existing Whakamaru Substation which are mostly owned by Transpower. The site for the new substation is already affected by five overhead lines which are to be incorporated in the designation. The land is largely in pastoral and other agricultural use and contains an existing dwelling and large shed. This type of activity and use will continue on the land in accordance with the underlying zoning.

While changes within the proposed extended designated area at the existing substation are relatively modest, much of the designation relates to land to the north. Here the proposed substation designation will bring substantial changes in the area where the new substation is proposed. However, because of the location, the

distance from the road and nearest dwellings, the set backs from the river, the existing planting, and the extensive electricity development and forestry landuse in the wider area, any long term effects of development of the two substations are considered to be minor. During the construction stage there are potential effects which will need to be carefully managed to ensure that their impact is minimised. These include the transport of heavy equipment on the national and regional road network and environmental aspects of earthworks, transport and on-site construction.

The existing transmission lines and proposed new tower and gantry associated with the new overhead line, and the tie-lines between the two substations have effects which are either existing or which will be mitigated by the presence of the existing lines and other electricity generation and transmission facilities in the area.

13. Suggested Restrictions and Conditions

Proposed restrictions and indicative subject matter for conditions are proposed for the Whakamaru and Whakamaru North Substation in this Notice of Requirement. Transpower would seek to progressively develop the precise wording of any specific conditions in consultation with the Council during the processing of this Notice of Requirement.

13.1 Proposed restrictions

Height:

- Maximum height of new overhead tower on site (tower 429) 58 metres.
- Maximum height of security fence, 3.5 metres.

Noise levels:

- Compliance with NZS 6803:1999 Acoustics – Construction Noise, for the construction stage.
- Not to exceed 40 dBA L_{eq} at any time at the designation boundary, for the operational stage.

Electromagnetic fields:

- Electric and magnetic fields – compliance with ICNIRP Guidelines.

Radio frequency emissions:

- Radio frequency emissions – compliance with NZS 6869:2004 Limits and Measurement Methods of Electromagnetic Noise from AC Power Systems.

Earth Potential Rise

- Compliance with regulations 58 and 60 of the NZ Electricity Regulations 2002.

Vibration

- Compliance with German Standard DIN 4150.

Hazardous Substances

- Compliance with Transpower's Oil Spill Management Policy (TP GS.54.01).

13.2 Other proposed conditions

- A construction management plan to be provided as part of the outline plans for the successive stages of the project, as discussed in this document.
- An accidental discovery protocol for archaeological and cultural sites.
- Amenity planting to be provided in the vicinity of the new access of State Highway 30.