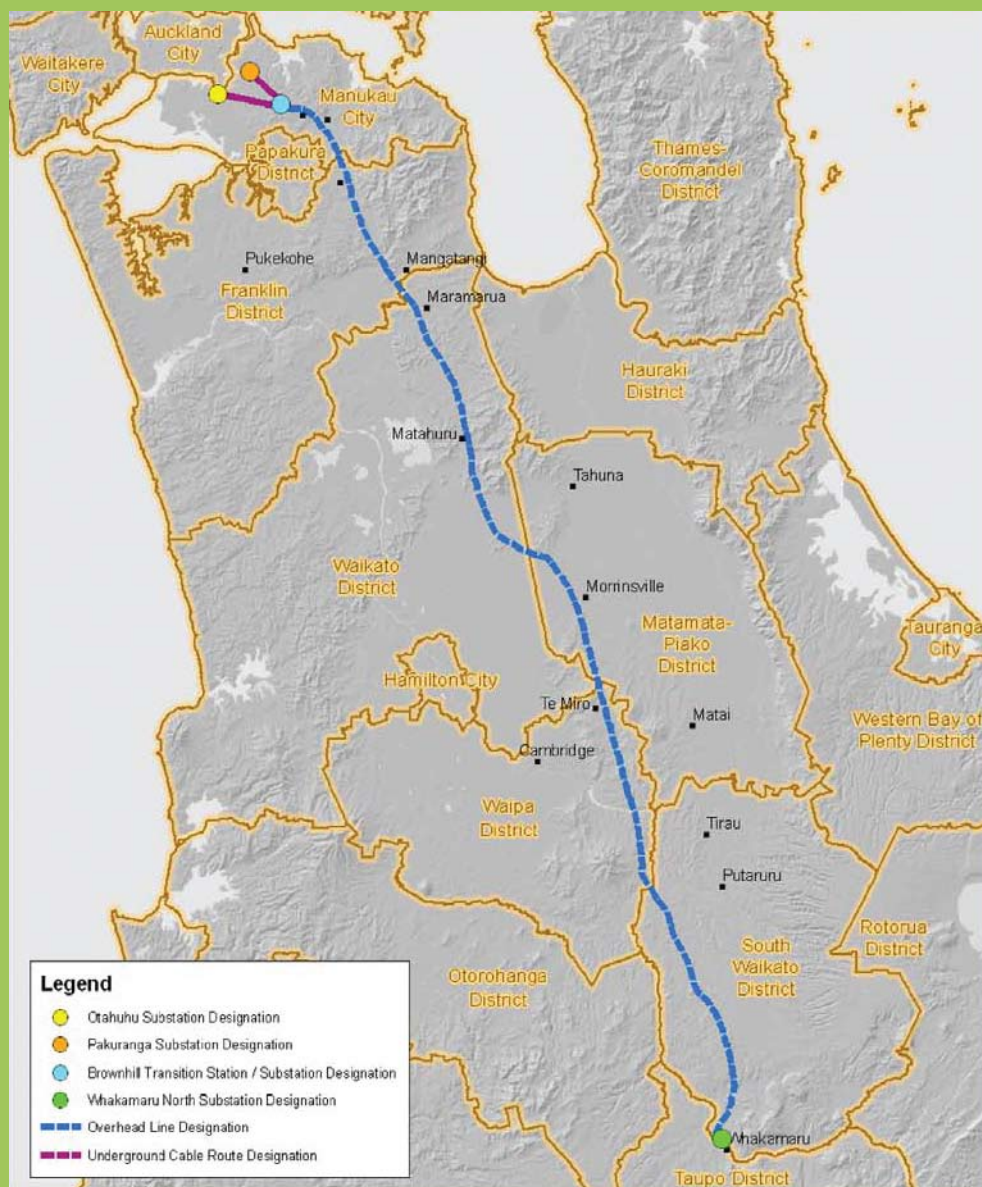


Transpower New Zealand Ltd North Island Grid Upgrade Project

Notices of Requirement Documentation

Part III



PART III

INFORMATION, DESCRIPTION AND ASSESSMENT OF EFFECTS ON THE ENVIRONMENT

PAKURANGA SUBSTATION

Transpower NZ Ltd

North Island Grid Upgrade Project

Pakuranga Substation

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1. Introduction

1.1 Purpose of this document

This report has been prepared to support Transpower's Notice of Requirement to Manukau City Council (MCC) to designate the Pakuranga Substation site. The designation is required to provide for the installation of new 220kV equipment at the Pakuranga Substation and for the continued operation, maintenance and upgrading of the existing Pakuranga Substation. These works are part of the North Island Grid Upgrade Project involving the construction of a new transmission line between Whakamaru, north of Taupo, via a new substation/transition station at Brownhill Road to Otahuhu and Pakuranga Substations in Manukau City.

This report has been prepared in accordance with section 168 of the Resource Management Act 1991 (RMA). It includes a description of the existing Pakuranga Substation and the works associated with the proposed upgrade. It describes the existing environment and the changes to the environment that will result from the proposed substation works. It also includes measures to avoid remedy or mitigate adverse effects on the environment and an evaluation of alternatives.

The Notice of Requirement does not include an outline plan. This will be prepared and submitted to MCC once detailed designs have been completed and prior to commencement of construction.

1.2 Transpower's objectives

In considering and responding to a Notice of Requirement, particular regard must be had to:

"Whether the designation is reasonably necessary for achieving the objectives of the ... project or work for which the designation is sought" (section 171(3)(c) RMA).

Transpower's common objective for the project is as follows:

"To ensure the continued security and certainty of electricity supply to 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."

It is considered that the Upgrade Project as a whole, and its component parts are all necessary parts of achieving this objective in the context of the national grid. Therefore the above common objective applies to all components of the Notice of Requirement. However, as the different components of the project have different characteristics there are also specific objectives for each, as set out below:

The specific objectives for the Notice of Requirement for the Pakuranga Substation are as follows:

“To provide for the development, expansion and operation of a secure facility which enables the transformation and transmission of electricity within the Auckland region and beyond.

To enable operational flexibility of the facility to meet growing demand for electricity and requirements for security and diversity 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:

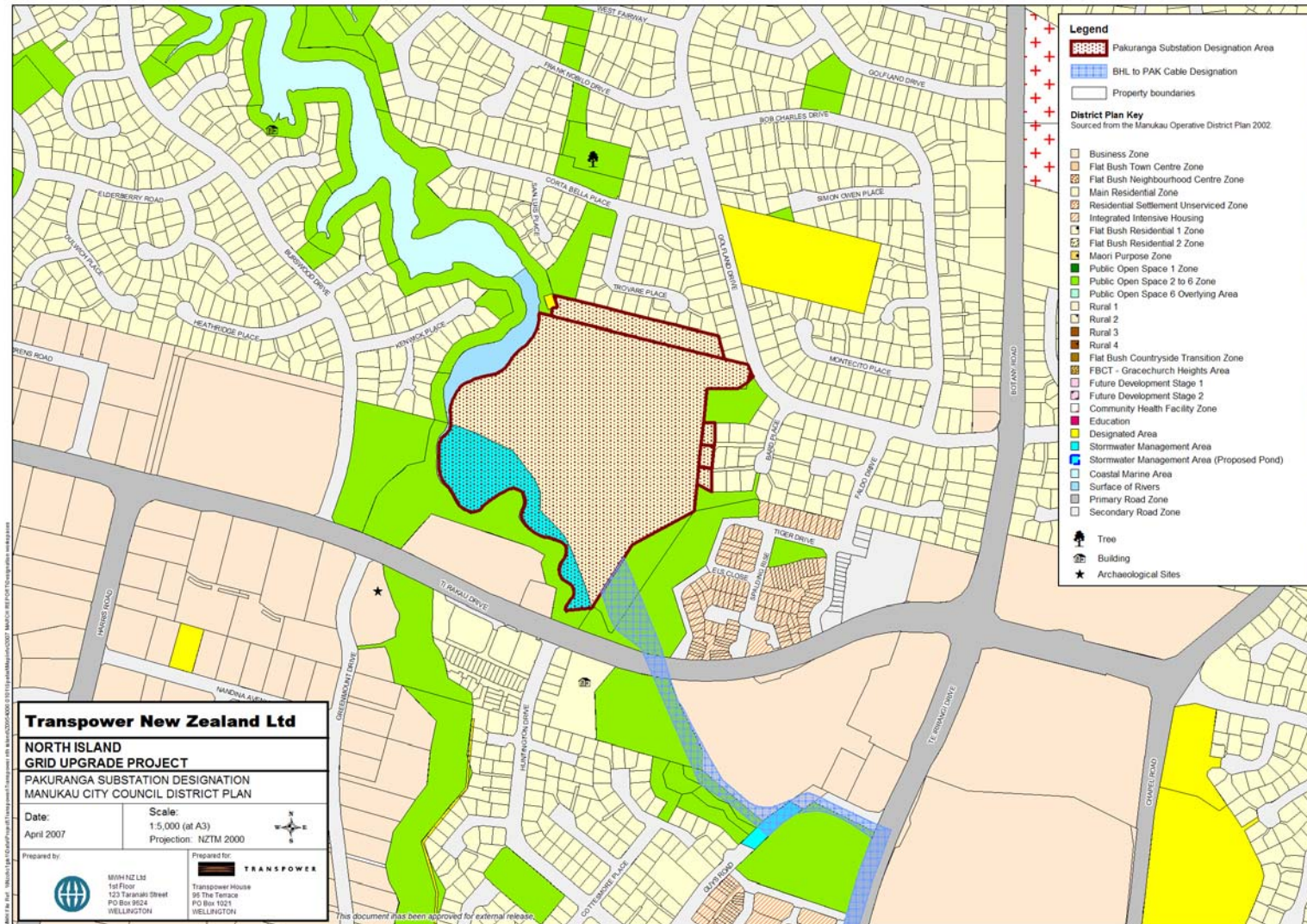
- The substation, being one of the two northern termination points, forms an integral part of the Grid Upgrade Project and cannot be considered in isolation from the remainder of the project, thereby meeting the common objective;
- A new 220kV substation is reasonably necessary to enable transmission of electricity into and north of Auckland, and is also considered necessary to deal with growing electricity demand in Auckland and beyond;
- The new substation equipment at Pakuranga is considered reasonably necessary to ensure security and diversity of electricity supply as it will provide an alternative termination point for the Grid Upgrade project in South Auckland;
- 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 in an integrated manner;
- The use of the designation technique allows for operational flexibility and certainty with regard to future activities on the site, which its current legal status and other RMA mechanisms would not provide; and
- The size and scope of the designation will provide sufficient land and separation distances from adjoining activities to enable adverse construction and operational effects to be avoided or mitigated.

2. Project description

2.1 Introduction

Part of the North Island Grid Upgrade Project involves the redevelopment of the Pakuranga Substation from 110kV equipment to 220kV equipment. To provide for these new works, associated changes to the existing substation and its ongoing operation, maintenance and future upgrades, Transpower is proposing to designate the whole site which is already in Transpower's ownership. Figure 1 shows the extent of the land to be designated.

Figure 1 Pakuranga Substation Designation



The existing Pakuranga Substation is located on the eastern edge of the suburb of Pakuranga in Manukau City and adjacent to Ti Rakau Drive to the south and Golfland Drive to the north east. It occupies a site of approximately 12.5 hectares, all of which is owned by Transpower.

The site slopes at the western and southern margins towards the Pakuranga Creek. The creek forms the legal boundary on these extremities. Riparian vegetation lines the creek and mainly consists of toetoe, mangrove, bracken, manuka/kanuka and exotic weed species. Due to the contour of the land and the low level planting, the southern side of the property facing Ti Rakau Drive receives little screening. Residential properties adjoin the site on the northern and eastern boundaries. These properties are well screened by bunding and planting.

The Botany Downs Town Centre is located about 500 metres southeast of the site. It is the focal point for eastern Manukau and is located at the intersection of two major arterial roads (Te Irirangi Drive and Ti Rakau Drive) that connect central Auckland with Manukau City. The centre attracts people from all over the Greater Auckland Area.

Botany Downs is a rapidly growing area that is identified as an intensive node in the Auckland Regional Growth Strategy.

Figure 2 shows the location of the Pakuranga Substation.

Figure 2: Locality Map



2.2 Existing substation

The existing Pakuranga 110kV Substation is located on the eastern edge of the suburb of Pakuranga in Manukau City on Golfland Drive, which is accessed off Te Irirangi Drive /Botany Road. The land for the existing Substation was acquired in 1971. The total area of the site comprises approximately 12.5 hectares. Nearby land uses include residential properties, a bus depot, the Botany Downs Town Centre, a large business/light industrial area, substantial roading infrastructure, and open space around the tidal estuary of the Pakuranga Creek.

The primary purpose of a substation is to connect two or more transmission lines together and change the power from one voltage to another e.g. 220kV to 110kV, 220kV to 33kV, etc. The main components are circuit breakers (to switch lines and transformers into and out of service), power transformers, and busbars (to connect the components together). Buildings are required to accommodate the electrical control and protection equipment (for the busbars, circuit breakers and transformers) and substation auxiliary systems (power supplies, metering, communications, etc).

The existing Pakuranga 110kV Substation is a power supply point for the local distribution utility, Vector. The Pakuranga Substation has existing 110kV connections to Penrose Substation to the north, Otahuhu Substation to the southwest and Arapuni Power Station to the south. The overall capacity of the Pakuranga Substation is restricted by the low current rating of the existing Arapuni to Pakuranga lines, and is therefore not presently considered as being a major transmission circuit.

The existing Pakuranga Substation comprises:

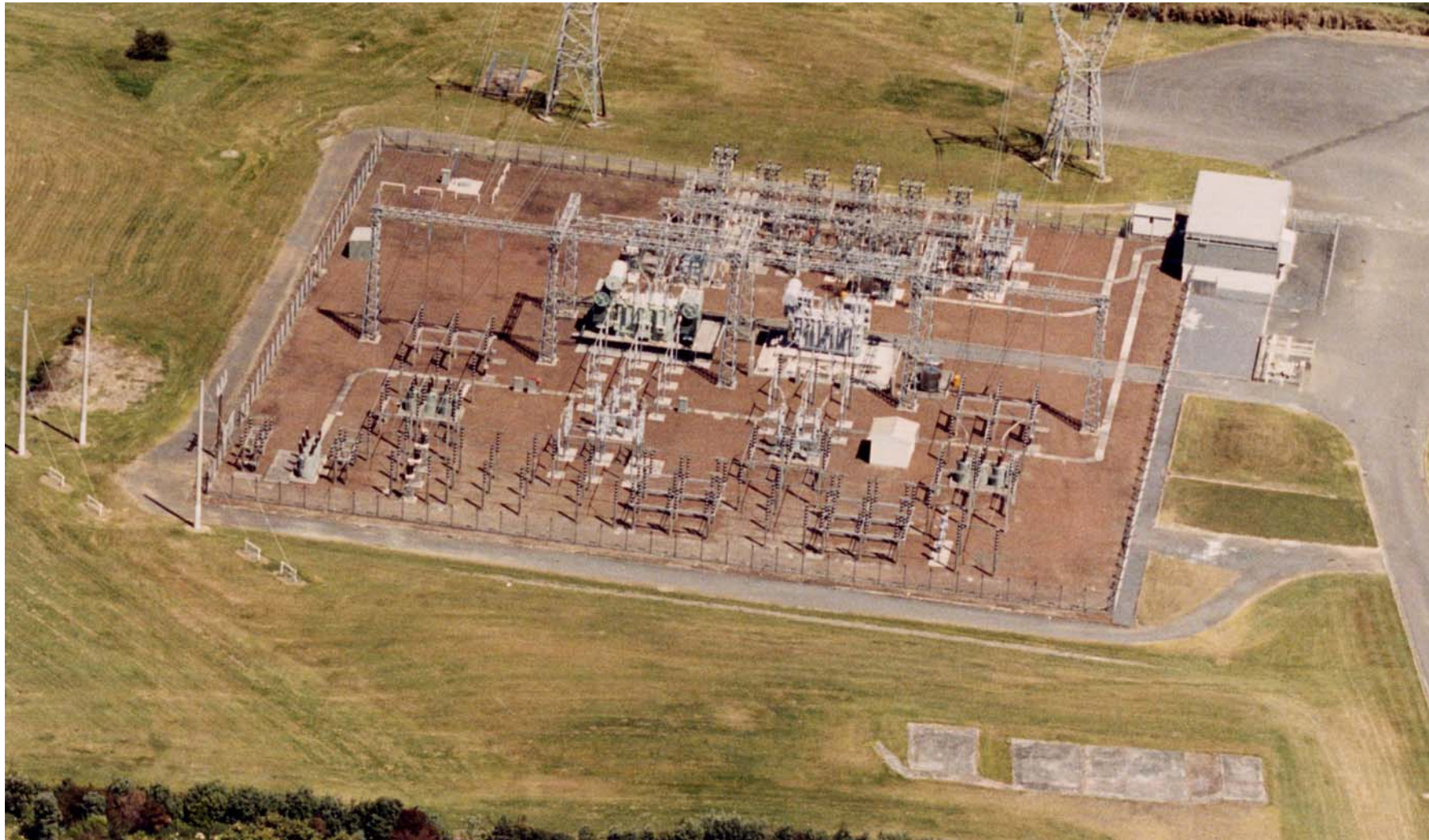
- A combined 110kV and 33kV outdoor switchyard of less than one hectare
- Transformer oil containment facilities
- 110kV overhead transmission lines
- An 18 x 10 x 6.5 metre high control and relay building
- 33kV ripple control plant and associated building (these assets are owned by Vector)
- Access road onto Golfland Drive
- Underground 33kV cables (these assets are owned by Vector)
- Planting, bunding and security fences

The security fences are all located well inside the legal boundary of the substation property. The existing switchyard includes circuit breakers and associated switchgear and instrument transformers, power transformers, support structures for terminating incoming lines, overhead buswork and a security fence.

Existing onsite facilities provide for the management and discharge of stormwater and the containment of oil in the event of a spill.

Figure 3 is an aerial photograph viewed from the north east showing the existing activities (including the location of existing lines and towers) comprising the existing Pakuranga Substation.

Figure 3: Existing Pakuranga Substation



2.3 Proposed substation works

It is proposed to develop the Pakuranga Substation by installing a new 220kV switchyard and decommissioning the existing 110kV switchyard.

The new 220kV equipment at Pakuranga will transform (i.e. change) the voltage of the power transferred from Whakamaru, via the new Brownhill Road substation/transition station, from 220kV down to 33kV as well as allowing for onward transmission at 220kV. The new 220kV switchyard will also connect to Otahuhu Substation and facilitate connection with Penrose Substation, strengthening Transpower's 220kV transmission network that supplies Auckland and Northland.

Air Insulated Switchgear (AIS) is the preferred option for the new Pakuranga 220kV Substation. AIS is the conventional design using outdoor equipment as seen in 97% of Transpower's substations.

A new 220kV AIS facility, will comprise switchgear located in the area abutting the south side of the existing 110kV switchyard. A new 33kV indoor switchboard will be located in a new building close to the existing control and relay building.

The substation will be rebuilt by approximately 2011. A new 220kV switchyard will allow for the removal of all the existing 110kV switchyard including 110/33kV transformers, outdoor 33kV switchgear, outdoor 110kV switchgear, oil containment facilities, security fences and access road.

The upgraded substation will include:

- Twelve 220kV circuit breakers and associated switchgear and instrument transformers. Buswork and gantries will be about 10 metres high;
- Three 220/33kV transformers;
- Approximately 20 metre high support structures for terminating incoming 220kV lines, overhead buswork and lightning protection shield wires or lightning poles;
- The existing control and relay building;
- A new 33kV switchgear building approximately 25 metres long by 6 metres wide and less than 5 m high; and
- New oil containment facilities (e.g. bunding associated with the transformers and a new oil interceptor system).

The footprint of the AIS 220kV substation will be approximately 110 metres by 155 metres, but the electrical equipment initially installed may only utilise an area of about 80 metres by 130 metres.

The tallest items of plant (excluding the existing transmission line towers) will be the approximately 20 metre high lightning pole structures.

The existing Otahuhu-Pakuranga 110 kV line termination tower is constructed for 220 kV operation but may require modification, subject to detailed design, to allow termination on to the new 220 kV switchyard gantries.

The existing Pakuranga-Penrose 110kV circuits will require modification to operate at 220kV once the new substation has been commissioned. This is likely to require some line works and/or the installation of new underground cables, with small equipment changes within the substation site itself.

The existing Arapuni-Pakuranga 110kV line will be decommissioned and the associated poles located on the site will be removed. The new Brownhill-Pakuranga 220kV circuits from the south will be via underground cables, with small changes required within the substation site itself.

Figure 4 is an indicative plan showing the proposed AIS Pakuranga Substation developments. It should be noted that this plan is indicative only and actual locations of existing and proposed equipment may vary. Some of the existing lines coming into the substation may remain in the future, but are not shown on this isometric. The final form of such development will be subject to an outline plan process.

2.4 Construction methodology

It is proposed that a new 220kV AIS substation be constructed at Pakuranga using conventional separate design contract and construction contracts. This is the normal method used by Transpower which is well established.

The construction period at the Pakuranga Substation site is anticipated to be approximately 18 months.

All affected underground services will be relocated and commissioned where required prior to the civil works being started.

Site levelling and earthworks will take place prior to the construction of the foundations for the substation equipment items. The substation equipment items will, in the main, be manufactured overseas. The largest equipment items will be the 220/33kV supply transformers. Each transformer has an estimated transportation weight of approximately 100 tonnes.

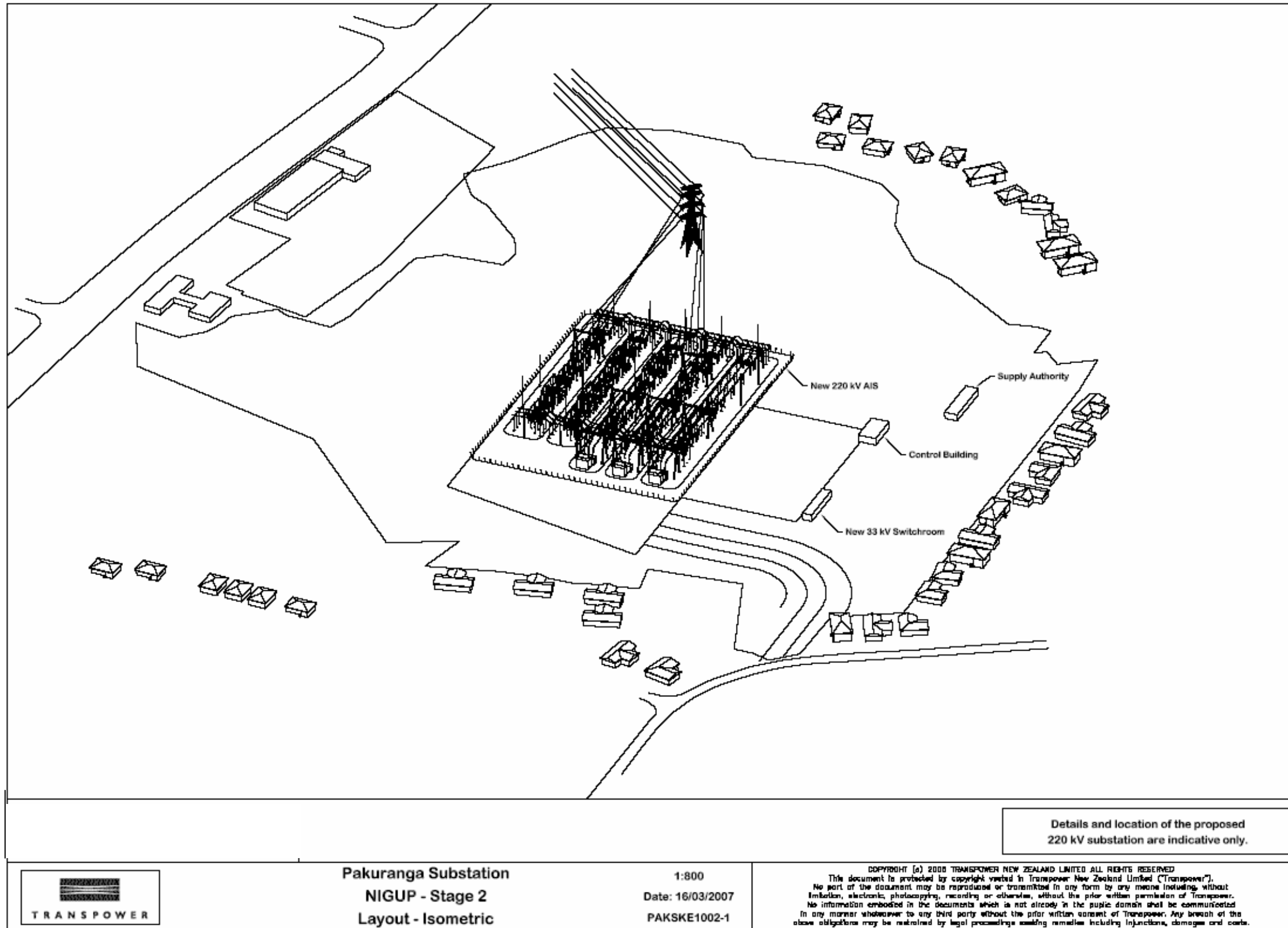
Following the installation of the substation equipment items on to their foundations and completion of electrical connections, the new equipment will be progressively commissioned.

It is anticipated that all construction activities including the storage of plant, materials and equipment will be accommodated within the substation site.

All construction vehicles will access the site via the existing access from Golfland Drive.

Construction effects are assessed in Section 6 of this report.

Figure 4: Likely Future Development at the Pakuranga Substation



2.5 Construction management

Mitigation of most construction impacts will be achieved through a Construction Management Plan, which will be submitted to MCC at the outline plan stage.

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

Construction Management Plans will be implemented by the contractor and will address such matters as:

- Storage and reuse of top soil
- On and off site disposal of spoil
- Silt and dust control during site levelling and earthwork stages
- Traffic management for road movement of the 220/33kV transformers from the Ports of Auckland to the site
- Temporary equipment storage on site in specified areas
- Contractor car parking on the site in specified areas
- Site security and lighting during construction
- Contaminated land management procedures
- Handling of insulation oil
- Construction noise and vibration
- Hours of work
- Community information and liaison

The Contractor will be required to comply with all designation and resource consent conditions relevant to the scope of work.

2.6 Operational requirements

2.6.1 Access

Following construction, the ongoing operation and maintenance of the Pakuranga Substation will involve minimal traffic movements as the substation will not be permanently staffed. Vehicle parking for the ongoing operation and maintenance of the substation can be accommodated on site.

The existing access from Golfland Drive will continue to be used.

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 can vary from every four years to every 10 years. Non routine maintenance is carried out to rectify minor repairs. This is normally scheduled to be carried out in conjunction with routine (scheduled) maintenance but, in cases of emergency, this may not be practical.

3. Statutory context

3.1 Introduction

The statutory context of the RMA is set out in Part II of the documentation for the Notices of Requirement. It includes consideration of the relevant sections of the RMA, Transpower's objectives for the Project and an explanation of the need for the Project.

3.2 Relevant planning instruments

The Manukau District Plan (MDP), operative 2002, is the main planning instrument to be considered when assessing the Notice of Requirement for the designation for the Pakuranga Substation. The other relevant planning instrument to be considered is the Auckland Regional Policy Statement.

3.3 Auckland Regional Policy Statement

The Auckland Regional Policy Statement became operative in August 1999. It is a statement about managing the use, development and protection of the natural and physical resources of the Auckland Region. The key objectives and policies that are of relevance in assessing the Notice of Requirement are contained in Part X section 4.

It is considered that the proposal is generally in accordance with the objectives and policies in the Regional Policy Statement, the most relevant being those that relate to the provision of national and regional infrastructure, in the interest of the economic and social wellbeing of people and communities in the region.

3.4 Manukau District Plan

While it is intended to provide for the development, operation and maintenance of the existing and new substation facilities by way of the designation process, the provisions of the MDP provide useful guidelines in terms of anticipated environmental effects and outcomes when assessing the Notice of Requirement.

The existing Pakuranga Substation is not designated in the MDP and the site is zoned Main Residential Zone. This residential zoning does not reflect in any way the activity which has been established on the site since 1971.

As provision has not been made in the MDP for network utilities of such a character and scale, the Substation is reliant on existing use rights for its ongoing operation and maintenance.

The key provisions of the MDP that are considered relevant in considering the NOR are contained within Chapter 7 - Network Utility Services.

3.4.1 Network Utility Services

The Pakuranga Substation falls within the definition of “Network Utility Services” as these activities include “*distribution or transmission of electricity*”. Provisions in respect of Network Utility Services are contained in Chapter 7 of the MDP. These provisions apply on a district wide basis and override the provisions of individual zones.

Due to its scale, the existing Pakuranga Substation and proposed works would not comply with the rules for permitted, controlled or restricted discretionary activities. Therefore, the activities would fall under the categories in Rule 7.8.2.1 of:

“Buildings equipment or structure, or any mast, aerial, tower, pole, antenna or support structure for a network utility service throughout the City not being permitted or controlled or restricted discretionary activities”

or

“Any activity for Network Utility Services which cannot meet the Development and Performance Standards of Rule 7.9”,

and as such would be considered as a discretionary activity if resource consents were sought.

Chapter 7 of the MDP contains specific assessment criteria for Network Utility Services considered to be discretionary activities. These criteria are contained in Rule 7.14.1.2. The overarching assessment criterion is “*Effects on existing character of the locality and amenity values*”. The specific relevant criteria that under-pin this criterion are summarised as follows and cross referenced to the particular section of this report that addresses these matters.

- Effects on amenity values of any sensitive activities in the vicinity including residential neighbourhoods. (Sections 6.1, 6.2, 6.3, 6.4, 7.3, 7.4, 7.7, and 7.8 evaluate these effects).
- Effects on landforms, landscapes, or areas of visual or scenic worth which contribute to the amenity values of the City, particularly where these areas are located on the coast. (Sections 6.4, 7.7, and 7.8 evaluate these effects).
- Effects on native bush, bird or wildlife habitats. (Section 6.11 evaluates these effects).
- Effects on landforms or areas with scientific, cultural or archaeological value. (Section 6.10 evaluates these effects).
- Whether alternative technologies and design have been considered and included in the proposal, which would avoid, remedy or mitigate adverse effects on the environment. (Section 4 addresses alternative technologies).

- Effects on amenity values of properties from noise, dust and vibration. (Sections 6.1, 6.2, 6.3 and 7.3 and 7.4 evaluate these effects).
- Whether the proposed location of the Network Utility Service will improve the operational efficiency of the network utility service, and the extent or impacts of such effects. (Section 2 evaluates these effects).
- Any discharge of fumes, smoke or gases that cause a nuisance or effect amenity values. (Sections 7.9 and 7.10 evaluate these effects).
- Effects of dust in terms of nuisance and detraction from visual amenity values. (Section 6.3 evaluates these effects).
- Whether conditions are required to address adverse effects on health and safety. (Sections 7.1, 7.2 and 7.9 evaluate these effects).

The key objectives and policies contained in Chapter 7 of the MDP in respect of Network Utility Services that are relevant in considering the Notice of Requirement are contained in Part X, section 5. It is considered that the proposal is generally consistent with the policy framework for network utilities.

3.4.2 Main Residential Zone

The site is located within the Main Residential Zone in the operative MDP. The existing and historic land use of the site bears no relevance to the objectives policies or rules for this zone. The zone does however provide useful guidelines in terms of anticipated environmental effects and outcomes in the surrounding environment.

The Main Residential Zone allows for consolidation and intensification of residential development while ensuring the maintenance and enhancement of residential amenity values by way of development and performance standards. The zone applies to residential areas where there are no significant environmental constraints which suggest that intensified residential development should not occur.

A wide range of activities are permitted in the Main Residential Zone, subject to meeting performance standards and other criteria.

There are a number of General Development and Performance Standards that assist in determining the amenity values of the area and against which the effects of the substation activities can be assessed. A summary of the relevant standards is set out below along with a cross - reference to the section of this report that demonstrates the consistency of the proposed activities with these standards.

Height, Site Coverage, Density and Yards

To control the effects of residential development on the intensity of development, in keeping with the local environmental constraints of the Main Residential Zone, Rule 13.11.1.3 sets out the maximum height limit of 8 metres, site coverage of 35%, and density of 400m² per household or 300m² on 1000m² properties. There is also a height in relation to boundary provision that requires that buildings must be contained within a prescribed building envelope. The proposed structures are located well away from property boundaries and will not trigger this provision.

Rule 13.11.1.5 requires that activities in the Main Residential Zone provide a front yard with a minimum 6 metres, a rear yard of 1 metre, one side yard of 1 metre and one side yard of 2.4 metres. There is ample room within the Pakuranga substation site to accommodate these requirements.

Noise

To ensure that noise generated by activities in the Main Residential Zone does not cause significant nuisance, Rule 13.11.1.1 requires that activities comply with specified noise levels. Section 7.3 of this report sets out the noise levels and evaluates the noise effects of the existing and proposed substation activities.

Rule 13.11.1.1 refers to general noise requirements under 5.18.3. Section 5.18.3.6 requires that noise from construction work (including maintenance and demolition works) shall be measured, assessed and controlled in accordance with procedures and limits set out in NZS 6803:1999 being the New Zealand Standard for Acoustics – Construction Noise. Section 6.1 of this report proposes that compliance with this standard be adopted as a condition of the designation.

Hazardous Facilities and Substances

Rule 13.11.1.9.8 sets out the MDP's requirements in respect of Hazardous Substances. The Hazardous Facility Screening Procedure (HFSP) is a mechanism to ensure that hazardous facilities or activities are safely located, designed and built and also that they continue to operate safely throughout their life. An assessment has been done of the hazardous substances that will be stored on the Substation site.

The Quantity Ratios for the site have been calculated using the criteria for the Hazardous Facility Screening Procedure set out in the recently revised document "Land Use Planning for Hazardous Facilities" (Ministry for the Environment, 2005).

The Quantity Ratios (QR) so derived for the site are, for the three Effect Types, 0.139 (Fire/Explosion); 0.582 (Human Health); and 1.71 (Environment).

Comparison of these QR values with the Quantity Ratio ranges for the Main Residential Zone in the MDP shows that the activities involving hazardous substances at the site would fall within the category of a discretionary activity. This is because for the "Environment Effect Type", the Quantity Ratio total calculated using the HFSP criteria is greater than the 1.5 trigger threshold which the MDP stipulates.

Lighting

To minimise the impacts of light spill, especially in respect of residential areas, Rule 13.11.2 requires that all exterior lighting must be designed, located and at all times directed, screened, adjusted and maintained to meet specified standards. Section 7.4 of this report assesses the effects of light spill on the surrounding environment.

Traffic Generation

To ensure that traffic does not adversely impact on the amenity of residential streets, Rule 13.11.1.6 requires that non-residential activities shall not generate more than 200 vehicle trips per day, or more than 6 heavy vehicle trips per day within a residential local road.

Sections 5.7 and 6.9 assess effects on the roading network from the proposed development and from construction traffic. Any effects generated are likely to be during the construction phase and these will be mitigated by ensuring that heavy vehicles trips are in off peak hours.

The key objectives and policies contained in the MDP that are relevant in considering the Notice of Requirement are contained in Part X, section 5. The zoning of the site is somewhat of an anomaly, given the site's history of use and development, but it is considered that the proposal is consistent with the policy framework for network utilities, development and hazardous substances in the Plan.

3.5 Other legislation

3.5.1 Hauraki Gulf Marine Park Act

The Hauraki Gulf Marine Park Act 2000 created the Hauraki Gulf Marine Park and is also intended to achieve integrated management of the Gulf. The Hauraki Gulf and its catchments fall under the jurisdiction of a number of local authorities including Auckland Regional Council and Manukau City Council. The Act applies not just to the waters and islands of the Gulf, but also to its catchment.

Section 10 of the Hauraki Gulf Marine Park Act requires that for the coastal environment of the Hauraki Gulf, Sections 7 (Recognition of National Significance of the Hauraki Gulf) and 8 (Management of Hauraki Gulf) of the Act must be treated as a NZ Coastal Policy Statement issued under the Resource Management Act, and where there are any conflicts between the two, the NZ Coastal Policy Statement prevails.

Given the nature of the proposed works associated with the upgrade of the Pakuranga Substation and the mitigation measures proposed, it is considered that the Act has no particular relevance in terms of the designation.

3.5.2 New Zealand Coastal Policy Statement

The New Zealand Coastal Policy Statement (NZCPS) became operative in May 1994. It was prepared and issued by the Minister for Conservation. The purpose of the NZCPS is to promote the sustainable management of natural and physical resources in relation to the coastal environment of New Zealand.

It focuses on preservation of natural character, and the integrity and functioning of the coastal environment. The policy places a certain amount of emphasis on the avoidance of adverse effects and, where this is not practicable, the effects should be mitigated and/or provision made for remedying those effects.

Given that the Substation is located in a highly modified environment, on land that is zoned for residential development which has been used for substation purposes for many years, it is considered that the NZCPS has no particular relevance in terms of the designation.

3.6 Resource consents required

A preliminary analysis of the proposed activities indicates that the following resource consents may be needed from the Auckland Regional Council:

- Landuse consent for earthworks associated with foundation excavations, levelling of the substation site, undergrounding of cables and other excavations.
- Discharge permit to discharge contaminants to land from ancillary activities, such as the washing of vehicles, plant or machinery, drilling activities, dust suppression, concrete or asphalt laying or reworking, associated with the installation of the underground cable.

- A water permit for the diversion of groundwater (dewatering during trenching if required, to enable dry working conditions).
- Discharge permit to discharge contaminants to land from an industrial or trade process associated with the use of the site by a high risk activity (Electrical Substation > 5000m²).
- Discharge permit to discharge stormwater from a site with an impervious areas greater than 5000m².

It is intended to seek the necessary consents once design details have been finalised.

4. Alternatives considered

4.1 Introduction

As the demand for electricity is largely driven from within Auckland, the project seeks to ensure the continued security and certainty of electricity supply for Auckland, Northland, and parts of the Coromandel and Waikato. It is therefore essential for the new transmission link to terminate somewhere in Auckland. As such, a terminal station is required in Auckland or its close vicinity.

For security of supply the North Island Grid Upgrade Project proposes two termination points in Auckland, one at Pakuranga as detailed in this part of the Notice of Requirement documentation, and one at Otahuhu.

In terms of consideration of alternatives for a northern termination point, Transpower considered using existing substations, and also separately considered alternative equipment. These processes are summarised below.

4.2 Substation alternatives

Transpower, in its report entitled "Security of Supply into Auckland, Assessment of Alternative Solutions" dated October 2004,¹ considered a number of locations for the northern terminal stations for the 400kV transmission link. Key factors in these considerations were:

- System Security
- Technical Feasibility
- Economics
- Environmental Impact

A range of existing Transpower substation sites in Auckland including Otahuhu, Pakuranga and Penrose were considered for the northern terminal station. The new overhead transmission line was assumed to be connected to the terminal station by underground cables. At this stage Otahuhu was the preferred site based on the existing and committed transmission and generation investment in Auckland.

¹ See references in section 16 of Part II of this documentation.

The proposal to terminate the line at Otahuhu was suspended in late May 2006. Transpower then worked closely with the Electricity Commission to clarify aspects of the Grid Investment Test. While this work was underway, a failure at Transpower's Otahuhu substation on 12 June 2006 highlighted the importance of the connections to Auckland and Northland at this substation and the need for greater diversity of supply. The need for diversity was also emphasised in a Government Policy Statement on Electricity Governance in 2006.

With this heightened emphasis on grid security/diversity, as well as using Otahuhu as a termination point, Transpower decided to take the new line from Whakamaru, via a new substation at Brownhill Road, into the existing Pakuranga Substation to add another major transmission route into the Auckland Grid (complementing the Otahuhu – Whakamaru and Otahuhu - Huntly links). Under this scenario, the links from Pakuranga to Otahuhu and Penrose can also be upgraded to strengthen the security of supply.

Additional factors for the inclusion of an upgraded substation at the existing Pakuranga Substation site are:

- The Pakuranga site is already owned by Transpower and there is sufficient land available to accommodate a new substation and its effects.
- Locating a new substation in place of the existing 110kV substation avoids the need to procure and consent a new greenfield site with consequential environmental and economic implications.
- Pakuranga Substation is a grid exit point, providing a distribution node to the local community - meaning that if the Pakuranga Substation was otherwise relocated, Vector would also have to relocate its equipment.

Accordingly, both the system and environmental studies strongly favoured a location at the existing Pakuranga Substation for one of the termination points for the North Island Grid Upgrade Project.

4.3 Equipment alternatives

Transpower identified two options for the switchgear for the proposed 220kV Pakuranga Substation. Either Gas Insulated Switchgear (GIS) or Air Insulated Switch Gear (AIS). The main differences between the two are:

- AIS switchgear is out in the open (as at the present 110kV substation at Pakuranga) whereas GIS is contained within a building
- AIS requires a larger area than GIS and therefore more earthworks (neither option requires fill to be removed from or brought on to the site)
- GIS equipment contains larger quantities of SF₆ gas. SF₆ is a greenhouse gas. Leaks must be accounted for as part of any greenhouse gas emission target and need to be managed
- GIS takes longer to repair, and thereby requires greater redundancy in order to mitigate any risk to security of supply
- Noise levels would be very similar for either AIS or GIS.
- GIS costs 1.5 times more than AIS.

As the Electricity Commission has instructed Transpower to take the most cost efficient option, and consultation did not reveal any preference from nearby residents or others consulted, the AIS option has been selected as the preferred equipment option.

5. Description of the environment

5.1 Existing landscape

The existing landscape is dominated by a range of urban landuses including residential, commercial and roading. In respect of the nearby residential areas, the substation is a “rear lot” development. There is also a band of reserve land along the Pakuranga Creek defining the two non-residential boundaries of the site. This latter feature is not dominant in landscape terms and currently has little natural character, however it does provide a foundation for significant mitigation opportunities on the substation site.

The level of aesthetic amenity in the area is mixed. Nearby residential streets have a pleasant amenity typical of recent suburban areas. Ti Rakau Drive has lower amenity, dominated by its wide carriageway and heavy traffic, large format commercial buildings, and forecourts typically dedicated to carparking. Existing lattice tower transmission lines feeding the Pakuranga Substation also detract from visual amenity.

5.2 Existing noise

Noise surveys have measured background L_{10} noise levels between 47dBA and 49dBA. This was measured at four different locations along the northern and eastern boundaries of the property. At all locations, traffic noise from the nearby Ti Rakau Drive (to the south) was dominant.

Transformer load profiles show that in the early hours of the morning the existing 110/33kV transformers are loaded at approximately 40% of the peak demand. However, the noise logger recorded only small variation across the 24 hour period. So despite the higher demand there is little change in the noise recorded at the site.

The area surrounding the Pakuranga Substation can generally be described as noisy. It is subject to noise from traffic on Ti Rakau Drive and aircraft.

5.3 Land stability

The Pakuranga Substation is located on gently rolling land with a gradual overall fall to the southeast. The ground level varies between 12 and 2 metres above mean sea level. The terrace is composed of Puketoka Formation, Tauranga Group Alluvium underlain by East Costs Bays Formation of the Waitemata Group (interbedded very weak sandstone and mudstone).

Geotechnical investigations in the area show that the Tauranga Group alluvium consists of soft firm orange brown silty clay in the top few metres, grading to alternating thinly bedded succession of very soft dark brown to black clayey peat with uncommon thin beds of pumiceous silty fine sand. The thickness of alluvium across the terrace ranges from 4 metres to 11 metres across the site. The underlying East Coast Bays Formation (Waitemata Group) consists of alternating beds of sandstone and mudstone, grading from completely weathered material in the upper 4 metres to very weak moderately weathered rock with depth. Minor fill of up to 1 metre was noted in localised areas. It is likely to be from excavations for the current platform on the site and pervious building platforms. From investigations in the area, it is envisaged groundwater will be about 2 to 3.6 metres below ground level at the substation.

The closest active fault to the Pakuranga Substation is the North Wairoa Fault the northern extension of which is inferred to be the Waikopua Fault about 11 kilometres to the northeast of the site and therefore the negligible risk of the substation being affected by surface fault rupture is negligible.

Analysis of the susceptibility of the site to liquefaction, based on design horizontal ground accelerations under the AS/NZS1170 ultimate limit state earthquake loading shows some potential liquefaction of silty and sandy units as does the design horizontal ground accelerations under the Transpower Design Level earthquake. The sand units are of a limited extent and therefore the potential for lateral spread is considered to be low. As such, this will be specifically addressed as part of the substation foundation investigations and design at outline plan stage.

The near surface cohesive soils (8 to 12 metres deep) are not prone to liquefaction. Estimated settlements under the AS/NZS1170 ultimate limit state earthquake loading are 0.15cm to 13cm, and under Transpower's Design Level earthquake they are 0.1cm to 10cm.

5.4 Tangata whenua values

Historically the Pakuranga Substation is located within what has been recognised in contemporary times as the wider Waikato-Tainui rohe and the iwi and hapu links associated with this part of Tamaki Makaurau reflect this.

Consultation has been undertaken with Te Aki Tai, Ngai Tai ki Tamaki, Ngai Tai ki Umupuia and Ngati Paoa all of whom have Tainui links. The nearest marae to the Pakuranga substation is the Umupuia marae of Ngai Tai ki Umupuia located in Maraetai.

After an initial round of consultation (Consultation hui at Pukaki marae, 15 November 2006) with the Ngai Tai ki Umupuia Te Waka Totara Trust, Te Aki Tai, Ngai Tai ki Tamaki and Ngati Paoa, these iwi authorities agreed that the Te Waka Totara Trust would represent:

- Ngai Tai Umupuia, Umupuia Marae;
- Ngati Paoa, Kaiaua Marae;
- Te Aki Tai, Pukaki Marae; and
- Te Ahi Waru, Makaurau Marae.

There are no sites identified in the MDP as being of significance to tangata whenua located on the Substation site. However, Ngati Tai ki Umupuia, through James Brown, has advised that the site has some significance in terms of its proximity the Mangimangiroa Estuary. No sites of significance have been identified on or immediately adjacent to the subject site by Te Waka Totara Trust.

5.5 Heritage values

There are no archaeological or heritage items on the site identified in the MDP. The site has been developed for many years and no record of such sites has been recorded in this time.

An archaeological survey of the site has been undertaken for this project. Early plans held by LINZ show a number of archaeological features on the farm that the Pakuranga Substation has been subdivided from, although none are depicted within the grounds of what is now the substation site.

A survey was carried out on site. Where the cable is planned to enter the substation, two subsurface midden deposits (R11/2381 and R11/2382) were located by probing and test pitting. They appear to be mostly within the Manukau City drainage reserve but possibly partially within the Pakuranga Substation grounds. Both these sites have been damaged in the past, and may be damaged or destroyed by the proposed cable into the Substation.

As well as the middens, a remnant hawthorn hedge, which is likely to be a pre-1900 planting, was located with the grounds. The proposed works will destroy this hedge; however the site is not archaeologically significant.

Investigations on the site found that the majority of the substation grounds, where it is planned to locate the 220kV substation, have already been substantially earthworked. The archaeological assessment indicated that it is reasonable to expect, due to topography and known surrounding archaeological landscape, that further archaeological evidence may be found within the Pakuranga Substation site, however given the past earthworks it is unlikely that substantial evidence will have survived where it is proposed to build the new substation.

5.6 Ecological values

The ecology of the Substation site has been highly modified through historical vegetation clearance and site development. The majority of the site is vegetated in common grass species, which are managed as a large mown lawn. Areas of the main boundaries abutting residential land use have been planted in amenity buffers. These buffers comprise a number of common indigenous plant species, such as Flax (*Phormium tenax*), *Pittosporum* spp., cabbage trees (*Cordyline* spp.) etc. Considering the site's highly modified condition, it is considered to possess and contribute only very limited ecological benefits.

An approximately 20 to 30 metre wide margin of riparian vegetation, associated with Pakuranga Creek, is located both within and to the east of the site. This riparian vegetation has a relatively disturbed structure, comprising long grass, Toetoe (*Cortaderia* spp.), mangrove (*Avicennia marina*), bracken, manuka / kanuka, cabbage trees and an array of exotic weed species typical of disturbed sites in moist soil conditions.

A network of minor drainage channels cross the lower portion of the site. These channels are vegetated in grass species, and managed as lawn, and are therefore considered to provide no ecological benefits in terms of biological diversity or ecological function.

5.7 Roding network and access

The Pakuranga Substation is located adjacent to the residential area of Golfland, to the northwest of and close to Botany Centre. There is one access from the site which is directly onto Golfland Drive. Golfland Drive is a residential collector which leads directly to Botany Downs Road which is an arterial route. Botany Downs Road links directly with the Manukau major arterial road network using Ti Rakau Drive or Te Irirangi Drive. Botany Downs Road, Ti Rakau Drive and Te Irirangi Drive are all heavily trafficked roads, seven days a week. The Te Irirangi Drive/ Ti Rakau Drive intersection is a key, major intersection in Manukau City.

The substation access point is located west of and approximately 400 metres from the Golfland Drive/Botany Downs Road intersection which is traffic signal controlled. Golfland Drive is a loop road which intersects again with Botany Downs Road some 500 metres further north. Access to the substation via the more northerly intersection is not desirable (nor necessary) as the upper part of the Golfland Drive loop passes through residential areas.

Although Ti Rakau Drive, a major arterial route, passes along the southern boundary of the substation site access from the south is not provided, nor is it desirable. A bus depot fronting onto Ti Rakau Drive is also located on the south side of the site.

Adjacent land uses north, south and east are mainly residential and around Botany Centre there are retail and commercial activities.

5.8 Existing utilities

Existing utilities at the Pakuranga Substation include:

Utility	Equipment	Location
Watercare Services	Botany Branch Sewer	Crosses the site from northwest corner where the sewer crosses Pakuranga Creek between Kenwick Place and Trovare Place, to the southeast corner adjacent to Tiger Drive and Els Close.
Vector	33 kV switchgear building 33 kV power cables and various control and protection cables. Relays and check metering	20 m northwest of Transpower's control and relay building. 1. Between Vector's 33kV switchgear building; and Golfland Drive on the north side of the access road. 2. From the southwest corner of Transpower's 110 kV switchyard, diagonally across the site to a point on the west of the Bus depot to the south. 3. From the southwest corner of Transpower's 110 kV switchyard, diagonally across the site to a point approximately 135 meters North of the western corner of the bus depot. Transpower's control, relay and switchgear building.

6. Assessment of construction effects

The construction methodology for the extensions to the Pakuranga Substation has been described in section 2.4 of this report. This following section assesses the effects on the environment of the construction phase.

6.1 Noise

Description

During the construction of the new Pakuranga Substation there will be noise generated from the construction activities, including construction traffic, ground improvement works such as dynamic penetration, pile driving, dewatering/ pumping equipment.

Potential Effects

The effect of noise from construction is likely to have a minor potential effect only on the residential properties adjoining the northern and eastern boundaries of the Transpower site and those on the opposite side of the Pakuranga Creek to the west. The effect experienced to the north and west will be minimised by the existing earth bunding on these boundaries. Land use activities adjoining the site include a bus depot and Ti Rakau Drive to the south. These activities contribute to the existing high noise environment. Noise during the construction phase may however have the potential to affect residential properties to the north, east and west of the Substation site.

The construction activities will be of a temporary nature, with the proposed substation extensions anticipated to be completed within 18 months.

Mitigation Measures

A condition is proposed requiring that any noise generated by construction activities will not exceed the limits specified in New Zealand Standard 6803:1999 Acoustics – Construction Work, and that sound levels are measured in accordance with NZS 6803:1999, as part of an overall Construction Management Plan. This will ensure that effects of noise generated by construction activities will be minor, particularly given the existing noise environment and high ambient noise levels in the vicinity of the site.

6.2 Vibration

Description

Some earthworks on the substation site may require compacting of earth with large machinery to ensure a stable foundation platform for new transformers or other structures.

Potential Effects

The use of large machinery on the site may produce a vibration nuisance effect on nearby properties if continued for long periods of time. Vibration can cause complex sensations depending on the severity and location which may cause discomfort or annoyance.

Mitigation Measures

Rule 5.18.4.1 of the MDP states that activities should not create vibration that exceeds specified levels and that measurements should be at the boundaries of residentially zoned land. However, these standards apply to permanent or on-going vibration levels and are significantly lower than vibration levels that can be tolerated for relatively short construction periods.

In the absence of a specific requirement for construction vibration, it is appropriate to take the “Best Practicable Option” approach to avoid, remedy or mitigate any adverse effect of vibration. For transient construction activities, vibration criteria should be based on the avoidance of damage to any buildings adjacent to the demolition and construction sites. In the absence of an appropriate New Zealand standard, it is recommended

that the German Standard DIN 4150 be used. The structural damage criteria specified by DIN 4150 are presented in the following Table. Measurement locations for compliance with these acceleration levels would be identified following an initial assessment of the area. This would be done as part of the development of the Construction Management Plan, described below.

Type of building	Vibration limit (PPV)
Industrial buildings, concrete buildings	20mm/s
Dwellings	5mm/s
Other buildings, including buildings of historical value	3mm/s

Vibration effects can be adequately mitigated by the imposition of a condition requiring compliance with the German Standard DIN 4150 and through the implementation of a Construction Management Plan. The Plan will include such measures as:

- Limits on hours of operations where vibration causing machinery is used
- Identification of assessment locations where compliance with the vibration limits is required.
- Review of the proposed vibration sources and avoidance of use of equipment that produces excessive or unnecessary vibration
- Consultation with residents, including advising residents of any upcoming periods of potential vibration effects.
- Monitoring and reporting of vibration levels at affected buildings
- Investigation and mitigation of any specific activities or response to complaints.
- Establishment of a programme to inspect houses and measure vibration to address the issue of ground vibration

6.3 Dust

Description

Earthworks associated with the decommissioning of the existing 110kV substation, excavation of the site, the transportation of equipment and material to and from the site and the construction of the proposed 220kV substation could generate dust.

Potential Effects

The activities associated with the works have the potential to generate dust, which may affect the surrounding environment. There is the potential that dust may be an irritant to occupiers of adjacent residential properties. Unmanaged dust may cause a flashover which could self extinguish or cause a circuit breaker to trip and disconnect the affected equipment that may lead to a temporary reduced system security or loss of supply.

Mitigation Measures

During construction, appropriate dust control measures will be put in place through the Construction Management Plan process. Following completion of the works any exposed soil will be re-grassed to mitigate the effects of dust and runoff. Any potential flashover risk can be avoided by appropriate dust control measures.

Vehicles will go through a water bath before leaving the site during the construction phase, and potentially dusty loads may need to be covered.

6.4 Visual

Description

During construction a significant amount of machinery and equipment such as transformers and towers/gantries will be temporarily stored and then erected on the site. The site will appear different from its existing format in that a new 220kV switchyard will be built and the existing 110kV substation will be permanently removed, and some equipment may be temporarily relocated to allow room for site development.

Potential Effects

The potential visual effects during construction are considered to be minor. The site is not undergoing any change in its 'use' and the appearance of the site during construction will be temporary. The site is an existing large industrial site. It is well buffered in visual terms from nearby residential areas. Given this existing environment it is anticipated that the visual effects generated by the construction activities will be minor.

Mitigation Measures

During construction, careful consideration will be given to where particular structures and machinery are stored on site so as to not create adverse visual effects from Ti Rakau Drive or from adjacent residential properties. Existing bunding and planting will assist in screening the construction works, the construction management plan will address visual distractions to drivers.

6.5 Earthworks

Description

The extent of the earthworks will depend on underlying soil conditions and the allowable gradient for the substation building platforms. Earthworks will include break out and removal of concrete slabs, concrete footings and asphaltic concrete.

Cut and fill volumes have been estimated using a LINZ generated topographic survey and a finished surface grade of 2° extending south from the existing compound. The volume of cut is estimated at about 31000m³ and fill is 25000m³, including access road construction. Excess spoil will be used within the site as described in section 6.13, below.

Potential Effects

During the excavation of material there is potential for runoff and stormwater flow to occur. This could result in sediment entering the nearby water bodies and affecting water clarity and the amount of suspended solids present in the water bodies.

Mitigation Measures

Depending on the scale and location of the proposed earthworks, resource consents may be required from the ARC. This process (if required) will determine the specific mitigation measures required.

However during construction, appropriate sediment control measures will be put in place through the Construction Management Plan process. This plan will be prepared to address the effects of site works. Following completion of the works any exposed soil will be re-grassed to mitigate the effects of dust and runoff.

6.6 Land stability and erosion

Description

Given the variation in loading and generally weak compressible ground, the building structure and heavier equipment items will be supported on pile foundations.

Potential Effects

Differential settlement may occur on areas of fill.

Mitigation Measures

To avoid differential settlement the floor of the building structure and heavier equipment will be supported on the piled foundations.

6.7 Stormwater

Description

Stormwater from the impervious surfaces of the site arise during rainfall and will consequentially be directed into a stormwater network and discharged offsite. The addition of the 220kV transformer and AIS installation and the associated works on site will lead to an increase in impervious surfaces areas, consequentially increasing the stormwater run-off. Investigations into stormwater at the Pakuranga Substation has determined that the stormwater is collected by an existing stormwater network within the site, and then discharged through an oil separator into an oil interceptor tank located on the western side of the site. The treated stormwater runoff is pumped to an existing manhole and then discharged through 325mm diameter pipe into the Pakuranga Creek which borders the site on the south, south west and west.

Parts of the existing stormwater network at the southern side of the site, including the oil containment tank, will be affected by the construction works for the new 220kV transformers and will be rebuilt to Transpower's oil containment standards.

The increase in the stormwater discharge associated with the proposed activities will be minor if the finished surface is mainly metalled. However, the stormwater discharge will increase significantly if the whole site is paved with asphalt.

A significant increase in the impervious areas will eventually lead to a considerable change in the stormwater flows hence will require the upgrade of the stormwater pipe and the outfall structure into the Pakuranga Creek.

The size of the proposed impervious area and any consequential increase in stormwater flow rate or volumes may require further resource consents from Auckland Regional Council.

Potential Effects

Stormwater has the potential to collect contaminants as it drains over impervious surfaces. An increase in run-off can have consequential impacts on the capacity of the stormwater network and then point of discharge. An increase in flow rates or volumes of water from a stormwater pipe can cause erosion or scouring around the end of the pipe, and create discoloration and deterioration of receiving water quality. A deterioration in the water quality can impact on the aquatic life in the receiving waters by degrading clarity (affecting the amount of light that can penetrate the water column), decreasing the availability of oxygen, and contaminant particles can smother benthic dwelling organisms.

Mitigation Measures

The effects of any increased stormwater run-off can be mitigated through the implementation of suitable treatment devices and the replacement of parts of the stormwater network which may need to be increased in capacity if there is any significant change in the impervious areas. In addition, any resource consents required will have conditions imposed to mitigate and minimise the effects of any discharge of stormwater from the site.

6.8 Existing utilities

Description

A number of existing network utility services, owned by other network utility operators, cross and / or are located on the Pakuranga Substation site. These are set out in Section 5.8.

The construction of the new 220kV switchgear on the Substation site will necessitate the relocation of the Botany Branch Sewer belonging to Watercare Services Limited (Watercare) as the 310mm rising main and 600mm gravity main cannot be built over. Any relocation will only be carried out following discussions with Watercare.

Construction of the new 220kV switchgear in conjunction with a new 33kV indoor switchboard will necessitate relocation of a number of Vector Limited (Vector) cables. These include 33kV, 11kV, fibre and pilot wire protection cables. Relocation will only be carried out following discussions with Vector.

It has yet to be determined if any of the existing towers on site will need to be removed or relocated.

Potential Effects

Works associated with the proposed substation extensions have the potential to affect existing utilities under the substation site.

Effects on third party infrastructure services can be appropriately avoided, remedied or mitigated through consultation with the various network utility operators to ensure that appropriate protocols and design requirements are incorporated into the final designs and where relevant included in the Construction Management Plan.

Mitigation Measures

Transpower will work closely with the various network utility operators to identify the precise location of existing utilities and/or to determine appropriate mitigation measures. Such measures will include the relocation of the Botany Branch Sewer, to avoid an impact on the utility. Provisions for alterations to utilities are set out in the appropriate licence agreements between Transpower and the utility owners.

6.9 Construction traffic and access

Description

The construction phase will involve transport of some large and heavy components onto the site. The largest unit transported will be the 220/33kV transformers which will weigh approximately 100 tonnes and special arrangements for the transportation of loads will need to be made. All other equipment and materials will be suitably broken down so that conventional heavy transportation will be sufficient.

The journey from Auckland Port to the Pakuranga substation site is approximately 25 kilometres by road. The roads on the route are under the jurisdiction either of Transit NZ, Auckland City Council or Manukau City Council.

Heavy haulage transportation will follow the requirements as described in the current version of the Overweight Permit Manual published by Transit NZ Limited and agreed to by Manakau City Council and Auckland City Council.

Following the construction phase, traffic volumes associated with typical substation activities will be similar to existing levels.

Potential Effects

During construction there will be increased vehicle movements to and from the site by light and heavy vehicles. It is anticipated that the movement of the transformers will not cause significant congestion as the transportation will be carried out at night. Such loads will generally occupy one lane of the carriageway, although additional carriageway width may be required when manoeuvring at junctions. The load is expected to travel at variable speeds from 2 km/h to 15 km/h depending on the terrain. Some local road closures will be required and some parking will have to be restricted. This may cause disruption to normal traffic flows and movements along the route between the Port and the substation site.

The Substation is accessed by a private road where there will be ample space to accommodate the transformer's transporter while it awaits access to allow for unloading.

Mitigation Measures

Moving the transformers at night will mitigate the potential disruption to traffic. These loads will travel at a predetermined time and on a predetermined route. In the event of the journey taking more than the time available over one single night period, it will be laid up at a suitable location en route, before recommencing the journey the next night.

There is an existing procedure to be followed when carrying out this type of transportation. The procedure consists of consultation and the preparation of a Traffic Management Plan. The Plan is then submitted for approval prior to the work taking place. The Traffic Management Plan will involve consultation with the Police and the relevant City Councils, the Haulage Company and Transit, network utility operators and other relevant parties.

The Traffic Management Plan will contain a method statement breaking the route down and providing a full itinerary, of:

- any deviations to avoid low bridges;
- road side furniture temporarily removed;

- any bridge strengthening required;
- any lay over points etc.;
- a detail description of any road closures or other traffic control measures required; and
- a full description of all contingency plans should the convoy break down.

Transit and the local authorities will need to be consulted as to the requirements when crossing bridge structures.

A team of people will accompany the transporter and where necessary this will be headed up by the Police with powers to temporarily close roads as the convoy passes. It may also be necessary for utility companies to be on hand on the night of the move to ensure that any problems en-route are solved as quickly as possible i.e. temporary removal/lifting of aerial telephone and power cables.

6.10 Tangata whenua and heritage

Description

The subject site contains no sites of significance to tangata whenua that have been identified in the operative Manukau District Plan. The archaeologist on the project assessed the site, which resulted in the identification of two subsurface midden deposits (R11/2381 and R11/2382) and a hawthorn hedge which most likely a pre-1900 planting (R11/2398). They appear to be mostly within the Manukau City drainage reserve and possibly partially within the Pakuranga substation grounds. As indicated in Heritage Values section above both these sites have been damaged in the past.

Potential Effects

The archaeological assessment indicated that it is reasonable to expect, due to topography and known surrounding archaeological landscape, that further archaeological evidence may be found within the Pakuranga Substation site.

Mitigation Measures

As there will be disturbance of known archaeological sites, a section 12 authority from the Historic Places Trust will be needed. It is anticipated that this will contain conditions such as those recommended in the archaeological report (Part X, section 9) as well as other possible requirements. This will ensure that the known sites and any other sites that may be revealed during the works, are fully recorded.

In cultural terms any excavation work in the area shall be undertaken in conjunction with agreed protocols, this is particularly so in respect of the possibility of uncovering koiwi or skeletal remains. It is anticipated that the protocol (which is currently in draft) will require the cessation of work in the vicinity of any such find until such time as the appropriate authorities and nominated iwi representatives have had the opportunity to examine the "find site" and make appropriate recommendations as to how the matter should be dealt with.

6.11 Ecology

Description

The ecology of the substation site has been highly modified through historical vegetation clearance and site development. The majority of the site is vegetated in common grass species, which are managed as a large

mown lawn. Areas of the main boundaries abutting residential properties have been planted in amenity buffers. These buffers compose a number of common indigenous plant species, such as Flax (*Phormium tenax*), *Pittosporum* spp., cabbage trees (*Cordyline* spp.) etc. Considering the sites highly modified condition, it is considered to possess and contribute only very limited ecological benefits.

An approximately 20 to 30 metre wide margin of riparian vegetation, associated with Pakuranga Creek, is located both within and to the east of the site. This riparian vegetation has a relatively disturbed structure, comprising of long grass, Toetoe (*Cortaderia* spp.), mangrove (*Avicennia marina*), bracken, manuka / kanuka, cabbage trees and an array of exotic weed species typical of disturbed sites in moist soil conditions.

A network of minor drainage channels cross the lower portion of the site. These channels are vegetated in grass species, and managed as lawn, and are therefore considered to provide minimal ecological benefits in terms of biological diversity or ecological function.

Potential Effects

Due to the degraded nature of the site's ecology, and the proposed separation of construction works on site from the riparian vegetation and Pakuranga Creek, it is considered that the potential for adverse effects to ecology arising from the construction of the proposed substation is no more than minor.

It is considered that there is limited potential for adverse effects to the aquatic ecology of Pakuranga Creek during the construction of the proposed substation. Adverse effects to Pakuranga Creek could potentially arise through migration of sediment laden runoff from loose soil on the construction site to the aquatic environment.

Insulating oil is present on the existing substation site, and the volume of oil on site is likely to increase with the installation of the new substation. Currently, existing onsite facilities provide for the management and discharge of stormwater and the containment of oil in the event of a spill. New oil containment facilities (e.g.: bunding associated with the new transformers and new oil interceptor system) are proposed to serve the new substation equipment.

Mitigation Measures

The potential for adverse effects to the Pakuranga Creek by sediment laden runoff from the active construction areas will be mitigated by the implementation of Construction Management Plans focusing on the storage and reuse of top soil, on and off site disposal of spoil, and silt and dust control during site leveling and earthworks stages.

The potential for sediment to migrate to Pakuranga Creek is further mitigated by the location of the proposed works being separated from Pakuranga Creek by approximately 60 metres. This separation will allow sufficient area for the effective control of sediments originating from the area of works and therefore mitigating the potential for adverse aquatic ecological effects. An existing riparian zone buffers the ecology of Pakuranga Creek from activities on the site. This riparian buffer zone will not be disturbed during the proposed substation construction works. Therefore any benefits this buffer zone currently provides to the aquatic ecology of Pakuranga Creek will be maintained.

The potential for degradation of terrestrial and aquatic ecology by spillage of insulating oil on site is mitigated by the existing and proposed oil containment facilities, thereby avoiding the potential for contamination on site and the potential for migration of oil contamination to the surrounding environment.

Should consents for earthworks be required from the ARC, these will also include conditions to mitigate any effects of these activities on the Pakuranga Creek.

6.12 Contaminated land

Description

It is possible that some earthworks excavations may encounter contaminated soils (e.g. asbestos, hydrocarbons) on the substation site. The site is not recorded as a contaminated site in the MDP or MCC asbestos database.

The Auckland Regional Council did not find any record of the Pakuranga Substation on its contaminated sites database. The database files contain information on historical pollution incidents and some site specific information from archived files. However, just because the site does not appear on the database does not mean the site is totally uncontaminated. Therefore a Contaminated Site Management Plan that sets out the procedures and protocols to be followed should any contaminated soil be discovered will be required.

Potential Effects

It is possible that some earthworks or excavations may disturb contaminated soils.

The type and degree of contamination could conceivably create effects on the operation or functionality of some equipment, the health and safety of on-site construction staff, and on nearby residents if the contamination is particulate (dust) and able to disperse in the air.

Mitigation

The approach to contamination assessment and, if contamination is suspected or found, to quantification, mitigation and possibly clean-up will be based around the hierarchy of approaches and procedures to be found in the Ministry for the Environment's Contaminated Sites Guidelines series. These MfE documents set out the detailed protocols for qualitative site assessment (already conducted at the Otahuhu substation site) through to soil sampling methodologies, concentrations of contaminants which trigger specific further actions, and the nature and necessary extent of these actions. If contamination is found on site, the appropriate Auckland Regional Council consents will be sought, and mitigation measures will be put in place.

Significant hydrocarbon contamination is typically indicated by a distinctive odour in the exposed soil. Should odorous material be uncovered during excavations, work should cease and representative samples should be obtained for analysis. Similarly, if foreign material suspected to contain asbestos (such as asbestos-cement board fragments) is uncovered samples will be collected and tested in accordance with a method specified by a New Zealand accredited laboratory for the identification of asbestos. A Contaminated Site Management Plan that sets out the procedures and protocols to be followed should any contaminated soil be discovered at the Substation site will be included as part of the Construction Management Plan and will include the following steps:

- Qualitatively assess excavated soils for contamination; indications can include visual observations such as staining or obvious foreign material (e.g. asbestos-cement), or odour.

- In the event that suspected contaminated material is encountered, cease excavation work, take samples as noted above and have these analysed by an accredited laboratory for the suspected contaminants.
- Retain and isolate exposed/excavated soil suspected of being contaminated until laboratory results are received.
- If the material is contaminated above Guideline levels, dispose of as hazardous waste.
- Replace the excavated contaminated material with clean fill, as necessary.
- Groundwater or stormwater which may be contaminated by contact with impacted soils will be retained in a secured area, such as a lined pond. The retained water will be analysed for suspected contaminants; if concentrations are below relevant Guidelines (ANZECC) the water can be disposed to the stormwater system. If contaminants are at or above levels of concern the retained water shall be removed for off-site disposal by a liquid waste disposal contractor.
- At all times isolate site workers from the contaminated material by:
 - removing the material to a dedicated position on site
 - dampening down and/or covering the material until analytical results are received and off-site disposal can be arranged if required
 - ensuring that workers know about the potential risks posed by contact with the material
 - prohibiting eating, drinking or smoking except at designated site locations and following thorough washing of exposed skin

6.13 Removal of clean fill

Description

Spoil from cut consistent with the MDP requirements, will be mostly or entirely reused on site.

Potential Effects

Spoil from cut will mostly be used on site to form the platform for the substation. Most of the topsoil and excess spoil is proposed to be retained on or in the vicinity and used for remediation in accordance with the requirements set out in the MDP.

Any excess clean fill removed from site is a resource, which may be able to be reused in an appropriate approved off-site location, or disposed of in a cleanfill or landfill.

Mitigation Measures

Effects associated with the removal of spoil from the site will be avoided remedied or mitigated through the implementation of the requirements of the Construction Management Plan.

6.14 Summary of mitigation measures

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 surrounding activities and the environment, including dust, noise, traffic, lighting and safety.

Section 2.5 lists the various aspects which will be included in the Construction Management Plan. A draft Plan will be provided to MCC for review as part of the outline plan process. The Construction Management Plan will also address aspects relating to resource consents required from the ARC.

7. Operational effects

7.1 Electric and Magnetic Fields

Description

As described in Part II of the Notices of Requirement documentation, electric and magnetic fields (EMF) are a component of the North Island Grid Upgrade Project, as they are part of all systems involving the transmission, transformation and use of electricity.

Potential Effects

It is Transpower's intention that any EMF from the Substation will meet the guidelines set by the International Commission on Non-ionizing Radiation Protection (ICNIRP). These guidelines have been endorsed in New Zealand by the National Radiation Laboratory (part of the Ministry of Health). In particular, the guidelines recommend a limit of 100 μ T (microtesla) for magnetic flux density and 5kV/m for maximum electric field strength for public areas.

Mitigation Measures

Transpower is in the process of confirming that any EMF associated with the proposed redevelopment of Pakuranga Substation will meet all the guidelines set by the ICNIRP, even bearing in mind the nature of the immediately adjacent environment. As explained in Part II, and in section 12 of Part X, these guidelines safeguard against any potential adverse health effects from EMF.

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

Potential Effects

Gap discharge and tracking are identified by their disturbance characteristic and are commonly attributed to incipient faults. Transpower's policy is to quickly correct these events before they can cause 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).

Corona discharge is the only source of continuous RFI emission and is the principal source of RFI in substations. Corona only becomes a significant issue on networks where the operating voltage exceeds 300kV, but can be controlled by design.

NZS 6869:2004 sets out compliance criteria for RFI emissions from High Voltage Electrical Installations within New Zealand. NZS 6869 requires the RFI strength to be less than 62 dB/1 μ V/m, 20 metres outside the security fence. NZS 6869 also allows an additional 10 dB margin for urban environments where the radio signal strengths are stronger than in a rural setting.

Calculations for the proposed 220kV AIS installation indicate RFI will be below the NZS 6869 limits at all points 20 metres outside the security fence.

Mitigation Measures

A 15kV/cm voltage gradient design limit will limit the inception of corona even during humid or wet weather.

Given the nature of the surrounding environment, effects associated with RFI will be no more than minor.

7.3 Noise

Description

The area surrounding the Pakuranga Substation can generally be described as noisy. The area is subject to high ambient noise levels from traffic noise from Ti Rakau Drive. Estimates of the background noise indicate levels well in excess of 30dBA.

The Pakuranga Substation has existing use rights for existing levels of noise emissions which are set out in Part X section 13 of the NOR documentation. These levels do not meet the current rules for the Main Residential Zone in the MDP. The noise levels set out in the MDP (Rule 13.11.1) are as follows:

"The noise level measured at or within the boundary of a site zoned Residential shall not exceed the following:

CATEGORY	ACTIVITY	Average Maximum Noise Level			Maximum Noise Level
		L ₁₀ dBA			L _{MAX} dBA
		Monday to Saturday 7am - 8pm (0700-1800)	Monday to Saturday 8pm-10pm (1800-2200) Sunday and Public Holidays 7am-10pm (0700-2200)	At all other times	10pm-7am (2200-0700)
1	Activities on sites other than those described in category 2	45	40	35	65
2	Activities on sites located adjacent to business zones 4, 5, 6, or where the background noise level is 50 dBA or greater when measured during the period of 7am-8pm (0700 - 1800)	50	45	40	70

The noise shall be measured with a sound level meter complying at least with the International Standard IEC 651: 1979 Sound Level Meters, Type 1."

Transformer noise is tonal in character, and thus it incurs a 5dBA penalty for special audible characteristics as prescribed in NZS 6802:1991 *Assessment of Environmental Sound* and NZS6802:1999 *Acoustics-Assessment of Environmental Noise*. Thus any noise levels specified in district plans need to be reduced by 5dBA.

Transformer noise is relatively constant, and therefore contributes to the “ambient” or background noise of the area. It is most likely to be noticed at night when other noise is at lowest levels.

Potential Effects

Noise effects can become a nuisance for people in nearby inhabited dwellings or workplaces that cause discomfort or annoyance to people who hear the noise or consider they are particularly sensitive to noise. As far as is known, there have been no noise complaints relating to the existing substation, which makes a relatively small contribution to overall noise levels in the area.

Mitigation Measures

To provide a framework, which is both reasonable for Transpower and for the surrounding community, the following is proposed as a condition for the Pakuranga Substation Designation:

- Noise limit at the Boundary of the Designation – 40dBA (allowing for 5dBA penalty) 7am – 10pm.
- Noise limit at the Boundary of the Designation – 30dBA (allowing for 5dBA penalty) 10pm – 7am.

These limits recognise the general character of the surrounding environment, relatively high ambient noise levels, and the proximity to major noise sources, particularly transport routes. While there is considered to be a basis on which to distinguish daytime and night time noise limits, in the context it is considered that there is no justification for lower noise emission levels during daytime hours on specific days of the week or year.

Compliance with the above provision is proposed to be assessed by measurement of sound power levels at transformers and other equipment and calculated at the designation boundary where it adjoins land zoned Residential. This method of measurement and assessment of compliance will overcome the difficulty of actual measurement and demonstration of compliance within the high ambient noise environment.

The designation boundary adjacent to the Residential Zone as a compliance location, rather than the more typical measurement location at or within a zone boundary, is also proposed for simplicity, because of the varying noise levels received in different parts of the residential area.

7.4 Light spill

Description

Transpower's policy is for outdoor switchyards to be lit to 15 lux average, maintained and horizontal on the ground. This figure represents about 22 lux average for a new installation and a general range of 10 to 30 lux (new) spot measured within the switchyard. There is no reference to vertical lighting levels at the boundaries but it is unlikely they would exceed the horizontal levels if the lighting installation is appropriately designed. The indicative substation layout has the new switchyards located some distance from the Transpower boundaries.

The AS/NZS 1158 Lighting for Roads and Public spaces 2005 Part 3.1 : pedestrian area (category P) lighting - performance and design requirements applies to the lighting of low volume roads (previously referred to as minor roads), pathways, cycleways, public parks and outdoor carparks where the needs of the pedestrian take

precedence over the needs of the motorist. The standard is not mandatory but compliance will provide an installation that conforms to current international guidelines. For carparks, the relevant factors are night time vehicle and pedestrian movements, night time occupancy and risk of crime and the parameters to be met include average illuminance, minimum illuminance, uniformity of illuminance and vertical plane illuminance.

Rule 14.11.11 of the MDP applies for the main lighting of the site. This Rule refers back to Rule 5.18.2

Rule 5.18.2 in the MDP requires that:

(a) All exterior lighting must be designed, located and at all times directed, screened, adjusted and maintained to ensure that:

(i) the direct illuminance from the lighting installation shall not exceed:

- *10 lux (lumens per square metre) at or within the boundary of all affected residential sites between the hours of 10.00pm and 7.00 am;*
- *20 lux at or within the boundary of all affected residential sites at all other times when exterior lighting is required;*

(ii) Any adverse effects from indirect illuminance from the lighting installation are avoided, remedied or mitigated;

(iii) Any adverse effects from glare on adjacent residential properties and the roading network are avoided, remedied or mitigated.

(b) For exterior lighting adjacent to a residential zone, and in any other case where the applicant, or, the Council is unsure as to the ability of the lighting to comply with these performance standards, the applicant shall provide the Council with a report from a Professional Illumination Engineer confirming that the lighting installation has been designed, installed and aimed in a manner that will ensure compliance with Rule 5.18.2.1 In the case of a new installation, design information must be provided at the time of applying for a building consent.

Potential Effects – residential land

The lighting associated with the Pakuranga Substation works will be designed to ensure compliance with the MPD light spill rules at the residential boundaries that adjoin the site.

The existing 110kV substation is currently within 85 metres of a residential boundary in Trovare Place and within 95m of a residential boundary at Bard Place. Under normal conditions, the lighting at the substation is minimal and it would be completely screened by vegetation on those boundaries.

The new substation will be over 95 metres from the nearest residential boundary in Bard Place and at least 150 metres from the closest western properties in Kenwick Place. At these distances, an obtrusive light level of 10 lux (horizontal or vertical) resulting from the additional switchyard lighting is extremely unlikely.

There is presently no carpark or driveway lighting at this site. Any new general amenity/car park lighting in this area will be to P11b or P11c class (AS / NZS 1159 part 3.1 2005 refers) to meet the MDP requirements.

The Transpower's policy is to limit glare in accordance in AS4282 1997. Therefore, the effects of obtrusive light spill, glare or other visual disturbance on or at the nearest residential boundaries will be no more than minor.

Potential Effects – roading network

Rule 14.11.11 (a)(iii) of the MDP Rule 5.18.2 (iii) of the MDP refers to glare issues related to the roading network. Provided the proposed substation redevelopment is lit in accordance with Transpower's design

standards, it is unlikely to affect the surrounding major roads. The placement of lighting in the new switchyard area will need to be designed to consider limiting glare to Ti Rakau Drive eastbound traffic but given the level of existing commercial lighting in this area, this design objective will not be difficult to achieve.

The conditions of Rule 14.11.11 (a)(ii) will be met by planned planting along the edge of the site platform to the west and south.

Mitigation

Compliance with Transpower's Requirements for Outdoor Switchyard Lighting Policy (2003).

Compliance with AS / NZS 1159 part 3.1 2005.

Compliance with Australian Standard – Control of obtrusive effects of outdoor lighting (AS 4282 – 1997).

Preparation of a lighting design assessment plan as part of the Construction Management Plan.

Planting to the west and south edges of the site.

7.5 Earth Potential Rise (EPR)

For a description of earth potential rise (EPR) and its potential effects refer to Part II, of the Notices of Requirement.

Transpower will design all substation equipment 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 (2002) "*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.

Potential Effects on other Utilities and Mitigation

Design work will be carried out to ensure compliance with the above regulations and industry recognised guidelines in relation to infrastructure services located in close proximity to overhead lines and underground cables within the Pakuranga Substation. This can include use of standard mitigation measures such as use of earth mats and other targeted protection.

Where specific instances require, Transpower will work with utility owners to modify or improve conductive telecommunications, pipelines, or power and utility services, in order to reduce risks associated with EPR issues to industry design codes, rules and statutory requirements. These works would be designed and agreed upon between Transpower and the service owner to minimise any service and safety issues for customers.

7.6 Landscape effects

Description

The proposed development will replace an existing substation development in an urban landscape context with a similar but more extensive substation development. The types of structures will be similar although their location and scale may differ around the site.

Potential Effects

The potential effects are consequentially considerably less than would be the case in a greenfields site. There will be little change in landscape terms.

Mitigation Measures

The mitigation planting proposed along the creek and site margins will have the potential to achieve a net landscape benefit in the area over time.

7.7 Visual Effects

Description

The substation and the existing substation site is highly visible from Ti Rakau Drive where it is seen behind a bus depot and Pakuranga Creek. Similarly, from the Burswood area the site is visible, but in the middle distance. From these two directions the substation is currently unscreened. There are also several prominent transmission structures associated with an incoming circuit, which will be removed as part of the new Brownhill-Pakuranga cable circuit construction.

From the residential area to the north and west there is good screening at present.

The new substation will be slightly to the south of the current location and some structures will be taller.

Potential Effects

Because of distance, context and the removal of some existing prominent structures, the proposed substation is not expected to be more visually significant than the present one from the south and west. The intention is that significant planting along the creek will, over time, offset any visual or amenity effects of the new substation.

From the residential locations, the substation will be slightly more distant, although some structures will be higher. There is likely to be little change here in visual amenity because of the existing comprehensive screening.

Mitigation Measures

Structured planting to break up the appearance of the substation site from the west and south, along the creek and drainage area is proposed. While it will not be possible to screen the site fully, significant landscape and amenity improvements can be achieved.

7.8 Hazardous substances

Description

Pakuranga Substation utilises insulating oil in power transformers, circuit breakers and other transmission equipment. Transpower's own 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. In total, there will be approximately 150,250 litres of transformer oil in use at the site, when the Pakuranga Substation reaches its expected final configuration based on projected load growth.

Potential Effects

The likelihood of leakage or spillage of transformer oil is considered to be low as the equipment is sealed or self contained; nonetheless the transformers will be bunded to provide additional secondary containment.

Mitigation Measures

Any oil and/or stormwater within the bunded areas around the transformers will be contained and will pass through an oil plate separator then interceptor tanks 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 Oil Spill Management and Contingency Plan for the site as required by TP:GS 54.01.

The Hazardous Facility Screening Procedure (HFSP) has been applied to the types and quantities of hazardous substances stored at the Pakuranga Substation site. The storage of transformer oil within the transformers is by far the most significant risk issue. In fact the HFSP calculations show that the derived Quantity Ratio for the "Fire/Explosions", "Human Health" and "Environment" Effect Type exceed the trigger level for which the storage or use of hazardous substances would be a discretionary activity under the MDP. Thus this requires that conditions on the designation with respect to hazardous substances use at the Pakuranga Substation site should focus on containment of transformer oil and other contingencies to prevent or mitigate spillage. As noted above, such extensive mitigation measures will be put place.

7.9 Summary of mitigation measures

Mitigation of the operational effects of the Pakuranga Substation and proposed extensions is achieved through the choice of site, design requirements and the imposition of conditions on the designation. The site is sufficiently large that most effects (other than visual and construction traffic) are or will be readily contained within the site boundaries. The site and the adjacent land provides opportunities for improvement to current visual and amenity values through a comprehensive planting plan as part of the substation redevelopment.

Mitigation through the construction phase is provided for through contract specifications, which include a range of requirements including the preparation and implementation of a Construction Management Plan. This will address and seek to avoid or minimise construction noise, dust, sediment, traffic and any community/social effects. These are temporary, but potentially significant effects if not well managed.

Long-term potential effects relating to hazards such as oil storage involve appropriate maintenance and best practice in compliance with Transpower's standards and policies. The minor potential risk of other effects of electrical origin, including EPR, affecting network utilities will be addressed through ongoing investigations and negotiations as design proceeds. Step, touch and transfer voltages in the substation earth grid will be designed for safe levels as specified in industry codes, rules and statutory requirements.

Any long-term adverse effects of the use and maintenance of the Pakuranga 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 Pakuranga Substation will have the following additional effects.

8.1 Cumulative effects

Installing a larger Substation at Pakuranga will lead to a consequential increase in a number of effects such as visual and stormwater discharge volumes. The cumulative visual effect will arise from the increased built development on the site. However, there will be no change to the use of the site, nor will any visual effect be markedly different given that similar equipment is already located on site. Therefore, the visual effects are likely to lessen as people who live nearby or travel past regularly become more accustomed and used to what they are viewing. Visual effects are also expected to improve with the planting associated with the substation redevelopment, so that in the long term, a net benefit could be achieved.

It is considered that the effects of the increased stormwater discharges can be appropriately managed throughout the implementation of effective and efficient on-site stormwater treatment.

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 upgrade of the Pakuranga Substation as part of the North Island Grid Upgrade Project from Whakamaru to Auckland will enable Transpower to ensure the bulk supply of electricity to Auckland and the upper North Island to meet growing demand by approximately 2011, and for the following decades. The 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.

The upgrade of the Pakuranga Substation is an integral part of this project and has a specific role in the transformation of electricity into appropriate voltage for transmission between the 220kV and 33kV transmission systems.

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 construction stage.

8.3 Social effects

No potential social effects on the households living in the vicinity of the Pakuranga Substation have been identified in the consultation documentation. It can be anticipated that the project will create some uncertainty about the nature and scale of impacts for these households, particularly prior to and during construction.

In the operational phase the 220kV substation will be integrated into the wider site and operated within a range of performance conditions, which should limit any on-going effects.

9. Consultation

A consultation programme for the changes at Pakuranga Substation was undertaken as part of the wider consultation for the amended underground cable proposal. This is described in section 9 of Part II and in section 2 of Part X. A brief outline is provided here.

On the advice of Mikaere and Associates Ltd, Transpower consulted with the following iwi, hapu and organisations.

- Ngai Tai Umupuia, Umupuia Marae;
- Ngati Paoa, Kaiaua Marae;
- Te Aki Tai, Pukaki Marae; and
- Te Ahi Waru, Makaurau Marae.

Stakeholder and statutory organisations consulted included:

Utility Operators

Watercare Services
Vector

Statutory Bodies

Auckland Regional Council
Manukau City Council
Department of Conservation
New Zealand Historic Places Trust

Others

Botany Community Board
Forest and Bird (Northern Office)

Public consultation activities in relation to the Pakuranga Substation were also undertaken, including:

- Customised letters and dedicated information sheets about the proposal for the Pakuranga substation delivered to properties in the vicinity of the existing substation;
- Drop in days six days a week at the Botany Downs Library Friday 27 Oct – Sat 11 Nov 2006
- Website information;
- Address to the Botany Community Board
- Media Releases

There were very few enquires from people living in the vicinity of the substation, and only four submissions were received in relation to the upgrade of the Pakuranga Substation. Comments were made on the substation development at the meeting with the Botany Community Board of Manukau City Council.

These raised issues of:

- Property related effects
- Potential health effects related to EMF and future school in Golflands Road
- Visual

There were no identified community preferences in terms of technology to be use for the proposed 220 kV Substation at Pakuranga. However, the local community board sought “improvement of the view” for people travelling on Ti Rakau Drive.

10. Conclusion

The upgrade of the Pakuranga Substation is an integral part of the North Island Grid Upgrade Project. The upgrade will help to meet the growing demand for electricity in the upper North Island and to ensure that homes and workplaces have a secure electricity transmission system by 2011. The positive effects associated with the Project require consideration in any assessment under the RMA.

Installation of a 220 kV Substation at the site is the most suitable option and it is considered that the mechanism of a designation is the best way to holistically consider all aspects of the operation and obtain longer-term security equal to the large investment being made into the infrastructure upgrade.

Given the context of the site, in a modified urban environment, well shielded from adjacent residential development and with significant opportunity for screening and feature planting in the vicinity of the creek, there is the potential for long-term elements of net benefit in landscape and amenity terms.

The range of mitigation measures proposed will ensure that adverse effects are appropriately avoided, remedied or mitigated.

11. Section 171(1) of the RMA

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

11.1 Relevant Provisions of Plans and Policy Statements

The relevant provisions of the Auckland Regional Policy Statement are set out in section 4 of Part X of the documentation, and it is considered that the proposal is generally in accordance with the objectives and policies that relate to the provision of national and regional infrastructure, in the interest of the economic and social wellbeing of people and communities in the regions. Generally, the choice of the existing Pakuranga substation site has avoided conflict with other policy provisions. In summary, the Notice of Requirement is generally consistent with the relevant rules and standards, and is not inconsistent with the objectives and policies of the relevant parts of the Manukau District Plan.

The plans generally have objectives and policies that are supportive of infrastructure and network utilities, although where a utility involves a component above a specified size or other specified threshold specified in the plan, it needs to be assessed on its individual merits.

11.2 Consideration of Alternatives

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 AEE, it is considered that Transpower's consideration of alternative sites and methods has in any event been adequate in

the circumstances. Transpower has considered both location and equipment alternatives in considerable detail and taken into account a range of relevant factors, including environmental effects.

11.3 Work and Designation Reasonably Necessary to Achieve Objectives

This aspect is addressed in section 1 of this report (and in Part II as part of the overall project), and it is concluded that both the work and the designation are reasonable for achieving Transpower's objectives.

11.4 Other Relevant Matters

There are no other matters which are considered reasonably necessary to consider in relation to the Notice of Requirement, other than emphasising that while components of the entire project are addressed in separate documents because of the legal requirements of the RMA, the entire project is an integrated project. This means that there is a need to consider the Notices of Requirement for all parts of the project together in an integrated manner, and, where appropriate, the associated applications for resource consents.

11.5 Part II 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 needs generally 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. 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 is part of a developed urban area. The proposal does not affect section 6(c) – the protection of areas of significant indigenous vegetation - as no removal of vegetation is proposed and there is in fact no significant vegetation or habitats affected. In terms of section 6(d), the proposal does not further impact on public access to the coastal environment in comparison with the existing situation, 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. Section 7(b) refers to the efficient use and development of natural and physical resources. The Pakuranga Substation forms an integral part of the transmission link between Whakamaru and Pakuranga 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 on the same site as the existing substation is considered to be an efficient use of the land and existing physical resources in the vicinity, avoiding the need for development of a substation on a greenfields site. Due to 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 and potentially enhanced with regard to noise emissions, consistent with sections 7(c) and (f).

12. Suggested conditions

Proposed restrictions and indicative outline conditions are proposed for the Pakuranga Station in this Notice of Requirement. Transpower would wish to discuss further the precise wording of any specific conditions with the MCC during the processing of this NOR.

12.1 Proposed restrictions

Noise levels:

- Noise limit at the Boundary of the Designation – 40dBA (allowing for 5dBA penalty) 7am – 10pm
- Noise limit at the Boundary of the Designation – 30dBA (allowing for 5dBA penalty) 10pm – 7am.

The above limits apply on all days of the year.

- Any noise generated by construction activities will not exceed the limits specified in New Zealand Standard 6803:1999 Acoustics – Construction Work.

Earth Potential Rise

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

Electromagnetic fields

- Compliance with ICNIRP Guidelines

Radio frequency emissions

- Compliance with Radio Frequency Standards – NZS 6869:2004 Limits and Measurement Methods of Electromagnetic Noise from AC Power Systems

Vibration

- Compliance with German Standard DIN 4150

Light Spill

- Compliance with AS/NZS 1158 Lighting for Roads and Public Spaces 2005 Part 3.1
- Compliance with Transpower's Requirements for Outdoor Switchyard Lighting Policy (2003)

Hazardous Substances

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

12.2 Other Proposed Conditions

- A Construction Management Plan to be provided as part of the outline plan process as set out in Section 2.5 of this AEE.
- An accidental discovery protocol for archaeological and cultural sites to be implemented should any sites be uncovered.
- Amenity planting around substation.