TE RERE HAU EASTERN EXTENSION

NORTH RANGE ROAD

CONSTRUCTION EFFECTS REPORT

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1. INTRODUCTION

NZ Windfarms Ltd received consent in May 2005 to construct up to 97 turbines within the Te Rere Hau Windfarm on the western side of the Tararua ranges. They now wish to extend the site to allow for an additional 56 turbines and are seeking resource consent for the construction, operation and maintenance for these additional turbines. The site for the proposed extension called Te Rere Hau Eastern Extension (TRHE) is immediately to the east of the current site i.e. eastern side of North Range Road.

The construction site, subject to this application is approximately 2 kilometers in length (measured along the ranges) and is up to 1.5 kilometers wide, with a total site area of approximately 3 square kilometers.

The site topography consists of a main ridge, which runs northeast-southwest. From this ridge, the land slopes to the east with strongly defined ridges and gullies. The terrain for the back of the site could be considered as being undulating to gently rolling. There is however, some pockets of very steep terrain within the construction site with the balance of the land beyond the site being classified as steep terrain.

Access to the site is from North Range Road, which connects onto the Pahiatua Aokautere Road (Pahiatua Track). All new roads are accessed either from roads within the existing site or off North Range Road immediately adjacent to the current access road into the existing Te Rere Hau Windfarm.

The construction site within TRHE will include but not be limited to:

- The construction of approximately 7.3 km of internal access roads
- The construction of platforms and foundations at each turbine site
- The construction of 56 wind turbines
- Commissioning of each turbine
- The installation of up to 10 km of underground 33kV electrical cabling connecting the turbines to the existing electrical infrastructure within the existing Te Rere Hau Windfarm
- Stormwater controls
- Disposal on site of excess excavation material
- Site reinstatment

This report covers the effects of the construction activities within the TRHE development.

2. CONSTRUCTION REQUIREMENTS

2.1. Design Parameters

The design for TRHE is based on that used for the original Te Rere Hau Windfiarm

a. Earthworks

The earthworks within this project is for the construction of roads and turbine platforms. The design for cut batters is 1 vertical to 1 horizontal and for fill batters, 1 vertical to 2 horizontal. After assessing slope stability, these gradients have been used successfully within the existing Te Rere Hau Windfarm site. These batter slopes will be modified on site if it is shown that shallower gradients are required within TRHE.

b. Roading

Pavement design is based on that used for Te Rere Hau Windfarm site. Allowance has been made for testing of the subgrade and possible undercutting of unsuitable material where this is identified during construction.

Longitudinal gradients have been designed to have a maximum gradient of 1 vertical to 5 horizontal

Where possible, roads have been designed to incorporate the turbine platforms so that the track itself can be used as part of the turbine construction site. This assists in minimizing the extent of earthworks required.

c. Turbine Foundations

The process used on the existing Te Rere Hau Windfarm will be incorporated in assessing each turbine foundation. The geological structure of each tower foundation will be inspected and assessed and the foundation depth will be confirmed after that inspection.

d. Aggregate

As there is no suitable aggregate source within the site, all aggregate for road construction will be sourced off site.

All concrete will be supplied from off-site batching plants.

2.2. External Roading Upgrade

As North Range Road was upgraded as part of the original Te Rere Hau Consent, no further upgrade is anticipated as part of TRHE project works. The maintenance of North Range Road will continue as per the requirements of the original Te Rere Hau Consent.

2.3. Access Tracks / Roads

To enable access to the turbines sites, new access roads will be constructed to accommodate construction machinery and vehicles. This will require approximately 7.3 km of roads construction consisting of around 2.2 km of existing tracks being upgraded, 2.5km of new roads servicing more than one turbine and 2.6 km of new roads servicing only one turbine. In addition to this, there is an existing track of approximately 1.1 km which no additional upgrading works is proposed.

The above roads are identified as follows:

- Existing track (no additional work) – Road 4.
- Upgraded tracks – Roads 1 and 19.
- New access roads servicing 2+ turbines – Roads 2, 3, 6, 10, 15, 21, 27, 32 and 35.
- New access roads servicing only 1 turbine – Roads 5, 7-9, 11-14, 16-18, 20, 22-26, 28-31 and 33.

The access roads have been designed to enable the turbines to be delivered directly to the platform locations. The road width is in the order of 5 m with side drains on each side. Longitudinal gradients have been designed to have a maximum gradient of 1 vertical to 5 horizontal. Each road will have 200 mm depth of AP65 aggregate.

Where possible, the access roads have been designed to follow the ground contour to minimize the amount of cut and fill required hence the amount of earth works. This assists in limiting the ground disturbance and potential site erosion.

2.4. Turbine Platforms / Pads

Each turbine position has been determined after extensive investigation and analysis of wind patterns.

Where possible, roads have been designed to incorporate the turbine platforms so that the track itself can be used as part of the turbine construction site. This assists in minimizing the extent of earthworks required

The turbine platforms have been designed to have a working area of 20 m x 12 m. This allows for storage of the turbine parts on site plus room for the construction crane to erect each turbine. At each site, in addition to the turbine, there will be a 33 kV transformer.

2.5. Internal Reticulation

Each turbine transformer will be connected to 33 kV cable that connects all the turbine sites along the access roads which then connects into a main 33 kV cable to the existing Windfarm site. All cables will be direct buried within the access roads.

2.6. Spoil Disposal Sites

Possible spoil disposal sites have been identified to so that all material is contained with the TRHE site. The exact locations will be identified to minimize possible erosion and sediment escaping into existing water ways. The spoil sites will be shaped to enable easy grassing of the site so that the areas can be successfully grazed by the land owner.

2.7. Culvert Crossings

The crossing of existing gullies has been minimized to reduce the requirement to place culverts within waterways. As the position of such structures are at the head of each catchment, the maximum catchment area for each structure is less than 1 ha in area. Each culvert has been sized at 300 mm diameter at a grade of 1 vertical to 100 horizontal provides a flow capacity of 100 litres / second. This will cater for most storm events.

The catchment area for each structure has been assessed using base contour information.

2.8. Stormwater

All catchment areas will continue to drain through existing water courses. Where stormwater is captured on site, it will be drained via road side drains to grit traps to settle out any sediment and contaminants before entering stormwater piped systems to suitable discharge points on the downhill side of access roads and/or turbine platform sites.

Stormwater outlets into existing waterways will be designed to ensure that the discharge is undertaken in a controlled manner. This may require rip rap to be placed immediately downstream to breakdown the energy of the stormwater discharge and hence reduced scouring and erosion. Silt fences downstream of the discharge points will also be used to control sediment.

To reduce the possibility of contaminates entering the waterways, the refueling of machinery near waterways will not be permitted.

3. CONSTRUCTION EFFECTS

3.1. Earthworks

The earthworks proposed at the site are as follows:

- Formation of access roads
- Construction turbine platforms and subsequent foundations
- Disposal of surplus excavated material
- Trenching of underground cables

The design volume of earthworks for the tracks and turbine platform sites has been assessed at around 316,000 m^3 with approximately 35,000 m^3 of fill material required. The surplus material will be disposed of on site by controlled filling in the areas identified (refer Appendix 1). The fill sites have been identified to ensure minimal effect of erosion and stormwater run off.

During earthworks, in dry conditions, dust may be generated due to construction traffic movements and/or wind. This generally is for short periods of time and in extreme conditions can be mitigated by dampening down the exposed areas. Due to the location of the site, the effect of dust on adjoining properties is negligible. There will be no long term effects due to dust.

The respreading of topsoil and regrassing of cut and fill batters plus fill sites will be done as soon as is practicable after the completion of the major earthworks to minimize dust and sediment run off.

While there will be some initial scars visible due to the earthworks, this will quickly be mitigated as the areas are re-sown with grass. The only areas not to be re-grassed will be cut batters along the roads and at the turbine platform sites. These will not be visible from the west i.e. Manawatu side due to the site being on the eastern side of the Tararua Range. Some cut batters may be visible from the Pahiatua side of the range however due to the shape of the ground contour there would only be visible from a distance and visual effects would be less than minor.

The greatest visual effect, due to cut batters, would be from North Range Road however the users of this road are limited in number due to it being metalled, winding and the rough nature of its surface beyond the entrance to the Te Rere Hau Site. It is considered that the visual effects would be no different to the road batters that already exist.

3.2. Formation of Access Roads

This will require approximately 7.3 km of tracks construction consisting of around 2.2 km of existing tracks being upgraded, 2.5km of tracks servicing more than one turbine and 2.6 km of track servicing only one turbine.

The road width is in the order of 5 m with side drains on each side. Longitudinal gradients have been designed to have a maximum gradient of 1 vertical to 5 horizontal

Generally, the access roads have been designed to follow ridge lines, however road 2 cuts across the natural terrain which will cross a couple of ridges and gullies. Culverts will be required at these points and will need to be sized to fit the catchment areas.

Side drains are designed to control stormwater runoff and these drain to grit traps to minimise sediment flow and reduce contaminants entering waterways.

The construction of the access roads beyond this servicing of the principal Windfarm will improve the efficiency of farming operations by providing easier, safer access to areas of the farm that until now, had limited access.

3.3. Turbine Platforms / Foundations

The size of the platform is dictated by the construction requirements of the turbines. Experiences gained on the consented Te Rere Hau Windfarm have shown that a pad size of 20 m x 12 m provides for storage of the turbine parts on site plus room for the construction crane to erect the turbine plus a 33 kV transformer.

All turbine sites are designed so that the foundations are within original ground.

Where possible, roads have been designed to incorporate the turbine pads so that the track itself can be used as part of the turbine construction site. This assists in minimizing the extent of earthworks required.

The construction of the turbine platforms apart from possible loss of farming land, will have negligible effects. Experience from the consented Te Rere Hau wind farm has shown the loss of possible farm land is offset by the improved efficiency of farming operations and the ability for stock to use the drier, warmer metal surface during storm events.

3.4. Disposal of Surplus Excavated Material

As there is a surplus of excavated material, possible disposal sites have been identified on the plans attached as Appendix 1. The sites proposed are either depressions or flat land that can be shaped to be retained as suitable grazing land or the head of small gullies where the fill will have minimal effect on existing waterways.

Prior to filling, all topsoil will be removed. Any ground water seepage as a result of construction activities identified will be drained by installation of subsoil drains prior to any fill material being placed.

Prior to commencement of the major earthworks onsite, sediment control measures will be installed by the contractor. The maintenance of these control measures will be

the responsibility of the Contractor. The Contracts Engineer will inspect the sites regularly to ensure compliance.

In general, the construction contract will require the contractor to comply with the Resource Consent Conditions and to take all necessary steps to ensure all adverse effects are mitigated to an accepted standard.

Our standard specification for construction contracts is attached as Appendix 2 and the relevant standards will be incorporated in the final specifications for this extension.

The construction process for fill sites is as follows:

- Establish silt fences.
- Remove topsoil and other unsuitable materials.
- Lay subsoil drains where there are signs of water seepage.
- Place cut off drains to reduce effects of stormwater run off on site.
- Compact fill materials to a sufficient standard.
- Shape finished surface to ensure land stability and minimize erosion effects.
- Resurface fill site with topsoil and re-grass as soon as is practicable.

The proposed fill sites are generally in areas of undulating ground. By filling these areas it will increase the area of usable grazing land, improves stock management and improves slope stability. Overall, the fill sites will be beneficial to the overall management of farming operations with the areas being grazed, therefore there will be no long term visual impacts due to these soil disposal sites.

3.5. Internal Reticulation

The internal reticulation of power cables connecting all the turbine sites will be excavated using chain diggers and will be direct buried. The cable routes will be along the new access roads.

As the power cables are buried within the road formation there are no visible or other effects due to this work.

3.6. Stormwater / Sediment Control

Stormwater run off from the access tracks in a cut situation will consist of side drains at the base of the cut. In steep terrain, these side drains may be rock filled to reduce erosional effects. Water from these side drains will be directed and discharged into the location identified on the plans within Appendix 1. All stormwater run off will be contained within the existing naturally occurring catchment area. The existing waterways within these catchments areas are able to accommodated any additional runoff that may be created due to the construction works. The location of the discharge may vary from that identified depending on site condition. Any changes will be as approved by the Project Engineer.

The capture of sediment via grit traps is as shown on page 7 of the plans within Appendix 1. These have been designed to enable easy cleaning of the traps during normal maintenance of the side drains.

To confine any sediment due to stormwater run off, silt fencing will be placed on the lower half of all fill areas. These silt fences will be maintained until a good strike of grass has been established on all fill sites. This will reduce the possibility of sediment and other contaminants from entering the waterways.

General guidelines for the above will be as per the Wellington Regional Councils "Erosion and Sediment Control Guidelines" dated 2002.

Where drainage slopes are over 1 vertical and 10 horizontal, rock cobbling or rip rap has been placed within the existing Te Rere Hau Windfarm drainage areas to reduce water velocity and therefore lessen any erosion impact.

With the above controls, we consider that there will be no long term effects due to the construction of stormwater side drains, the establishment of grit traps and the construction of culvert where required.

4. CONSTRUCTION METHODOLOGY

From commencement of site works to completion of the turbines it is envisaged to be in the order of 2 years.

The development will proceed in stages with the construction equipment moving from road to road so that the entire site is completed in an orderly fashion. This will mean that at any one time that only a small portion of the site will be subject to construction effects.

The likely construction sequence is as follows:

a. Site establishment including temporary site office.
b. Installing erosion and sediment control measures.
c. Preparing disposal sites and haulage tracks.
d. Access tracks excavation, removal of surplus material to disposal sites and installation of culverts.
e. Turbine platform construction.
f. Installation of electrical cabling and other works.
g. Establishing ground cover over earthworks areas.
h. Construction of turbine foundations.
i. Delivery and installation of turbines.
j. Commissioning of works.
k. Removal of temporary construction site office and any remaining temporary structures and materials.

5. SUMMARY

The proposed construction works will necessitate site excavation, filling of disposal areas, laying of culvert, electrical component installation, concreting, metalling and topsoiling.

The resultant construction effects have been previously discussed and can be summarised as:

i)	Earthworks	- From experience in the Te Rere Hau Windfarm, the natural slopes and existing cuttings are generally stable. - Fill batters will be grassed and will therefore have nil visual impact. - Cut batters will remain exposed but due to location, will have only minor visual impact.
ii)	Access roads and turbine platforms	- The proposed side drains and position of stormwater disposal areas will minimize the effects of runoff. Grit traps are to be constructed for the control of sediment from roads and road batters. - All areas will be reinstated as soon as practicable after completion of the works. - While it is not envisaged that the turbine positions will alter, it should be accepted that at construction stage the proposed road alignments or turbine platform may vary slightly. - The construction of the roads will improve the efficiency of farming and also provide easier, safer access to isolated areas. The construction of the turbine platform will assist in stock management and health. Overall, there will be only be less than minor effects due to the construction of access roads and turbine platforms.
iii)	Soil disposal sites	- Possible disposal sites have been identified and these will be further assessed on site before any fill occurs. Sediment control is proposed by way of silt fences. - When grassed, the fill areas will have no long term visual impact.
iv)	Power cabling	- All power cables will be laid underground and have no visual impact.
v)	Erosion and sediment control	- These will be controlled on site by ensuring silt fences are constructed along the lower

		half of all fill sites All exposed areas are to be re grassed as soon as is practicable. - With the regrassing and use of silt traps to capture sediment, this will have negligible impact on existing water ways.
vi)	Stormwater runoff	- The road side drains will be protected when steeper grades are encountered. - By using either rock cobbling or rip rap, in steeper areas, this will lessen any erosion impact of these areas - As all discharges into overland flow paths or gullies will be in a controlled fashion, this will have less than minor impact on water ways.
vii)	Culvert Construction	- Proposed new culverts have been sized appropriately and installed with minimal effect on the overland flow or waterways. - As all culverts are high in the catchment area, culvert sizes are small and the effects on the water ways will be less than minor.

While the proposed works will result in the disturbances of land in the way of access roads, turbine platforms and soil disposal sites, any adverse effects are able to be mitigated to the point where they will be less than minor.

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22/1/09.

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APPENDIX 1

PLANS