



## Geotechnical Review

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**RE:** Proposed wind turbine development at:

**Stockyard Hills Wind Farm.**

**Client:** Wind Power Pty Ltd  
Attention: Mr. Peter Lausberg  
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**Distribution:** - Wind Power Pty Ltd

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## **Introduction:**

A “desk-top” study was undertaken to provide an initial geotechnical assessment of the proposed Stockyard Hills Wind Farm site. Relevant geological maps were examined with the purpose of providing feasibility foundation and pavement advice for the proposed construction of the wind turbines.

The wind farm is to comprise of up to approximately 242 wind turbines, generating up to 2.0MW of power per turbine. It is understood that the turbines are approximately 80m height with rotating blades with a diameter of 82m. The turbines are to be supported on a single tapered cylindrical hollow section (CHS) with a maximum diameter of approximately 6.0m at the base. The base collar of the CHS bolted to the foundation. The wind turbines will be assembled on site using large mobile cranes.

## **Scope of the Study:**

The study is limited to a desk top review only.

The scope of this report is to provide comments on the anticipated foundation systems and pavement options, based on experience in the region and its geology, as interpreted from appropriate maps.

Site investigation work will be required to confirm the assumptions made in this report and for any design purpose.

## **Site Description:**

The proposed wind turbine site is located approximately 40km west of Ballarat, with an irregular layout stretching from 5.0km south of Beaufort and 3.0km north of Skipton. The site extends to Shirly to the north west and Pittong to the south east. The site of the proposed turbines includes Stockyard Hill centrally located), Fishers Hill and the north side of Nanimia Hill. The site is currently used for predominantly agricultural purposes.

## **Subsurface Conditions:**

### ***Regional geology***

The area of the proposed wind turbine development lies within the ‘Geological Survey of Victoria’ Skipton Sheet (1:100,000). The geology of the turbine site identified on the geological map comprises:

- Quaternary “Newer Volcanics” – comprising ‘Olivine basalt’ and ‘Blochy vesicular basalt flows: Stockyard Hill area’ in the central, south and east areas of the site, and;
- the Ordovician “Pyrenees Formation” and “Warrak Formation” – comprising ‘Laminated silty micaceous quartz-rich arenite’ and ‘Phyllite, micaceous quartz-rich arenite’
- with Devonian “Mount Emu Granite” and “Warrawidgee Granite” – comprising ‘Coarse-grained equigranular biotite granite’ and ‘magnetic granite in subsurface’ outcropping in two isolated areas within the south east corner of the proposed Wind Farm boundary (below Mount Emu/Nanimia Hill).

## **Discussion:**

### ***Anticipated subsurface conditions***

The major geological provinces are common throughout the Melbourne area and south west Victoria.



The engineering properties of the Quaternary “Newer Volcanics”, Ordovician “Castlemaine Supergroup”, and Devonian granites and their associated residual soil profiles are well documented. These geological materials have been widely used and adapted for engineering structures ranging from large multistorey buildings, roads, bridges and other significant civil infrastructure, as well as smaller scale structures which have resulted in a thorough understanding of their properties and characteristics.

The subsurface profile is expected to comprise surface residual silts and sands, underlain by moderately to highly reactive clay soils which grade to variably weathered rock with depth. It is also expected that the surface soils would be eroded and transported in alluvial and/or colluvial deposits in the lower lying areas of the region.

The depth to bedrock may be variable and may be shallow in the case of basalt (“Newer Volcanics”) and granite (“Mount Emu & Warrawidgee”) though variable, and may be deeper with a deeper weathering profile in the case of the sedimentary rock (“Castlemaine Supergroup”). Numerous discreet floaters and closely packed boulders may be present above the basalt and granitic rock interface.

The subsurface geology will need to be confirmed through direct sampling methods. The regional groundwater regime would be investigated during a detailed geotechnical investigation as necessary.

The geological setting is favourable in terms of interaction between the soil and rock mass and groundwater regime. Unstable underground features (such as caverns) present in limestone ‘karst’ regions found in NSW are not present in this region.

Foundations will have no impact on underground water bodies, and/or groundwater.

### ***Foundation options***

It is understood that loading conditions are relatively light for wind turbine structures, with overturning movements usually the critical loading condition in the order of 200kPa (peak edge pressures). Either the natural clay soils or residual rock should readily accommodate such loads.

It is expected that a mass pad footing will provide the most practicable foundation type for the structure.

Piled foundations and rock/cable anchors would provide further alternatives to a conventional pad type footing, however the final foundation design will be based on economics with all alternatives providing a stable foundation.

At this stage, it is expected that no unusual difficulties will be associated with the construction of the wind turbine foundation.

The excavation of rock for foundations would normally be minimised where ever practicable, and where necessary, would be undertaken using conventional methods with any impact short term and localised. Indeed, where present bedrock at the foundation level would provide the “best” founding option and left in place with minimal disturbance.

### ***Pavements***

It is expected that access roads will be required for the construction of the WT farm and future maintenance.

Heavy construction vehicles and large cranes may be required during the construction period. Traffic frequency and loading conditions on access roads during construction may be high. However, post-construction traffic is likely to be low and comprise light vehicles for maintenance purposes only.

Subgrade properties within the region may range from poor to good. Some form of subgrade improvement may be required in the “Newer Volcanics”. This could include in situ lime/cement stabilisation upon which



the pavement is constructed or placement of a geo-fabric on the stripped surface upon which the pavement is constructed. This is common practice and foresee no difficulties in pavement construction.

### **Report notes**

This report contains information for the feasibility stage of the proposed development. Detailed geotechnical site investigation and reporting will be required for design purposes.

During the construction period land may be disturbed and exposed to erosion. Erosion and sediment runoff can be minimised/controlled by adopting good construction practices referenced below (1), (2) and (3).

Further information regarding geotechnical site investigation reports is referenced below (5).

Should there be any further queries please do not hesitate to contact this office for further advice.

Yours Faithfully,

**HardRock Geotechnical Pty Ltd**

James Harrison B.E.(Geo.) M.E.(Env.)  
(Geotechnical Engineer)

### **References**

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- (3) Ransom, M.J., 1987: *Control of erosion on construction sites*. Department of Conservation Forests and Lands, Victoria
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- (6) Cochrane, G. W., Quick, G.W. and Spencer-Jones, D. (Eds), 1991. *Introducing Victorian Geology* Geological Society of Australia (Victorian Division).
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