Soils, Geology and Groundwater – Summary of Key Outcomes

The Site lies within the Lachlan Fold Belt geological unit and the Lachlan Fold Belt Groundwater Management Unit. Previous studies have indicated that the water table would be at some depth and below the proposed depth of excavation.

At present the Site is unmined. Historically, the area around Gunning has been mined for gold, however the last recorded mining activity was in 1956. Therefore it is considered unlikely that mine subsidence would affect the site. However, Commissioners Gold hold an exploration permit over the area. No issues were raised by Commissioners Gold during consultation with them.

The mitigation measures and safeguards would ensure that soils and groundwater are satisfactorily managed using suitable design, construction and management. With these measures, any impacts on soils and groundwater resulting from the construction and operation of the Project are likely to be negligible.

Chapter 8 Soils, Geology and Groundwater

8.1 Existing Environment

8.1.1 Topography

The northern and eastern boundaries of the Site are formed by the Lachlan River with the most western and eastern sections having areas of land that slope gently towards the River. Some sections of the Site, adjacent to the River, are relatively steep. The south-western corner of the property is characterised by a large hill which is clearly visible from the surrounding areas.

8.1.2 Regional Geology

The geology of the Dalton area is illustrated on the Gunning 1:100,000 Geology Map. The 1:100,000 Gunning Geology Map shows the Site lies within the Lachlan Fold Belt and is underlain by a series of metamorphosed Ordovician Age sediments and Silurian Age intrusives. The major rock unit in the area is the Adaminaby Group, which in this area comprises mostly phyllite and metamorphosed quartz arenite with some chert. These beds are folded and generally steeply dipping. This rock type mostly forms rounded hills with varying degrees of outcrop and soil depth.

To the south of the Site, the Adaminaby Group is intruded by the Silurian Age Wyangala Batholith, which comprises a typical granitic material, known locally as the Oolong Granite. The granite area is characterised by steep sided hills with numerous rounded boulder (Tors) outcrops.

The Tertiary age Wheeo Basalt forms a capping on the ridge tops to the east of the project area, but is also indicated to be present on only one hill top on the south-western side of the Development Footprint. The Wheeo Basalt comprises black alkali basalt to basanite flows, containing porphyritic olivine and titanium augite, with flow banding, vesicles and doleritic textures. The basalt is more resistant than the phyllites but like the phyllite can be closely jointed.

The weathering process has resulted in the formation of broad flat alluvial soil deposits in the valleys of the creek that forms the southern boundary of the Site and in the valley of the Lachlan River along the northern side of the Site.

8.1.3 Geological Structure

The Ordovician sequence has been extensively faulted and folded, with several major north–south trending thrust faults recognised to the east of the project area. A major north-south trending fault zone is also located to the west of the Site but there are no known regional faults shown on the mapping within the area under consideration.

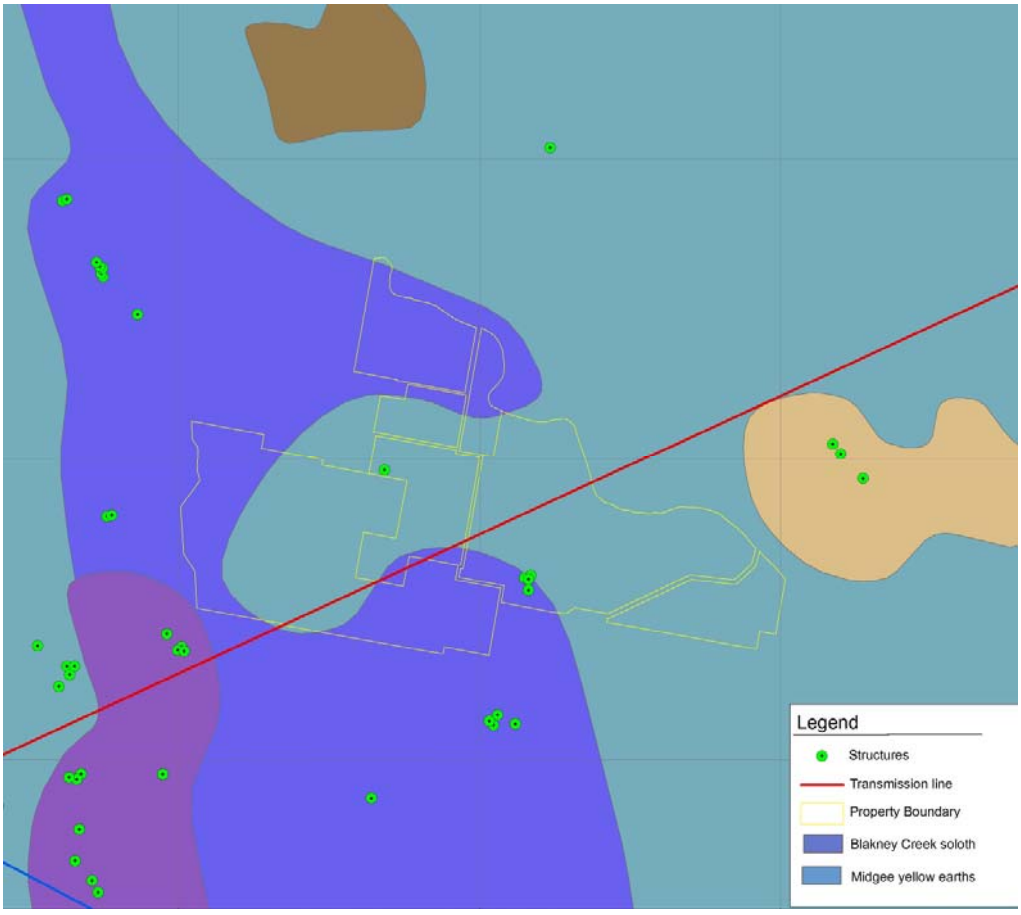
8.1.4 Soils

The Soil Conservation Service of New South Wales 1:250,000 Goulburn Soil Landscape Map indicates the two predominant soil types in the project area are Blakney Creek soloth and Midgee yellow earths (Aurecon, 2009), illustrated in **Figure 8-1**.

The Blakney Creek unit is located on the footslopes and valley floors and comprises undifferentiated Ordivician and early Silurian metasediments. It is an acid to neutral yellow duplex soil with minor stony yellow earths and red podzolic soils. Erosion hazard for this soil type is high (topsoil) and low to high (sub-soil). This unit dominates the footprint of the gas pipeline (northern portion) and access road and a small portion of the southern area of the Plant footprint.

The Midgee unit occurs on the rolling hills at higher elevations and comprises Ordivician and some Devonian and Silurian metasediments. It is commonly acid stony yellow earths and yellow podzolic soils in association with lithosols and red earths. Erosion hazard for this soil type is high to very high. This unit dominates the Plant footprint.

Figure 8-1 Soil landscapes of the Project area



Source: Siting Study Report, Aurecon (2009)

While detailed mapping of soils has not been undertaken, there is some evident variation in soil depth and characteristics across the site. Variations relate to the underlying geology, slope, position on the slope and ground water level and variations in ground water levels. It is considered that soils should be regarded as erodible and managed to limit erosion and off site sedimentation (Aurecon, 2009).

8.1.5 Groundwater

In December 2008, two orders were made which embargo new applications for groundwater licences for all groundwater not covered by water sharing plans in the inland part of NSW. The order was made under Section 113(a) of *The Water Act 1912* and applies to all land within the Upper Lachlan Alluvium, in which the Project site is located.

Extractions (5000 ML/year) are currently operating well below the sustainable yield of 1,057 599 ML/year (Aurecon, 2009). However as studies between 2004 and 2008 have shown a consistent seasonally adjust drop in water level, a continuing trend since 1991, entitlements for groundwater use must be obtained.

AGL is currently investigating options for obtaining the relevant permits and licensing arrangements for the transfer of existing groundwater entitlements for the Project. AGL has located numerous water licences for sale and therefore has a high level of certainty that sufficient water licensing requirements could be met for the project.

Water source options are discussed further in **Chapter 14**.

8.1.6 Geotechnical aspects

Based a field inspection of the site, it was considered that there appear to be no geotechnical aspects that would preclude the use of the site for a gas turbine power station (Aurecon, 2009). The site preparation would involve a typical cut/fill operation with cuts of the order of 10 m required to establish a level bench for the power station. In steeper areas, the site could be established on split benches to reduce the volume of strong rock to be excavated in the site preparation.

A geotechnical investigation would be required to establish whether the rock can be excavated by mechanical means or whether blasting would be required. The weathered rock and fill material should accommodate the likely loads imposed by the foundations. If alluvial material occurs at the preferred site, a geotechnical investigation would be required to establish its suitability as a foundation material.

A data review was undertaken on the earthquake potential of the area (Aurecon, 2009). On average one earthquake a month was reported heard or felt in the Dalton area during the period June 1993 – December 1995. These events had magnitudes as low as ML 0.6. In the Dalton-Gunning zone, the average time interval between large, potentially damaging magnitude ML 6.0 earthquakes is of the order of 120 years (Aurecon, 2009). The review concluded that the potential for heightened earthquake activity at the Site could be accommodated in the design of the foundations for the proposed plant (Aurecon, 2009).

Apart from the earthquake hazard, the assessment concluded that are no other known geological hazards in the area. In particular:

- there is no evidence on any large scale landslides; and
- there are no known major active volcanic or surface tectonic structures in the project area.

8.2 Assessment of Potential Impacts

8.2.1 Construction Phase Impacts

Excavation

A nominal platform level of RL 575m has been adopted at the location of the exhaust stacks in order to minimise the top level of the stacks and resulting visual impact. A geotechnical investigation would be undertaken to establish whether the rock can be excavated by mechanical means or whether blasting would be required. The weathered rock and fill material should accommodate the likely loads imposed by the foundations. If alluvial material occurs at the preferred site, a geotechnical investigation would be required to establish its suitability as a foundation material.

Erosion of Disturbed Areas

During the construction period, a small proportion of the total Site would be disturbed in order to construct the compound, access roads, gas and water pipelines, and electricity supply. Rainfall on these disturbed sites may cause soil erosion and runoff may contain high levels of sediments which could then enter the natural drainage system. It is considered that soils should be regarded as erodible and therefore managed to limit erosion and off site sedimentation.

Groundwater

It is considered that the water table under the area would be at some depth and below the proposed depth of excavation. This would be confirmed during detailed design through a groundwater assessment.

Soil Contamination

Given the undeveloped nature of the Site, it is unlikely that soil has been significantly impacted by site based activities. As a result, it is unlikely that any soil contamination is present on the Site.

8.2.2 Operational Phase Impacts

There is potential for contamination at the site during operation from spills of fuel, oil or chemicals. Surface water from the site that may be potentially contaminated by spills or leaks include:

- rainfall runoff from operational areas of the site; and
- accumulated water within bunds.

In addition, where flows are concentrated, soil erosion may occur. The impact of surface water flows is addressed in **Chapter 14** *Water Management*.

8.3 Mitigation Measures

8.3.1 Design

Further assessment of the geotechnical and groundwater conditions would be undertaken during detailed design.

8.3.2 Construction

A Construction Soil and Water Management Plan would be developed and implemented as part of the CEMP for the construction works to ensure effective management of potential soil erosion issues. Construction would be planned to minimise the time that disturbed land is exposed. Disturbed areas would be quickly revegetated or covered with a non-erodable surface following construction. During the construction period water may be required for dust suppression.

8.3.3 Operation

Management of surface water flows from the plant footprint are described in detail in **Chapter 14**. The outlet of the compound's stormwater system would be designed to maximize the dispersion of these high flows and thereby minimize their potential to cause soil erosion downstream.

Appropriately bunded areas would be included for storage of fuels, oils and chemicals.

Areas within the plant area would be appropriately drained so that surface runoff would be prevented from infiltrating directly onto the ground and from reaching the groundwater.

8.3.4 Summary

The mitigation measures and safeguards would ensure that soils and groundwater are satisfactorily managed using suitable design, construction and management. Accordingly any impacts on soils resulting from the construction and operation of the Project are likely to be negligible.

Table 8-1 presents the mitigation measures to address the soil and geological issues for the Dalton Power Project.

Table 8-1 Summary of Mitigation Measures

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Further geotechnical and groundwater assessments would undertaken to inform the detailed design.	✓		
A Construction Soil and Water Management Plan would be developed and implemented for the construction works to ensure effective management of potential soil erosion issues.		✓	
At a minimum the measures outlined in the *Managing Urban Stormwater – Vol 1 Soils and Construction* would be implemented. Measures may include: • limiting slope length, • installation of sediment filters and the construction of a sedimentation basin downstream of the plant area.		✓	
Construction would be planned to minimise the time that disturbed land is exposed.		✓	
Disturbed areas would be quickly revegetated or covered with a non-erodable surface following construction.		✓	
During the construction period water may be required for dust suppression.		✓	
Discharge from the sedimentation pond would be through an appropriately designed dissipating structure to minimise soil erosion potential.			✓
Appropriately bunded areas would be included for storage of fuels, oils and chemicals.		✓	✓
Areas within the operational plant area would be appropriately drained so that surface runoff would be prevented from infilitrating directly onto the ground and from reaching the groundwater.			✓