

WANT Geotechnics

Site Classification & Bearing Capacity Assessment

For

Stage 3E, Zuccoli, Northern Territory

Prepared for HiQA

Project NTG2019920

5 February 2019

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Site Classification & Bearing Capacity Assessment for 27 Lots in Stage 3E, Zuccoli, Northern Territory

1. Introduction

WANT Geotechnics (WANT) was commissioned to undertake a review of geotechnical investigation data relating to the site classification and bearing capacity of 27 Lots developed as Stage 3E, Zuccoli in the Northern Territory. The review was commissioned by HiQA Darwin.

The assessment of individual lot site classification has been undertaken in general accordance with AS2870. The assessment of bearing capacity has been in accordance with the methodology presented in MJ Stockwell (1977) and titled *Determination of Allowable Bearing Pressure Under Small Structures*.

The geotechnical investigation undertaken by HiQA comprised:

- A total of 42 boreholes or test pits, typically 1.5 to 2 excavations per lot, and
- A dynamic cone penetrometer test adjacent to each excavation.

This report presents a review of the data and certification of the site class and bearing capacity of each lot based on data provided by HiQA Darwin, a copy of the data is included in Appendix A.

In our judgement, the extent of this investigation has been sufficient to correlate the observed soil conditions with the known geology and published information for this area. However, localised variations are very difficult to locate using test holes and boreholes and natural soils can vary greatly over short distances. In which case, it would be prudent to commission site inspections during construction, in order that the true site conditions are verified.

2. Zuccoli Stage 3E

Zuccoli Stage 3E comprises 27 individual lots, earthworks to form the lots involved filling up to 1.10m and was undertaken by Ostojic Pty Ltd, and Level 2 Inspection and Testing by HiQA Darwin. A plan showing the lot layout along with the test hole locations are included in Appendix A.

3. Geology and Land System

The Extractive Geology of the Outer Darwin Area 1:100 000 Geological Series map indicates Stage 3E is underlain by Tertiary age laterite gravel and ferricrete.

Reference to NT Government Natural Resource Maps website indicates the site sits on land of the Bustad Land System (sandstone plains and rises and no occurrence of acid sulphate soils).

4. Assessment

Australian Standard AS 2870 provides a system of site classification as shown in the table below.

Class	Predicted Surface Movement	Foundation
A		Most sand and rock sites with little or no ground movement from moisture changes
S	<20mm	Slightly reactive clay or silt sites with slight ground movement from moisture changes
M	20mm to 40mm	Moderately reactive clay or silt sites which can experience moderate ground movement from moisture changes
H1	40mm to 60mm	Highly reactive clay site, which can experience high ground movement from moisture changes
H2	60mm to 75mm	Highly reactive clay site, which can experience very high ground movement from moisture changes
E	>75mm	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P		Filled sites
P		Sites which include: soft soils, such as soft clays, silts or organic soils, loose sands, landslip, mine subsidence, collapsing soils, soils subject to erosion, reactive sites subject to abnormal moisture conditions, sites with highly variable conditions such as weathered dolerite dykes, and sites which cannot be classified otherwise.

Table 1 – AS2870 Site Classes

The following tables summarise the ground investigation and DCP results and provide an assessment of site class along with the assessed allowable bearing capacity at likely foundation depth (0.30m)

Lot	Summary of Strata			Site Class	DCP Blows per 100mm	Allowable Bearing Capacity at 0.30m
	Fill	Gravel and Laterite	Weathered Rock/Laterite			
15224	0.00-0.20m	0.20-0.30m	0.30-0.40m	S	10, 12, 18, 25	>380kPa
15225	0.00-0.30m	0.30-0.40m	0.40-0.50m	S	18, 24, 25	>380kPa
15226	0.00-1.00m	1.00-1.10m	1.10m	P equivalent to S	13, 23, 25	>380kPa
15227	0.00-1.05m	1.05-1.10m	1.10-1.20m	P equivalent to S	20, 24, 21, 25	>380kPa
15228	0.00-1.00m	1.00-1.10m	1.10m	P equivalent to S	16, 25	>380kPa
15229	0.00-1.10m			P equivalent to S	19, 25	>380kPa
15230	0.00-1.10m			P equivalent to S	15, 14, 25	>380kPa
15231	0.00-0.60m	0.60-1.00m		P equivalent to S	19, 22, 25	>380kPa
15232	0.00-0.90m			P equivalent to S	22, 25	>380kPa
15233	0.00-0.45m	0.45-0.75m		P equivalent to S	15, 25	>380kPa
15234	0.00-0.20m	0.20-0.45m		S	8, 10, 9, 18, 25	230kPa
15235	0.00-0.25m	0.25-0.45m	0.45m	S	13, 19, 16, 12, 25	280kPa
15236	0.00-0.20m	0.20-0.45m	0.45m	S	22, 13, 18, 25	360kPa
15237	0.00-0.18m	0.18-0.80m	0.80m	S	11, 25	>380kPa
15238	0.00-0.05m	0.05-0.50m	0.50m	S	10, 25	>380kPa
15239	0.00-0.10m	0.10-0.20m	0.20m	S	17, 25	>380kPa
15240	0.00-0.10m	0.10-0.35m	0.35m	S	15, 18, 12, 15, 9, 11, 11, 12, 25	230kPa
15241	0.00-0.15m	0.15-1.10m	1.10m	S	7, 5, 14, 25	310kPa
15242	0.00-0.22m	0.22-0.80m	0.80m	S	14, 8, 5, 5, 23, 25	>380kPa
15243	0.00-0.12m	0.12-0.55m	0.55m	S	5, 7, 23, 25	>380kPa
15244	0.00-0.10m	0.10-0.40m	0.40m	S	11, 14, 25	>380kPa

Table 2 – Site Classification and Allowable Bearing Capacity for Lots 15224 to 15244

Lot	Summary of St0rata			Site Class	DCP Blows per 100mm	Allowable Bearing Capacity at 0.30m
	Fill	Sand/Gravel	Weathered Rock			
15245	0.00-0.18m	0.18-0.75m	0.75m	S	5, 17, 16, 17, 13, 17, 25	280kPa
15246	0.00-0.15m	0.15-0.75m	0.75m	S	4, 7, 8, 7, 7, 4, 8, 25	130kPa
15248	0.00-0.50m	0.50-1.50m		P equivalent to S	14, 23, 24, 25	>380kPa
15249	0.00-0.35m	0.35-1.50m		S	8, 15, 14, 16, 25	340kPa
15250	0.00-0.35m	0.35-1.50m		S	18, 14, 15, 19, 25	310kPa
15251	0.00-0.55m	0.55-1.50m		P equivalent to S	6, 8, 16, 25	340kPa

Table 3 – Site Classification and Allowable Bearing Capacity for Lots 15245 to 15246 and 15248 to 15251

5. Site Preparation

All earthworks should be carried out in general accordance with the requirements of AS 3798 *Guidelines on earthworks for commercial and residential developments*.

Prior to construction any remnant topsoil, uncontrolled fill and material containing organic matter should be stripped from the site. This material is not considered suitable for use as selected fill but can be stockpiled for later use as non-structural fill or for landscaping purposes.

The exposed surface should then be wetted or dried back to approximate optimum moisture content (OMC) and the exposed subgrade compacted to 95% Standard Maximum Dry Density as required by AS3798. A final test roll, under the supervision of a suitably qualified and experienced engineering geologist, should be undertaken to identify any remaining areas requiring further rolling (sand and gravel) or removal (clay and silt).

If required, additional fill for the building footprint should comprise granular material that is placed in 250mm thick layers, and then compacted to 95% modified maximum dry density ratio, within $\pm 2\%$ of OMC.

6. Foundations

Footing systems for residential dwellings on Class S and P equivalent to S sites can be designed in accordance with standard footings as set out in Section 3 of AS 2870.

P equivalent to S class means that in places the site is underlain by more than 0.40m of engineered fill, however because the fill has been engineered (rolled, moisture conditioned and compacted under Level 1 supervision) the fill can be considered equivalent to in situ material, in effect the site is classed as S Class.

7. Certification

Subject to the site preparation set out in Section 3, the data provided, the above review, and utilising Stockwell's method for the determination of bearing capacity, then all 27 Lots making up Zuccoli Stage 3E are certified as having:

- an allowable bearing capacity of at least 100kPa at likely foundation depth (at least 0.30m depth);
- are Class S or P equivalent to S; and
- hence are considered suitable for the construction of single or double residential dwellings.

8. References

1. Northern Territory Geological Survey *Extractive Minerals Within the Outer Darwin Area*
2. Australian Standard AS 2870 *Residential Slabs and Footings*
3. MJ Stockwell, 1977, *Determination of Allowable Bearing Pressure Under Small Structures*

9. Limitations

This report is provided for the exclusive use of HiQA and their client for this project only and for the purposes described in the report. It should not be used for other projects or by a third party. In preparing this report WANT has necessarily relied upon information provided by the client and/or others.

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared to meet the specific needs of individuals. The results provided in the report are indicative of the sub-surface conditions only at the specific testing locations to the depths investigated at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic influences.

During construction, excavation is frequently undertaken which exposes the actual subsurface conditions. For this reason geotechnical consultants should be retained through the construction stage, to identify variations if they are exposed and to conduct additional tests which may be required and to deal quickly with geotechnical problems if they arise.

This report cannot be applied to other sites.

Appendix A

Location Plan

Borehole / Test Pit Logs

Dynamic Cone Penetrometer Results