



Douglas Partners
Geotechnics | Environment | Groundwater

Report on
Land Capability Assessment

Site 5 - Wallarah Rezoning
380 Motorway Link, Wallarah

Prepared for
Darkinjung Local Aboriginal Land Council

Project 83145.01
November 2017

Integrated Practical Solutions





Douglas Partners

Geotechnics | Environment | Groundwater

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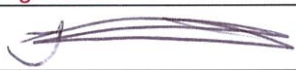
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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

Signature		Date
Author		29 November 2017
Reviewer		29 November 2017



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Report on Land Capability Assessment

Site 5 - Wallarah Rezoning

380 Motorway Link, Wallarah

1. Introduction

This report presents the results of a land capability assessment undertaken for Site 5 – Wallarah Rezoning at 380 Motorway Link, Wallarah. The investigation was commissioned in an email received from Chris Smith from ADW Johnson on behalf of Darkinjung Local Aboriginal Land Council (DLALC) dated 19 October 2017 and was undertaken in accordance with Douglas Partners' (DP) proposal CCT170104 dated 10 October 2017 and in consultation with ADW Johnson Pty Ltd.

It is understood that the development of the site will include rezoning, leading to a number of possible land uses. The objective of this land capability assessment was to provide preliminary information on the following issues:

- Agricultural potential / suitability;
- Mining / mine subsidence;
- Groundwater data;
- Areas of soft / unsuitable ground;
- Slope and drainage;
- Areas of potential flooding;
- Soil erodibility / dispersion;
- Soil permeability;
- Salinity potential;
- Extractive Resource Areas; and
- Provide recommendations for further intrusive investigation / ground truthing.

This assessment comprised a desktop review of available data, including a previous report prepared for the site by DP. It should be noted that some of the information presented in this report is taken from the previous report prepared for the site (Section 3).

The details of the desktop review are presented in this report, together with comments and recommendations on the issues listed above.

No intrusive investigation was undertaken.

2. Site Information

2.1 Site Identification

A summary of the site identification details is presented in Table 1, and the location of the site is shown in Figure 1 and Figure 2 (below) and Drawings 1 and 2, Appendix A.

Table 1: Site Identification Details

Identification	Description
Registered Owner	Darkinjung Local Aboriginal Land Council
Street Address	380 Motorway Link, Wallarah
Lot Numbers	Part of Lot 1 in Deposited Plan 1156997; and Lots 2 and 3 in Deposited Plan 1156997.
Site Area	Approximately 47 hectares proposed for re-zoning
Current Site Zoning	E2 Environmental Conservation and RU6 Transition
Parish	Munmorah, County of Northumberland
Local Government Area	Central Coast Council (CCC)
Current Land use	Vacant bushland.

Figure 1, is a plan of the local area and shows the site in relation to various local features.

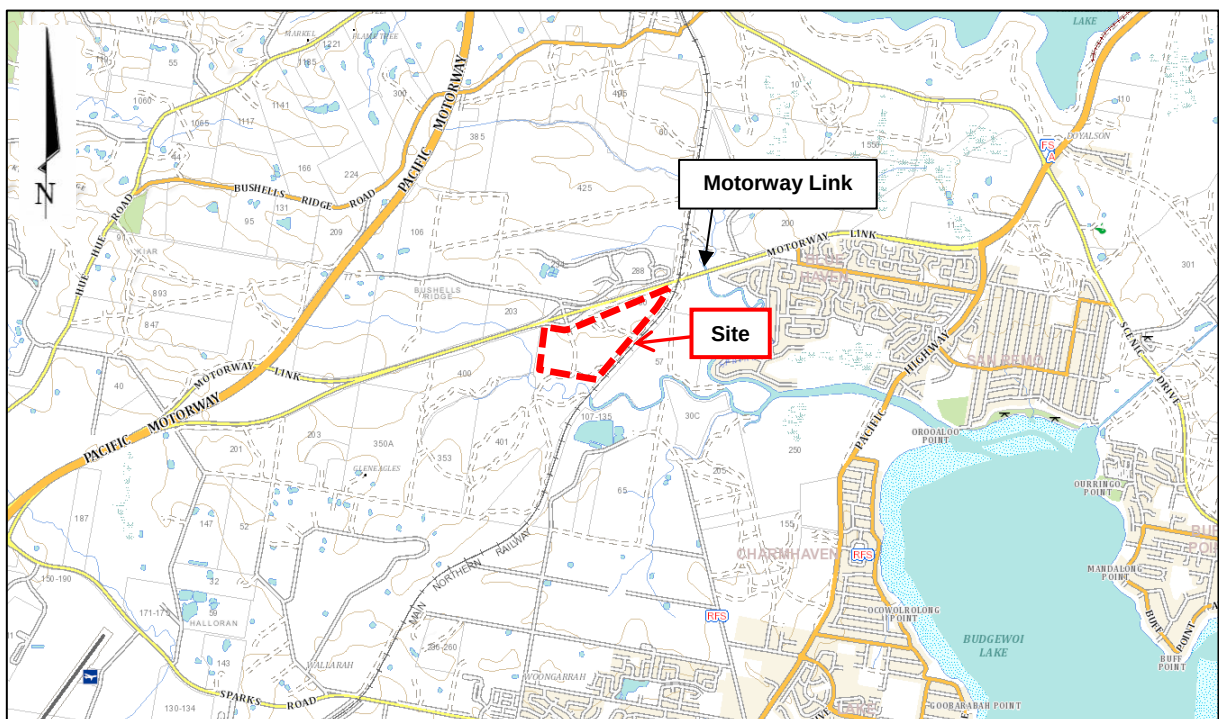


Figure 1: Location of the Site (image sourced from SIX Maps)

Figure 2 is an aerial view of the local area.

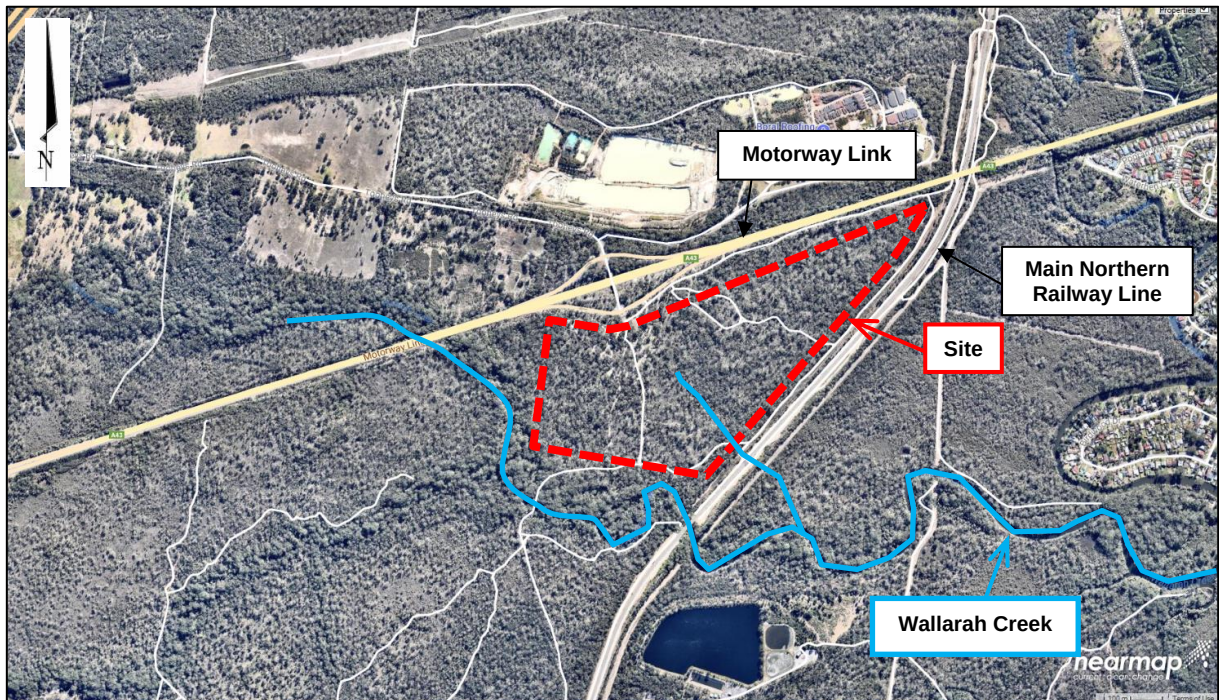


Figure 2: Location of the site (image sourced from nearmap.com, dated 18 July 2017)

2.2 Site Description

At the time of the previous investigation (Section 3), the majority of the site comprised bushland and typically had a grass surface cover. No structures were evident at the site, although the site was traversed by several tracks. Other Site features are discussed in Section 3.

3. Previous Report

DP prepared a report for the site titled *Report on Preliminary Site Investigation, Site 5 – Wallarah Rezoning, 380 Motorway Link, Wallarah*, prepared for DLALC (DP Project No. 83145.00) dated September 2017.

The objective of the preliminary site investigation (PSI) was to provide an initial assessment of the site's contamination status to support a rezoning application. The future development was understood to comprise a low density residential land use.

The PSI comprised a review of desktop information, site walkover by a Senior Environmental Scientist and a Senior Geotechnical Engineer, development of a preliminary conceptual site model (CSM) and comments on slope stability.

The site walkover completed as part of the PSI noted the following:

- With the exception of minor tracks traversing the site and the area to the south of Tooheys Road, the remainder of the site comprised native bushland vegetation with a surface cover of grass which limited access to other areas. Therefore, the walkover was limited to accessible areas along the existing tracks;
- A number of fragments of potential asbestos-containing material (PACM) were observed amongst demolition debris and fly-tipped materials, and were typically concentrated around the tracks that traversed the site. The approximate locations of some of these areas where PACM fragments were observed are shown on Drawing 1, Appendix A. It should be noted, however, that small quantities of fly-tipped debris were dispersed intermittently along or adjacent to most tracks, and therefore the potential for such materials to be present in other areas of the site cannot be completely ruled out;
- The area located to the south of the intersection of Tooheys Road and the Motorway Link appeared to be partially cleared. Based on the historical photographs, the original clearance activities appeared to be associated with the construction of Tooheys Road and the Motorway Link. Furthermore, areas of suspected excavation and filling were identified; with inclusions of tile, brick, concrete, asphalt and PACM fragments at the surface of the filling...

Surface slopes across most of the site were generally less than about 4°, although locally steeper areas were observed in areas of suspected past disturbance (south of the intersection of Tooheys Road and the Motorway Link) and also adjacent to the intermittent watercourse. Soils exposed along the network of tracks within the site comprised predominately residual sandy clay / clayey sand. Pockets of weathered sandstone were also exposed in elevated parts of the site where the trails had been worn to depths of about 0.5 m below the surrounding ground.

The PSI Report concluded:

...Based on the findings of the desktop review and site walkover assessment, DP considers that there is a low to medium potential for contamination given the past site activities and the existing site conditions. Some potential contamination sources were identified; including fly-tipped materials and imported filling materials.

Overall, Site 5 would generally be considered compatible (from a site contamination perspective) with the proposed residential land uses, subject to removal of all existing fly-tipped material (including PACM) and to the results of further intrusive contamination investigations to obtain quantitative data on the contamination status of the site. In this regard, prior to commencement of intrusive investigations, it would be prudent to also undertake a detailed site walkover in conjunction with vegetation clearing activities with a view to verifying the presence/absence of additional fly-tipped materials and/or areas of concern in parts of the site that were previously inaccessible. Subsequent to removal of all fly-tipped materials, the intrusive investigations could initially be limited to the assessment of soils on a broad grid, combined with additional targeted sampling in the areas of environmental concern (e.g. the area located to the south of the intersection of Tooheys Road and the Motorway Link).

These investigations should include an assessment of site soils for chemical and physical characteristics to confirm the perceived low to moderate risk of contamination. The investigations should also target the areas where PACM have been observed on the ground surface to evaluate the vertical and lateral extent of PACM contamination (if any) at the site. Should the results of the intrusive investigations identify the need for remediation, then an adequate remediation and validation

programme will need to be implemented to render Site 5 suitable for the proposed residential development.

Based on the proposed development area, preliminary investigations for acid sulfate soils are currently not warranted. If the areas of proposed development were to change such that work is expected to encroach into the lower-lying areas associated with the watercourses, then further review and assessment for the presence of acid sulfate soils would be required.

Furthermore, it is considered that the portions of the sites that are currently proposed to be developed for residential allotments and roads do not pose any significant risk with regard to landslide or slope instability. Construction of the development will still need to adopt suitable excavation support measures and safe batter slopes, and these would be determined at a later stage...

4. Topography

Review of the local topographic mapping and site observations indicated that site is located near the crest of a relatively low hill (at approximately RL 28 m AHD) (refer to Figure 3). Surface levels at the site generally slope down towards all site boundaries, however, the majority of the site slopes down to the south and south-east toward tributaries of Wallarah Creek. Surface levels adjacent to the southern site boundary are approximately RL 8 m AHD.

Surface water would generally be expected to infiltrate at the site and/or would flow into Wallarah Creek and its tributaries.

Figure 3 is a plan of the local area and shows the site in relation to surface elevation contours and local watercourses.

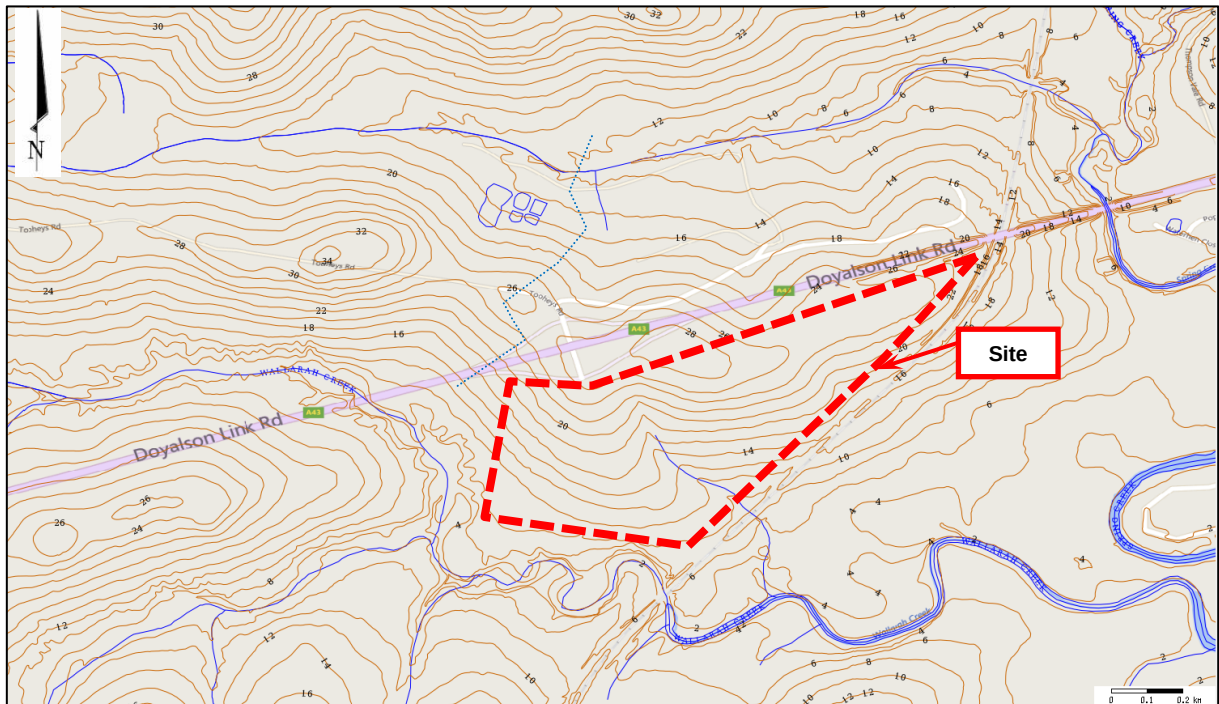


Figure 3: Site Topography (image sourced from Microsoft Virtual Earth with 2 m elevation contour overlay)

5. Adjacent Site Uses

Surrounding land uses include the following:

- North – Motorway Link and then Boral Roofing and Masonry (quarry and manufacturing plant) further north which is situated down slope from Motorway Link ;
- East – Main Northern Railway line then bushland;
- South – Main Northern Railway Line and then Wallarah Creek surrounded by bushland; and
- West – Bushland.

6. Regional Geology and Soil Landscape

6.1 Geological Setting

Reference to the NSW Sydney Regional Geology Sheet indicates that the majority of the site is underlain by Tuggerah Formation (identified as 'Rnu' in Figure 4), which typically comprises red, green and grey shale and quartz-lithic sandstone. This is overlain in the areas close to Wallarah Creek by Quaternary Alluvium (identified as 'Qa' in Figure 4) which typically comprises a mix of gravel, sand, silt and clay.

6.2 Soil Landscape

Reference to Gosford-Lake Macquarie 1:100,000 Soil Landscapes Sheet indicates that the majority of the site is underlain by Gorokan Erosional soil landscape (identified as 'gk' in Figure 5). Additionally, areas in close proximity to the Wallarah Creek are mapped as Wyong Alluvial (identified as 'wy' in Figure 5) soil landscape.

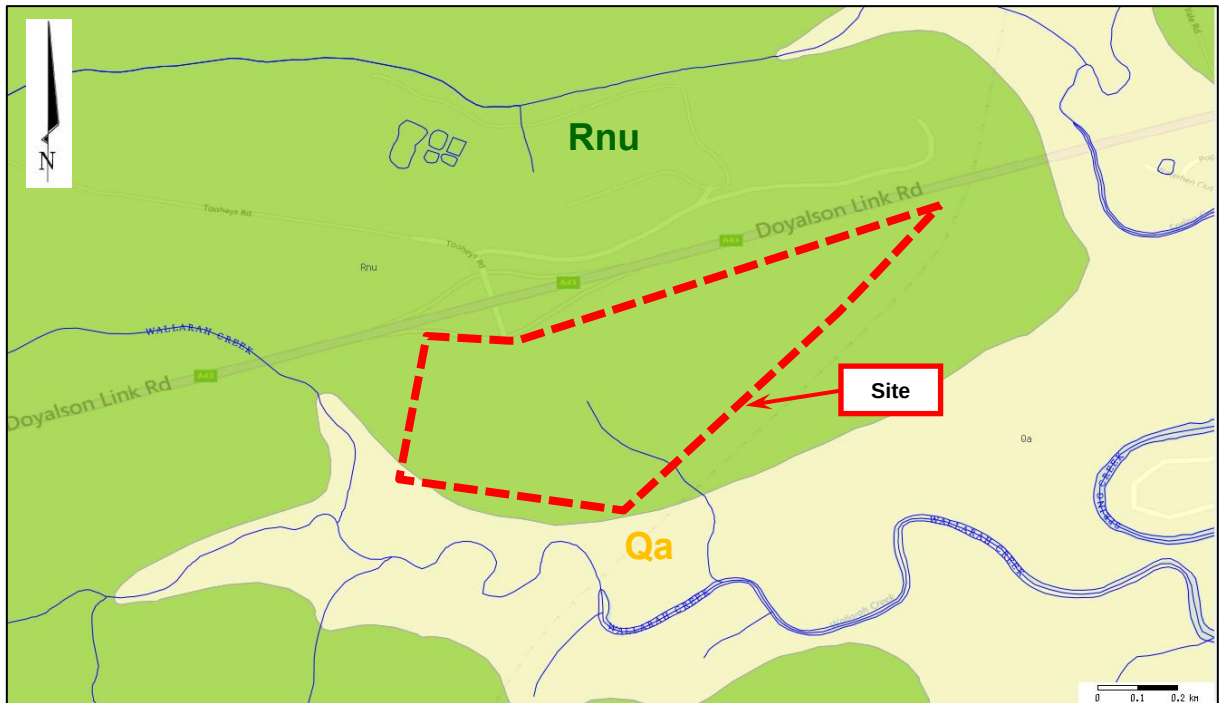


Figure 4: Site Geology Mapping (image sourced from Microsoft Virtual Earth with NSW Sydney Regional Geology Sheet)

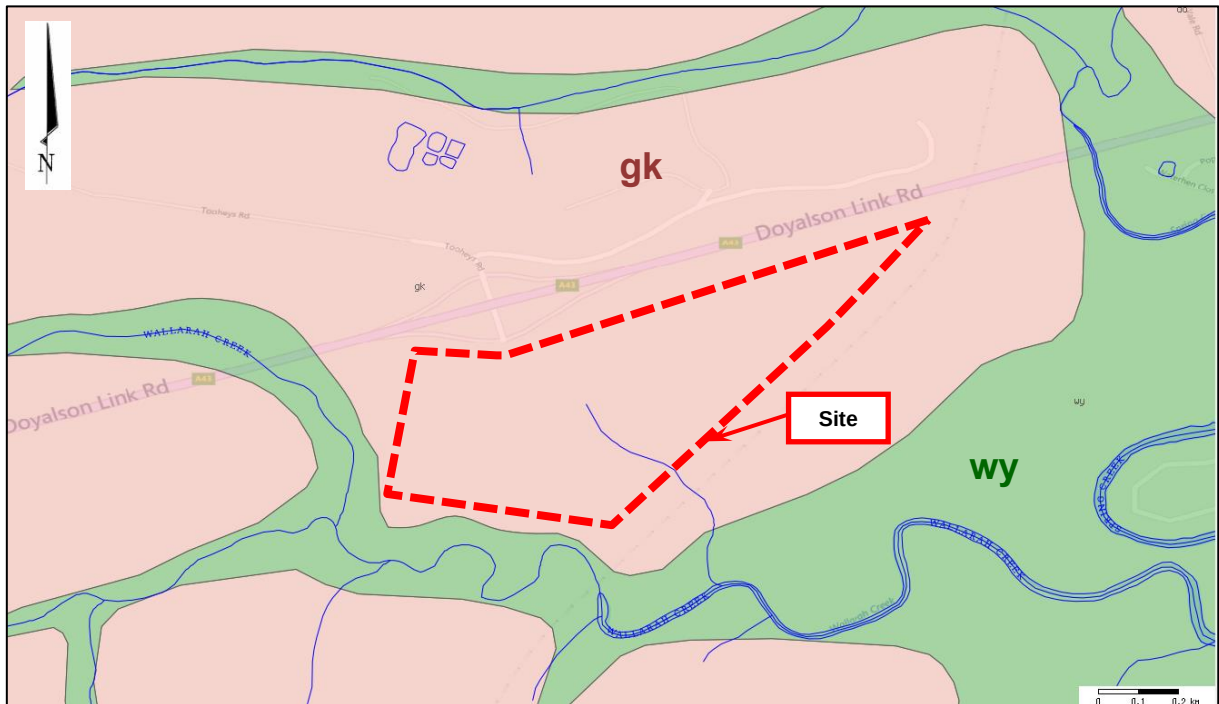


Figure 5: Site Soil Landscape Mapping (image sourced from Microsoft Virtual Earth with Gosford-Lake Macquarie 1:100,000 Soil Landscapes Sheet overlay)

The soil landscape sheet provides the following regarding the soil landscapes mapped within the area:

6.2.1 Gorokan Erosional Soils

The entire site area is mapped as comprising Gorokan Erosional Soils.

- Identified as 'gk' in Figure 5;
- Landscape – undulating low hills and rises; local relief <30 m; slope gradients <15%
- Partially cleared low open-forest;
- Current land use is mostly native or unimproved pasture with some uncleared woodland. Pastures are mainly use for horse and cattle grazing;
- Limitations –
 - Very high erosion hazard;
 - High erodibility;
 - Localised Run-on;
 - Localised seasonal waterlogging;
 - Localised high foundation hazard;
 - Moderate foundation hazard;
 - Hardsetting;
 - Strongly acid; and
 - Low fertility, plastic, impermeable soils.

Overall, mapping indicates generally moderate limitations for urban development and high to severe limitations for regular cultivation but low limitations for grazing for the Gorokan erosional soils.

6.2.2 Wyong Alluvial

The site is not mapped as Wyong Alluvial, however, the site is surrounded by land mapped as comprising Wyong Alluvial Soils.

- Identified as 'wy' in Figure 5;
- Landscape – broad poorly drained floodplains and alluvial flats, slope gradients <3%, local relief <10 m, meander scolls, oxbows and swamps are common;
- Extensively cleared open forest;
- Current land use includes mostly cattle and horse grazing on improved pastures, industrial and urban areas;
- Limitations –
 - Flooding;
 - Seasonal waterlogging;
 - High foundation hazard;
 - Localised permanent waterlogging;
 - Localised stream bank erosion;
 - Localised acid sulfate potential;
 - Strongly acid, poorly drained;
 - Impermeable soils of low fertility; and
 - Saline subsoils.

Overall, mapping indicates high to severe limitations for urban development due to the flooding hazard, generally low limitations for cultivation and generally low to moderate limitations for grazing for the Wyong Alluvial soils landscape.

7. Acid Sulfate Soils

The local acid sulfate risk mapping indicates that site is mapped as having no known occurrence of acid sulfate soils. Notwithstanding, nearby areas, on the south-east side of the Main Northern Railway Line, are mapped as having a high risk of acid sulfate soils between 1 m and 3 m below the ground surface. Figure 6 is a street map of the local area and shows the site in relation to areas mapped as having a probability of acid sulfate soils.

It is noted that the mapping generally only provides an indication of the presence / absence of acid sulfate soils. In this regard, during the site walkover, soils exposed along the tracks were considered to be residual soils weathered from the Tuggerah Formation and therefore would not be acid sulfate soils.

For the currently proposed low density residential subdivision development, therefore, acid sulfate soils are not considered to be an issue. If the areas of proposed development were to change such that work is expected to encroach into the lower-lying areas associated with the watercourses, then further review and assessment for the presence of acid sulfate soils would be required.

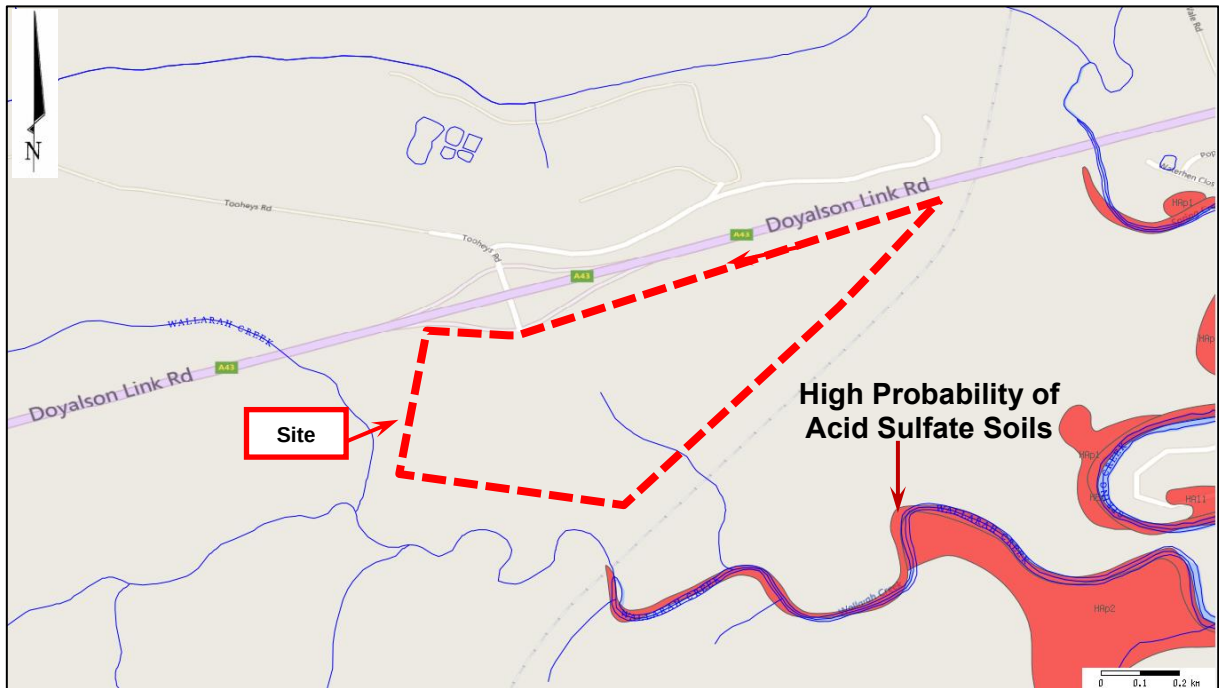


Figure 6: Site Acid Sulfate Soil Risk Mapping (image sourced from Microsoft Virtual Earth with Acid Sulfate Risk Mapping Sheet overlay)

8. Groundwater

Given the topography and geology, and noting the presence of an intermittent tributary of Wallarah Creek within the site, it is considered likely that a permanent groundwater table is present at relatively shallow depths (i.e. less than 5 m to 10 m depth) in the southern portions of the site. It should be noted that groundwater levels are transient and can be affected by factors such as soil permeability and recent weather conditions...

Figure 7 is a street map of the local area and shows the site in relation to the local registered groundwater bores.

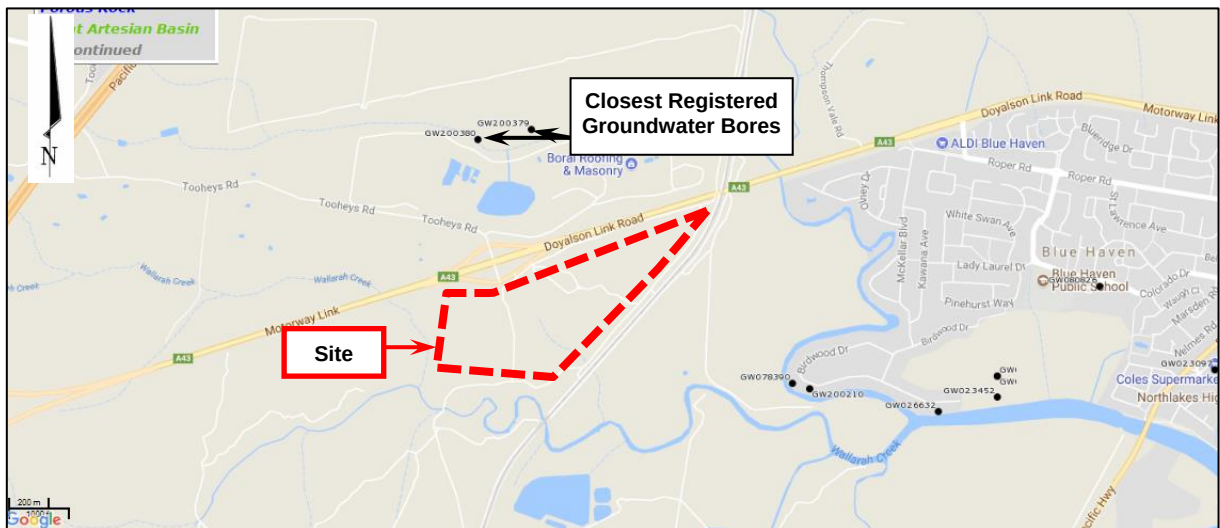


Figure 7: Registered Groundwater Bores (image sourced from Microsoft Virtual Earth with NSW Office of Water Registered Groundwater Bore location overlay)

A search for registered groundwater bores in the Department of Natural Resources groundwater bore database [Note: this function has been taken up by NSW Department of Industries Water] indicated that there are four registered groundwater bores within a 1.0 km distance of the site. The information available from the reports suggests that the closest bores (GW200379 and GW200380) were installed for monitoring purposes to depths of approximately 5 m. The available information shows that both bores were installed within clay soils.

Given the site topography in relation to the locations of the bores and the presence of intermittent watercourses within the site, it is considered unlikely that any potential groundwater contamination from the site would impact any registered groundwater bores.

9. Comments

9.1 Agricultural potential / suitability

The soil landscape mapping indicates that the site would be suitable for grazing but not suitable for cultivation. This is largely due to the site having low fertility and acidic soils.

9.2 Mining / mine subsidence

The site is not within a proclaimed mine subsidence district. The approval of Subsidence Advisory NSW (formerly the NSW Mine Subsidence Board) is not required for development of the site.

9.3 Groundwater

Given the topography and geology, and noting the presence of an intermittent tributary of Wallarah Creek within the site, it is considered likely that a permanent groundwater table is present at relatively shallow depths (i.e. less than 5 m to 10 m depth) in the southern portions of the site. It should be noted that groundwater levels are potentially transient and can be affected by factors such as soil permeability and recent weather conditions.

9.4 Areas of soft / unsuitable ground and Potential Flooding

The site (mapped as Gorokan Erosional Soils) is likely to experience seasonal flooding and waterlogging.

9.5 Slope and Drainage

The mapped and observed slopes across the site were generally <15% and the site soils are mapped as being impermeable / poor drainage and are likely to experience seasonal waterlogging and flooding.

9.6 Soil erodibility / dispersion

The site (mapped as Gorokan Erosional Soils) is considered to have a high to very high erosion and dispersion potential.

9.7 Soil permeability

Based on the mapping, the site is considered to comprise impermeable / low permeability soils. These soils are consistent with seasonal waterlogging and flooding.

9.8 Salinity potential

Mapping does not indicate that the site has saline subsoils.

9.9 Extractive Resource Areas

According to the North Wyong Shire Structure Plan, prepared by the NSW Government Department of Planning and Infrastructure, dated October 2012, the whole of Site 5 is within an area mapped as an extractive resource area (clay and gravel). The clay resource in the area has state significance due to presence of the clay and the existence of a nearby roof tile manufacturing plant. The gravel resource has regional significance.

The plan states that...*Planning for this area needs to ensure that:*

- *Mining and quarrying remains a permissible use, with development consent, in the resources areas;*
- *Appropriate land use buffers are provided between these areas and future development; and*
- *These areas contribute to the longer-term formation of a green corridor, both during extraction (e.g. by maintaining existing vegetation links and / restoration on areas not being quarried or mined) and on completion of resource extraction...*

The client has also indicated the following information in relation to the extractive resource areas:

- Boral lodged an *Assessment Lease Application* (ALA), over a large area (including the subject site) and the subject site was mapped as covering approximately 7.8% of the identified resource area; and
- Boral has previously advised that the undisturbed area of the existing clay pit at 234 Tooheys Rd (Lot 194 DP1032847) had approximately 35-40 yrs of resource remaining, based on current market demands. The option to extract from the subject site area was considered by Boral, and found to not be viable as once the clay (used for roofing tiles) is extracted (in 6 week campaigns), it deteriorates fairly quickly if left exposed.

10. Recommendations for further intrusive investigation

Overall, it is considered that the site is generally compatible with the proposed rezoning for residential subdivision, subject to further remedial works / investigation being completed as follows:

- Removal of all existing fly-tipped material;
- Further targeted intrusive investigations to obtain quantitative data on the contamination status of the site;
- Detailed geotechnical assessment once layout of roads, services and lots are finalised; and
- Assessment of the quality and quantity of clay and gravel for possible quarrying in the extractive resource area, if required.

11. Limitations

Douglas Partners (DP) has prepared this report for this project at Site 5 – Wallarah Rezoning in accordance with DP's proposal CCT170104 dated 10 October 2017 and acceptance received from Chris Smith from ADW Johnson on behalf of Darkinjung Local Aboriginal Land Council (DLALC) dated 19 October 2017. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Darkinjung Local Aboriginal Land Council and ADW Johnson for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations

or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

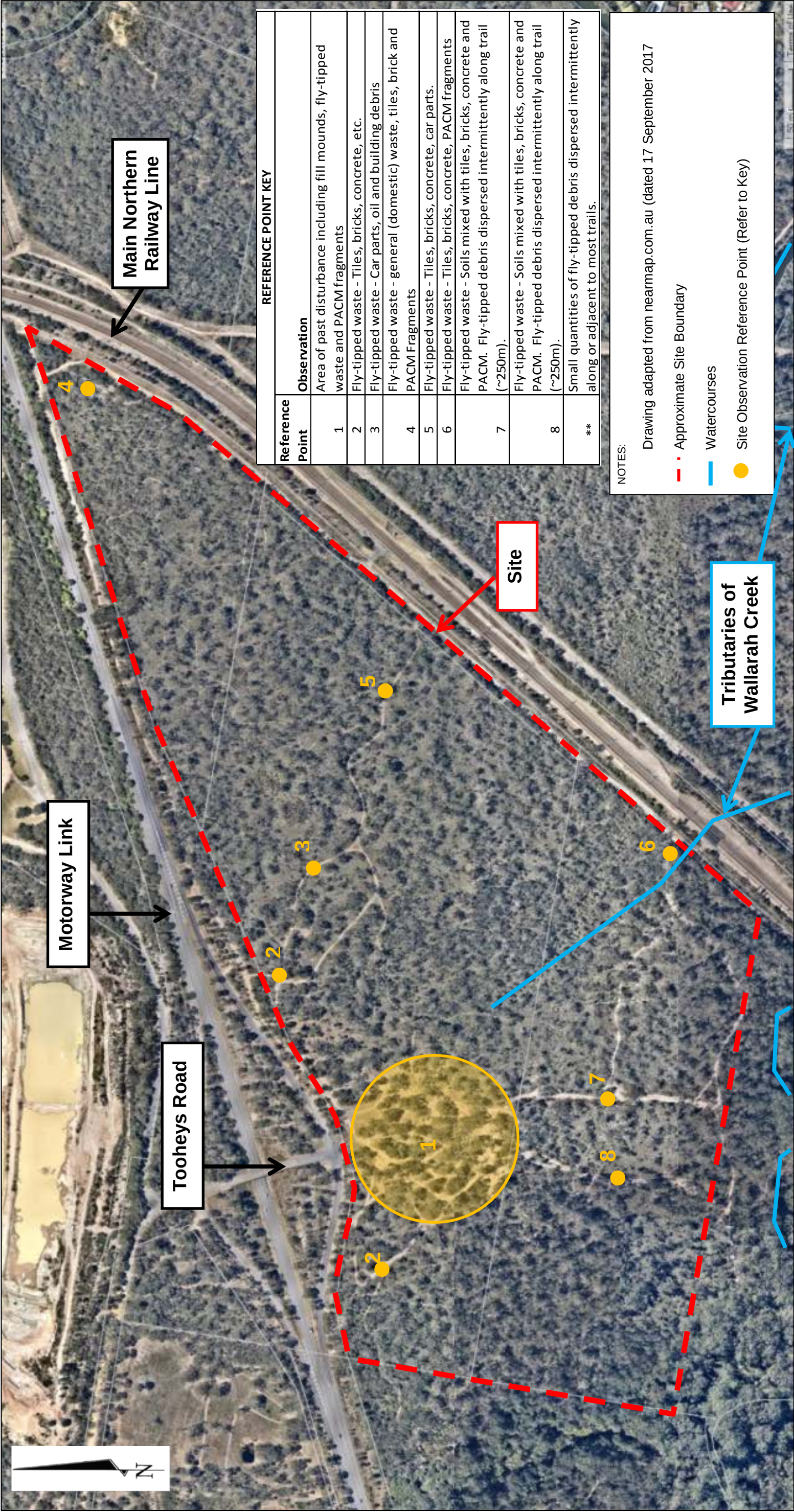
The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

Drawing 1

Proposed Subdivision Layout



Douglas Partners Geotechnics Environment Groundwater	CLIENT: Darkinjung Local Aboriginal Land Council			TITLE: Site Plan and Features		PROJECT No: 83145.00
	OFFICE: Central Coast	DRAWN BY: BJK		Preliminary Site Investigation		DRAWING No: 1
	SCALE: As shown	DATE: Sept 2017		380 Motorway Link, Wallarah		REVISION: A



238532(7)-PSK-001-B

Plotted By: Patrick Buscombe Plot Date: 31/10/17 1:30:47PM Cod File: S:\238532(7)\238532(7) WALLARAH\DRAWINGS\PLANNING\SKETCHES\238532(7)-PSK-001-B.DWG
This plan includes coloured information. If you have a black and white copy you do not have all of the information. This note is coloured red.

ver	date	comment	drawn	pm	level information	scale (A1 original size)	notes
B	31.10.17	FOR INFORMATION	PB	BW	DATUM: N/A CONTOUR INTERVAL: N/A	0 50 100 125m SCALE: 1:2500 (FULL)	

• project management

• civil engineering

• infrastructure

• superintendency

• economic analysis

• social impact

• town planning

• surveying

• development feasibility

• visualisation

• urban design

drawing title:

WALLARAH INDICATIVE
SUBDIVISION LAYOUT

location: LAKE MUNMORAH

council: -

dwg ref: 238532(7)-PSK-001

client:

Local Aboriginal Land Council
DARKINJUNG

qaw

johnson

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www.odwjohnson.com.au

Working beyond expectations

Appendix B

Notes About This Report

About this Report

Douglas Partners



Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

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This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;

- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.