



Douglas Partners

Geotechnics | Environment | Groundwater

Report on
Desktop Geotechnical Assessment

Aland Leppington – Residential Core
Lots 37 & 38A DP8979, 156 - 166 Rickard Road,
Leppington

Prepared for
Leppington (1) 88 Development Pty Ltd

Project 217600.01
August 2023

Integrated Practical Solutions



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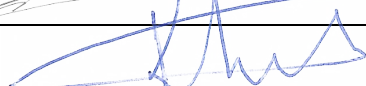
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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

Signature	Date
Author 	29 August 2023
Reviewer 	29 August 2023



Douglas Partners Pty Ltd
 ABN 75 053 980 117
www.douglaspartners.com.au
 18 Waler Crescent
 Smeaton Grange NSW 2567
 Phone (02) 4647 0075

Table of Contents

	Page
1. Introduction.....	1
2. Background	2
3. Site Description	2
4. Published Data	4
5. Site Walkover Inspection.....	9
6. Proposed Development.....	10
7. Comments	10
7.1 Geotechnical Model	10
7.2 Slope Stability	11
7.3 Erosion Potential.....	11
7.4 Water logging.....	11
7.5 Soil Salinity and Aggressivity.....	11
7.6 Site Preparation and Earthworks	11
7.7 Desilting of Dams.....	12
7.8 Excavation and Support.....	12
7.9 Site Classification.....	12
7.10 Foundations	12
7.11 Anticipated Geotechnical Constraints.....	13
8. Further Investigation	13
9. Conclusion.....	13
10. References	14
11. Limitations	14
 Appendix A: About This Report	
Appendix B: Drawing 1 – Site Location Plan and Features Drawing 2 – Slope Analysis Plan	
Appendix C: Site Photographs (Photo Plates 1 – 5)	

Report on Desktop Geotechnical Assessment

Aland Leppington – Residential Core

Lots 37 & 38A DP8979, 156 - 166 Rickard Road, Leppington

1. Introduction

This report presents the results of a desktop geotechnical assessment undertaken for the proposed Aland Leppington – Residential Core at Lots 37 & 38A DP8979, 156 - 166 Rickard Road, Leppington. The investigation was commissioned by David Hamilton of Leppington (1) 88 Development Pty Ltd and was undertaken in accordance with Douglas Partners Pty Ltd (DP) proposal 217600.P.001.Rev0 dated 24 August 2022.

It is understood that the proposed development of the site includes the construction of a mixed-use subdivision. The assessment was carried out to provide information on the following to support a development application:

- A review of information provided;
- A site walkover assessment by a geotechnical engineer;
- Review of publicly available geological, survey and other associated mapping;
- Review of in-house geotechnical information;
- Assessment and reporting on the data review and site walkover findings with comments on potential geotechnical constraints including:
 - Published geology, soil landscape, soil salinity and acid sulfate soil mapping and aerial photography of the site;
 - Preliminary geotechnical model for the site (including groundwater);
 - Site preparation and earthworks;
 - Risk of slope instability;
 - Water logging, erosion and salinity;
 - Mine subsidence; and
 - Recommendations for further investigations.

The assessment included a site walkover and a review of previous investigations and publicly available data. The details are presented in this report, together with comments and recommendations on the items listed above.

2. Background

No intrusive subsurface investigation has been carried out by DP on the site and the comments provided within this report are based on information provided by the client, published information and information from previous work undertaken by DP in the area on nearby projects.

3. Site Description

The site comprises a quadrilateral shaped area of approximately 4.2 ha, with maximum north-south and east-west dimensions of some 250 m by 250 m. The site is bounded to the north and east by other properties similar to the subject site, to the south by Leppington Public School and to the west by Rickard Road.

The site generally slopes down to the west from Rickard Road with the overall difference in level of approximately 10 m from RL 94 m relative to Australian Height Datum (AHD) to RL 84 m. The site comprised levelled areas facing Rickard Road associated with the house structures, before falling away at grades of generally less than 10 degrees and localised grades of up to 15 degrees. Slopes in excess of 20 degrees are present where batters have been constructed around the shed structures.

At the time of inspection, the site was occupied by multiple dwellings and sheds.

A site plan with 1 m contour mapping along with the site boundary (shown in red) are presented in Figure 1 and site information is given in Table 1.



Figure 1: Site plan with 1 m contours

Table 1: Site Identification

Item	Details
Site Address	156 - 166 Rickard Road, Leppington
Legal Description	Lots 37 and 38A of Deposited Plan (D.P.) 8979
Local Council Area	Camden Council
Zoning	<ul style="list-style-type: none"> o Zone B7 Business Park
Current Use	<ul style="list-style-type: none"> o 166 Rickard Road (northern area) – Rural residential. A private truck servicing business with associated garage was located in the western portion of the property. o 156 Rickard Road (southern area) - Rural residential
Surrounding Uses	North – rural residential beyond which is Leppington railway station; East – Rural residential; South – Rural residential, educational (Leppington Public School); and West – Rural residential.

4. Published Data

4.1 Geology

The NSW Seamless Geological Series (GSNSW, 2019) indicates that the site is underlain by Triassic Aged Bringelly Shale of the Wianamatta Group and Cenozoic Aged alluvial floodplain deposits. The Bringelly Shale typically comprises shale, carbonaceous claystone, claystone, laminite and fine to medium-grained lithic sandstone with occasional coal and tuff. Bringelly Shale typically weathers to form clays of medium to high plasticity. The alluvial floodplain deposits typically comprise silt, very fine to medium grained, lithic to quartz rich sand and clay. The regional geology mapping is presented in Figure 2.



Figure 2: Regional Geology

Where: Dark green = Bringelly Shale (Twib), site boundary shown in red

4.2 Soil Landscape

Reference to the Penrith 1:100 000 Soils Landscape Sheet indicates that the site is underlain by the Blacktown soil landscape.

The Blacktown soil landscape (dark green with mapping unit bt) is characterised by topography of gently undulating rises on Wianamatta Group Shale, with local relief to 30 m and slopes usually less than 5%, typically represented by broad rounded crests and ridges with gently inclined slopes. This is a residual soil landscape, which the mapping indicates comprises multiple soil horizons that include shallow red-brown podzolic soils comprising mostly clayey soils on crests and upper slopes, to deep brown to yellow clay soils on mid to lower slopes and in areas of poor drainage. These soils are typically of low fertility, are moderately reactive, highly plastic and generally have a low wet strength. The soil landscape mapping is presented in Figure 3.



Figure 3: Soil Landscape

Where: Dark green = Blacktown (bt), site boundary shown in red

4.3 Hydrogeology

No watercourses are mapped within the site. It is however noted, that there is a small dam in the south eastern area of the site. Watercourses mapped within the vicinity of the site are presented in Figure 4.



Figure 4: Watercourses

4.4 Salinity

Reference to the Salinity Potential in Western Sydney Plan prepared by the Department of Infrastructure, Planning and Natural Resources in 2002, shows the site is located in an area of moderate salinity potential. It is noted that the mapping is based on soil type, surface level and general groundwater considerations but is not generally ground-truthed, hence actual soil salinity needs to be assessed to confirm the potential salinity. An extract of the salinity potential from available mapping is presented in Figure 5.

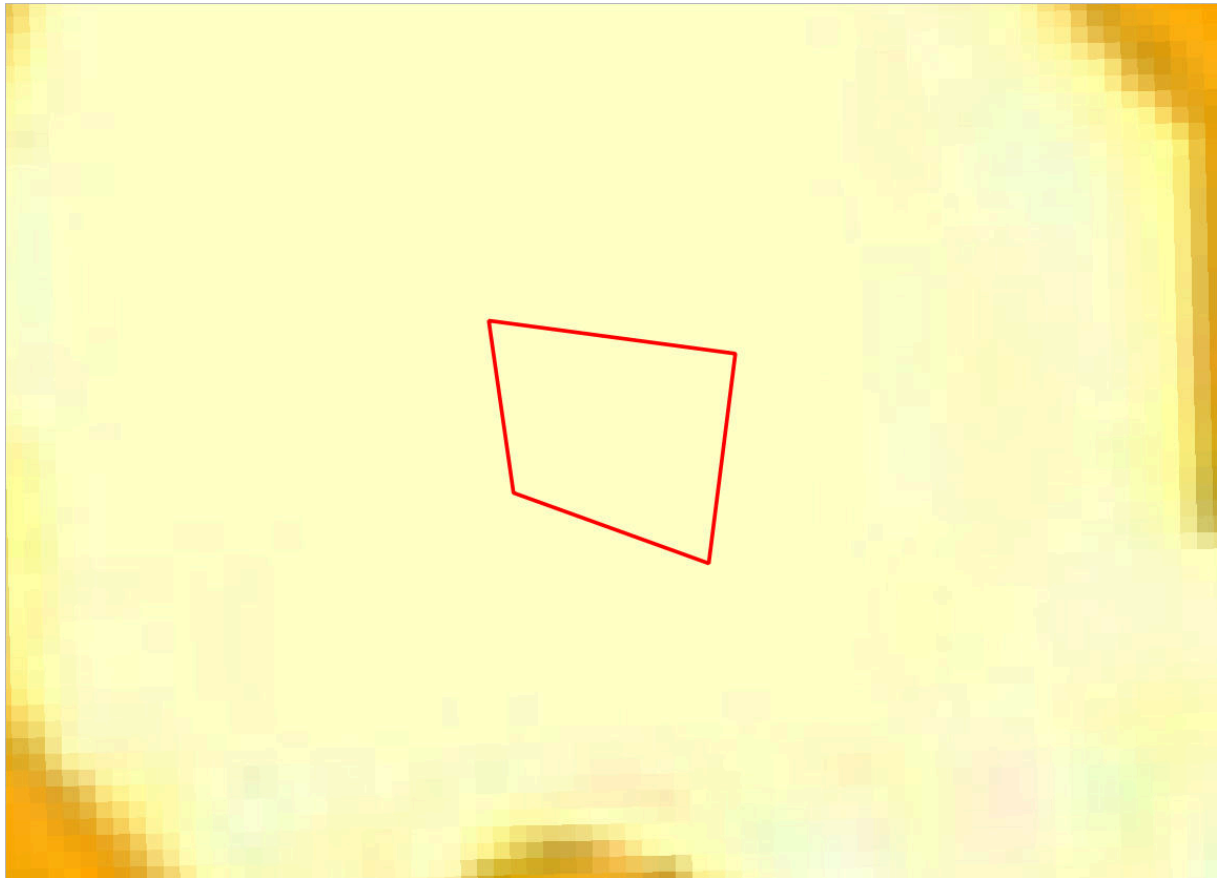


Figure 5: Salinity Potential

Where: Yellow = Moderate Salinity Potential, Orange = High Salinity Potential, site boundary in red

4.5 Acid Sulfate Soils

Reference to the acid sulfate soils information provided by the CSIRO Australian Soil Resource Information System website (CSIRO, 2014) indicates the site is in an area mapped as having an extremely low probability of occurrence (C4 rating) of acid sulfate soils.

4.6 Mine Subsidence

Reference to the digital data obtained from the NSW Government Subsidence Advisory Board (2011) indicates that the site is not located within a mine subsidence district.

4.7 Desktop Aerial Photo Review

Review of aerial photographs dating back to 2005 indicate that:

- 2005 - Significant ground disturbances were present in the north eastern area of the site. An extension of the farm shed in the north western corner had occurred;

- 2011 – Slight ground disturbance was visible in the north eastern area. An additional building, likely to be a house or farm shed, along with an extension of the sealed driveway, was built in the north western corner. Unknown materials, possibly refuse materials, appeared to be present adjacent to the eastern boundary;
- 2016 - Ground disturbances were visible in the south western and north eastern corners of the site. The north western area also underwent changes including the addition of two small and one large farm sheds, and visible agricultural land use with associated fencing and concrete slabs. The former pool was also removed. Ground disturbance and possible refuse materials were present on the eastern boundary of the site;
- 2022 - An additional shed and concrete slabs were installed in the north western area, with truck storage visible in the aerial photograph. Small stockpiling of unknown materials was also present in the vicinity. One of the sheds was extended and the nearby fencing was modified to resemble an animal enclosure/stockyard. Ground disturbances and further potential stockpiling of refuse materials were visible north of the animal enclosure. Ground disturbances, likely to be as a result of motorbike riding activities, was apparent in the southern area. Stockpiling of refuse materials, likely to be timber, was visible in the north eastern area.

5. Site Walkover Inspection

Inspection of the site, limited field mapping and photography (refer Photo Plates 1 – 5 in Appendix C) was carried out by geotechnical engineers on 12 October 2022. The site conditions and main features observed are summarised below with site photograph locations shown on Drawing 1 in Appendix B.

Stability

- The site generally slopes downwards from Rickard Road to the north east at grades of generally 5 – 10 degrees (Photos 1 and 2);
- Localised grades of up to approximately 15 – 20 degrees are associated with the levelled building platform constructed for the shed (Photo 3); and
- No evidence of recent slope instability on the site.

Soil and Rock Profiles

- No exposed natural soil or rock was observed.

Uncontrolled Fill

- Multiple structures were observed across the sites including the residences, workshops, sheds and installed services along with hardstands and unsealed driveways. Fill is expected to be present and associated with these structures and areas where earthworks have been undertaken on site (Photos 4 – 6);
- Uncontrolled fill was observed adjacent where the hardstand drain has been constructed, refer Drawing 1 (Photo 7); and
- Dam walls for the dam located on the southern boundary are considered uncontrolled fill.

Buried Services

- Underground services, including telecom and water were observed; and

Water Logging, Erosion and Salinity

- Water logging was observed along the northern lower lying areas in the vicinity of the neighbouring property's dam (Photos 8 and 9);
- Water logging was observed on the northern low side of the dam wall located on the south eastern boundary of the site (Photo 10); and
- No surface erosion or salt efflorescence was observed.

Other Site Observations

- The sites were occupied by multiple residential dwellings and workshops/sheds (Photos 1 and 6); and
- Overhead electrical services were observed along the Rickard Road site boundaries (Photo 4).

6. Proposed Development

Based on information provided by the client, it is understood that the proposed development for this site is residential and mixed use.

7. Comments

7.1 Geotechnical Model

Review of projects on nearby sites along with the results of the walkover indicate that the subsurface conditions are likely to comprise limited areas of uncontrolled fill overlying residual clays, then siltstone, shale and sandstone bedrock. Based on previous experience in the area, it is anticipated that the soil profile (depth to rock) could exceed depths of 5 – 6 m in the lower lying areas of the site with poor drainage, with a shallower soil profile likely in the higher areas of site as the surface elevation increases and drainage improves.

Bedrock is generally anticipated to be of initially very low to medium strength, increasing up to potentially very high strength, with variable strength layers. Intrusive investigation (boreholes) should be done to provide information on rock types and depths. If there is high strength rock within bulk excavation level, there can be significant effect on the costs of excavation and difficulties associated with the reuse of materials. A detailed rock depth investigation will be required to accurately estimate development costs and for conceptual planning.

The properties of the fill present on site could be highly variable. The identified water logged areas, and site levels of the dam relative to adjacent surface levels, indicate the potential for perched water.

7.2 Slope Stability

Desktop slope analysis mapping based on 2019 publicly available government LIDAR data (refer Drawing 2, Appendix B) was undertaken in conjunction with the site walkover investigation. In areas where steep grades were observed during the walkover (refer Section 5) and where noted on Drawing 2 in excess of approximately 15 – 20 degrees, care will be required to ensure that earthworks and excavation are undertaken in a safe manner and in accordance with design requirements. Any areas with steep grades that are to remain as part of the development must be assessed by a geotechnical engineer for stability and suitability.

7.3 Erosion Potential

Soils of the Blacktown soil landscape are typically of moderate to high erodibility. The more sodic or saline soils can have a high to very high erodibility and the erosion hazard for this landscape is estimated as moderate to very high.

It is considered that the erosion hazard within the areas proposed for development would be within usually accepted limits and could be managed by good engineering and land management practices.

7.4 Water logging

Water logging may be a constraint to development in the lower-lying areas of site, such as around the dam located on the south eastern boundary and around the neighbouring property's dam on the northern boundary. Further investigation should be undertaken including borehole or test pit excavation to determine soil moisture profiles.

7.5 Soil Salinity and Aggressivity

There is potential for the site to be affected by salinity and soil aggressivity to both steel and concrete, more likely in the lower lying portions of the site. Notwithstanding this, the salinity potential of the site would most likely be within usually accepted limits which could be managed by good engineering and land management practices. Further assessment of salinity and preparation of salinity management plans may be required prior to construction.

7.6 Site Preparation and Earthworks

The majority of the site should be suitable for conventional site preparation and earthworks that would typically comprise:

- Stripping of topsoils;
- Removal of all uncontrolled fill;
- Test rolling of exposed subgrades;
- Cutting (where required) to achieve design levels; and

- Placement of controlled fill in accordance AS3798 2007 Guidelines on Earthworks for Commercial and Residential Development.

It should be noted that any off-site disposal of spoil will generally require assessment for re-use or classification in accordance with current “Waste Classification Guidelines” (NSW EPA, 2014).

7.7 Desilting of Dams

A methodology may need to be developed for desilting and filling of the dam on the southern boundary if it is not retained during the site redevelopment and would include:

- Disposal of water away from the dam and spreading on the ground surface;
- Excavation of the silt and water affect material then moisture conditioning (drying) prior to blending;
- Removal of the uncontrolled fill in the dam wall, drying and blending for use as controlled fill or landscaping (subject to environmental and geotechnical suitability), or removed off site; and
- Placement of controlled fill to achieve design levels.

Any discharge or disposal of the pond water should be in accordance with Camden Council requirements.

7.8 Excavation and Support

All uncontrolled fill, natural soils and bedrock up to very low to low strength should be readily removed using a conventional medium sized excavator with a toothed bucket with some light ripping, or a D6 or equivalent dozer. Excavations in soil and weathered rock should include provision for temporary support using batters, benching or shoring. Alternatively, excavations and fill areas can be supported by engineer-designed retaining walls.

7.9 Site Classification

Based on DP’s experience in the area with soils associated with the site mapping and on nearby projects, following bulk earthworks undertaken in accordance with Section 7.6, classification in accordance with the “Residential Slabs and Footings” code (AS 2870, 2011) will likely result in lot classifications ranging from Class M (moderately reactive) to Class H1 (highly reactive), where the profile will be predominantly reactive clay or controlled clay fill.

7.10 Foundations

Design of foundations for proposed structures can only be undertaken once further (more detailed) investigation has been undertaken. However, as a guide based on expected subsurface conditions, the site is likely suitable for the design of conventional pad or strip footings or deeper piled footings to support loads usually associated with multi-level buildings. Footing systems founded uniformly in natural stiff to very stiff or stronger clay or controlled clay fill could be designed using an allowable bearing

pressure of 150 kPa and footings founded on weathered rock could be designed using an allowable bearing pressure of 700 kPa.

If differential or total estimated settlements are beyond tolerable limits or where high loads are proposed, a footings-to-rock system would be required. The principal advantage of footings-to-rock systems would be that settlements (both total and differential) would be negligible.

All footing systems must be designed and constructed in accordance with sound engineering principles. Care must be exercised to ensure that all footing trenches/piers are inspected for design compliance prior to the placement of steel and the pouring of concrete.

7.11 Anticipated Geotechnical Constraints

Based on the site walkover and available information, the following issues would be the major geotechnical constraints that need to be considered for the proposed development:

- Removal or management of uncontrolled fill surrounding the footings and platforms constructed associated with the structures present on site, and other identified areas;
- Potential differential settlement of fill beneath large structures; and
- Water logging of the site through the low-lying areas.

8. Further Investigation

Further investigation will be required as the project planning and design progresses and any relevant geotechnical comments or recommendations arising from this work will be required to be incorporated into the design. Additional work will also be required during the project's construction phase. Specific investigation would likely include (but not necessarily be limited to):

- Detailed intrusive geotechnical investigation including a rock depth and rippability assessment to determine subsurface conditions within the site to provide design parameters and to inform construction methodology as well as identify geotechnical constraints;
- Salinity and aggressivity investigation for site soils;
- Detailed geotechnical investigations on a stage-by-stage basis to determine pavement thickness designs and lot specific investigations, as well as stage specific issues; and
- Routine inspections and earthworks monitoring during construction.

9. Conclusion

The results of the desktop geotechnical assessment indicate that the proposed development of the site should be feasible from a geotechnical perspective. Additional investigation will be required as the detailed design progresses and any relevant geotechnical comments or recommendations arising from this work will be required to be incorporated into the design.

The planning, design and construction should be carried out in accordance with good engineering practice.

10. References

AS 2870. (2011). *Residential Slabs and Footings*. Standards Australia.

CSIRO. (2014). *Australian Soil Resource Information System*. Retrieved from asris.csiro.au

GSNSW. (2019). *NSW Seamless Geology*. Geological Survey NSW Web Map Service.

NSW EPA. (2014). *Waste Classification Guidelines, Part 1: Classifying Waste*. NSW Environment Protection Authority.

11. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at Lots 1 & 2 DP812366 and Lots 36A & 37 DP8979, Leppington in accordance with DP's proposal dated 24 August 2022 and acceptance received from David Hamilton. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Leppington (1) 88 Development Pty Ltd 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.

The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

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.

Douglas Partners Pty Ltd

Appendix A

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.

Copyright

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

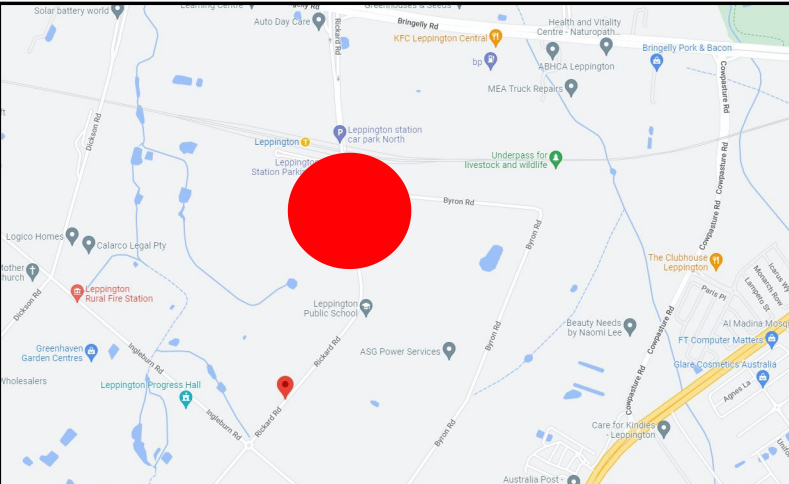
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate 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.

Appendix B



Drawing 1 – Site Location Plan and Features
Drawing 2 – Slope Analysis Plan



Site Locality

Legend

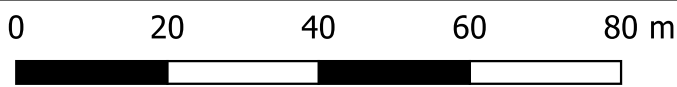
- Site Boundary
- Site Photograph
- Water Logging
- Potential Uncontrolled Fill

 Douglas Partners <i>Geotechnics Environment Groundwater</i>	TITLE: Site Location Plan and Features Desktop Geotechnical Assessment Lots 37 & 38A DP8979, 156-166 Rickard Road, Leppington			 MGA	OFFICE: Macarthur	
					DRAWN BY: NG	
					DATE: 29 August 2023	
					SCALE: As Shown	
CLIENT: Leppington (1) 88 Development Pty Ltd	PROJ. #: 217600.01	DRAWING No: 1	REVISION: 1			



Legend

- Site Boundary
- 0 - 10 Degrees
- 10 - 15 Degrees
- 15 - 20 Degrees
- >20 Degrees



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Geotechnics | Environment | Groundwater

TITLE: **Slope Analysis Plan**
Desktop Geotechnical Assessment
Lots 37 & 38A DP8979, 156-166 Rickard Road, Leppington



OFFICE: Macarthur

DRAWN BY: NG

DATE: 29 August 2023

CLIENT: Leppington (1) 88 Development Pty Ltd

PROJ. #: 217600.01

DRAWING No: 2

REVISION: 1

SCALE: As Shown

Appendix C

Site Photographs (Photo Plates 1 – 5)



Photograph 1 - View looking north from center



Photograph 2 - View looking west from northern area



Site Photographs

Desktop Geotechnical Assessment

Lots 36A & 37 DP8979, Leppington

CLIENT: Leppington (1) 88 Development Pty Ltd

PROJECT: 217600.01

PLATE No: 1

REV: 0

DATE: Aug-23



Photograph 3 - Batter adjacent shed



Photograph 4 - Northern residence



Photograph 5 - Hardstand looking east



Photograph 6 - Southern residence



Site Photographs

Desktop Geotechnical Assessment

Lots 36A & 37 DP8979, Leppington

CLIENT: Leppington (1) 88 Development Pty Ltd

PROJECT: 217600.01

PLATE No: 3

REV: 0

DATE: Aug-23



Photograph 7 - Stockpile adjacent hardstand drain



Photograph 8 - Waterlogging in northern area looking west



Photograph 9 - Neighboring dam outside northern boundary



Photograph 10 - Dam on south eastern boundary



Site Photographs

Desktop Geotechnical Assessment

Lots 36A & 37 DP8979, Leppington

CLIENT: Leppington (1) 88 Development Pty Ltd

PROJECT: 217600.01

PLATE No: 5

REV: 0

DATE: Aug-23