



Douglas Partners
Geotechnics | Environment | Groundwater

Integrated Practical Solutions

Report on
Preliminary Geotechnical Land Capability Assessment

Proposed Appin (Part 2) Precinct

Appin NSW

Prepared for
Walker Corporation Pty Ltd

Project 76589.18

October 2024



Document History

Document details

Project No.	76589.18	Document No.	R.002.Rev3
Document title	Report on Preliminary Geotechnical Land Capability Assessment Proposed Appin (Part 2) Precinct		
Site address	Appin NSW		
Report prepared for	Walker Corporation Pty Ltd		
File name	76589.18.R.002.Rev3.Land Cap		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Rev 0	Chris Kline	Konrad Schultz	24 May 2023
Rev 1	Chris Kline	Konrad Schultz	06 September 2023
Rev 2	Chris Kline	Konrad Schultz	06 September 2024
Rev 3	Chris Kline	Konrad Schultz	09 October 2024

Distribution of copies

Status	Electronic	Paper	Issued to
Rev 0	1	0	Walker Corporation Pty Ltd; Ahmad Ali
Rev 1	1	0	Walker Corporation Pty Ltd; Ahmad Ali
Rev 2	1	0	Walker Corporation Pty Ltd; Ahmad Ali
Rev 3	1	0	Walker Corporation Pty Ltd; Ahmad Ali

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	09 October 2024
Reviewer	09 October 2024



ABN 75 053 980 117 www.douglaspartners.com.au

Douglas Partners Pty Ltd

Smeaton Grange NSW 256718 Waler Crescent

FS 604853

Phone (02) 4647 0075

Table of Contents

	Page
1. The Appin Project.....	1
1.1 The Appin (Part 2) Precinct Planning Proposal	1
2. Introduction.....	2
3. Site Information	4
3.1 Site Identification.....	4
3.2 Regional and Site-Specific Land Use	5
4. Geotechnical Setting	5
4.1 Topography, Hydrology and Hydrogeology	5
4.2 Soils	6
4.3 Geology.....	8
4.4 Acid Sulfate Soils	9
5. Field Work	9
6. Comments	11
6.1 Slope Instability	11
6.2 Erosion Potential	12
6.3 Sub Surface Mining.....	12
6.4 Soil Salinity.....	12
6.5 Sodidity.....	13
6.6 Site Preparation and Earthworks	13
7. Further Investigations.....	13
8. Summary of Constraints for Site Development.....	14
9. References	14
10. Limitations	15

Appendix A: Drawing 1
 About This Report

Report on Preliminary Geotechnical Land Capability Assessment Proposed Appin (Part 2) Precinct Appin NSW

1. The Appin Project

Greater Sydney's population is projected to grow to approximately 6.1 million by 2041 – over a million more people than currently live in the region.

The NSW Government has identified Growth Areas as major development areas that will assist in accommodating this growth. The Greater Macarthur Growth Area (GMGA) is one such growth area and is a logical extension of the urban form of south-west Sydney. The GMGA is divided into precincts. The Appin Precinct and North Appin Precincts are the southernmost land release precincts of the GMGA. The goal is to deliver 21,000+ dwellings.

The land is to be rezoned and released for development to achieve this goal. A submission has been prepared by Walker Corporation Pty Limited and Walker Group Holdings Pty Limited (the Proponent) to rezone 100.10 hectares (ha) of land (the site) within the Appin Precinct from *RU2 Rural Landscape* to the following zones:

Urban Development Zone

Zone 1 Urban Development (UDZ)

Conservation Zone

Zone C2 Environmental Conservation (C2)

The site is known as the Appin (Part 2) Precinct. The site directly adjoins the Appin (Part 1) Precinct, as shown in Figure 1, in Section 2.

1.1 The Appin (Part 2) Precinct Planning Proposal

The Appin (Part 2) Precinct Plan (the precinct plan) shows the proposed new zones. 'The precinct plan' will be incorporated into the *State Environmental Planning Policy (Precincts – Western Parkland City) 2021* and contain the provisions (clauses and maps) that will apply to the site. 'The precinct plan' envisages the delivery of the following:


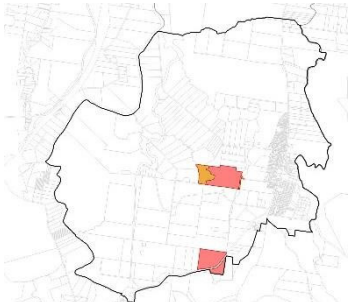

- 1,312 dwellings (as a mix of low-density, medium density and apartments);
- 30,312 m² of gross lettable retail/commercial floor area; and
- 16.91 ha conservation land.

The planning proposal submission is aligned with strategic land use planning, State and local government policies, infrastructure delivery and PP-2022-3979. The development potential is tempered

by a landscape-based approach that protects the environment and landscape values, shaping the character of new communities. A series of residential neighbourhoods are to be delivered within the landscape corridors of the Nepean and Cataract Rivers, supported by local amenities, transit corridors and community infrastructure.

The submission includes a hierarchy of plans. The plans and their purpose are summarised in Table 2.

Table 1: The subject Planning Proposal's Plans and Proposal

<p>(1) APPIN & NORTH APPIN PRECINCTS INDICATIVE PLAN</p> <p><i>Broader context and for information purposes only. It has no statutory weight. It identifies:</i></p> <ul style="list-style-type: none"> • Higher-order transport network • Centres hierarchy • School sites • Conservation areas • Residential areas • Cultural Sites and Connections 	<p>(2) APPIN (PART 2) PRECINCT PLAN (THE PRECINCT PLAN)</p> <p><i>It shows the land proposed to be rezoned and incorporated into a new schedule in the Western Parkland City SEPP 2021.</i></p> <p><i>The precinct plan contains the development provisions (clauses and maps) applicable to the Site and is used in assessing development applications.</i></p>	<p>(3) APPIN (PART 2) PRECINCT STRUCTURE PLAN (THE STRUCTURE PLAN)</p> <p><i>Structure plan for the Site, showing staging of release areas.</i></p> <p><i>Development is to be generally consistent with the structure plan. It illustrates land use components including (but not limited to):</i></p> <ul style="list-style-type: none"> • Low and medium-density residential • Retail and employment centres • School • Open space • Drainage network/basins • Transport network
 <p>(21,000 dwellings)</p>	 <p>(1,312 dwellings)</p>	 <p>(1,312 dwellings)</p>

2. Introduction

Douglas Partners Pty Ltd (DP) has been engaged by the Proponent to prepare a Preliminary Land Capability (Geotechnical) Assessment to support the Appin (Part 2) Precinct Plan (the precinct plan) and Appin (Part 2) Precinct Structure Plan (the structure plan).

The precinct and structure plan boundaries are Wilton Road to the east, the Nepean River to the west and Ousedale Creek to the north. Refer to Figure 1 and Table 3 for key attributes of the precinct plan and structure plan area.

The Appin (Part 2) Precinct Plan zones land for conservation and urban development. It establishes the statutory planning framework permitting the delivery of a range of residential typologies, retail, education, business premises, recreation areas, and infrastructure services and provides development standards that development must fulfil.

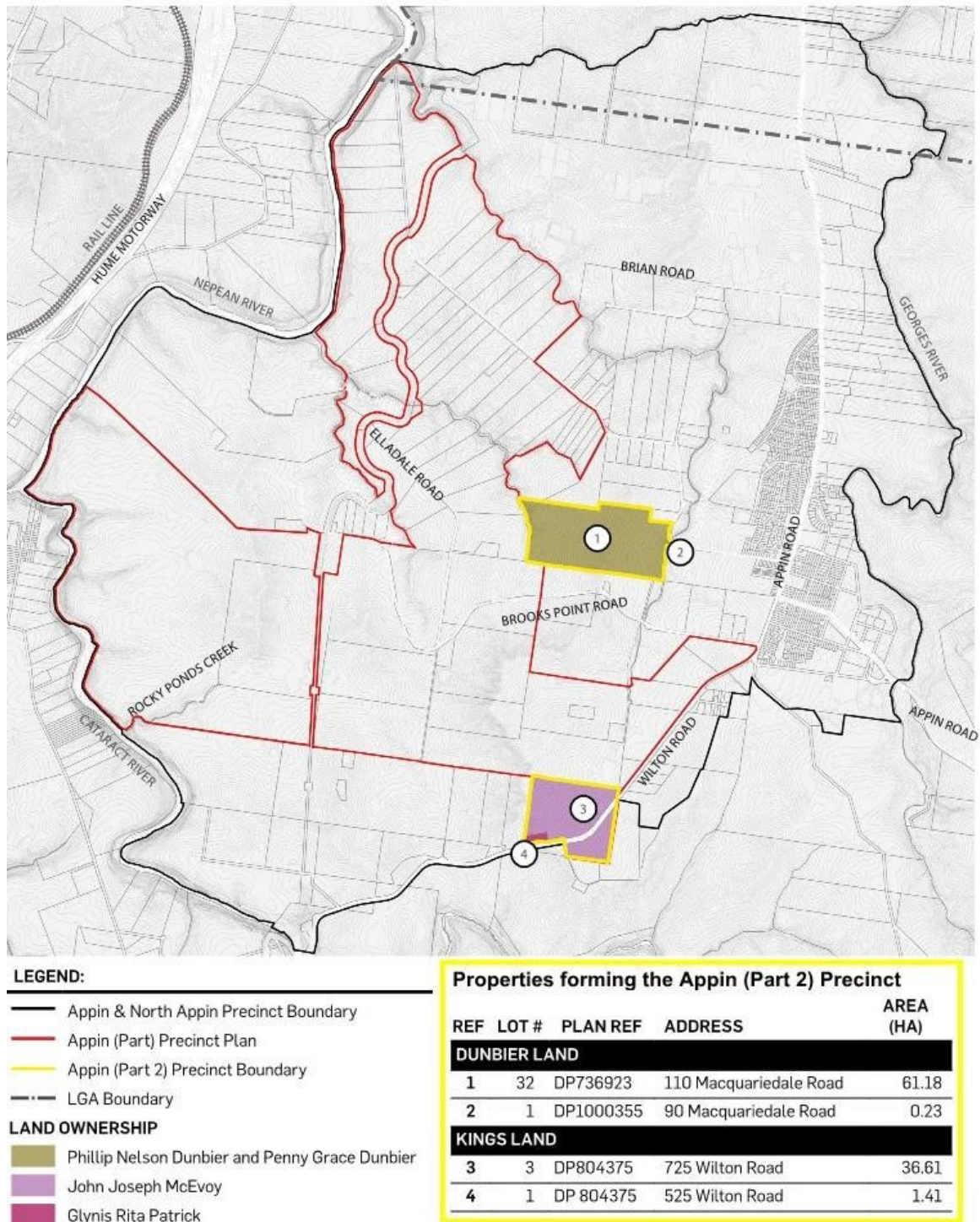
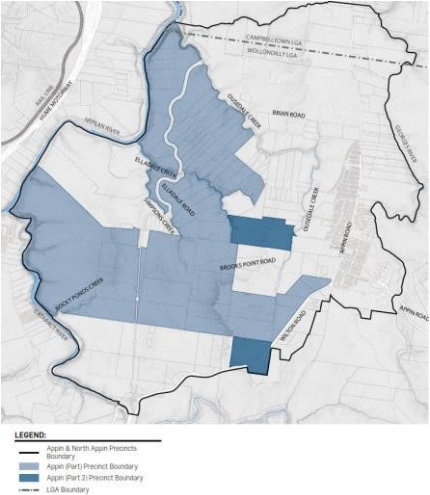


Figure 1: Appin (Part 2) Precinct Boundary

Table 3: Summary of Appin (Part 2) Precinct Key Attributes

Location		Key Attributes	
Appin (Part 2) Precinct		Area	<ul style="list-style-type: none"> - Total – 100.10 ha - Private Ownership – 100.10 ha
		LGA	Wholly Wollondilly LGA
		Proposed Dwellings	1,312
		Proposed retail & commercial floor space	30,000+
		Proposed Population	3,709

The purpose of this investigation is to provide a preliminary evaluation of the geotechnical features of the site and its suitability, from a geotechnical standpoint, for future urban redevelopment. The boundary of the investigation is shown on Figure 1.

The investigation also included a preliminary review of the salinity characteristics of the site. This investigation was also undertaken concurrently with a preliminary site investigation (contamination) which has been reported separately (Project 76589.18.R.001.Rev4).

The scope of work entailed a review of available mapping, a review of the work undertaken for the Part 1 assessment and a site walkover.

3. Site Information

3.1 Site Identification

The site, which has a total area of approximately 100.10 ha, is located in the local government area of Wollondilly Shire Council ('Council'). Table 3 below and Figure 1 shows the formally registered lots located in the site.

Table 3: Registered lots within the site boundary

Lot(s)	Deposited Plan (D.P.)
1	804375
3	804375

1	1000355
32	736923

The site is bordered by the Nepean River along the western boundary, Ousedale Creek along the north eastern site boundary, Elladale Creek along the eastern site boundary, The Cataract River and Wilton Road along the south eastern and south western site boundary and rural residential/pastoral lots along the southern boundary.

3.2 Regional and Site-Specific Land Use

The site is primarily used for low density agricultural/pastoral and rural residential purposes. The residences are located along Northamptondale Road, in the northern portion of the site – lot 32 DP736923; and Wilton Road in the south east – lots 1 and 3 DP804375.

Surrounding land use generally comprises low density agricultural/pastoral, rural residential and commercial land use as well as the power station site located near the southeast boundary and Appin Colliery in the south east. Appin town centre is located approximately 1 km east of the site.

4. Geotechnical Setting

4.1 Topography, Hydrology and Hydrogeology

The site topography is undulating with two valleys ranging from 226 m Australian Height Datum (AHD) to approximately 250 m AHD in the south portion of the site (lots 1 and 3 DP804375) and between approximately 150 m AHD to 230 m AHD in the north portion of the site (lot 32 DP736923 and lot 1 1000355).

The slope gradient generally ranges from approximately 5-10% in low lying generally flat areas of the site. Slopes increase to approximately 20 - 30% in the vicinity of incised creek lines.

Figure 2 below presents regional topography mapping (10 m Australian Height Datum (AHD) intervals between contours) as obtained from NSW Spatial Services, key surface water features and registered groundwater bores as recorded by the NSW Department of Primary Industries (Water) and the Bureau of Meteorology Groundwater Explorer.

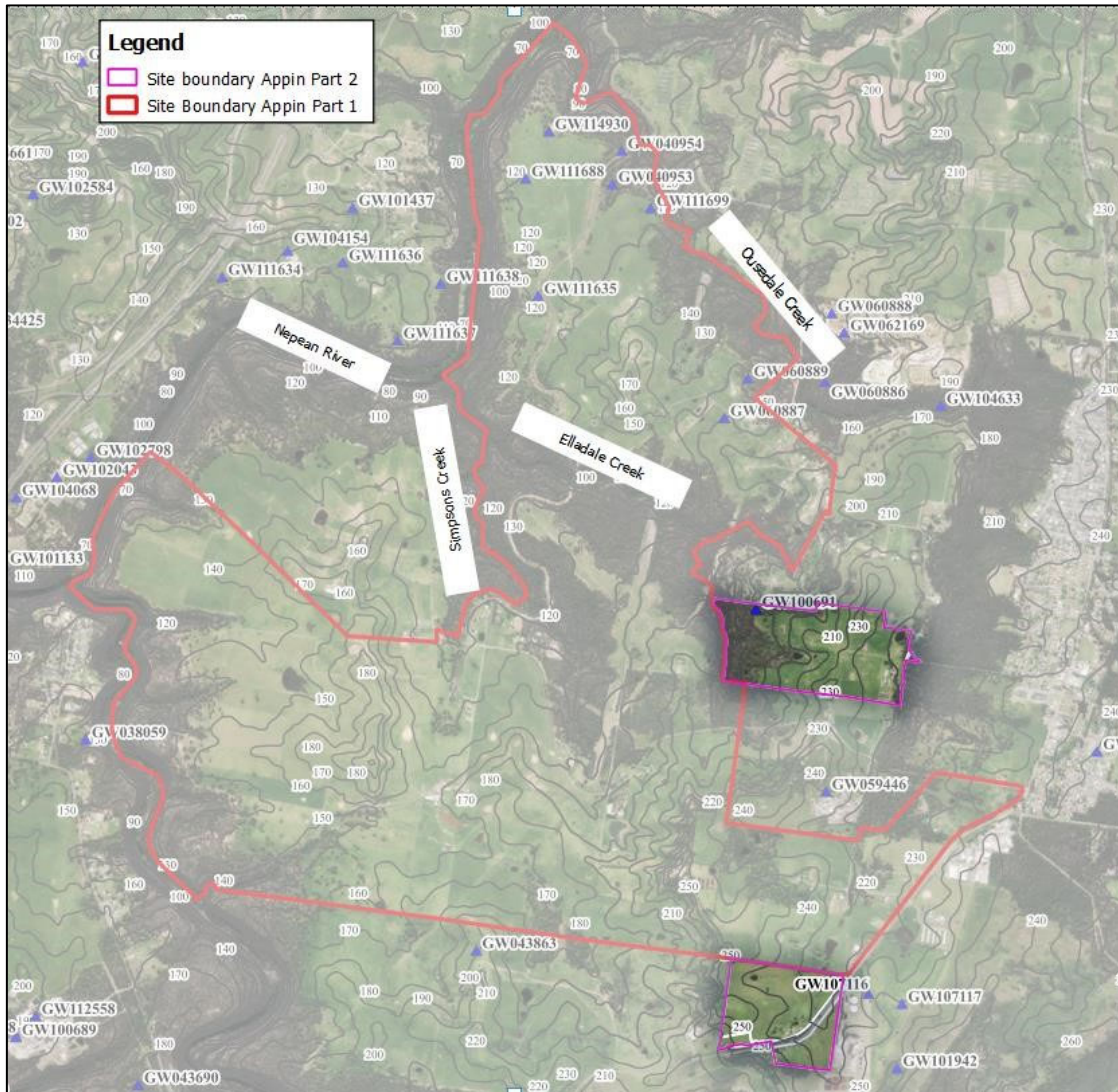


Figure 2: Site Topography (dark grey lines are 10 m intervals), Surface Water Features and Registered Groundwater Bores (blue triangles)

4.2 Soils

Regional soils mapping for the site as obtained from Soil Conservation Service of NSW, *Soil Landscapes of the Penrith 1:100 000 Sheet* is presented in Figure 3, below.



Figure 3: Regional soils mapping for the site (yellow boundary)

Regional soils mapping as presented and referenced above indicates that the majority of the site is mapped as Luddenham soils (light pink) in the southern portion of the site (lots 1 and 3 DP804375), and centre portion of the site (lot 32 DP736923 and lot 1 1000355), comprising shallow dark podzolic or massive earthy clays on crests being erosional soils. Luddenham soils are associated with undulating to rolling low hills of the Wianamatta Group shales and lower slopes and drainage lines. Also mapped as present at the site are the following:

- Blacktown soils (dark green) which are associated with the gently undulating rises on Wianamatta Group shales and Hawkesbury Sandstone. Blacktown soils comprise shallow to moderately deep red and brown podzolic soils on crests, upper slopes and well drained areas and deep yellow podzolic soils and soloths on lower slopes and in areas of poor drainage. Such soils are generally moderately reactive highly plastic subsoil, of low soil fertility with poor soil drainage; and
- Hawkesbury soils (dark pink) which are colluvial lithosols/siliceous sands comprising podzolic soils, siliceous sands and secondary yellow earths associated with drainage lines dissecting Hawkesbury Sandstones, along the Nepean River and tributaries.

4.3 Geology

Regional geology mapping for the site as obtained from Geological Survey of New South Wales *Wollongong – Port Hacking 1:100 000 scale Geological Series Sheet 9029 - 9129*, 1st Edition 1985 is presented in Figure 4 below.



Figure 4: Regional geology mapping for the site (yellow boundary)

Regional geology mapping as presented and referenced above indicates that the majority of the site is underlain by Ashfield Shale of the Wianamatta Group (dark green) comprising laminite and dark grey siltstone. Also mapped as present at the site Hawkesbury Sandstone (light green) comprising medium to coarse-grained quartz sandstone with very minor shale and laminite lenses.

Figure 5 below presents regional salinity mapping for the site as obtained from the Department of Infrastructure, Planning and Natural Resources *Salinity Potential in Western Sydney* (2002).

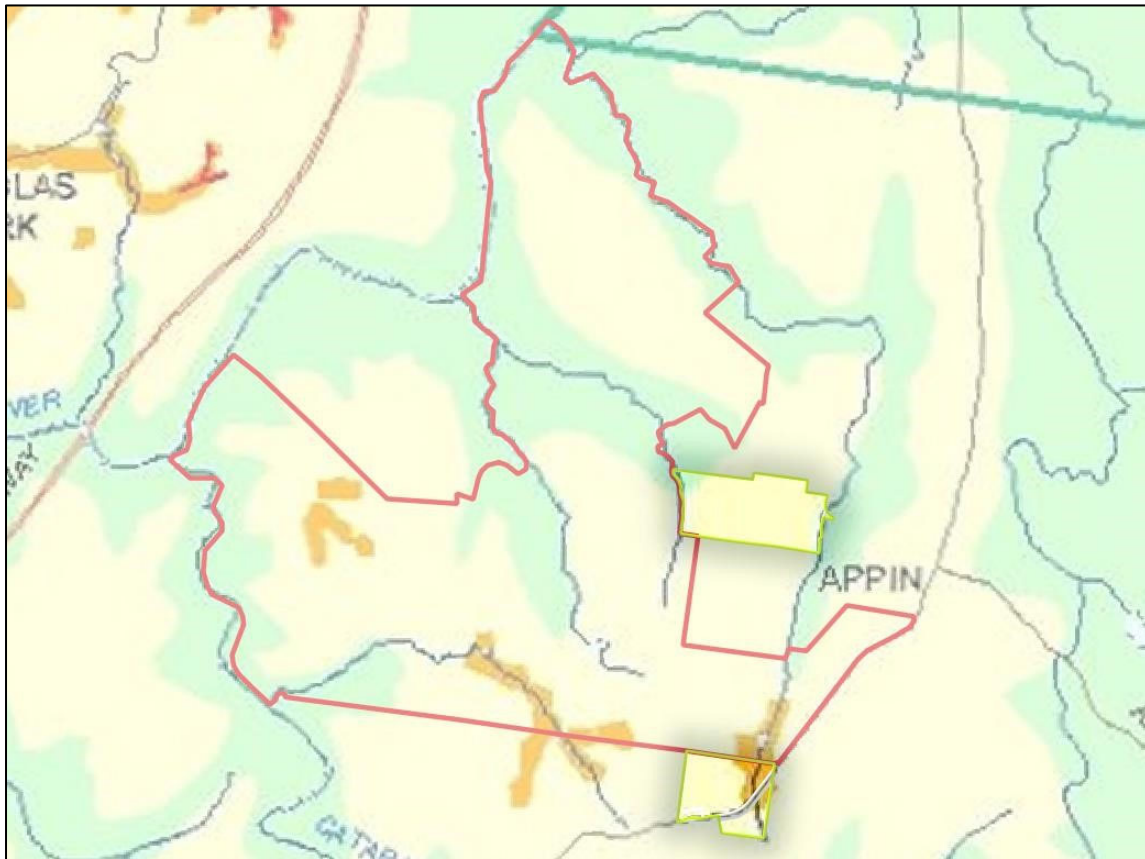


Figure 5: Regional Salinity Mapping

Regional salinity mapping as presented and referenced above indicates that the site is located in an area mapped as follows:

- Very low salinity potential (green) along the Nepean River and tributaries;
- Moderate salinity potential (pale yellow) across the majority (approximately 90%) of the site; and
- High salinity potential (orange) along the southernmost portion of an unnamed creek in the southern portion of the site.

4.4 Acid Sulfate Soils

The lowest elevation on site is RL 70 m AHD and this is well above the level at which Acid Sulphate soils are known to occur. For this reason, there is no government-produced mapping in this region. ASS is not considered to be a constraint to development.

5. Field Work

Site walk overs were conducted by a DP Environmental Engineer/Scientist in June/July 2020, 30 March 2023, and 19 April 2023, to assess for geotechnical constraints.

The observations made during the various inspections of the site undertaken during the field investigation are summarised below:

Stability

- The landform is predominantly gently sloping undulating terrain. Crests and gullies are mostly broad, although deep and steeply incised gullies are present along the major creek lines;
- In general, the site is considered to be stable, with slopes typically less than 5 – 10 degrees, occasionally increasing to 10 degrees and rarely 15 degrees in paddocks adjacent to ridgelines (refer Drawing 1, Appendix A); and
- The banks of the major creek lines are typically steep (greater than 30 degrees) especially in the areas of the site underlain by Hawkesbury Sandstone.

Erosion

- No widespread erosion was noted.

Soil and Rock Profiles

- The most consistent feature of the site, especially those parts underlain by Hawkesbury Sandstone, was the presence of outcropping rock. Outcropping rock was noted at the top of all creek banks, at the base of all dams and in numerous other locations within the paddocks. Exposed rock was typically high strength medium grained sandstone.

Stockpiles

- Two stockpiles of quarried materials and one stockpile of crushed gravel and cobble material was also observed in the eastern portion of Lot 32 DP736923 (refer to the PSI for further detail).

Water logging and Salinity

- In dams and drainages, some water logging was noted. Salt tolerant vegetation was noted in these water logged areas (*Juncus acutus*). It is noted that whilst salinity tolerant *Juncus* is also tolerant of water logged soil; and
- No other signs of dryland salinity were noted during the site walkover.

6. Comments

6.1 Slope Instability

Slope stability is not considered to be a major geotechnical constraint to the proposed development. The majority of the site is developable, with no effect from stability considerations. The following exception is noted:

- Deeply incised creeks and associated escarpments – rock fall is a natural process that must be considered in the development of any of the creek lines or escarpment areas. As these areas are typically outside of the development footprint, then they will not present a major constraint to development.

6.2 Erosion Potential

Soils of the Blacktown soil landscape are typically of moderate erodibility. The more sodic or saline soils of the Blacktown soil landscape can have a high to very high erodibility and the erosion hazard for this landscape is estimated as moderate to very high. The results of Emerson class number tests and salinity testing indicate a low to moderate risk of erosion.

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

6.3 Sub Surface Mining

The site is within the mine subsidence district of Appin. From records available on the NSW ePlanning portal, we understand that mining has already occurred across the majority of the site, with the northern portion of the site between the Nepean River and Ousedale Creek the only area where mining has not occurred.

Mining is of the Bulli seam which is at a depth of approximately 550 m. The seam is approximately 2.6 m thick in the vicinity of the site.

Subsidence Advisory (SA) NSW provide the following guideline for residential development in the area: Single or two storey brick veneer on AS 2870 footings/slabs. Maximum length of 24 m and maximum footprint of 400 sqm. Further advice should be sought from SA NSW on matters related to subsidence.

6.4 Soil Salinity

Initial assessment indicates that salinity will be consistent with the findings of Part 1 of the assessment. The findings of Part 1 are replicated below:

Methods of assessment of soil salinity were adopted to ground-truth the salinity potential map of DECC (2008) and included:

- A site walkover inspection to locate and map visible indicators of salinity; and
- EC_e analysis of 126 laboratory tests on soil samples collected from the test pits (reported in the Part 1 Assessment).

Although the salinity works undertaken during this study are preliminary in nature, it is considered that the results obtained together with DP's knowledge of the surrounding sites in similar geology provide a reasonable early indication of the actual salinity potential for the site. Further salinity studies will be necessary to achieve a greater density of test data, although the preliminary study did not identify any specific areas of concern with regards to urban development.

With respect to salinity risks, the site has been assessed, indicating that non-saline to slightly saline conditions are present. The results, however, are from a relatively small statistical sample size and

although considered adequate for the current rezoning assessment, they will require additional support for any future development application before the site is considered free from salinity concern.

Preliminary salinity testing indicates that the salinity potential of this site would be within usually accepted limits, which could be managed by good engineering and land management practices. Based on the works undertaken to date, specific salinity management plans are not required for this site at this time.

6.5 Sodicty

Based on the presence and extent of the Blacktown soil landscape, sodic soils are expected. Accordingly, management strategies will be required to manage the exposure of sodic and highly sodic soils. Strategies should include the design and implementation of an appropriate site drainage system that prevents sodic and highly sodic soils from breaking down and changing the water balance/water movement regime at the site.

6.6 Site Preparation and Earthworks

Based on the results of the walkover and desktop assessment the Part 2 site is considered to have similar constraints to the Part 1 site. No site specific recommendations are required and reference should be made to the Part 1 report for design advice.

7. Further Investigations

The results of the preliminary geotechnical assessment have not identified any issue that would preclude urban development at the site. Further investigation will be required as the project progresses to Development Application. Additional work will also be required during the project's construction phase. Specific investigation would include (but not necessarily be limited to):

- Further rock depth and rippability assessment;
- Additional salinity investigations for site soils and surface waters (ie: dams) to increase the density of the data obtained to date. The investigation programme should be increased to compliment the current study and augment the findings to a frequency of testing satisfying one test location per one to two hectares, including additional full depth profile sampling and laboratory analysis. A cost effective way of conducting the salinity assessment would be to measure site conductivity using an electro-magnetic (EM) transceiver mounted to an all-terrain vehicle (ATV or quad-bike), thus reducing the number of test pits required for the assessment. This method would also significantly increase the number of conductivity readings measured and thus provide greater coverage of the site;
- Additional testing of the site soils and surface water (and groundwater, if encountered) for aggressivity testing and to determine the effects on buried concrete and steel structures;
- Additional testing of site soils for erosion and dispersion for the detailed design and construction of future water bodies and the ability of the soils to be used as clay liners, or similar;
- Stability analysis of the banks of creek lines if development is proposed within these areas;

- Detailed geotechnical investigations on a stage-by-stage basis to determine pavement thickness designs and lot classifications, as well as stage specific issues, such as deep excavations and construction of roads, dwellings/structures on steeper landforms and crests; • Routine inspections and earthworks monitoring during construction; and
- Ongoing consultation with Subsidence Advisory NSW.

8. Summary of Constraints for Site Development

Based on the results of the assessment thus far, the following summary points are noted:

- Some evidence of hillside/slope instability was observed within discrete areas of the proposed development area. It is therefore considered that the potential for instability does not impose significant constraints on the proposed site development. Further assessment of creek lines where rockfall is a hazard will be required if development (including foot paths) is proposed in these areas. As recommended in Section 9, further investigation of the instability affected land will be required prior to detailed design;
- Shallow rock depth is likely to be a minor constraint to the economic and efficient development of the site, based on reduced production rates during earthworks and the requirement for additional plant (eg: large dozers, crushers etc);
- The presence of erodible soils on the site should not present significant constraints to development provided they are well managed during site preparation and earthworks;
- No significant evidence of saline soil was identified within the site. Although further salinity testing will be required, the results of the testing indicate that salinity levels are sufficiently low for this site to be considered free of significant salinity constraints;
- Although mildly aggressive soil conditions were encountered surrounding the site, aggressivity levels are considered to be manageable, subject to appropriate design and construction considerations; and
- Highly sodic and sodic soils appear widespread and will require management to reduce dispersion, erosion and to improve drainage this is typical of south western Sydney and will be managed by good engineering practice.

The results of the land capability assessment have not identified any issue that would preclude the urban development of the Appin site (Part 2).

9. References

Department of Planning, Industry and Environment 2018, *Soil Landscapes of the Penrith 1:100 000 Sheet*

Department of Mines 1985, *Geology of Wollongong – Port Hacking 1:100 000 Geological Series Sheet No 9029 – 9129.*

Richards, L. A. (ed.) 1954, *Diagnosis and Improvement of Saline and Alkaline Soils* USDA Handbook No. 60, Washington D.C.

Hazelton, P. A. and Murphy B. W. 2007, *Interpreting Soil Test Results* Department of Natural Resources.
Department of Infrastructure, Planning and Natural Resources, New South Wales (DIPNR) 2003, *Salinity Potential in Western Sydney 1:100 000 Sheet* (now managed by the Department of Primary Industries – DPI).
Standards Australia 2011, AS 2870 – 1996 *Residential Slabs and Footings*.

10. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for the proposed Appin Precinct in accordance with DP's proposal MAC200172 with acceptance received from Walker Corporation dated 15 June 2020, and DP's email proposal dated 1 February 2023. The work was carried out in accordance the Consultancy Deed (Major Services). This report is provided for the exclusive use of Walker Corporation for this project only and for the purposes as described in the report. It should not be used for other projects or purposes 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 attachments 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.

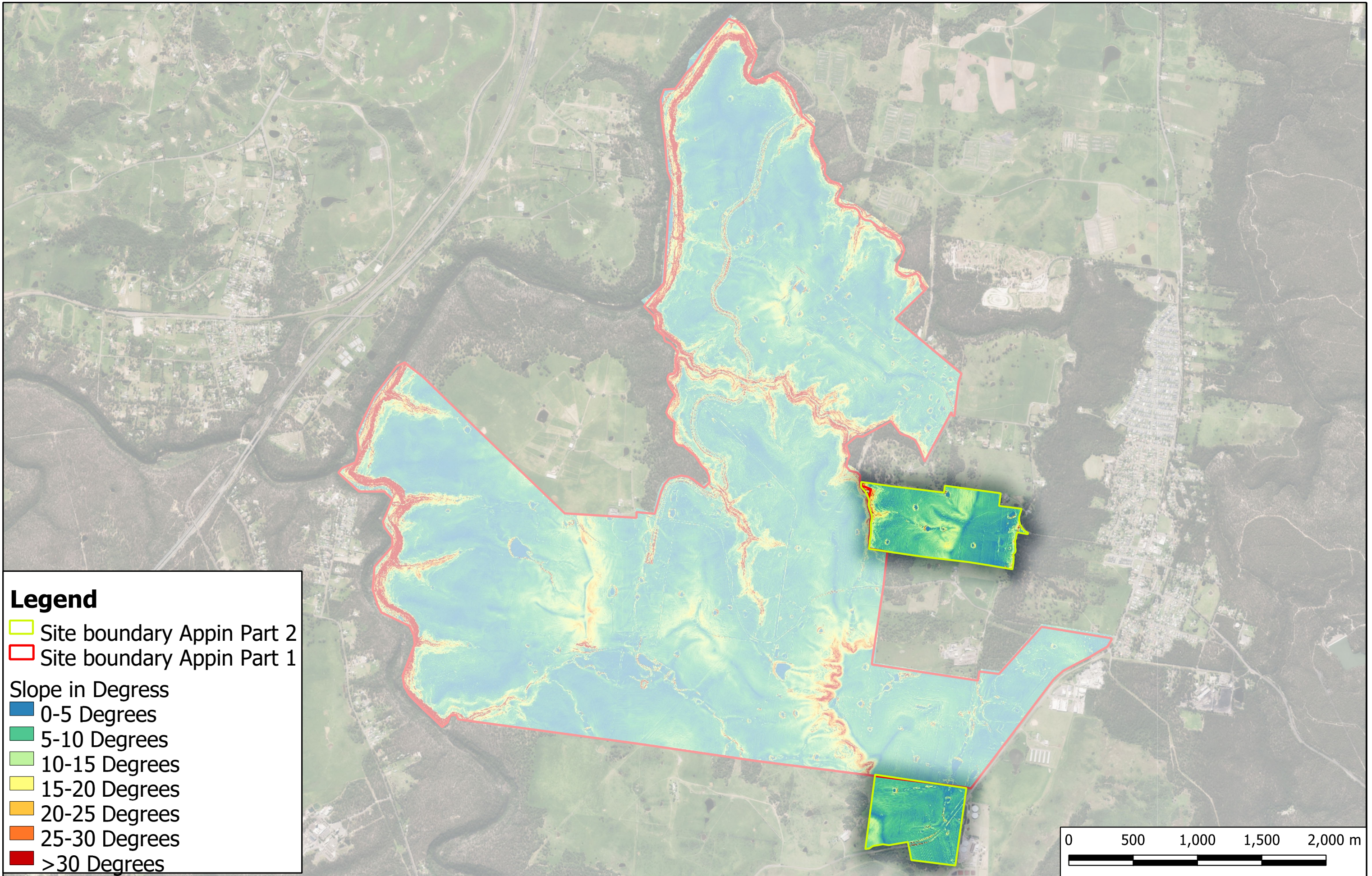
The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design 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 (geotechnical/environmental/groundwater) 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 About This Report



Legend

Site boundary Appin Part 2

Site boundary Appin Part 1

Slope in Degree

0-5 Degrees

5-10 Degrees

10-15 Degrees

15-20 Degrees

20-25 Degrees

25-30 Degrees

>30 Degrees

Introduction

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

Douglas' 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 Engagement Terms 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, Douglas 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, Douglas 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, Douglas will be pleased to assist with investigations or advice to resolve the matter.

About this Report



October 2024

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, Douglas 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. Douglas 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.

intentionally blank