Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Preliminary Site Investigation (Contamination)

Proposed Rezoning
Sub-Precinct 5, South Creek West, NSW

Prepared for
Boyuan Bringelly Pty Ltd

Project 92225.04
December 2022

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

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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	[redacted]	7 December 2022
Reviewer		7 December 2022

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Executive Summary

Douglas Partners Pty Ltd (DP) has been engaged by Boyuan Bringelly Pty Ltd to complete this preliminary site investigation (contamination) (PSI) undertaken for a proposed rezoning for the site at Sub-Precinct 5, South Creek West, NSW (the site). The site is shown on Drawing 1, Appendix A.

The objective of the PSI is to assess the potential for contamination at the site based on past and present land uses and to comment on the need for further investigation and/or management with regard to any future proposed development. It is understood that the report will be used to support a rezoning application for the precinct.

The scope of the current investigation included a desktop study and site walkover to identify any potential areas of environmental concern (PAEC).

The site was found to be formerly and currently used as rural residential land with agricultural activities. A total of nine PAECs were identified across the site, consisting of:

- Potential ground disturbances and general fill
- Agricultural land use;
- Farm Dams;
- High voltage powerline towers;
- Access roads;
- Current and former buildings and structures;
- Vehicle Storage Area;
- Bulk earthworks surrounding and underlying current service station; and
- Timber Power Poles.

Based on the information presented above, the site has the potential for contamination due to the historical site uses. The presence or extent of potential contamination has not been fully confirmed. Further assessment of soil and groundwater at the site would be required to assess the presence, degree and extent of contamination and any remediation requirements associated with the potential contamination sources identified. Targeted investigations of all PAECs should be undertaken, in the form of a Detailed Site Investigation (DSI) to inform any future DA. The recommended further assessment should build on the information provided in this report with reference to National Environment Protection Council (NEPC, 1999) National Environment Protection Council (Assessment of Site Contamination) Measure 1999 (amended 2013) (NEPC, 2013). Further assessment should include intrusive investigations, sampling, analysis and assessment to assess land use suitability and to determine remediation requirements, if necessary.

A hazardous building survey is also recommended to identify any hazardous building materials prior to any maintenance or site redevelopment.

The PAECs encountered were typical for a rural residential site with agricultural activity. It is considered unlikely that any of the identified PAECs will present a major constraint to the proposed rezoning and that the site can be rendered suitable for any beneficial land use scenarios (e.g. residential), subject to further investigation and remediation, as required.

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Report on Preliminary Site Investigation (Contamination)
Proposed Rezoning
Sub-Precinct 5, South Creek West, NSW

1. Introduction

Douglas Partners Pty Ltd (DP) has been engaged by Boyuan Bringelly Pty Ltd to complete this preliminary site investigation (contamination) (PSI) undertaken for a proposed rezoning for Sub-Precinct 5, South Creek West, NSW (the 'site'). The site is shown on Drawing 1, Appendix A.

It is noted that the previous versions of this PSI were completed with reference to a previous Indicative Layout Plan (ILP) which considered the entirety of Sub Precinct 5. The current ILP incorporates only Lots 2 and 4 in DP1216380, Lots 1 and 4 in DP1273487, and Lot 500 in DP1231858, as depicted in Drawing 1. As such, this report has been revised to exclude part Lot 45 in DP1104369 which is no longer within the current ILP.

The objective of the PSI is to assess the potential for contamination at the site based on past and present land uses and to comment on the need for further investigation and/or management with regard to any future proposed development. It is understood that the report will be used to support a rezoning application for the precinct.

This report must be read in conjunction with all appendices including the notes provided in Appendix B.

The following key guidelines were consulted in the preparation of this report:

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013);
- NSW DUAP/EPA. (1998). *Managing Land Contamination, Planning Guidelines, SEPP 55 – Remediation of Land* . NSW Department of Urban Affairs and Planning/Environment Protection Authority; and
- NSW EPA *Guidelines for Consultants Reporting on Contaminated Land* (NSW EPA, 2020).

A preliminary geotechnical and salinity assessment as well as a Groundwater Investigation were also undertaken in conjunction with this PSI, with results presented in separate reports titled:

- Preliminary Geotechnical and Salinity Assessment, reference 92225.02.R.001.Rev0 (DP, 2021).
- Preliminary Geotechnical and Salinity Assessment, reference 92225.04.R.002.Rev0 (DP, 2021a).

2. Background

The following relevant environmental reports have been previously conducted on areas that encompass the site:

- DP *Report on Land Capability and Contamination Assessment, Oran Park Precinct, Oran Park and Cobbitty* (Project 40740) dated February 2007 for Growth Centres Commission (DP, 2007); and
- DP *Report on Preliminary Site Investigation (Desktop Assessment), Precinct Acceleration Submission, 621 – 707 The Northern Road, Bringelly, NSW, Project 92225.00.R.001 Rev 1,* dated December 2017 (DP, 2017) which was carried out for an area of approximately 317 ha which encompasses the current site.

DP (2017) was based wholly on a desktop review, including a review and incorporation of information presented in DP (2007) which included site walkovers of limited portions of the site. DP (2017) identified a total of 29 potential areas of environmental concern (PAEC) at the site (not all were located within the current site boundary) primarily associated with the following:

- Chemical storage and hazardous building materials within sheds and dwellings;
- Imported fill of unknown quantity and origin as marked by ground disturbances;
- Agricultural activities including the possible use of fertilizers, pesticides and herbicides; and
- Leaks and spills resulting from onsite use of machinery

DP (2017) recommended the following future investigations be carried out (in order):

- Site inspection;
- Preparation of a sampling plan with a view towards intrusive investigation;
- Investigate PAEC; and
- Carry out a Detailed Site Investigation (DSI).

The desktop assessment concluded that it was considered unlikely that any of the identified PAEC will present a major constraint to the proposed development and that the site can be rendered suitable for the proposed residential subdivision, subject to further investigation and remediation, as required.

3. Scope of Works

The works undertaken was as follows:

- A desktop investigation to determine potential areas of environmental concern (PAEC) for the site including:
  - Review of previous reports;
  - Review of aerial photographs to identify land uses and changes in the land that may indicate potential for contamination;
  - A review of previous site ownership records including land title records archived at the Land Titles Office, historical records archived at local Libraries and historical societies;

  - Search on the Contaminated Land Register for Notices issued under the *Contaminated Land Management Act* 1997; and
  - NSW Office of Water groundwater bore search.
- Field mapping and site walkover assessment of the accessible areas of the site by an environmental engineer/scientist to identify any Potential Areas of Environmental Concern (PAEC);
- Review of geotechnical test pit logs;
- Development of a preliminary conceptual site model (CSM) incorporating all PAECs identified; and
- Preparation and provision of this PSI report detailing the findings of the assessment including comments on the risk and nature of potential contamination at the site, the sites suitability for the proposed rezoning and recommendations for further assessment, if required.

Some of the above scope has previously been completed in DP (2007) and DP (2017), said information will be incorporated or updated as necessary into this PSI.

4. Site Information

Site Address	Sub-Precinct 5, South Creek West, NSW
Legal Description	Lot 2 in DP 1216380 on 705 The Northern Road, Bringelly; Lot 4 in DP 1216380 on 657 The Northern Road, Bringelly; Lot 1 in DP1273487 on 621 The Northern Road, Bringelly; Lot 4 in DP1273487 on The Northern Road, Bringelly. Part Lot 500 in DP 1231858 on 421D The Northern Road, Bringelly.
Area	172.7 hectares (ha)
Zoning	RU1 - Primary Production
Local Council Area	Camden Council
Current Use	Rural Residential land use. Predominantly used for the agistment of cattle.
Surrounding Uses	**North:** Rural agricultural land beyond which is a general waste recycling centre. **East:** The Northern Road beyond which is the rural agricultural land. **South:** Rural agricultural land, beyond which is residential**.** **West:** Rural agricultural land.

5. Environmental Setting

Site Topography	The topography within the site is generally classifiable as undulating terrain. Elevations range from a topographical high-point of 154 m Australian Height Datum (AHD), on a ridgeline located in the south east portion of the site, to a topographical low-point of approximately 84 m AHD. The gradient generally rises towards both the west and the south at the site.
Soil Landscape	Reference to the Penrith 1:100,000 Soils Landscape Sheet indicates that the site is located on the residual Blacktown, the erosional Luddenham and alluvial South Creek soil landscape groups. Further details can be found in DP (2021).
Geology	Reference to the Penrith 1:100,000 Geological Sheet indicates that the site is underlain by both Bringelly Shale of the Wianamatta Group of Triassic age and Fluvial Sediments of Quaternary age. Further details can be found in DP (2021).
Acid Sulfate Soils	The published Atlas of Australian Acid Sulfate Soils mapping, compiled by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) indicates that the site has an extremely low probability of acid sulfate soil occurrence.
Surface Water	The landform dictates the alignment of a number of ephemeral water courses across the site, with numerous farm dams present within the site, located along the ephemeral water course alignments. Surface water is anticipated to flow towards the north along the ephemeral water courses towards Lowes Creek. 2 km to the north.
Groundwater	Groundwater is anticipated to flow beneath the surface along the same direction of the surface water towards Lowes Creek, the likely receiving surface water body for groundwater flow path. Given the local geology (ie: Bringelly Shale), the groundwater in the fractured rock beneath the site is anticipated to have low groundwater flow likely to be dominated by fracture flow with resultant low yields (typically < 1 L/s) in bores. Accordingly, there would be no significant potential beneficial uses of the shallow groundwater system.

6. Site History

6.1 Title Deeds

A historical title deed search was conducted as part of DP (2007). DP (2007) concluded that no potential areas of environmental concern (PAEC) were warranted for the site based on the review of title deeds.

6.2 Historical Aerial Photography

Historical aerial photographs were sourced from NSW Land and Property Information for the years 1947, 1961, 1970, 1984/1986 and 1994. Aerial photographs from 2005 to 2022 were sourced from MetroMap. Copies of the relevant aerial photographs are presented in Appendix D.

The first available historical aerial for the site, 1947, shows that the site was largely cleared of vegetation, with evidence of the site being used for agricultural uses, such as cattle grazing, including a number of farm dams and potential ground disturbances likely from the result of the ploughing of the land. The site has remained relatively unchanged since 1947 with some notable modifications including additional farm dams, high-voltage power line towers, access roads, additional structures (residential and sheds).

A review of available MetroMap 2021 and 2022 aerial photographs identified that a portion of the site just off The Northern Road has undergone bulk earthworks for the construction of a stub road for a new intersection and subsequently the construction of a service station, as well as a road being constructed on the south-east portion of the site.

Bulk earthworks, likely for the construction of residential subdivisions, appear to be present in the eastern and south eastern areas from the site. The surrounding land (excluding the eastern and south eastern areas from the site) have remained relatively unchanged since the 1947 aerial photograph, which showed generally cleared land, likely used for agricultural purposes, with some rural residential dwellings with the most significant changes observed included the upgrade of The Northern Road to the east, which was upgraded between 2016 and 2020, and the residential subdivisions appearing to the south and south east.

The PAECs that were identified from the aerial photographs are summarised in Section 9, below.

6.3 Public Registers and Planning Records

EPA Notices available under Section 58 of the Contaminated Lands Management Act (CLM Act) Database searched 1 July 2021	There were no records of notices for the site or adjacent sites.
Sites notified to EPA under Section 60 of the CLM Act Database searched 1 July 2021	The site and adjacent sites were not listed as a notified contaminated site.
Licences listed under Section 308 of the Protection of the Environment Operations Act 1997 (POEO Act) Database searched 1 July 2021	There were no records issued to the site. However, licenses have been issued for the following properties within a 500 m radius of the site: • The Northern Road and Bringelly Road Upgrade Stage 2, directly east of the site, had been issued a licence for land-base extractive activity, crushing, grinding or separating and road construction. The license was surrendered in March 2021 on the completion of the road; • 761, The Northern Road, Bringelly NSW (Hi-Quality Waste Management Pty Ltd) has been issued a licence to regulate waste storage, recovery of general waste and composting. It has also been issued a number of section 91 Clean up Notices for stockpiling of non-permitted waste (ie plastics); and

- 769 The Northern Road, Bringelly NSW (W2R Organics Pty Ltd) has been issued a licence to regulate compositing activities.

6.4 Site History Integrity Assessment

The information used to establish the history of the site was sourced from reputable and reliable reference documents, many of which were official records held by Government departments/agencies. The databases maintained by various Government agencies potentially can contain high quality information, but some of these do not contain any data at all. A NSW SafeWork Dangerous Goods search was not undertaken due to the preliminary nature of the investigation. A Dangerous Goods search is completed to identify potentially hazardous substances that may be kept on site (such as chemical or fuel storage tanks) that may pose a potential contamination issue. Given that the site comprises rural residential land use it is unlikely that dangerous goods are held on site, notwithstanding, a Dangerous Goods Search should be conducted in future investigations for due diligence purposes.

In particular, aerial photographs provide high quality information that is generally independent of memory or documentation. They are only available at intervals of several years, so some gaps exist in the information from this source. The observed site features are open to different interpretations and can be affected by the time of day and/or year at which they were taken, as well as specific events, such as flooding. Care has been taken to consider different possible interpretations of aerial photographs and to consider them in conjunction with other lines of evidence.

6.5 Summary of Site History

The site history information suggests that the site has a history of being used for a combination of rural residential and agricultural uses since at least the 1940s. The site has been subject to very little relative changes over the site history with the exception of some additional access roads, structures, and small section of earthworks.

7. Site Walkover

7.1 Observations

A site walkover was undertaken of the site by an environmental engineer on 14 – 15 January 2020. The general site topography was consistent with that described in Section 5. The site history search and historical aerial review indicated a number of potential areas of environmental concern (PAECs), the purpose of the site walkover was the confirm the status of the identified PAECs, as well as identify any additional PAECs not identified during the site history search. At the time of the site walkover the following key site features pertinent to the PSI were observed:

- At the time of inspection, the site was overall consistent with the 2020 aerial photograph, the property appeared to be mainly used as rural residential property with the large balance of the site consisting of grassed paddocks with scattered vegetation and numerous farm dams;

- There were various structures on the site, mainly concentrated to the central portion of the site including residential buildings, sheds, garages and stables/shelters;
- Numerous timber power poles were observed across the site;
- Evidence of fly tipping and/or filling (potential asbestos pipe and bricks) within a drainage line in the north-east portion of the property described as Part Lot 500 DP 1231858; and
- Fragments of brick and building materials on the slope to the north of the residence on the property described as Lot 4 DP 1216380 – MetroMap imagery from 2009, which shows several dozen stockpiles with an approximate combined footprint of 190 m^2. It is unclear if the stockpiles were removed or spread across site prior to becoming grassed over.

The findings of the site walkover have been incorporated into the PAECs as presented in Section 9 and a selection of site photographs is provided in Appendix E:

A review of a June 2022 aerial photograph indicates that the site has remained relatively unchanged since the completion of site walkover with the exception of the area just off The Northern Road which has undergone bulk earthworks for the construction of a new intersection and the construction of a service station (refer Section 6.2 and Drawing 2).

8. Review of Geotechnical Test Pit Logs

A review of DP (2021) test pit and bore hole logs was conducted to identifying any additional PAEC. Fill was only identified in one location (TP108) which included brick fragments, roof tiles, metal and concrete. The remainder of the 15 test pits and five boreholes did not identify any fill or signs of contamination, with the soil profile typically noted to be topsoil overlying natural silty clays with shale or sandstone bedrock underlying. The test pit logs are included in Appendix F, together with notes defining classification methods and descriptive terms.

9. Potential Areas of Environmental Concern

Based on the results of DP (2017), site history search and subsequent site walkover, 10 PAEC categories were identified, as summarised in Table 4, below, and their locations shown on Drawing 2, Appendix B.

Table 4.: Summary of Identified Potential Areas of Environmental Concern in the site

PAEC #	Identified from	Brief Description	Potential Environmental Concern
1	APs	Potential Ground disturbances.	Areas of ground disturbance indicating potential impacted surface soil or possible filling.
2	1947 AP	Agricultural land use	Application of pesticides and herbicides.
3	APs	Farm Dams	Fill may have been imported for the construction of the dam walls

PAEC #	Identified from	Brief Description	Potential Environmental Concern
4	APs	High voltage powerline towers	Impacted surface soils/possible filling during construction of towers
5	APs	Access roads	Fill may have been imported for the construction of the access roads, as well as potential leaching of chemicals from any asphalt into the underlying material.
6	APs	Current and former buildings and structures	Potential hazardous building materials were used in structures. Potentially impacted surface soils from construction and demolition of structures.
7	1984/1986 AP	Vehicle Storage Area	Potential vehicle spills or leak impacting surface soils.
8	2015 and 2021, 2022 AP	Bulk earthworks	Imported fill material and potential impact to surface soils from heavy machinery from the construction of a fill platform in 2015 and then further bulk earthworks and construction of a service station in 2021/2022. However, given the service station is <1 year old It is considered to have a low potential for contamination.
9	APs and Site walkover	Timber power poles	Leaching of timber treatment chemicals from power poles has potential to impact the adjacent soils.

Notes:
AP = Aerial Photograph(s).

10. Preliminary Conceptual Site Model

A conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM provides the framework for identifying how the site became contaminated and how potential receptors may be exposed to contamination either in the present or the future i.e.: it enables an assessment of the potential source – pathway – receptor linkages (complete pathways).

Potential Sources

Based on the current investigation, the following potential sources of contamination and associated contaminants of potential concern (COPC) have been identified.

- S1: Ground Disturbance and Fill: Associated with ground disturbances (i.e.: levelling, placement of fill, demolition of former and current buildings on the site and high voltage powerlines and bulk earthworks) and general filling observed in dams;
  - CoPC include metals (arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni) and zinc (Zn)), total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene, xylene (BTEX), polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), phenols and asbestos.

- S2: Agricultural land use:
  - CoPC include OCP, OPP and metals. DP notes that earlier agricultural activities identified (i.e. in the 1940s aerials) CoPC would not include OCP and OPP as they were not widely adopted during that period.
- S3: Buildings and structures (including potentially stored chemicals and vehicle storage area):
  - CoPC include metals, TRH, BTEX, PAH, OCP, phenols, PCB and asbestos.
- S4: Timber Power Poles:
  - CoPC include metals, TRH, BTEX and PAH.

Potential Receptors

The following potential human receptors have been identified:

- R1: Current and future site users;
- R2: Future construction and maintenance workers; and recreational users; and
- R3: Adjacent site users (rural residential).

The following potential environmental receptors have been identified:

- R4: Surface water (On site dams and South Creek);
- R5: Groundwater; and
- R6: Terrestrial ecology.

Potential Pathways

The following potential pathways have been identified:

- P1: Ingestion and dermal contact;
- P2: Inhalation of dust and/or vapours;
- P3: Surface water run-off;
- P4: Lateral migration of groundwater providing base flow to water bodies;
- P5: Leaching of contaminants and vertical migration into groundwater; and
- P6: Contact with terrestrial ecology.

Summary of Potentially Complete Exposure Pathways

A 'source–pathway–receptor' approach has been used to assess the potential risks of harm being caused to human or environmental receptors from contamination sources on or in the vicinity of the site, via exposure pathways (potential complete pathways). The possible pathways between the above sources (S1 to S6) and receptors (R1 to R6) are provided in Table 5.

Table 5: Summary of Potentially Complete Exposure Pathways

Source	Transport Pathway	Receptor	Risk Management Action
S1: Ground Disturbance and Fill S2: Agricultural land use S3: Buildings and structures S4: Timber Power Poles	P1: Ingestion and dermal contact P2: Inhalation of dust and/or vapours	R1: Current and future site users R2: Future construction and maintenance workers;	An intrusive investigation is recommended to assess possible contamination including testing of the soils and groundwater.
	P2: Inhalation of dust and/or vapours	R3: Adjacent site users [Rural residential].	
	P3: Surface water run-off P4: Lateral migration of groundwater providing base flow to water bodies	R4: Surface water bodies [On site dams and South Creek];	
	P5: Leaching of contaminants and vertical migration into groundwater	R5: Groundwater; and	
	P6: Contact with terrestrial ecology	R6: Terrestrial ecology.	
S3: Buildings and structures	P1: Ingestion and dermal contact. P2: Inhalation of dust and/or vapours. P3: Surface water run-off. P6: Contact with terrestrial ecology.	R1: Current and future site users. R2: Construction and maintenance workers (during any site. redevelopment). R6: Terrestrial ecology.	Hazardous building survey to identify any hazardous building materials prior to any site redevelopment.

11. Conclusions and Recommendations

The scope of the current investigation included a desktop study and a site walkover. The site was found to be formerly and currently used as rural residential land with agricultural activities. A total of nine PAECs were identified across the site requiring further investigation. The identified PAEC were as follows:

- PAEC 1 – Potential ground disturbances and general fill;
- PAEC 2 - Agricultural land use;
- PAEC 3 – Farm Dams;
- PAEC 4 – High voltage powerline towers;
- PAEC 5 – Access roads;
- PAEC 6 – Current and former buildings and structures;

- PAEC 7 – Vehicle Storage Area;
- PAEC 8 – Bulk earthworks surrounding and underlying the recently constructed Service Station; and
- PAEC 9 - Timber Power Poles

Based on the information presented above, the site has the potential for contamination due to the historical site uses. The presence or extent of potential contamination has not been fully confirmed. Further assessment of soil and groundwater at the site would be required to assess the presence, degree and extent of contamination and any remediation requirements associated with the potential contamination sources identified. Targeted investigations of all PAECs should be undertaken, in the form of a Detailed Site Investigation (DSI) to inform any future development applications. Prior to redevelopment a site walk over must be undertaken on the portions of the site which were not accessed during this investigation to confirm the mapping.

With respect to site contamination, the recommended further assessment should build on the information provided in this report with reference to National Environment Protection Council (NEPC, 1999) National Environment Protection Council (Assessment of Site Contamination) Measure 1999 (amended 2013) (NEPC, 2013). Further assessment should include intrusive investigations, sampling, analysis and assessment to assess land use suitability and to determine remediation requirements, if necessary. A hazardous building survey is also recommended to identify any hazardous building materials prior to any demolition or maintenance.

The PAECs encountered were typical for a rural residential site with agricultural activity. It is considered unlikely that any of the identified PAECs will present a major constraint to the proposed rezoning and that the site can be rendered suitable for any beneficial land use scenarios (e.g. residential), subject to further investigation and remediation, as required.

12. References

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM].* Australian Government Publishing Services Canberra: National Environment Protection Council.

NSW DUAP/EPA. (1998). *Managing Land Contamination, Planning Guidelines, SEPP 55 – Remediation of Land .* NSW Department of Urban Affairs and Planning / Environment Protection Authority.

NSW EPA. (2020). *Guidelines for Consultants Reporting on Contaminated Land.* Contaminated Land Guidelines: NSW Environment Protection Authority.

13. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at 621 - 705 The Northern Road, Cobbitty in accordance with DP's proposal MAC180379.P.001.Rev1 dated 9 February 2021. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Boyuan Bringelly 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 results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the environmental 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.

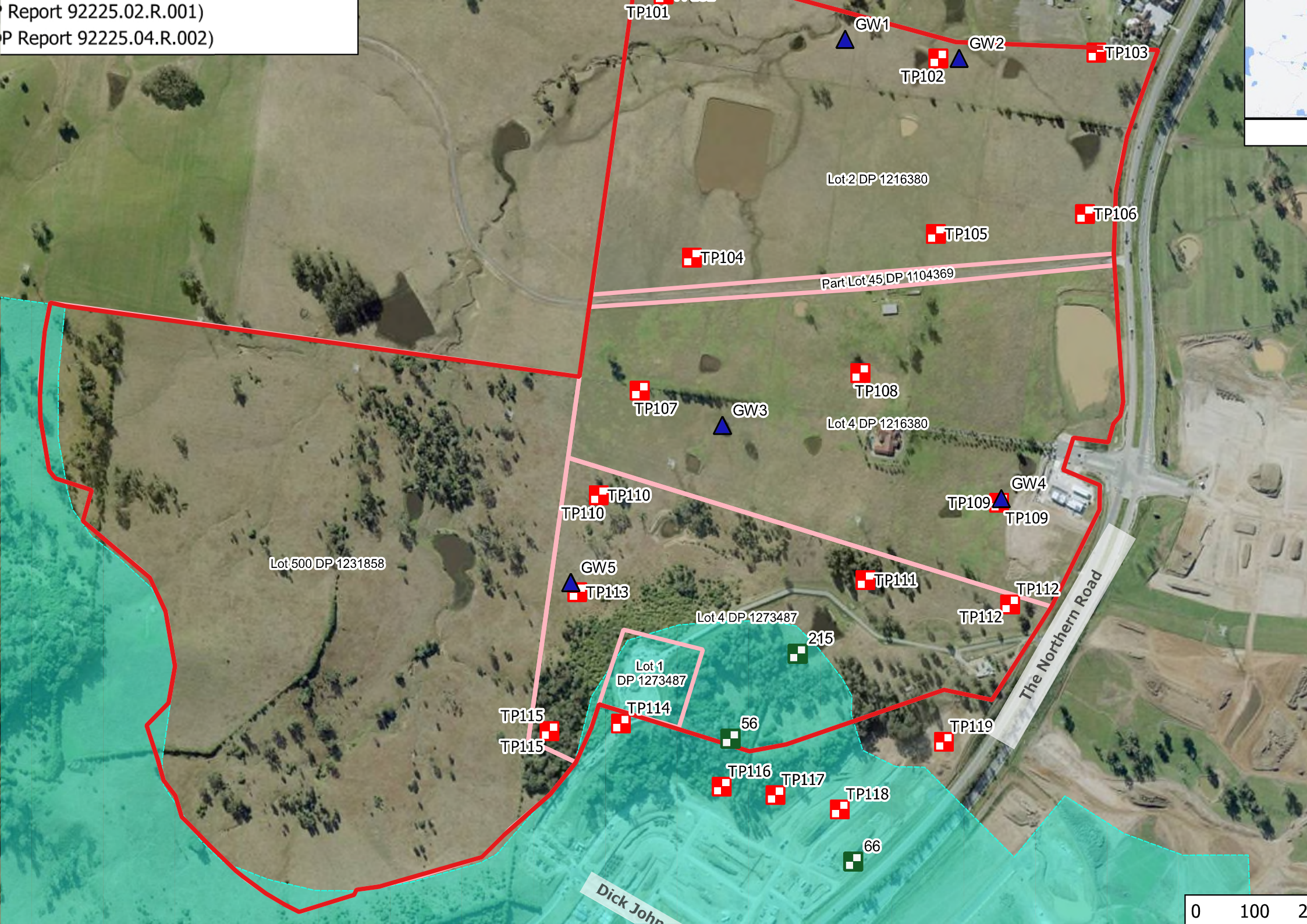
This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Although the sampling plan adopted for this investigation is considered appropriate to achieve the stated project objectives, there are necessarily parts of the site that have not been sampled and analysed. This is either due to undetected variations in ground conditions or to budget constraints (as discussed above), or to vegetation preventing visual inspection and reasonable access. It is therefore considered possible that HBM, including asbestos, may be present in unobserved or untested parts of the site, between and beyond sampling locations, and hence no warranty can be given that asbestos is not present.

Douglas Partners Pty Ltd

Appendix A

Drawings 1 and 2


Report 92225.02.R.001)
P Report 92225.04.R.002)
TP101
GW1
GW2
TP102
TP103
Lot 2 DP 1216380
TP106
TP105
TP104
Part Lot 45 DP 1104369
TP108
TP107
GW3
Lot 4 DP 1216380
GW4
TP109
TP109
TP110
TP110
Lot 500 DP 1231858
GW5
TP113
TP111
TP112
TP112
Lot 4 DP 1273487
215
Lot 1
DP 1273487
The Northern Road
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TP119
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Partially filled gully with bricks and potential asbestos pipe
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Appendix B

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

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

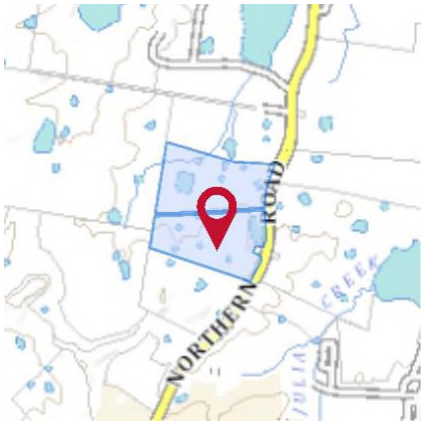
The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Appendix C

Site History documentation

Property Report

657-705 THE NORTHERN ROAD BRINGELLY 2556



Property Details

Address:	657-705 THE NORTHERN ROAD BRINGELLY 2556
Lot/Section /Plan No:	2/-/DP1216380 4/-/DP1216380
Council:	CAMDEN COUNCIL

Summary of planning controls

Planning controls held within the Planning Database are summarised below. The property may be affected by additional planning controls not outlined in this report. Please contact your council for more information.

Local Environmental Plans	Camden Local Environmental Plan 2010 (pub. 28-2-2019)
Land Zoning	RU1 - Primary Production: (pub. 3-9-2010)
Height Of Building	9.5 m
Floor Space Ratio	NA
Minimum Lot Size	40 ha
Heritage	NA
Land Reservation Acquisition	NA
Foreshore Building Line	NA
Local Provisions	Wildlife Buffer Zone
	Wind Turbine Buffer Zone
Obstacle Limitation Surface	230.5-230.5

Detailed planning information

State Environmental Planning Policies which apply to this property

State Environmental Planning Policies can specify planning controls for certain areas and/or types of development. They can also identify the development assessment system that applies and the type of environmental assessment that is required.

- State Environmental Planning Policy (Affordable Rental Housing) 2009: Land Application (pub. 31-7-2009)
- State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004: Land Application (pub. 25-6-2004)

- State Environmental Planning Policy (Concurrences and Consents) 2018: Land Application (pub. 21-12-2018)
- State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017: Land Application (pub. 1-9-2017)
- State Environmental Planning Policy (Exempt and Complying Development Codes) 2008: Land Application (pub. 12-12-2008)
- State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004: Land Application (pub. 31-3-2004)
- State Environmental Planning Policy (Infrastructure) 2007: Land Application (pub. 21-12-2007)
- State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007: Land Application (pub. 16-2-2007)
- State Environmental Planning Policy (Primary Production and Rural Development) 2019: Land Application (pub. 28-2-2019)
- State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017: Subject Land (pub. 25-8-2017)
- State Environmental Planning Policy No 19—Bushland in Urban Areas: Land Application (pub. 24-10-1986)
- State Environmental Planning Policy No 21—Caravan Parks: Land Application (pub. 24-4-1992)
- State Environmental Planning Policy No 33—Hazardous and Offensive Development: Land Application (pub. 13-3-1992)
- State Environmental Planning Policy No 36—Manufactured Home Estates: Land Application (pub. 16-7-1993)
- State Environmental Planning Policy No 50—Canal Estate Development: Land Application (pub. 10-11-1997)
- State Environmental Planning Policy No 55—Remediation of Land: Land Application (pub. 28-8-1998)
- State Environmental Planning Policy No 64—Advertising and Signage: Land Application (pub. 16-3-2001)
- State Environmental Planning Policy No 65—Design Quality of Residential Apartment Development: Land Application (pub. 26-7-2002)
- State Environmental Planning Policy No 70—Affordable Housing (Revised Schemes): Land Application (pub. 31-5-2002)
- Sydney Regional Environmental Plan No 20—Hawkesbury-Nepean River (No 2—1997): Land Application (pub. 7-11-1997)
- Sydney Regional Environmental Plan No 20—Hawkesbury-Nepean River (No 2—1997): Sub Catchment Boundaries (pub. 7-11-1997)
- Sydney Regional Environmental Plan No 9—Extractive Industry (No 2—1995): Land Application (pub. 15-9-1995)

Other matters affecting the property

Information held in the Planning Database about other matters affecting the property appears below. The property may also be affected by additional planning controls not outlined in this report. Please speak to your council for more information

1.5 m Buffer around Classified Roads	Classified Road Adjacent
Bushfire Prone Land	Vegetation Buffer
	Vegetation Category
Local Aboriginal Land Council	THARAWAL
Regional Plan Boundary	Greater Sydney
Special Infrastructure Contributions	Western Sydney Growth Centres SIC

Property Report

621 THE NORTHERN ROAD COBBITTY 2570

Property Details

Address:	621 THE NORTHERN ROAD COBBITTY 2570	
Lot/Section /Plan No:	1/-/DP1241819	2/-/DP1241819
Council:	CAMDEN COUNCIL	

Summary of planning controls

Planning controls held within the Planning Database are summarised below. The property may be affected by additional planning controls not outlined in this report. Please contact your council for more information.

Local Environmental Plans	Camden Local Environmental Plan 2010 (pub. 28-2-2019)
Land Zoning	E4 - Environmental Living: (pub. 25-9-2020)
	R1 - General Residential: (pub. 28-2-2019)
	RU1 - Primary Production: (pub. 3-9-2010)
Height Of Building	16 m
	9 m
	9.5 m
Floor Space Ratio	NA
Minimum Lot Size	1000 m²
	125 m²
	40 ha
Heritage	NA
Land Reservation Acquisition	NA
Foreshore Building Line	NA
Local Provisions	Wildlife Buffer Zone
	Wind Turbine Buffer Zone
Obstacle Limitation Surface	230.5-230.5

Greenfield Housing Code Area	Complying Development Code: https://www.planningportal.nsw.gov.au/greenfield-housing-code Building type: 1-2 storey homes, residential alterations and additions Development consent authority: Council or accredited certifier Note: Applications which meet all relevant requirements in the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 may be approved within 20 days. Exclusions may apply. https://legislation.nsw.gov.au/#/view/EPI/2008/572/full

Detailed planning information

State Environmental Planning Policies which apply to this property

State Environmental Planning Policies can specify planning controls for certain areas and/or types of development. They can also identify the development assessment system that applies and the type of environmental assessment that is required.

- State Environmental Planning Policy (Affordable Rental Housing) 2009: Land Application (pub. 31-7-2009)
- State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004: Land Application (pub. 25-6-2004)
- State Environmental Planning Policy (Concurrences and Consents) 2018: Land Application (pub. 21-12-2018)
- State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017: Land Application (pub. 1-9-2017)
- State Environmental Planning Policy (Exempt and Complying Development Codes) 2008: Land Application (pub. 12-12-2008)
- State Environmental Planning Policy (Exempt and Complying Development Codes) 2008: Subject Land (pub. 6-5-2018)
- State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004: Land Application (pub. 31-3-2004)
- State Environmental Planning Policy (Infrastructure) 2007: Land Application (pub. 21-12-2007)
- State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007: Land Application (pub. 16-2-2007)
- State Environmental Planning Policy (Primary Production and Rural Development) 2019: Land Application (pub. 28-2-2019)
- State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017: Subject Land (pub. 25-8-2017)

- State Environmental Planning Policy No 19—Bushland in Urban Areas: Land Application (pub. 24-10-1986)
- State Environmental Planning Policy No 21—Caravan Parks: Land Application (pub. 24-4-1992)
- State Environmental Planning Policy No 33—Hazardous and Offensive Development: Land Application (pub. 13-3-1992)
- State Environmental Planning Policy No 36—Manufactured Home Estates: Land Application (pub. 16-7-1993)
- State Environmental Planning Policy No 50—Canal Estate Development: Land Application (pub. 10-11-1997)
- State Environmental Planning Policy No 55—Remediation of Land: Land Application (pub. 28-8-1998)
- State Environmental Planning Policy No 64—Advertising and Signage: Land Application (pub. 16-3-2001)
- State Environmental Planning Policy No 65—Design Quality of Residential Apartment Development: Land Application (pub. 26-7-2002)
- State Environmental Planning Policy No 70—Affordable Housing (Revised Schemes): Land Application (pub. 31-5-2002)
- Sydney Regional Environmental Plan No 20—Hawkesbury-Nepean River (No 2—1997): Land Application (pub. 7-11-1997)
- Sydney Regional Environmental Plan No 20—Hawkesbury-Nepean River (No 2—1997): Sub Catchment Boundaries (pub. 7-11-1997)
- Sydney Regional Environmental Plan No 9—Extractive Industry (No 2—1995): Land Application (pub. 15-9-1995)

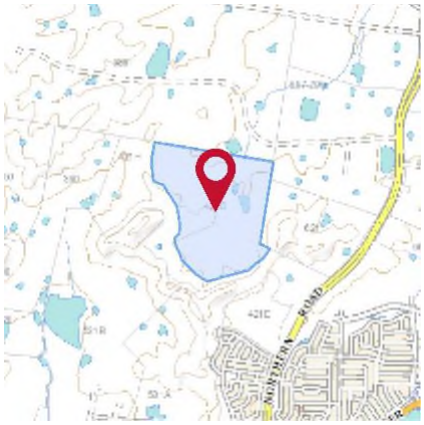
Other matters affecting the property

Information held in the Planning Database about other matters affecting the property appears below. The property may also be affected by additional planning controls not outlined in this report. Please speak to your council for more information

1.5 m Buffer around Classified Roads	Classified Road Adjacent
Bushfire Prone Land	Vegetation Buffer
	Vegetation Category
Local Aboriginal Land Council	THARAWAL
Regional Plan Boundary	Greater Sydney
Special Infrastructure Contributions	Western Sydney Growth Centres SIC

Property Report

421D THE NORTHERN ROAD COBBITTY 2570



Property Details

Address:	421D THE NORTHERN ROAD COBBITTY 2570
Lot/Section /Plan No:	500/-/DP1231858
Council:	CAMDEN COUNCIL

Summary of planning controls

Planning controls held within the Planning Database are summarised below. The property may be affected by additional planning controls not outlined in this report. Please contact your council for more information.

Local Environmental Plans	Camden Local Environmental Plan 2010 (pub. 28-2-2019)
Land Zoning	E4 - Environmental Living: (pub. 25-9-2020)
	R1 - General Residential: (pub. 28-2-2019)
	RU1 - Primary Production: (pub. 3-9-2010)
Height Of Building	16 m
	9 m
	9.5 m
Floor Space Ratio	NA
Minimum Lot Size	1000 m²
	40 ha
Heritage	NA
Land Reservation Acquisition	NA
Foreshore Building Line	NA
Local Provisions	Wildlife Buffer Zone
	Wind Turbine Buffer Zone
Obstacle Limitation Surface	230.5-230.5

Property Report

421D THE NORTHERN ROAD COBBITTY 2570

Greenfield Housing Code Area	Complying Development Code: https://www.planningportal.nsw.gov.au/greenfield-housing-code Building type: 1-2 storey homes, residential alterations and additions Development consent authority: Council or accredited certifier Note: Applications which meet all relevant requirements in the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 may be approved within 20 days. Exclusions may apply. https://legislation.nsw.gov.au/#/view/EPI/2008/572/full

Detailed planning information

State Environmental Planning Policies which apply to this property

State Environmental Planning Policies can specify planning controls for certain areas and/or types of development. They can also identify the development assessment system that applies and the type of environmental assessment that is required.

- State Environmental Planning Policy (Affordable Rental Housing) 2009: Land Application (pub. 31-7-2009)
- State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004: Land Application (pub. 25-6-2004)
- State Environmental Planning Policy (Concurrences and Consents) 2018: Land Application (pub. 21-12-2018)
- State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017: Land Application (pub. 1-9-2017)
- State Environmental Planning Policy (Exempt and Complying Development Codes) 2008: Land Application (pub. 12-12-2008)
- State Environmental Planning Policy (Exempt and Complying Development Codes) 2008: Subject Land (pub. 6-5-2018)
- State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004: Land Application (pub. 31-3-2004)
- State Environmental Planning Policy (Infrastructure) 2007: Land Application (pub. 21-12-2007)
- State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007: Land Application (pub. 16-2-2007)
- State Environmental Planning Policy (Primary Production and Rural Development) 2019: Land Application (pub. 28-2-2019)
- State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017: Subject Land (pub. 25-8-2017)

- State Environmental Planning Policy No 19—Bushland in Urban Areas: Land Application (pub. 24-10-1986)
- State Environmental Planning Policy No 21—Caravan Parks: Land Application (pub. 24-4-1992)
- State Environmental Planning Policy No 33—Hazardous and Offensive Development: Land Application (pub. 13-3-1992)
- State Environmental Planning Policy No 36—Manufactured Home Estates: Land Application (pub. 16-7-1993)
- State Environmental Planning Policy No 50—Canal Estate Development: Land Application (pub. 10-11-1997)
- State Environmental Planning Policy No 55—Remediation of Land: Land Application (pub. 28-8-1998)
- State Environmental Planning Policy No 64—Advertising and Signage: Land Application (pub. 16-3-2001)
- State Environmental Planning Policy No 65—Design Quality of Residential Apartment Development: Land Application (pub. 26-7-2002)
- State Environmental Planning Policy No 70—Affordable Housing (Revised Schemes): Land Application (pub. 31-5-2002)
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- Sydney Regional Environmental Plan No 20—Hawkesbury-Nepean River (No 2—1997): Sub Catchment Boundaries (pub. 7-11-1997)
- Sydney Regional Environmental Plan No 9—Extractive Industry (No 2—1995): Land Application (pub. 15-9-1995)

Other matters affecting the property

Information held in the Planning Database about other matters affecting the property appears below. The property may also be affected by additional planning controls not outlined in this report. Please speak to your council for more information

Bushfire Prone Land	Vegetation Category
Local Aboriginal Land Council	THARAWAL
Regional Plan Boundary	Greater Sydney
Special Infrastructure Contributions	Western Sydney Growth Centres SIC

Property Report

689 THE NORTHERN ROAD BRINGELLY 2556

Property Details

Address:	689 THE NORTHERN ROAD BRINGELLY 2556
Lot/Section /Plan No:	45/-/DP1104369
Council:	CAMDEN COUNCIL

Summary of planning controls

Planning controls held within the Planning Database are summarised below. The property may be affected by additional planning controls not outlined in this report. Please contact your council for more information.

Local Environmental Plans	Camden Local Environmental Plan 2010 (pub. 20-8-2021)
Land Zoning	RU1 - Primary Production: (pub. 20-8-2021)
Height Of Building	9.5 m
Floor Space Ratio	NA
Minimum Lot Size	40 ha
Heritage	NA
Land Reservation Acquisition	NA
Foreshore Building Line	NA
Local Provisions	13 km
	30 km
	8 km
Obstacle Limitation Surface	230.5-230.5
Riparian Lands and Watercourses	Riparian Area

Detailed planning information

State Environmental Planning Policies which apply to this property

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- State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004: Land Application (pub. 25-6-2004)
- State Environmental Planning Policy (Concurrences and Consents) 2018: Land Application (pub. 21-12-2018)
- State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017: Land Application (pub. 1-9-2017)
- State Environmental Planning Policy (Exempt and Complying Development Codes) 2008: Land Application (pub. 12-12-2008)
- State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004: Land Application (pub. 31-3-2004)
- State Environmental Planning Policy (Infrastructure) 2007: Land Application (pub. 21-12-2007)
- State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007: Land Application (pub. 16-2-2007)
- State Environmental Planning Policy (Primary Production and Rural Development) 2019: Land Application (pub. 28-2-2019)
- State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017: Subject Land (pub. 25-8-2017)
- State Environmental Planning Policy No 19—Bushland in Urban Areas: Land Application (pub. 24-10-1986)
- State Environmental Planning Policy No 21—Caravan Parks: Land Application (pub. 24-4-1992)
- State Environmental Planning Policy No 33—Hazardous and Offensive Development: Land Application (pub. 13-3-1992)
- State Environmental Planning Policy No 36—Manufactured Home Estates: Land Application (pub. 16-7-1993)
- State Environmental Planning Policy No 50—Canal Estate Development: Land Application (pub. 10-11-1997)
- State Environmental Planning Policy No 55—Remediation of Land: Land Application (pub. 28-8-1998)
- State Environmental Planning Policy No 64—Advertising and Signage: Land Application (pub. 16-3-2001)
- State Environmental Planning Policy No 65—Design Quality of Residential Apartment Development: Land Application (pub. 26-7-2002)
- State Environmental Planning Policy No 70—Affordable Housing (Revised Schemes): Land Application (pub. 31-5-2002)
- Sydney Regional Environmental Plan No 20—Hawkesbury-Nepean River (No 2—1997): Land Application (pub. 7-11-1997)
- Sydney Regional Environmental Plan No 20—Hawkesbury-Nepean River (No 2—1997): Sub Catchment Boundaries (pub. 7-11-1997)
- Sydney Regional Environmental Plan No 9—Extractive Industry (No 2—1995): Land Application (pub. 15-9-1995)

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1.5 m Buffer around Classified Roads	Classified Road Adjacent
Bushfire Prone Land	Vegetation Buffer
	Vegetation Category
Local Aboriginal Land Council	THARAWAL
Regional Plan Boundary	Greater Sydney
Special Infrastructure Contributions	Western Sydney Growth Centres SIC

Number	Name	Location	Type	Status	Issued date
1606411		Northern Road and Bringelly Road Upgrade Stage 2, BRINGELLY, NSW 2556	s.80 Surrender of a Licence	Issued	22-Mar-21
20864	ACCIONA INFRASTRUCTURE PROJECTS AUSTRALIA PTY LTD	Northern Road and Bringelly Road Upgrade Stage 2, BRINGELLY, NSW 2556	POEO licence	Surrendered	09-Dec-16
1553513	ACCIONA INFRASTRUCTURE PROJECTS AUSTRALIA PTY LTD	Northern Road and Bringelly Road Upgrade Stage 2, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	04-Jul-17
1572213	ACCIONA INFRASTRUCTURE PROJECTS AUSTRALIA PTY LTD	Northern Road and Bringelly Road Upgrade Stage 2, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	04-Dec-18
11539	CLEAN & GREEN ORGANICS PTY LTD	769 The Northern Road, BRINGELLY, NSW 2556	POEO licence	Issued	18-Oct-01
3085765587	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	Penalty Notice	Withdrawn	
3085765596	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	Penalty Notice	Withdrawn	
11233	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	POEO licence	Issued	18-Oct-00
1035465	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	19-Mar-04
1095376	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	17-Feb-09
1099072	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	31-Mar-09
1111306	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.91 Clean Up Notice	Issued	10-Feb-10
1111684	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.91 Clean Up Notice	Issued	09-Mar-10
1112249	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Clean Up Notice	Issued	10-Mar-10
1112260	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	21-Jun-10
1118231	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	20-Aug-10
1121730	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	11-Feb-11
1503776	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.96 Prevention Notice	Issued	09-Mar-12
1507951	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Prevention Notice	Issued	17-Aug-12
3085767576	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	Penalty Notice	Issued	18-Dec-12
1504950	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.79 Suspension of a Licence	Issued	10-Jan-13
1532259	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	13-Aug-15
1546630	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.91 Clean Up Notice	Issued	16-Nov-16
3085782563	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	Penalty Notice	Issued	08-Jun-17
3085782581	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	Penalty Notice	Issued	08-Jun-17
3085782572	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	Penalty Notice	Issued	08-Jun-17
1554407	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Clean Up Notice	Issued	31-Aug-17
1556796	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Clean Up Notice	Issued	18-Sep-17
1557957	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Clean Up Notice	Issued	25-Oct-17
1563262	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Clean Up Notice	Issued	29-Mar-18
1563297	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	03-Apr-18
1563465	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	05-Apr-18
1563830	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Clean Up Notice	Issued	20-Apr-18
1565460	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Clean Up Notice	Issued	05-Jun-18
1572231	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Clean Up Notice	Issued	27-Nov-18

1576537	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Clean Up Notice	Issued	01-Mar-19
1578978	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Clean Up Notice	Issued	13-May-19
1581395	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Clean Up Notice	Issued	10-Jul-19
1585698	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Clean Up Notice	Issued	07-Jan-20
1593192	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Clean Up Notice	Issued	31-Mar-20
1594779	HI-QUALITY WASTE MANAGEMENT PTY LTD	761 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Clean Up Notice	Issued	20-May-20
1028105	VOLK HOLDINGS PTY LTD	769 The Northern Road, BRINGELLY, NSW 2556	s.91 Clean Up Notice	Issued	23-Jun-03
1033769	VOLK HOLDINGS PTY LTD	769 The Northern Road, BRINGELLY, NSW 2556	s.91 Clean Up Notice	Issued	09-Jan-04
1096898	VOLK HOLDINGS PTY LTD	769 The Northern Road, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	19-Jan-09
1101429	VOLK HOLDINGS PTY LTD	769 The Northern Road, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	01-Jul-09
1103296	VOLK HOLDINGS PTY LTD	769 The Northern Road, BRINGELLY, NSW 2556	s.91 Clean Up Notice	Issued	25-Aug-09
1107272	VOLK HOLDINGS PTY LTD	769 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Clean Up Notice	Issued	22-Oct-09
1128831	VOLK HOLDINGS PTY LTD	769 The Northern Road, BRINGELLY, NSW 2556	s.91 Clean Up Notice	Issued	10-Jun-11
1500694	VOLK HOLDINGS PTY LTD	769 The Northern Road, BRINGELLY, NSW 2556	s.110 Variation of Clean Up Notice	Issued	28-Oct-11
3085770811	VOLK HOLDINGS PTY LTD	769 The Northern Road, BRINGELLY, NSW 2556	Penalty Notice	Issued	21-May-13
1519975	VOLK HOLDINGS PTY LTD	769 The Northern Road, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	18-Feb-14
1538776	W2R ORGANICS PTY LTD	769 The Northern Road, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	13-Apr-16
3173527794	W2R ORGANICS PTY LTD	769 The Northern Road, BRINGELLY, NSW 2556	Penalty Notice	Issued	24-May-19
1527358	W2R PTY LTD	769 The Northern Road, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	18-Mar-15
1535116	W2R PTY LTD	769 The Northern Road, BRINGELLY, NSW 2556	s.58 Licence Variation	Issued	19-Feb-16
3085779080	W2R PTY LTD	769 The Northern Road, BRINGELLY, NSW 2556	Penalty Notice	Issued	30-May-16

Background

A strategy to systematically prioritise, assess and respond to notifications under Section 60 of the ***Contaminated Land Management Act 1997*** (CLM Act) has been developed by the EPA. This strategy acknowledges the EPA's obligations to make information available to the public under ***Government Information (Public Access) Act 2009*** .

When a site is notified to the EPA, it may be accompanied by detailed site reports where the owner has been proactive in addressing the contamination and its source. However, often there is minimal information on the nature or extent of the contamination.

After receiving a report, the first step is to confirm that the report does not relate to a pollution incident. The Protection of the Environment Operations Act 1997 (POEO Act) deals with pollution incidents, waste stockpiling or dumping. The EPA also has an incident management process to manage significant incidents (https://www.epa.nsw.gov.au/reporting-and-incidents/incident-management).

In many cases, the information indicates the contamination is securely immobilised within the site, such as under a building or carpark, and is not currently causing any significant risks for the community or environment. Such sites may still need to be cleaned up, but this can be done in conjunction with any subsequent building or redevelopment of the land. These sites do not require intervention under the CLM Act, and are dealt with through the planning and development consent process. In these cases, the EPA informs the local council or other planning authority, so that the information can be recorded and considered at the appropriate time (https://www.epa.nsw.gov.au/your-environment/contaminated-land/managing-contaminated-land/role-of-planning-authorities).

Where indications are that the contamination could cause actual harm to the environment or an unacceptable offsite impact (i.e. the land is 'significantly contaminated'), the EPA would apply the regulatory provisions of the CLM Act to have the responsible polluter and/or landowner investigate and remediate the site. If the reported contamination could present an immediate or long-term threat to human health NSW Health will be consulted. SafeWork NSW and Water NSW can also be consulted if there appear to be occupational health and safety risks or an impact on groundwater quality.

As such, the sites notified to the EPA and presented in the list of contaminated sites notified to the EPA are at various stages of the assessment and remediation process. Understanding the nature of the underlying contamination, its implications and implementing a remediation program where required, can take a considerable period of time. The list provides an indication, in relation to each nominated site, as to the management status of that particular site. Further detailed information may be available from the EPA or the person who notified the site.

The following questions and answers may assist those interested in this issue.

Frequently asked questions

Why does my land appear on the list of notified sites?

Your land may appear on the list because:

- the site owner and/or the polluter has notified the EPA under section 60 of the CLM Act
- the EPA has been notified via other means and is satisfied that the site is or was contaminated.

If a site is on the list, it does not necessarily mean the contamination is significant enough to regulate under the CLM Act.

Does the list contain all contaminated sites in NSW?

No. The list only contains contaminated sites that EPA is aware of. If a site is not on the list, it does not necessarily mean the site is not contaminated.

The EPA relies on responsible parties and the public to notify contaminated sites.

How are notified contaminated sites managed by the EPA?

There are different ways the EPA can manage notified contaminated sites. Options include:

- regulation under the CLM Act, POEO Act, or both
- notifying the relevant planning authority for management under the planning and development process
- managing the site under the Protection of the Environment Operation (Underground Petroleum Storage Systems) Regulation 2014.

There are specific cases where contamination is managed under a tailored program operated by another agency (for example, the Resources & Geoscience's Legacy Mines Program).

What should I do if I am a potential buyer of a site that appears on the list?

You should seek advice from the seller to understand the contamination issue. You may need to seek independent contamination or legal advice.

The information provided in the list is indicative only and a starting point for your own assessment. Land contamination from past site uses is common, mainly in urban environments. If the site is properly remediated or managed, it may not affect the intended future use of the site.

Who can I contact if I need more information about a site?

You can contact the Environment Line at any time by calling 131 555 or by emailing info@environment.nsw.gov.au.

List of NSW Contaminated Sites Notified to the EPA

Disclaimer

The EPA has taken all reasonable care to ensure that the information in the list of contaminated sites notified to the EPA (the list) is complete and correct. The EPA does not, however, warrant or represent that the list is free from errors or omissions or that it is exhaustive.

The EPA may, without notice, change any or all of the information in the list at any time.

You should obtain independent advice before you make any decision based on the information in the list.

The list is made available on the understanding that the EPA, its servants and agents, to the extent permitted by law, accept no responsibility for any damage, cost, loss or expense incurred by you as a result of:

1. any information in the list; or
2. any error, omission or misrepresentation in the list; or
3. any malfunction or failure to function of the list;
4. without limiting (2) or (3) above, any delay, failure or error in recording, displaying or updating information.

Site Status	Explanation
Under assessment	The contamination is being assessed by the EPA to determine whether regulation is required. The EPA may require further information to complete the assessment. For example, the completion of management actions regulated under the planning process or *Protection of the Environment Operations Act 1997* .
Under Preliminary Investigation Order	The EPA has issued a Preliminary Investigation Order under s10 of the *Contaminated Land Management Act 1997* , to obtain additional information needed to complete the assessment.
Regulation under CLM Act not required	The EPA has completed an assessment of the contamination and decided that regulation under the *Contaminated Land Management Act 1997* is not required.
Regulation being finalised	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the *Contaminated Land Management Act 1997* . A regulatory approach is being finalised.
Contamination currently regulated under CLM Act	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the Contaminated Land Management Act 1997 (CLM Act). Management of the contamination is regulated by the EPA under the CLM Act. Regulatory notices are available on the EPA's Contaminated Land Public Record.
Contamination currently regulated under POEO Act	Contamination is currently regulated under the Protection of the Environment Operations Act 1997 (POEO Act). The EPA as the appropriate regulatory authority reasonably suspects that a pollution incident is occurring/ has occurred and that it requires regulation under the POEO Act. The EPA may use environment protection notices, such as clean up notices, to require clean up action to be taken. Such regulatory notices are available on the POEO public register.
Contamination being managed via the planning process (EP&A Act)	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation. The contamination of this site is managed by the consent authority under the *Environmental Planning and Assessment Act 1979* (EP&A Act) planning approval process, with EPA involvement as necessary to ensure significant contamination is adequately addressed. The consent authority is typically a local council or the Department of Planning and Environment.
Contamination formerly regulated under the CLM Act	The EPA has determined that the contamination is no longer significant enough to warrant regulation under the *Contaminated Land Management Act 1997* (CLM Act). The contamination was addressed under the CLM Act.
Contamination formerly regulated under the POEO Act	The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed under the *Protection of the Environment Operations Act 1997* (POEO Act).
Contamination was addressed via the planning process (EP&A Act)	The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed by the appropriate consent authority via the planning process under the *Environmental Planning and Assessment Act 1979* (EP&A Act).
Ongoing maintenance required to manage residual contamination (CLM Act)	The EPA has determined that ongoing maintenance, under the Contaminated Land Management Act 1997 (CLM Act), is required to manage the residual contamination. Regulatory notices under the CLM Act are available on the EPA's Contaminated Land Public Record.

Suburb	SiteName	Address	ContaminationActivityType	ManagementClass	Latitude	Longitude
BRANXTON	Former Service Station Branxton	Part of 70 Maitland STREET	Service Station	Contamination currently regulated under CLM Act	-32.65631582	151.3516243
BRANXTON	Branxton Wastewater Treatment Works	2151 New England HIGHWAY	Other Industry	Regulation under CLM Act not required	-32.66069944	151.3625572
BREWARRINA	Dowell's Fuel	39 Doyle STREET	Service Station	Regulation under CLM Act not required	-29.96152786	146.8612561
BRIGHTON-LE-SANDS	Shell Service Station Brighton Le Sands & adjacent land	2 General Holmes DRIVE	Service Station	Contamination formerly regulated under the CLM Act	-33.9579214	151.1578665
BRIGHTON-LE-SANDS	Cook Park	General Holmes DRIVE	Service Station	Contamination formerly regulated under the CLM Act	-33.9581072	151.1579572
BROADMEADOW	Former Industrial Site	16 Broadmeadow ROAD	Service Station	Regulation under CLM Act not required	-32.91444096	151.7300112
BROADMEADOW	Nineways Broadmeadow Coles Express SS	Corner Brunker Road and Lambton ROAD	Service Station	Regulation under CLM Act not required	-32.92511185	151.7364247
BROADMEADOW	2 Georgetown Road, Broadmeadow NSW 2292	2 Georgetown ROAD	Metal Industry	Under assessment	-32.912288	151.732211

Search results

Your search for:Suburb: BRINGELLY

Search Again
Refine Search

did not find any records in our database.

If a site does not appear on the record it may still be affected by contamination. For example:

- Contamination may be present but the site has not been regulated by the EPA under the Contaminated Land Management Act 1997 or the Environmentally Hazardous Chemicals Act 1985.
- The EPA may be regulating contamination at the site through a licence or notice under the Protection of the Environment Operations Act 1997 (POEO Act).
- Contamination at the site may be being managed under the planning process.

Search TIP

To search for a specific site, search by LGA (local government area) and carefully review all sites listed.

... more search tips

More information about particular sites may be available from:

- The POEO public register
- The appropriate planning authority: for example, on a planning certificate issued by the local council under section 149 of the Environmental Planning and Assessment Act.

See What's in the record and What's not in the record.

If you want to know whether a specific site has been the subject of notices issued by the EPA under the CLM Act, we suggest that you search by Local Government Area only and carefully review the sites that are listed.
This public record provides information about sites regulated by the EPA under the Contaminated Land Management Act 1997, including sites currently and previously regulated under the Environmentally Hazardous Chemicals Act 1985. Your inquiry using the above search criteria has not matched any record of current or former regulation. You should consider searching again using different criteria. The fact that a site does not appear on the record does not necessarily mean that it is not affected by contamination. The site may have been notified to the EPA but not yet assessed, or contamination may be present but the site is not yet being regulated by the EPA. Further information about particular sites may be available from the appropriate planning authority, for example, on a planning certificate issued by the local council under section 149 of the Environmental Planning and Assessment Act. In addition the EPA may be regulating contamination at the site through a licence under the Protection of the Environment Operations Act 1997. You may wish to search the POEO public register.POEO public register

1 July 2021

For business and industry

For local government

Contact us

131 555 (tel:131555)

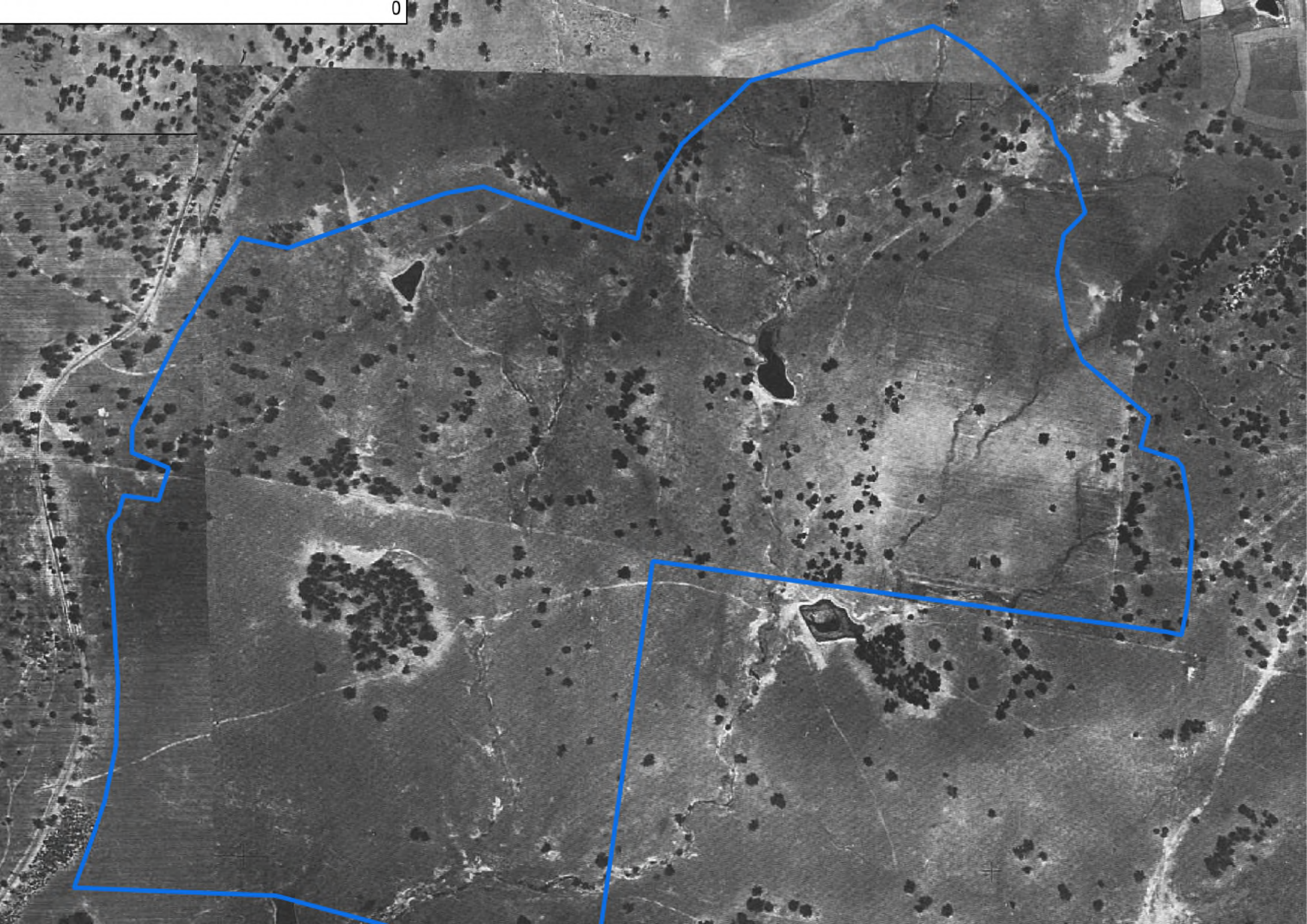
Online (https://yoursay.epa.nsw.gov.au/epa-website-feedback)

info@epa.nsw.gov.au (mailto:info@epa.nsw.gov.au)

EPA Office Locations (https://www.epa.nsw.gov.au/about-us/contact-us/locations)

Appendix D

Historical Aerials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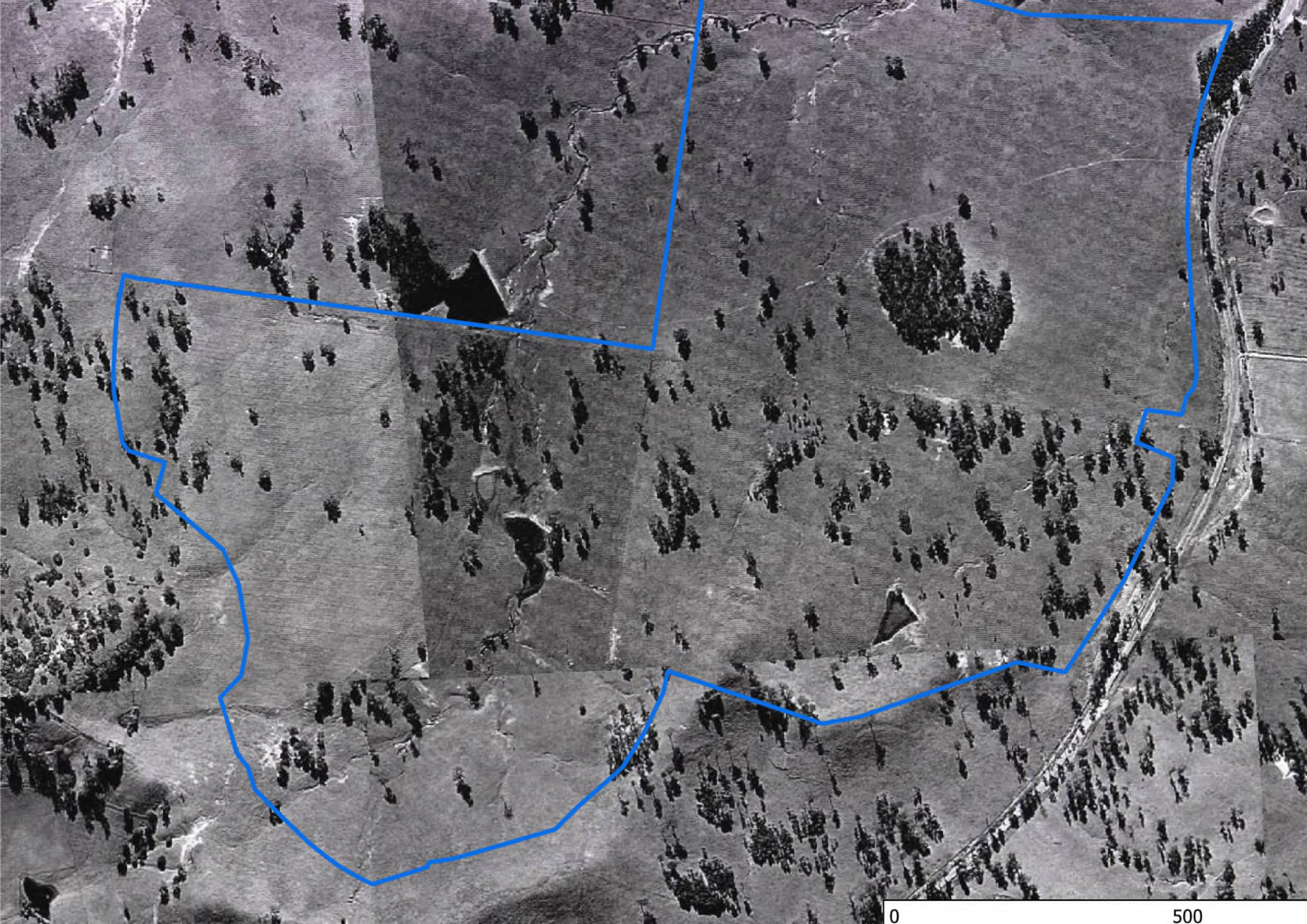
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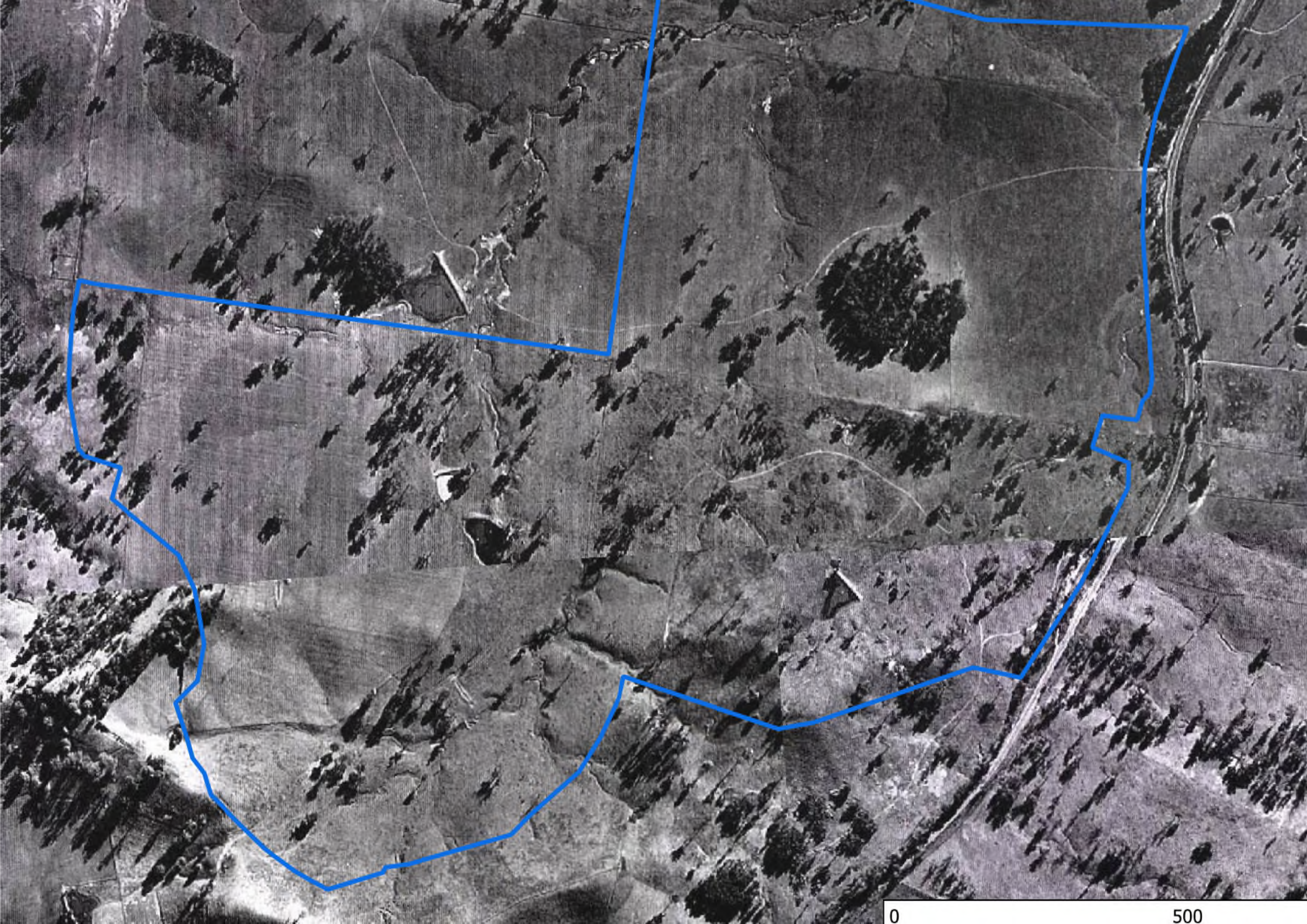
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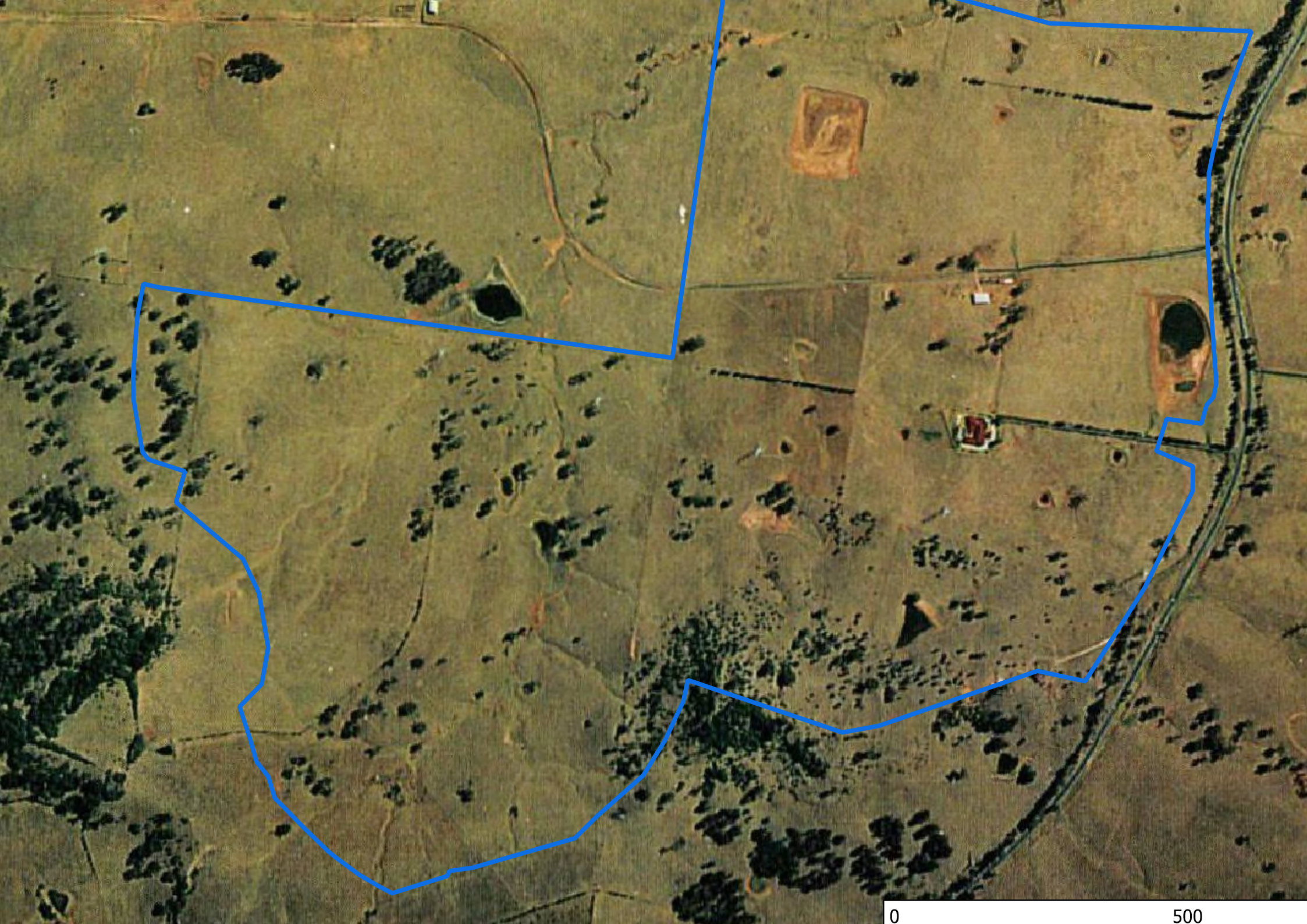
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Appendix E

Site Photographs

Photo 1 - General Site Photograph

Photo 2 - General Site Photograph

Douglas Partners Geotechnics / Environment / Groundwater	Site Photographs	PROJECT: 92225.04
	Preliminary Site Investigation	PLATE No: 1
	621 - 705 The Northern Road, Cobbitty	REV: 0
	CLIENT: Boyuan Bringelly Pty Ltd	DATE: Jul-20

Photo 3 - General Site Photograph

Photo 4 - Observed Fly Tipping

Douglas Partners Geotechnics / Environment / Groundwater	Site Photographs	PROJECT: 92225.04
	Preliminary Site Investigation	PLATE No: 2
	621 - 705 The Northern Road, Cobbitty	REV: 0
	CLIENT: Boyuan Bringelly Pty Ltd	DATE: Jul-20

Photo 5 - Potential ACM Pipe

Douglas Partners Geotechnics / Environment / Groundwater	Site Photographs	PROJECT: 92225.04
	Preliminary Site Investigation	PLATE No: 3
	621 - 705 The Northern Road, Cobbitty	REV: 0
	CLIENT: Boyuan Bringelly Pty Ltd	DATE: Jul-20

Appendix F

Logs

BOREHOLE LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: –
EASTING: 290132
NORTHING: 6237715
DIP/AZIMUTH: 90°/–

BORE No: GW1
PROJECT No: 92225.02
DATE: 21/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	TOPSOIL/Silty CLAY: brown, with rootlets							
		Silty CLAY: pale grey and brown							grout
	3.0	SHALE: pale grey and brown							bentonite
									sand
								10-03-21	screen
	7.1	Bore discontinued at 7.1m - limit of investigation							

RIG: Comacchio GEO 405 **DRILLER:** Terratest **LOGGED:** ERL **CASING:**

TYPE OF BORING: SFA and rotary air blast

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: –
EASTING: 290327
NORTHING: 6237683
DIP/AZIMUTH: 90°/–

BORE No: GW2
PROJECT No: 92225.02
DATE: 21/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	TOPSOIL/Silty CLAY: brown, with rootlets							
		Silty CLAY: orange brown and grey						10-03-21	grout
	2.5	SHALE: pale grey, possibly some sandstone							bentonite
									sand
	7.1	Bore discontinued at 7.1m - limit of investigation							screen

RIG: Comacchio GEO 405 **DRILLER:** Terratest **LOGGED:** ERL **CASING:**

TYPE OF BORING: SFA and rotary air blast

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: –
EASTING: 289923
NORTHING: 6237057
DIP/AZIMUTH: 90°/–

BORE No: GW3
PROJECT No: 92225.02
DATE: 24/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	TOPSOIL/Silty CLAY: brown, with rootlets							
		Silty CLAY: red brown and grey mottled							
		- becoming grey and orange mottled below 0.5m							
	3.5	SHALE: pale brown						10-03-21	grout; bentonite; sand; screen
	7.7	Bore discontinued at 7.7m - limit of investigation							

RIG: Comacchio GEO 405 **DRILLER:** Terratest **LOGGED:** ERL **CASING:**
TYPE OF BORING: SFA and rotary air blast
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: –
EASTING: 289665
NORTHING: 6236789
DIP/AZIMUTH: 90°/–

BORE No: GW4
PROJECT No: 92225.02
DATE: 24/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	TOPSOIL/Silty CLAY: brown, with rootlets							
		Silty CLAY: brown and grey						10-03-21	grout
	3.5	SHALE: pale brown and grey							bentonite
		- becoming dark grey below 6.0m							sand
									screen
	8.0	Bore discontinued at 8.0m - limit of investigation							

RIG: Comacchio GEO 405 **DRILLER:** Terratest **LOGGED:** ERL **CASING:**
TYPE OF BORING: SFA and rotary air blast
WATER OBSERVATIONS: Groundwater observed whilst augering at 7.3m
REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: –
EASTING: 289665
NORTHING: 6236789
DIP/AZIMUTH: 90°/–

BORE No: GW5
PROJECT No: 92225.02
DATE: 21/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	TOPSOIL/Silty CLAY: brown, with rootlets							
		Silty CLAY: red brown and orange brown							
		- becoming grey and red mottled below 3.0m						10-03-20	grout; bentonite
	4.5	SHALE: pale brown							sand; screen
	7.0	Bore discontinued at 7.0m - limit of investigation							

RIG: Comacchio GEO 405 **DRILLER:** Terratest **LOGGED:** ERL **CASING:**
TYPE OF BORING: SFA and rotary air blast
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56. Not bailed

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 90 mAHD
EASTING: 289823
NORTHING: 6237792

PIT No: 101
PROJECT No: 92225.02
DATE: 3/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
90	0.4	TOPSOIL/Silty CLAY CI: brow, trace gravel and sand, rootlets in top 0.1m, w<PL							
		Silty CLAY CI: grey, brown, yellow and red mottled, trace gravel and sand, w<PL, hard		Dx2	0.5				
				U_{50}	0.9		pp ≥400		
89	1			D	1.0				1
	1.4	Silty CLAY CI: grey and red brown, trace sandstone gravel, w<PL, hard		Dx2	1.5		pp ≥400		
		- becoming grey below 1.7m							
88	2			D	2.0		pp = 300		2
	2.2	SANDSTONE: brown, with iron staining, low to medium strength, highly to moderately weathered		D	2.5				
	2.6	Pit discontinued at 2.6m - refusal on low to medium strength sandstone							
87	3								3
86	4								4
85	5								5
84	6								6
83	7								7
82	8								8
81	9								9

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 88 mAHD
EASTING: 290291
NORTHING: 6237683

PIT No: 102
PROJECT No: 92225.02
DATE: 3/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
88	0.4	TOPSOIL/Silty CLAY CI: brown, trace gravel, rootlets in top 0.05m, w<PL							
87	1.8	Silty CLAY CI: red brown, trace ironstone gravel, w<PL, hard		D	0.5		pp >400		
				D/B	1.0		pp >400		
				D	1.5		pp >400		
86	3.0	Silty CLAY CI: grey and red brown mottled, trace sandstone gravel, w<PL, very stiff		D	2.0		pp = 300		
				D	2.5		pp = 300		
85		Pit discontinued at 3.0m - limit of investigation		D	3.0				
84									
83									
82									
81									
80									
79									

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 95 mAHD
EASTING: 290561
NORTHING: 6237693

PIT No: 103
PROJECT No: 92225.02
DATE: 3/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
95	0.3	TOPSOIL/Silty CLAY CI: brown, trace rootlets in top 0.1m, w<PL							
		Silty CLAY CI: red brown and grey mottled, trace gravel and sand, w<PL, hard		Dx2	0.5				
94	1			D	1.0				
	1.2	SANDSTONE: fine grained, grey, low strength, moderately weathered		Dx2	1.5				
		- becoming brown, low to medium strength, moderately weathered							
93	2	2.0 Pit discontinued at 2.0m		D	2.0				
		- refusal on low to medium strength sandstone							
92	3								
91	4								
90	5								
89	6								
88	7								
87	8								
86	9								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 94 mAHD
EASTING: 289871
NORTHING: 6237343

PIT No: 104
PROJECT No: 92225.02
DATE: 3/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
94	0.2	TOPSOIL/Silty CLAY CI: with rootlets in top 0.1m, w<PL							
	0.6	Silty CLAY CI: brown, trace gravel and sand, w<PL, hard		Dx2	0.5		pp >400		
93	1	Silty CLAY CI: red brown and grey mottled, trace gravel and sand, w<PL, hard		D	1.0				
				Dx2	1.5				
		- becoming more grey with depth below 1.7m							
92	2			D	2.0				
				Dx2	2.5		pp >400		
		- becoming extremely weathered below 2.8m							
91	3	3.0		D	3.0				
		Pit discontinued at 3.0m - limit of investigation							
90	4								
89	5								
88	6								
87	7								
86	8								
85	9								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 97 mAHD
EASTING: 290287
NORTHING: 6237383

PIT No: 105
PROJECT No: 92225.02
DATE: 3/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
97	0.2	TOPSOIL/Silty CLAY CI: brown, with rootlets in top 0.1m, w<PL							
	0.5	Silty CLAY CI: brown, trace gravel and sand, w<PL, hard		Dx2/B	0.35 0.5		pp ≥400		
96	1	Silty CLAY CI: red brown, trace gravel and sand, w<PL, hard		D	1.0				
				Dx2	1.5		pp ≥400		
95	2			D	2.0				
	2.2	SANDSTONE: fine grained, pale grey and brown, with iron staining, low strength, highly to moderately weathered							
	2.5	Pit discontinued at 2.5m - refusal on low to medium strength sandstone		Dx2	2.5				
94	3								
93	4								
92	5								
91	6								
90	7								
89	8								
88	9								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 95 mAHD
EASTING: 290542
NORTHING: 6237417

PIT No: 106
PROJECT No: 92225.02
DATE: 3/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
95	0.15	TOPSOIL/Silty CLAY CI: brown, trace gravel and sand, with rootlets in top 0.05m, w<PL, hard							
		Silty CLAY CI: brown and red brown, trace gravel and sand, w<PL, hard		Dx2	0.5		pp >400		
94	1			D	1.0				
		- becoming red grey mottled below 1.2m		Dx2	1.5				
		- becoming grey, red, yellow mottled below 1.6m							
93	1.9	SHALE: mid grey, with iron staining, low strength, highly to moderately weathered, Bringelly Shale		D	2.0				
	2			Dx2	2.5				
		- becoming extremely weathered below 2.8m							
92	3			D	3.0				
	3.0	Pit discontinued at 3.0m - limit of investigation							
91	4								
90	5								
89	6								
88	7								
87	8								
86	9								

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621-705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 102 mAHD
EASTING: 289782
NORTHING: 6237116

PIT No: 107
PROJECT No: 92225.02
DATE: 3/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
102	0.2	TOPSOIL/Silty CLAY CI: trace rootlets in top 0.05m, w<PL							
		Silty CLAY CI: red brown and grey mottled, becoming more grey with depth, trace ironstone and sandstone bands, w<PL		Dx2	0.5				
101	1			D	1.0				
				Dx2	1.5				
100	2			D	2.0				
	2.1	SANDSTONE: fine grained, grey, becoming more brown with depth, with iron staining, low strength, highly to moderately weathered		Dx2	2.5				
99	3			D	3.0				
	3.0	Pit discontinued at 3.0m - limit of investigation							
98	4								
97	5								
96	6								
95	7								
94	8								
93	9								

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 105 mAHD
EASTING: 290158
NORTHING: 6237146

PIT No: 108
PROJECT No: 92225.02
DATE: 3/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
105	0.8	FILL/Silty CLAY CI: with rootlets in top 0.1m, trace gravel and anthropogenics comprising brick fragments, roof tiles, pipe, metal, concrete, w<PL		Dx2	0.5		pp >400		
				U_{50}	0.9				
104	1	Silty CLAY CI: medium plasticity, red brown, trace gravel, with sandstone bands, w<PL, hard		D	1.0				
				Dx2	1.5		pp >400		
103	2			D	2.0				
	2.4	SANDSTONE: fine grained, brown and grey, with iron staining, very low to low strength, highly to moderately weathered		Dx2	2.5				
102	3			D	3.0				
	3.0	Pit discontinued at 3.0m - limit of investigation							
101	4								
100	5								
99	6								
98	7								
97	8								
96	9								

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621-705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 104 mAHD
EASTING: 290395
NORTHING: 6236925

PIT No: 109
PROJECT No: 92225.02
DATE: 3/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
104	0.3	TOPSOIL/Silty CLAY CI: trace rootlets in top 0.15m, w<PL							
		Silty CLAY CI: brown, trace gravel, w<PL, hard		Dx2	0.5		pp >400		
		-becoming red brown, very stiff below 0.6m		D	1.0				
103	1			Dx2	1.5				
		-becoming red brown grey mottled below 1.8m			1.8		pp = 350		
102	2			D	2.0				
	2.1	SANDSTONE: fine grained, grey and brown, with iron staining, low strength, highly to moderately weathered		Dx2	2.5				
		-becoming extremely weathered with depth							
101	3			D	3.0				
	3.0	Pit discontinued at 3.0m -limit of investigation							
100	4								
99	5								
98	6								
97	7								
96	8								
95	9								

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621-705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 105 mAHD
EASTING: 289712
NORTHING: 6236938

PIT No: 110
PROJECT No: 92225.02
DATE: 4/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
105	0.05	TOPSOIL/Silty CLAY CI: brown, trace rootlets, w<PL							
	0.3	Silty CLAY CI: brown, w<PL, hard							
104	1	Silty CLAY CI: medium to high plasticity, red brown and grey, yellow mottled, with ironstone gravel, w<PL, hard, residual			1.0		pp ≥400		
	1.4	Silty CLAY CH: high plasticity, pale grey, with iron staining (red and yellow), with very low to low strength siltstone bands, (extremely weathered siltstone, residual)							
103	2								
	2.1	SILTSTONE: pale brown and grey, with iron staining, with clay seams, very low to low strength, moderately to slightly weathered - no clay seams below 2.7m							
102	3								
	3.0	Pit discontinued at 3.0m - limit of investigation							
101	4								
100	5								
99	6								
98	7								
97	8								
96	9								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621-705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 113 mAHD
EASTING: 290167
NORTHING: 6236793

PIT No: 111
PROJECT No: 92225.02
DATE: 4/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
113	0.1	TOPSOIL/Silty CLAY CI: trace rootlets, w<PL							
	0.4	Silty CLAY CI: brown, trace gravel, w<PL, hard							
		Silty CLAY CI: medium to high plasticity, orange brown, trace ironstone and siltstone gravel, hard		Dx2	0.5				
112	1			D/B	1.0				
				Dx2	1.5				
111	2	- becoming grey and orange/red mottled, with siltstone (possible sandstone) bands (possible extremely weathered siltstone)		D	2.0				
				Dx2	2.5				
110	3	3.0 Pit discontinued at 3.0m - limit of investigation		D	3.0				
109	4								
108	5								
107	6								
106	7								
105	8								
104	9								

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621-705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 111 mAHD
EASTING: 290414
NORTHING: 6236752

PIT No: 112
PROJECT No: 92225.02
DATE: 4/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
111	0.05	TOPSOIL/Silty CLAY CI: trace rootlets, w<PL							
	0.3	Silty CLAY CI: w<PL, hard							
	0.6	Silty CLAY CI; medium to high plasticity, brown, w<PL, hard, residual		Dx2	0.5				
				U_{50}					
110	1	Silty CLAY CH: high plasticity, red brown and grey mottled, becoming grey with depth, w<PL, hard		D	0.9 1.0				
	1.4	SILTSTONE: pale grey and brown, with iron staining, with clay seams, low strength, highly weathered		Dx2	1.5				
109	2	-becoming extremely weathered below 2.1m		D	2.0				
				Dx2	2.5				
108	3			D	3.0				
	3.0	Pit discontinued at 3.0m -limit of investigation							
107	4								
106	5								
105	6								
104	7								
103	8								
102	9								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621-705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 114 mAHD
EASTING: 289676
NORTHING: 6236773

PIT No: 113
PROJECT No: 92225.02
DATE: 4/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
114	0.05	TOPSOIL/Silty CLAY CI: brown, trace rootlets, w<PL							
	0.2	Silty CLAY CI: brown, w<PL, hard							
		Silty CLAY CI: medium to high plasticity, orange brown, w<PL, hard		Dx2	0.5				
113	1	- becoming orange brown and grey mottled, trace ironstone gravel below 0.7m		D	1.0				
				Dx2	1.5				
	1.6	Silty CLAY CI: medium to high plasticity, pale brown and grey, with iron staining, with siltstone (possible sandstone) bands, w<PL, very low strength, highly to slightly weathered		D	2.0				
112	2	- becoming more grey, banding decreasing, hard below 2.4m		Dx2	2.5				
		- banding increasing below 2.8m							
111	3	3.0 Pit discontinued at 3.0m		D	3.0				
		- limit of investigation							
110	4								
109	5								
108	6								
107	7								
106	8								
105	9								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621-705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 148 mAHD
EASTING: 289750
NORTHING: 6236549

PIT No: 114
PROJECT No: 92225.02
DATE: 4/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
148		Silty CLAY CI: red brown, w<PL, hard, residual		D	0.5				
	0.6	SANDSTONE: fine to medium grained, low to medium strength, highly to slightly weathered, horizontally bedded, Bringelly Shale		D	0.9				
147	0.9	Pit discontinued at 0.9m - refusal on medium strength sandstone							
146	2								
145	3								
144	4								
143	5								
142	6								
141	7								
140	8								
139	9								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621-705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 119 mAHD
EASTING: 289628
NORTHING: 6236536

PIT No: 115
PROJECT No: 92225.02
DATE: 4/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
119	0.05	TOPSOIL/Silty CLAY CI: trace ironstone gravel and rootlets, w<PL							
	0.4	Silty CLAY CI: trace ironstone gravel, w<PL, hard		Dx2	0.5				
		Silty CLAY CI: brown, trace ironstone gravel, w<PL, hard, residual							
118	1.0	- becoming orange brown and dark grey mottled		D	1.0				
		Silty CLAY CH: high plasticity, brown and grey mottled, trace ironstone and sandstone bands, w<PL, hard, residual		Dx2	1.5				
117	1.9	SANDSTONE: fine grained, pale brown, iron staining, with ironstone gravel, low strength, highly to slightly weathered, Bringelly Shale		D	2.0				
				Dx2	2.5				
116	3.0	Pit discontinued at 3.0m - limit of investigation		D	3.0				
115	4								
114	5								
113	6								
112	7								
111	8								
110	9								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621-705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 131 mAHD
EASTING: 289922
NORTHING: 6236441

PIT No: 116
PROJECT No: 92225.02
DATE: 4/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
131	0.15	TOPSOIL/Silty CLAY CI: brown, trace gravel, with rootlets, w<PL, stiff							
	0.6	Silty CLAY CI: medium to high plasticity, orange brown, slightly mottled, with angular siltstone gravel (colluvium), w<PL, stiff		Dx2/B	0.5				
130	1	SILTSTONE: pale brown and grey, with clay seams, very low to low strength, highly to slightly weathered		D	1.0				
		-with clay seams, becoming low strength below 1.0m		Dx2	1.5				
129	2			D	2.0				
				Dx2	2.5				
	2.8	-becoming low to medium strength at 2.6m							
128	3	Pit discontinued at 2.8m -limit of investigation		D	3.0				
127	4								
126	5								
125	6								
124	7								
123	8								
122	9								

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 125 mAHD
EASTING: 290014
NORTHING: 6236427

PIT No: 117
PROJECT No: 92225.02
DATE: 4/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
125	0.1	TOPSOIL/Silty CLAY CI: brown, fissured, with rootlets, trace gravel (colluvium), w<PL							
	0.6	Silty CLAY CI: brown, fissured, trace SR ironstone and SA siltstone gravel (colluvium), w<PL			0.5				
124	1.0	Silty CLAY CI: orange brown, fissured, trace ironstone gravel, w<PL, residual		U_{50} / D	0.7 / 0.9				
		Silty CLAY CI: medium to high plasticity, orange brown and grey mottled, trace SR siltstone gravel, w<PL, residual		D	1.1				
		- very low to medium strength band below 1.5m		Dx2	1.5				
123	1.7	Clayey SILT ML: pale grey and orange mottled, friable, with very low to low strength siltstone seams, w<PL (extremely weathered siltstone)		D	2.0				
	2.0	SILTSTONE: pale orange and brown, with iron staining, low to medium strength, moderately to slightly weathered, Bringelly Shale		Dx2	2.5				
122	2.8	- becoming medium strength below 2.7m							
	3	Pit discontinued at 2.8m - limit of investigation							
121	4								
120	5								
119	6								
118	7								
117	8								
116	9								

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621 - 705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 117 mAHD
EASTING: 290123
NORTHING: 6236402

PIT No: 118
PROJECT No: 92225.02
DATE: 4/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
117	0.2	TOPSOIL/Silty CLAY CI: brown, with rootlets to 0.1m, trace gravel, w<PL, residual							
		Silty CLAY CI: red brown and grey mottled, trace gravel, w<PL, very stiff to hard, residual		Dx2	0.5				
116	0.9	SILTSTONE: pale grey and red brown, with clay seams, very low to low strength, moderately to slightly weathered, Bringelly Shale		D	1.0				
				Dx2	1.5				
115	2	- becoming low to medium strength, no clay seams below 2.0n		D	2.0				
				Dx2	2.5				
114	3	Pit discontinued at 3.0m - limit of investigation		D	3.0				
113	4								
112	5								
111	6								
110	7								
109	8								
108	9								

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Boyuan Bringelly Pty Ltd
PROJECT: Proposed Rezoning
LOCATION: 621-705 The Northern Road, Cobbitty, NSW

SURFACE LEVEL: 113 mAHD
EASTING: 290301
NORTHING: 6236517

PIT No: 119
PROJECT No: 92225.02
DATE: 4/2/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
113	0.15	TOPSOIL/Silty CLAY CI: brown, fissured, with rootlets, w<PL, stiff							
		Silty CLAY CI: medium to high plasticity, orange brown and grey mottled, fissured, trace ironstone and siltstone gravel, w<PL, stiff, residual		Dx2	0.5				
112	1	- becoming hard below 0.6m		D	1.0				
		- becoming grey and orange brown mottled, extremely weathered siltstone below 1.2m		Dx2	1.5				
	1.6	SILTSTONE: pale grey and brown, with yellow and red iron staining, low to medium strength, moderately to slightly weathered, Bringelly Shale		D	2.0				
111	2								
	2.1	Pit discontinued at 2.1m - refusal on low to medium strength siltstone							
110	3								
109	4								
108	5								
107	6								
106	7								
105	8								
104	9								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm toothed bucket

LOGGED: ERL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

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Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 2007. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approximate Unconfined Compressive Strength MPa*
Extremely low	EL	<0.03	<0.6
Very low	VL	0.03 - 0.1	0.6 - 2
Low	L	0.1 - 0.3	2 - 6
Medium	M	0.3 - 1.0	6 - 20
High	H	1 - 3	20 - 60
Very high	VH	3 - 10	60 - 200
Extremely high	EH	>10	>200

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$. It should be noted that the UCS to $Is_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and longer sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq \text{100 mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are generally based on Australian Standard AS1726:2017, Geotechnical Site Investigations. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	19 - 63
Medium gravel	6.7 - 19
Fine gravel	2.36 – 6.7
Coarse sand	0.6 - 2.36
Medium sand	0.21 - 0.6
Fine sand	0.075 - 0.21

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

The proportions of secondary constituents of soils are described as follows:

In fine grained soils (>35% fines)

Term	Proportion of sand or gravel	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	>30%	Sandy Clay
With	15 – 30%	Clay with sand
Trace	0 - 15%	Clay with trace sand

In coarse grained soils (>65% coarse)
- with clays or silts

Term	Proportion of fines	Example
And	Specify	Sand (70%) and Clay (30%)
Adjective	>12%	Clayey Sand
With	5 - 12%	Sand with clay
Trace	0 - 5%	Sand with trace clay

In coarse grained soils (>65% coarse)
- with coarser fraction

Term	Proportion of coarser fraction	Example
And	Specify	Sand (60%) and Gravel (40%)
Adjective	>30%	Gravelly Sand
With	15 - 30%	Sand with gravel
Trace	0 - 15%	Sand with trace gravel

The presence of cobbles and boulders shall be specifically noted by beginning the description with 'Mix of Soil and Cobbles/Boulders' with the word order indicating the dominant first and the proportion of cobbles and boulders described together.

Soil Descriptions

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	VS	<12
Soft	S	12 - 25
Firm	F	25 - 50
Stiff	St	50 - 100
Very stiff	VSt	100 - 200
Hard	H	>200
Friable	Fr	-

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	Density Index (%)
Very loose	VL	<15
Loose	L	15-35
Medium dense	MD	35-65
Dense	D	65-85
Very dense	VD	>85

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Extremely weathered material – formed from in-situ weathering of geological formations. Has soil strength but retains the structure or fabric of the parent rock;
- Alluvial soil – deposited by streams and rivers;
- Estuarine soil – deposited in coastal estuaries;
- Marine soil – deposited in a marine environment;
- Lacustrine soil – deposited in freshwater lakes;
- Aeolian soil – carried and deposited by wind;
- Colluvial soil – soil and rock debris transported down slopes by gravity;
- Topsoil – mantle of surface soil, often with high levels of organic material.
- Fill – any material which has been moved by man.

Moisture Condition – Coarse Grained Soils

For coarse grained soils the moisture condition should be described by appearance and feel using the following terms:

- Dry (D) Non-cohesive and free-running.
- Moist (M) Soil feels cool, darkened in colour.
  Soil tends to stick together.
  Sand forms weak ball but breaks easily.
- Wet (W) Soil feels cool, darkened in colour.
  Soil tends to stick together, free water forms when handling.

Moisture Condition – Fine Grained Soils

For fine grained soils the assessment of moisture content is relative to their plastic limit or liquid limit, as follows:

- 'Moist, dry of plastic limit' or 'w <PL' (i.e. hard and friable or powdery).
- 'Moist, near plastic limit' or 'w ≈ PL (i.e. soil can be moulded at moisture content approximately equal to the plastic limit).
- 'Moist, wet of plastic limit' or 'w >PL' (i.e. soils usually weakened and free water forms on the hands when handling).
- 'Wet' or 'w ≈LL' (i.e. near the liquid limit).
- 'Wet' or 'w >LL' (i.e. wet of the liquid limit).

Sampling Methods

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Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Symbols & Abbreviations

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Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

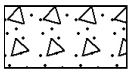
Symbols & Abbreviations

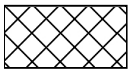
Graphic Symbols for Soil and Rock

General


Asphalt

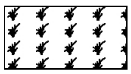

Road base

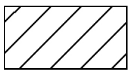

Concrete

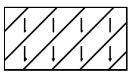

Filling

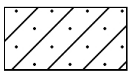
Soils


Topsoil

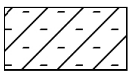

Peat

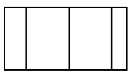

Clay

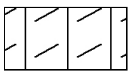

Silty clay

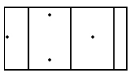

Sandy clay

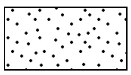

Gravelly clay

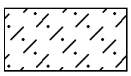

Shaly clay

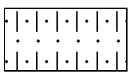

Silt


Clayey silt


Sandy silt

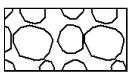

Sand

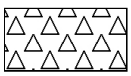

Clayey sand


Silty sand


Gravel

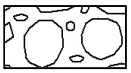

Sandy gravel


Cobbles, boulders

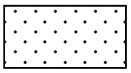

Talus

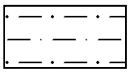
Sedimentary Rocks

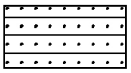

Boulder conglomerate

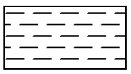

Conglomerate


Conglomeratic sandstone

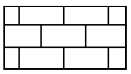

Sandstone


Siltstone

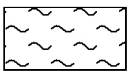

Laminite

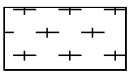

Mudstone, claystone, shale


Coal


Limestone

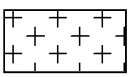
Metamorphic Rocks

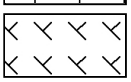

Slate, phyllite, schist

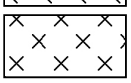

Gneiss

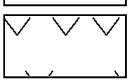

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry