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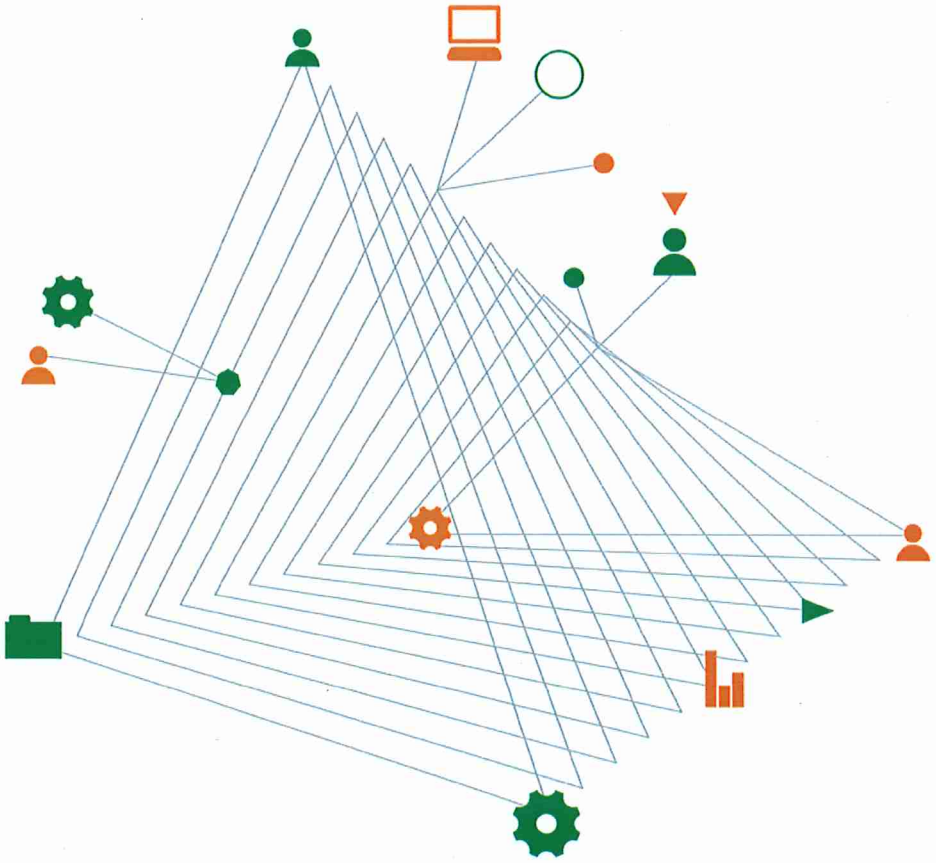
Conybeare Morrison International Pty Ltd

Lederer Group - Gosford Development Site B

Geotechnical Desktop Study Assessment

1 December 2015



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Lederer Group - Gosford Development Site B

Prepared for

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1 December 2015

Document authorisation

Our ref: GEOTLCOV25439AB-AB

For and on behalf of Coffey

Rolf Rohleder
Principal Engineering Geologist

Quality information

Revision history

Revision	Description	Date	Author	Reviewer	Signatory
0	Issue 1	01/12/2015	RMR		RMR

Distribution

Report Status	No. of copies	Format	Distributed to	Date
Issue 1	1	PDF		01/12/2015

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1. Introduction

The Lederer Group ('Lederer") is the landowner of a number of parcels of land and buildings within the Gosford CBD on the Central Coast, NSW. The Lederer Group has engaged several consultants to assist it with the re-development of the various land parcels from initial concept designs to full detailed design. Conybeare Morrison International Pty Ltd ("CM+") is the principal project manager managing the development process, including the Development Approval ('DA') application to Gosford City Council.

Conybeare Morrison has engaged Coffey Geotechnics to prepare a Geotechnical Assessment Report and a Contamination Assessment Report for each of the three main land parcels (designated as Site A, Site B, and Site C). These reports form part of the documentation that is required to support the DA application for re-development.

This report presents the Geotechnical Assessment for Site B. Separate reports are provided for Sites A and C, as well as separate reports for each of the three sites that present the Contamination Assessments.

The proposed re-development, across the three sites, is for combined residential and commercial use, and includes a park / leisure facility. The objectives of the Geotechnical Assessment are to:

- Describe the anticipated ground conditions beneath each of the sites;
- Identify any pertinent geotechnical constraints that may affect the proposed development;
- Identify likely foundation strategies for proposed buildings, pavements and structures;
- Recommend future site investigations strategy and scope to support the development of the Concept and Detailed designs.

A review of relevant information supplied by CM+, published information, as well as a search of the Coffey archives was performed to assess the likely ground conditions. In addition, a site walkover was undertaken by a Coffey Geo-Environmental Scientist to assess existing site conditions, obtain photographs, and identify any potential areas or issues of concern.

2. Site description

The site is currently occupied by a disused commercial centre, known as the Gosford Marketplace, with parking on two levels (including rooftop parking area). It is fronted by Henry Parry Drive on the west, William Street on the north, Albany Street on the east, and Donnison Street on the south. Access is provided by ramps along William Street and Albany Street. The entire land parcel (within the site boundary) is developed with no open unpaved areas.

The location of the site and approximate site boundaries are shown in Figure 1. Additional site information is provided in Table 1 below.

Table 1 – Site information summary

Site Address:	Gosford Marketplace Shopping Mall, William St, Gosford, NSW 2250
Approx. Total Land Area:	13,900 m^2
Title Identification Details:	Lots 136-146, 37, 41 and 148 Gosford
Current Land Use:	Commercial shopping mall and car parking
Historical Land Use:	Historical mapping and anecdotal evidence suggests that prior to commercial development (pre-1950's) the area currently occupied by the Gosford CBD was used predominantly as market gardens with houses on large plots.
Adjoining Site Use:	Commercial buildings along William Street. Residential /offices along Albany Street and Donnison Street. Kibble Park adjoins the site along Henry Parry Drive.
Site Coordinates:	The approximate UTM grid coordinates for the centre of the site are: 346160mE / 6300158mS

A site walkover was undertaken by a Coffey geo-environmental scientist on 17/11/2015. A selection of photographs taken on the day that are relevant to the geotechnical assessment are included in Appendix A. Some key notes obtained from the walkover site visit are included in the sections below.

3. Available information

3.1. Topography

A topographic survey database (in digital format) was supplied by Conybeare Morrison to inform the desktop study. The topographic contours are shown in Figure 1 (1m contour interval, levels to AHD). The contours show that the site is generally situated on the flanks of a low-lying valley area, roughly aligned north to south, with higher lying hillsides to the west and east. The valley forms part of the natural alluvial floodplain that drained into The Broadwater to the south, prior to development of the area.

The natural topography across the site would have had a gentle gradient rising to the east, from an RL of about 10m AHD to 18m AHD. The site is currently level (hardstand) at an average elevation of about 12m AHD. It is likely that the site has been subject to re-grading and filling during the course of development since the 1950's.

3.2. Published information

3.2.1. Geology

The Gosford 1:100,000 Scale Geological Sheet indicates that the site is underlain by sedimentary rock strata of the Terrigal Formation (part of theTriassic age Narrabeen Group). The bedrock

comprises interbedded laminites, sandstones with subordinate shale horizons. An extract of the geology map is overlain on the site plan in Figure 2.

Quaternary-age alluvial soils overlie the bedrock, which can be significantly deep along the centre alignment of the alluvial valley draining into The Broadwater. There is also a possibility of paleao-channels that are incised into the bedrock, formed during periods of lower sea level, which are infilled with older alluvium.

3.2.2. Soil Landscapes Map

A review of the Soil Landscape Series Sheet covering the Gosford area (Newcastle sheet) indicates the site is underlain by Disturbed Terrain (generally filled ground) across the west half of the site, with Erosional (mainly hillwash deposits) across the east half of the site.

An extract of the Soil Landscape Map is overlain on the site plan in Figure 3.

3.2.3. Acid Sulfate Soils Risk Map

An extract of the ASRIS (Australian Source Resource Information System) Acid Sulfate Soil Risk Map is overlain on the site plan in Figure 4. The ASRIS Acid Sulfate Soil Risk Map indicates that the site is within an area of Extremely Low Probability of encountering ASS within the development site. However, it should be noted that ASS map boundaries are approximate, and the area is relatively close to the alluvial channel zone, draining into The Broadwater, where the ASRIS map shows a zone of High Probability of encountering ASS. Therefore, the possibility cannot be ruled out that the development site may encounter some natural soils (beneath fill layers) that have a high ASS potential.

3.3. Hydrology study

Gosford Council has undertaken previous studies of flooding in the Gosford area. On the Council internet webpage, there is a published map showing the estimated extents of the 1% AEP (1-in-100 year) flood level for the area, as well as the Broadwater storm surge extents. A copy of this plan centred about the project development site is included in Appendix B.

The plan indicates that flooding is mostly constrained to the existing roadways on the west, north and south boundaries of Site B (namely Henry Parry Drive, William Street and Donnison Streets). The site itself is shown to be above the 1% AEP flood levels.

3.4. Coffey archive information

We have reviewed investigations information saved in Coffey's archive system, and have found reports on two separate investigations that are relevant to the development site. The information contained in these reports provides a sound basis for developing an anticipated ground model for the site.

The previous investigations relate to the following projects:

- 108-118 Mann St Development (2014): geotechnical investigation, including 3 no. boreholes
- Gosford Landing (2011): geotechnical desk study for foreshore development

The Gosford Landing desk study was a comprehensive geotechnical desk study that covered a large area of the foreshore including an area from the foreshore north to Georgiana Terrace. It relied on an extensive search of historical archives both from Coffey's archive library and other public sources.

A key finding of the Gosford Landing study was an inferred bedrock surface contour map covering most of Gosford city centre. This map is reproduced in Figure 5, which also shows the location of Site B. The study also mapped the approximate extent of the main part of the paleaochannel that drained to the south into The Broadwater. The paleaochannel is also shown in Figure 5.

Of the three boreholes drilled at the Mann Street site, one borehole was a deep borehole advanced to top of bedrock and terminated at 22.20m below ground level. The log of this borehole is reproduced in Appendix C. The location of this borehole (BH3) relative to Site B is also shown in Figure 5.

4. Preliminary site geotechnical model

Based on the desk study review, a preliminary ground model of the stratigraphic profile beneath the proposed development site is summarised in Table 2 below.

Table 2 – Preliminary Geotechnical Model

Geotechnical Unit	Description	Indicative thickness
Fill	Where re-profiling of the site has occurred, fill may consist of gravelly clay, with possible sandstone cobbles and boulders. The fill may also include demolition rubble from previous structures on site, such as bricks, tiles, sheeting.	Fill depths may be variable across the site. Based on our experience, we expect fill thickness to be less than 2m generally. Fill thickness is expected to be greater at the west side of the site compared to the east side.
Alluvium	The alluvium beneath the site, associated with creek deposits draining to the south, is an interbedded sequence of clays and sands of variable thickness and lateral persistence. In general, clayey soils occur to an RL of about 0m AHD, underlain by silty Sand to about RL -9m AH. The sands are typically medium dense. The sand is in turn underlain by overconsolidated, firm to stiff clays, some 5m to 8m thick.	The alluvium thickness may be variable across the site, but is expected to be at least 15m thick beneath the site.
Residual soil	Silty clay and sandy clay, low to high plasticity, likely stiff to hard. Residual soil will be derived from both shale and sandstone bedrock.	The residual soil layer encountered in BH3 (Mann St) was logged as being about 2m thick beneath the Alluvium.
Sandstone / shale bedrock	Shale, grey and dark grey, interlaminated with fine grained sandstone, grading from extremely weathered to, potentially, fresh. Low to medium strength.	Top of bedrock is anticipated to be encountered at an approximate RL of -15m AHD (about 22m depth). Sandstone bedrock in BH3 (Mann St) was proved in the top 3m and found to be generally fresh and of medium to high strength.

A shallow groundwater table is expected to be encountered across the development site, in view of the relatively low ground elevation and location in close proximity to the valley area.

All three boreholes at the Mann Street site investigation encountered groundwater at between 1m and 2m depth, generally near the top of the Alluvium.

Seepage into excavations from the upper clayey layers is expected to be slow, but high seepage rates may be expected to occur in the underlying sands (from about 5m depth in BH3).

Three samples obtained from the Mann Street investigation boreholes were analysed for potential and actual ASS. The results indicate that the upper clay and sand layers are generally not ASS, but that the deeper clay layers (beneath the sands) are potentially ASS, and can produce acidity when exposed to air (oxidised).

5. Identified geotechnical constraints

The information reviewed, including the anticipated ground model discussed in section 4 above, supplemented by the site walkover observations indicate the following key geotechnical constraints in relation to the proposed development of the site:

- Fill materials may be encountered near the surface and could be up to about 2m thick. The composition of fill materials may be variable, and they could also be contaminated;
- The groundwater table is expected to be at reasonable shallow depth (about 4m to 6m at this site), and generally at an RL of about +2m AHD. A shallow groundwater table has significant constraints for deep excavations, in that temporary support, dewatering, and other permanent drainage measures will generally be required;
- The alluvial soils are generally of a low consistency (relatively low strength) to at least the top of the older, overconsolidated clay and residual clay (i.e. to about RL -9m AHD). This implies that structures with high concentrated loads may require deep (piled) foundations to provide adequate bearing capacity;
- Acid Sulfate Soils may be encountered, essentially within the alluvial sequence. There is some evidence to suggest that the upper alluvial layers are less prone to ASS potential, but this would need to be confirmed by more extensive testing;
- With regards planning of future investigations, there are significant constraints with regards access to investigation locations (existing building), as well as buried services (paved areas), overhead cables, and pedestrian / vehicle traffic.

6. Discussion and recommendations

6.1. Suitability for development

Based on our site observations, preliminary geotechnical model, and experience on similar projects, the proposed development, including basements is considered feasible from a geotechnical perspective. Provided appropriate site investigation, design assessments, and construction monitoring normally associated with this type of development are carried out, the risks to adjacent structures and services should be able to be managed.

6.2. Potential impacts of excavation

It is our understanding that demolition of existing buildings and structures across Site B will be a phased approach. Final ground levels are yet to be considered, and the inclusion of any below-grade basement parking levels in the concept design has yet to be discussed.

Although final finished ground levels are expected to be similar to existing levels, any re-grading and/or excavations for services may require excavations into fill materials or upper alluvium. Consideration will need to be given to re-usability of the excavated materials.

Due to the anticipated stratigraphy beneath the site, the excavation of deep basements will present particular design challenges. Although conventional plant will be able to excavate the soils present, the presence of weak, saturated clayey and sandy soils will require significant temporary and permanent support to provide stability and minimise lateral deformation. For a project such as this shoring systems such as sheet piles, secant pile or diaphragm walls are considered possible. Excessive lateral movements from deep excavations could detrimentally affect adjacent structures in close proximity.

Appropriate investigations, designs, and monitoring will be required to assess the foundations of existing adjacent structures and services and to protect them from adverse impacts from ground movements and vibrations.

We recommend that prior to the commencement of the bulk excavation works dilapidation surveys of the adjacent structures be carried out to provide a baseline for excavation monitoring and management works.

6.3. Building foundations

A basement excavation of about 6m is typically required for a two-level basement. At this site, such an excavation could intersect the predominantly sandy layer beneath the upper alluvial clays. In such case, the lateral support system (eg. secant pile wall) may need to extend through the sands into the deeper clay / residual clay in order to provide a cut-off to excess groundwater flow through the sands (at the base of the excavation). A suitable system will require groundwater modelling at design stage in order to support the design of such a system.

The alluvial soil layers, in the upper 2m to 4m, will provide a limited net bearing capacity for design of shallow footings. A presumed bearing capacity of 150kPa to 200kPa may be achieved for pad or shallow pier footings.

For multi-storey building supported by columns with high concentrated loads, a piled foundation system may be appropriate. At this site, the top of the sandstone bedrock presents an ideal founding stratum for pile foundations. However, this will require relatively deep piles extending to about 20m to 23m depth. An ultimate end-bearing capacity of about 100 MPa can be achieved for piles socketed into competent, relatively unweathered sandstone.

Shorter piles, end-bearing in the sand or lower, stiffer, clay layer can also be considered but these will have a reduced bearing capacity compared to piles socketed into bedrock. A pile design analysis will need to be carried for such a "floating" pile system once more detailed information is obtained from a targeted, site-specific investigation.

6.4. Groundwater

The construction of basements (if considered at concept design) at the site will be highly dependent on groundwater conditions, particularly static levels and permeability within the alluvial soils. Deep excavations (deeper than 2m) will likely intersect the groundwater table. Seepage rates into excavations are expected to be generally low in the upper clayey soils, but higher seepage rates can be expected in the more sandy layers. Where deep excavations intersect the cleaner sand layers below about RL 0m AHD, upward groundwater pressure may significantly reduce the bearing capacity of the excavation floor.

Groundwater inflows into basement excavations are dependent on a number of factors, including groundwater level, size, location and depth of excavation, wall depth and permeability. These variables are not known in sufficient detail at this stage to allow estimation of groundwater inflows.

Dewatering can reduce groundwater levels in the immediate vicinity of a deep excavation. This could result in an increase in the soil effective stress, which in turn could induce settlement (of adjoining

structures). If dewatering is adopted, the system employed will need to consider a recharge system for the zones beyond the excavation walls in order to mitigate any adverse settlement effects.

It is anticipated that basements may be designed as 'drained' structures. Such a basement would require discharge of seepage from a below floor drainage and sump, potentially to sewer or stormwater.

As part of further site investigations groundwater inflow assessment and quality/chemistry testing will be necessary to obtain regulatory approvals for discharge to sewer or stormwater.

7. Further site investigations

We recommend that a site-specific, targeted geotechnical investigation, which may be combined with a Phase II contamination investigation, be carried out to support the development of the concept/detailed design for the proposed development. For a site of this size, which may potentially include future basements, it is recommended that geotechnical investigations would comprise of:

- Boreholes: to be drilled though soils and with follow-on rotary coring into bedrock. We would recommend between 4 no. boreholes on a grid pattern (near corners of site) as being appropriate. Due to site constraints, the boreholes may need to be located on the pavement areas near the four corners of the site. The purpose of the boreholes is to provide field test data and samples of the soils layers to assess consistency/strength with depth, depths/quality/strength of the bedrock, and groundwater data;

- CPT (Cone Penetration Testing): CPT testing typical supplements a borehole investigation and may be used to reduce the number of boreholes. CPT are comparatively faster to complete (a 20m deep CPT can be completed in a single day). The test provides a continuous assessment of soil type and strength (as well as groundwater pressure), but has limited penetration into weathered, low strength rock;

- Test Pits: these could be performed using a large diameter, truck mounted auger tool. Due to the site constraints, it may not be possible to undertake test pitting. Test pits are helpful in assessing the nature of any fill materials across the site.

Coffey can assist with planning an appropriate, targeted investigation with cost estimation for budgeting purposes.

8. Limitations

The initial geotechnical assessment and recommendations presented in this report are based on a desk study limited to regional information, and subsurface investigation data from outside of the site boundaries. Subsurface conditions can be complex, vary over relatively short distances and over time. Additional, site specific investigations will be required to support detailed design. Detailed design and construction should not proceed on the basis of this desk study report without further advice from Coffey.

The attached document entitled "Important Information about Your Coffey Report" forms an integral part of this report and presents additional information about the uses and limitations of the report.

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Important information about your **Coffey** Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

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Important information about your **Coffey** Report

Data should not be separated from the report*

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Rely on Coffey for additional assistance

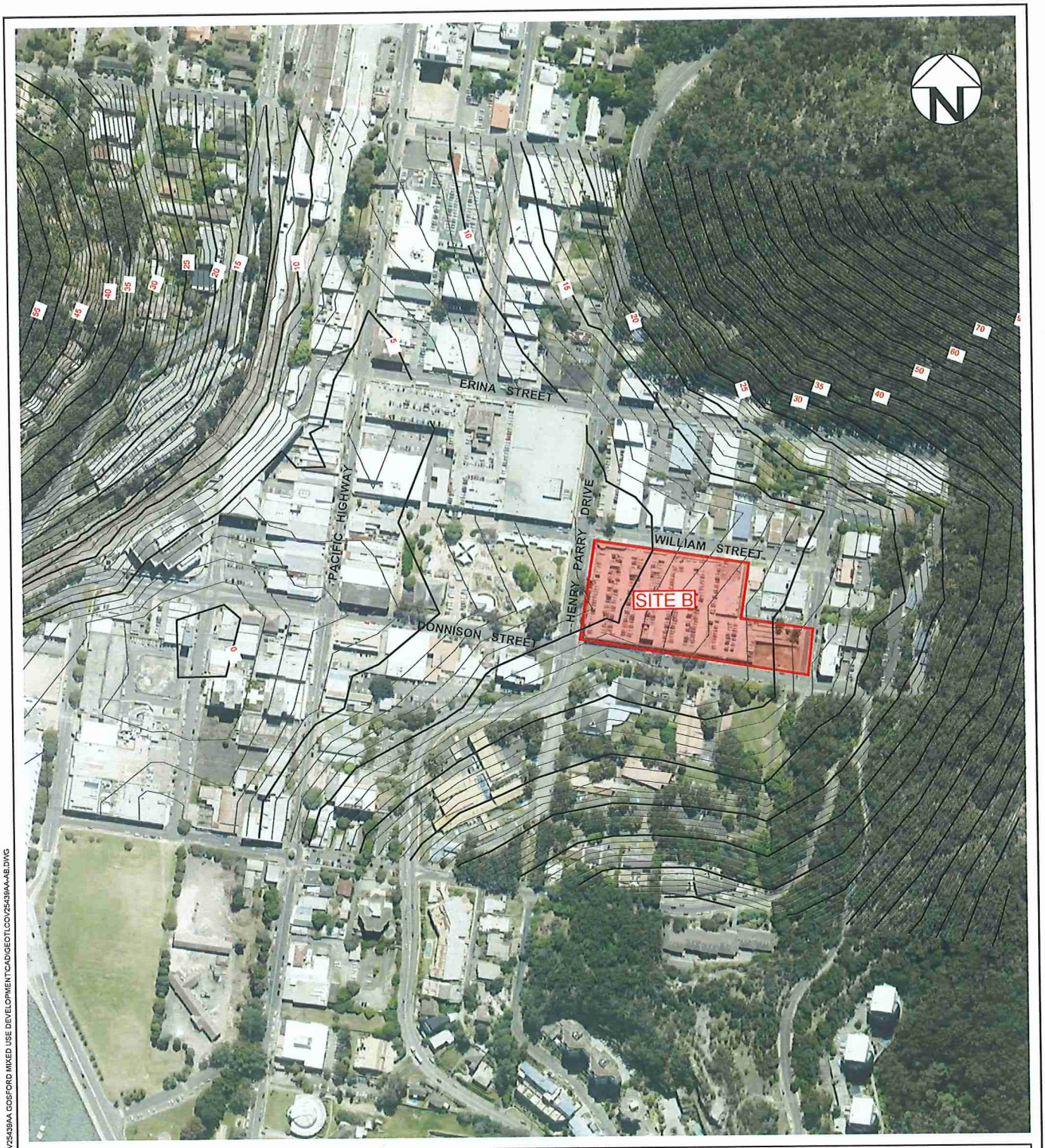
Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

* For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical information in Construction Contracts" published by the Institution of Engineers Australia, National headquarters, Canberra, 1987.

Figures



LEGEND

SITE B BOUNDARY

—10— ELEVATION CONTOURS (mAHD)

SOURCE: TOPOGRAPHIC DATA SUPPLIED BY CONYBEARE INTERNATIONAL

50 0 50 100 150 200 250

Scale (metres) 1:5000

AERIAL IMAGE SOURCE: GOOGLE EARTH PRO 7.1.2
AERIAL IMAGE ©: AEROMETREX 2015

drawn	RR / AW
approved	-
date	17 / 11 / 15
scale	AS SHOWN
original size	A4

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client: CONYBEARE MORRISON INTERNATIONAL

project: GOSFORD DEVELOPMENT PROJECT

title: SITE LOCATION AND TOPOGRAPHY

project no: GEOTLCOV25439AA-AB | figure no: FIGURE 1 | rev: A

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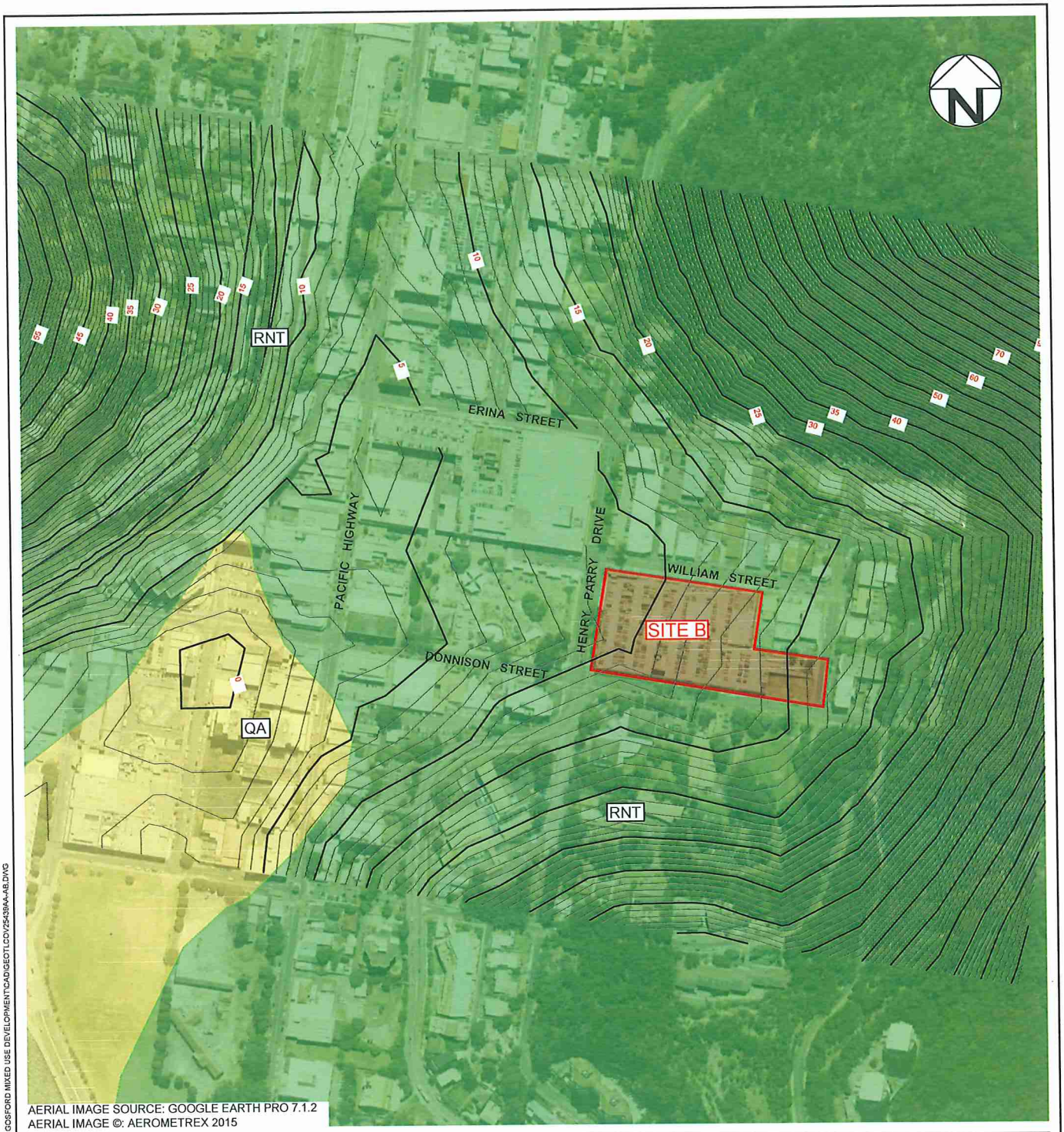

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- SITE B BOUNDARY
- QA — ALLUVIUM, GRAVEL, SAND, SILT CLAY
- RNT — INTERBEDDED LAMINITE, SHALE AND SANDSTONE
- —10— ELEVATION CONTOURS (mAHD)

SOURCE: TOPOGRAPHIC DATA SUPPLIED BY CONYBEARE INTERNATIONAL

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Scale (metres) 1:5000

SOURCE: NSW DEPT OF MINERAL RESOURCES - SHEET GOSFORD 9131

drawn	RR / AW
approved	-
date	17 / 11 / 15
scale	AS SHOWN
original size	A4

coffey

client: CONYBEARE MORRISON INTERNATIONAL

project: GOSFORD DEVELOPMENT PROJECT

title: INFERRED GEOLOGY

project no: GEOTLCOV25439AA-AB | figure no: FIGURE 2 | rev: A

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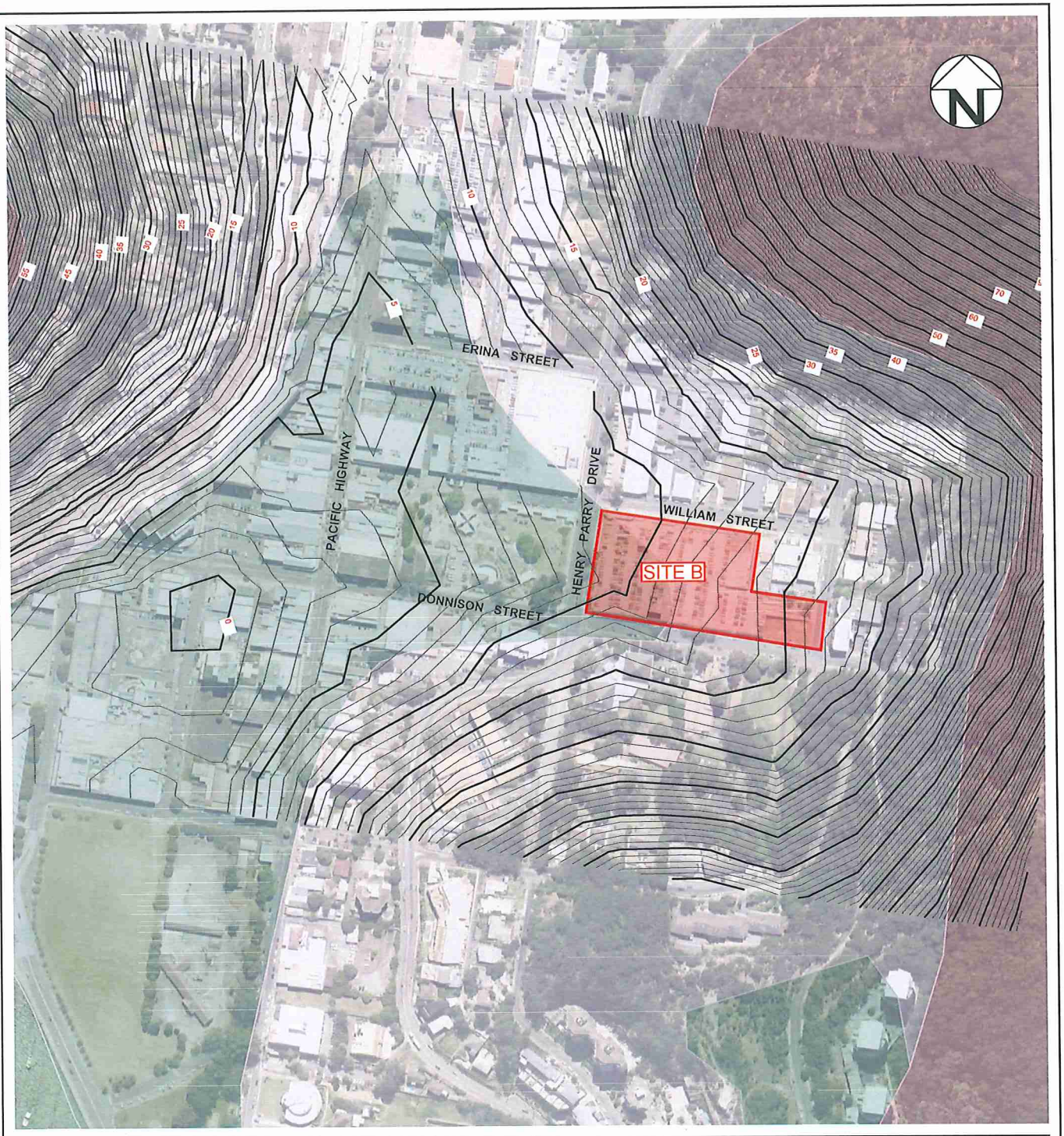

LEGEND

- SITE B BOUNDARY
- DISTURED TERRAIN
- EROSIONAL
- COLLUVIAL
- —10— ELEVATION CONTOURS (mAHD)

SOURCE: TOPOGRAPHIC DATA SUPPLIED BY CONYBEARE INTERNATIONAL

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Scale (metres) 1:5000

AERIAL IMAGE SOURCE: GOOGLE EARTH PRO 7.1.2
AERIAL IMAGE ©: AEROMETREX 2015

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date	17 / 11 / 15
scale	AS SHOWN
original size	A4

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client: CONYBEARE MORRISON INTERNATIONAL

project: GOSFORD DEVELOPMENT PROJECT

title: SOIL LANDSCAPE MAP

project no: GEOTLCOV25439AA-AB | figure no: FIGURE 3 | rev: A

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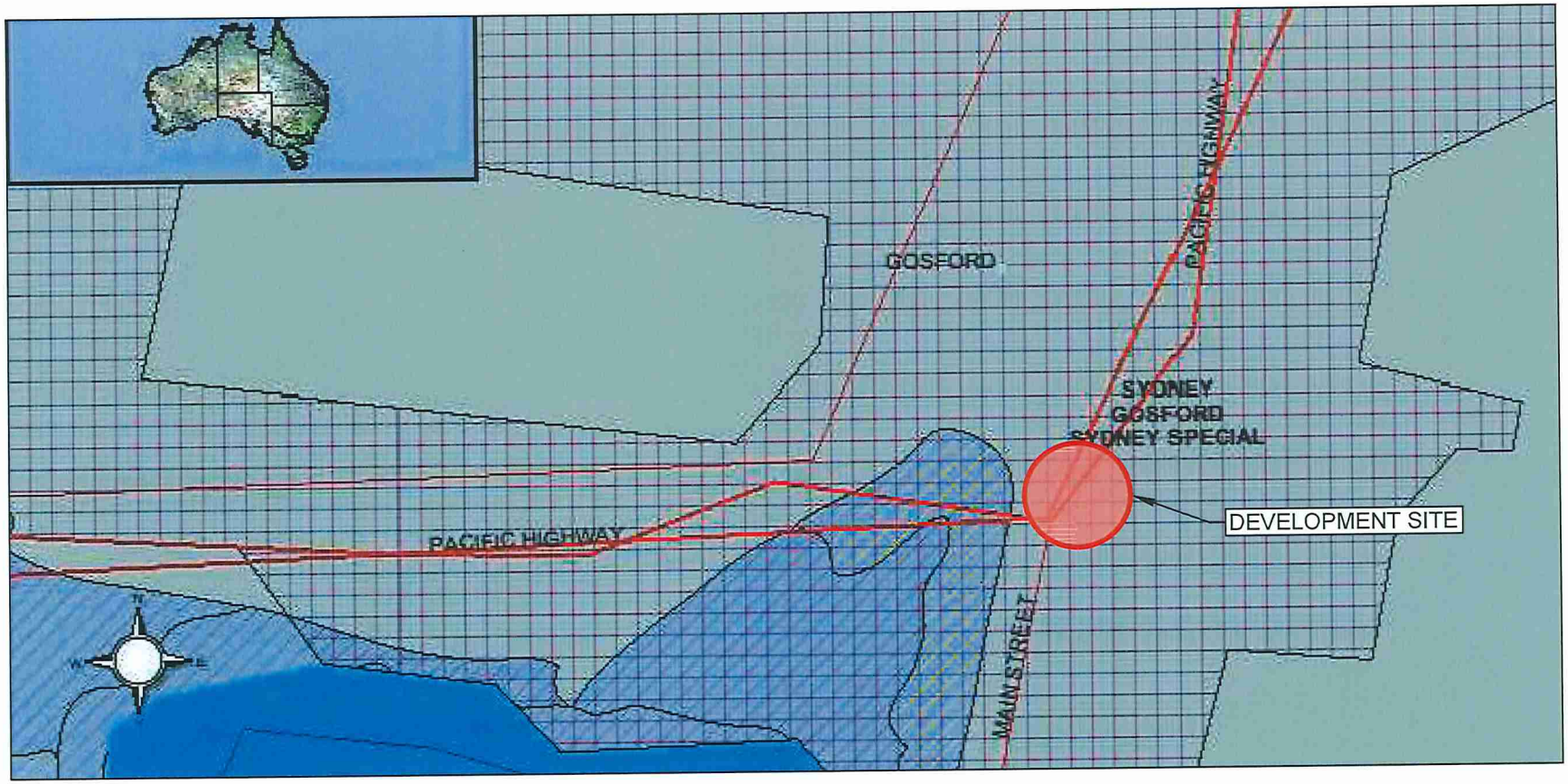

National ASS Atlas, 1 feature found

Rec	Acid Sulfate Soil Class	Acid Sulfate Soil Probability	Confidence	Scale of source map
1	Cq(p4)	Extremely Low Probability of Occurence	4	1:2M

8 0 8 24 40

Scale (metres) 1:800

SOURCE: ASRIS - CSIRO LAND AND WATER

drawn	RR / AW
approved	-
date	17 / 11 / 15
scale	AS SHOWN
original size	A4

coffey

client: CONYBEARE MORRISON INTERNATIONAL

project: GOSFORD DEVELOPMENT PROJECT

title: ACID SULFATE SOIL (ASS) RISK MAP

project no: GEOTLCOV25439AA-AB | figure no: FIGURE 4 | rev: A

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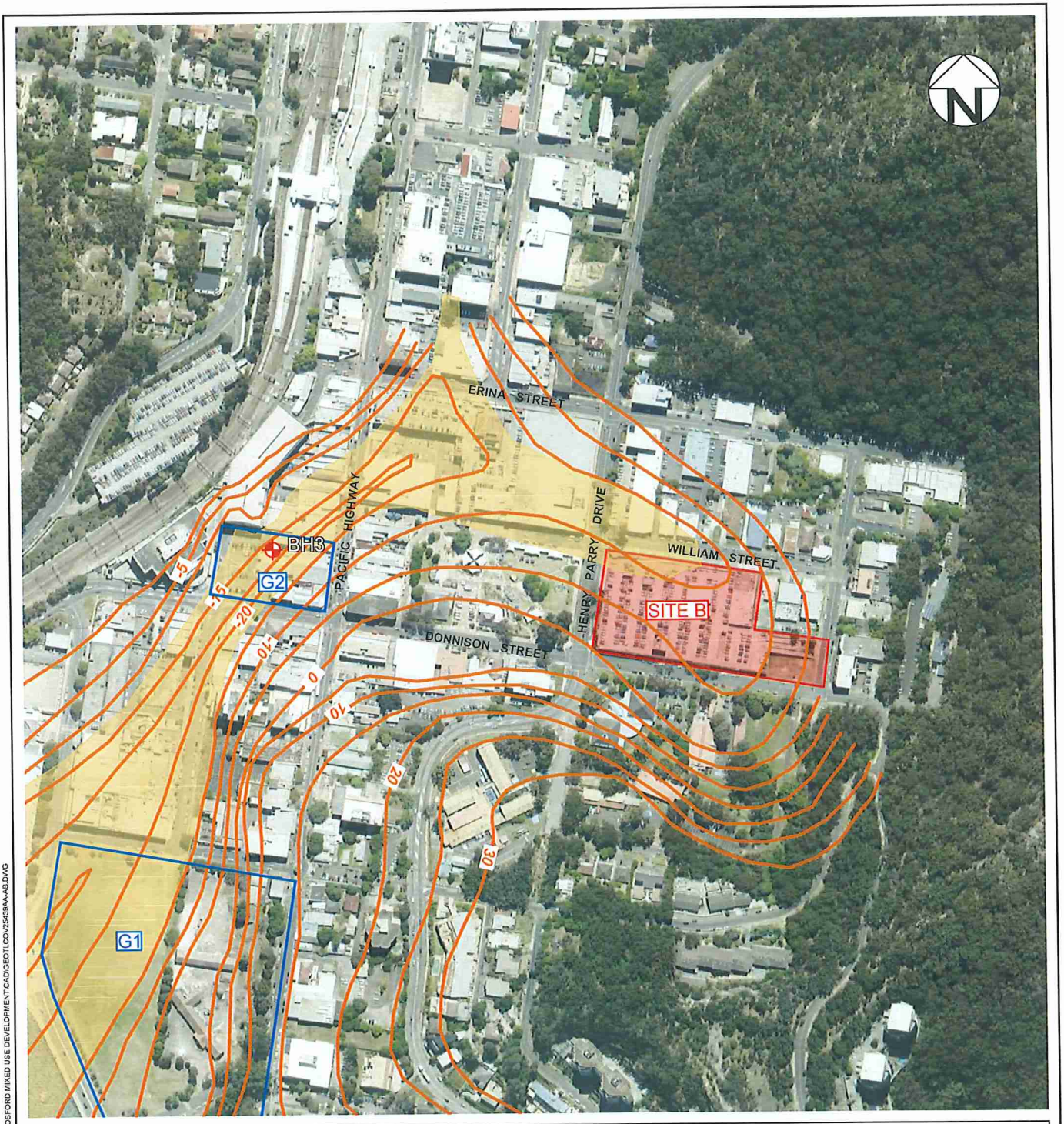


LEGEND

- SITE B BOUNDARY
- 30 — INDICATIVE TOP OF BEDROCK (mAHD)
- PALAEO-CHANNEL

COFFEY LIBRARY SERVICES

- G1 — GOSFORD LANDING STUDY
- G2 — 188-120 MANN STREET, INVESTIGATION

50 0 50 100 150 200 250

Scale (metres) 1:5000

AERIAL IMAGE SOURCE: GOOGLE EARTH PRO 7.1.2
AERIAL IMAGE ©: AEROMETREX 2015

drawn	RR / AW
approved	-
date	17 / 11 / 15
scale	AS SHOWN
original size	A4

coffey

client: CONYBEARE MORRISON INTERNATIONAL

project: GOSFORD DEVELOPMENT PROJECT

title: BEDROCK CONTOURS AND HISTORICAL DATA

project no: GEOTLCOV25439AA-AB | figure no: FIGURE 5 | rev: A

PLOT DATE: 17/11/2015 12:10:01 PM DWG FILE: F:\GEOTECHNICS\1.PROJECTS\GEOTLCOV25439AA GOSFORD MIXED USE DEVELOPMENT\CAD\GEOTLCOV25439AA-AB.DWG

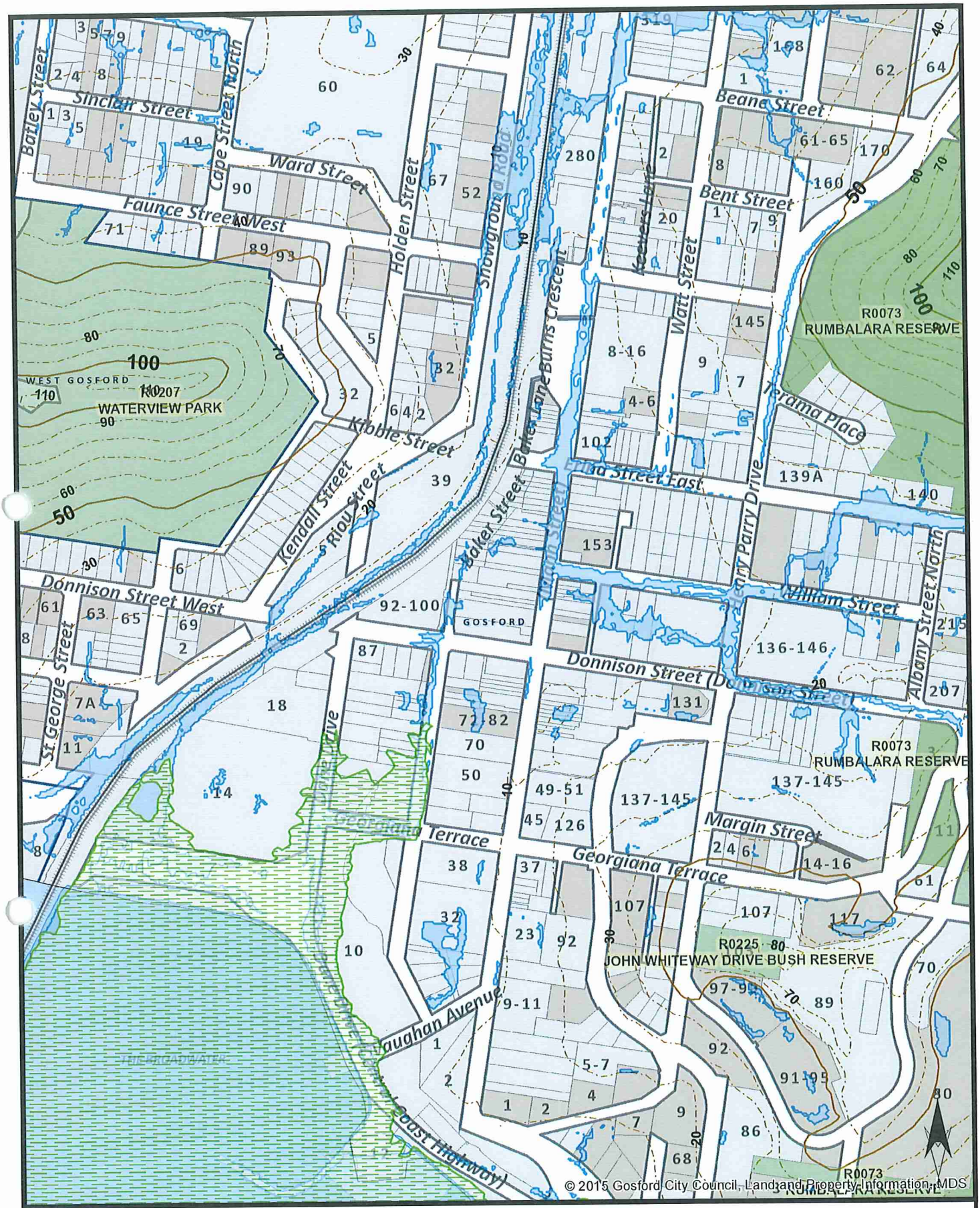
Appendices

Appendix A – Site Photos (walkover)

PHOTO 1: View of car park entrance ramp on William Street (view to east)

PHOTO 2: Ground level entrance on William Street (view to west)

Appendix B – 1% AEP Flood Extents Map



Gosford Electronic Mapping System

0 40 80 160 240 320 Metres

Date: 1/12/2015 Time: 12:47:22 PM

Projection: GDA_1994_Transverse_Mercator; GCS_GDA_1994
Created using ESRI ArcGIS 10.2

Appendix C – BH3 log (108-117 Mann Street)

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Engineering Log - Borehole

Borehole ID.	**BH 3**
sheet:	1 of 4
project no.	**GEOTLCOV25137AA**
date started:	**12 Jun 2014**
date completed:	**12 Jun 2014**
logged by:	**AWJ**
checked by:	

client: **GOSFORD CITY DEVELOPMENTS**

principal:

project: **108-118 MANN STREET, GOSFORD**

location: **GOSFORD**

position: E: 345788; N: 6300220 (MGA94 Zone 56) surface elevation : 3.50m (AHD) angle from horizontal: 90°

drill model: Geoprobe mounting: Track hole diameter : 100 mm

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
AD/T			E	3				**FILL: Sandy GRAVEL:** fine to medium grained, sub-angular, dark grey, fine to coarse grained sand, some fines.	M			FILL PID: 0.4 ppm
								FILL: Sandy CLAY: high plasticity, pale brown, some pale grey, trace gravel and wood.				
			E		1.0		SC	**Clayey SAND** fine to medium grained, pale grey mottled orange, clay of low plasticity.	>Wp	St		ALLUVIUM PID: 0.9 ppm
			SPT 2, 3, 4 N*=7	2								
		20/06/14 08:00			2.0		SM	**Silty SAND** fine and medium grained, pale grey and orange brown.	W	MD		
			SPT 4, 6, 7 N*=13	1								
N				0	3.0		CH	**CLAY:** high plasticity, grey-pale grey, trace of black organic content.	>Wp	St		
			SPT 3, 4, 5 N*=9	-1	4.0							
		12/06/14 17:00			5.0		SP	**SAND:** medium grained, pale grey, pockets of Clayey SAND to 7.0m.	W	MD		Faint sulfur odour
			SPT 3, 11, 14 N*=25	-2								
				-3	6.0							
W			SPT 6, 10, 14 N*=24	-4	7.0							

CDF_0_9_04BA.GLB Log COF BOREHOLE: NON CORED 25137AA.GPJ <<DrawingFile>> 02/07/2014 14:34

method
AD auger drilling*
AS auger screwing*
RR roller/tricone
W washbore
CT cable tool
HA hand auger
DT diatube
B blank bit
V V bit
T TC bit
* bit shown by suffix
e.g. AD/T

support
M mud N nil
C casing

penetration
1 2 3 no resistance ranging to refusal

water
10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
B bulk disturbed sample
D disturbed sample
E environmental sample
SS split spoon sample
U## undisturbed sample ##mm diameter
HP hand penetrometer (kPa)
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
VS vane shear; peak/remouded (kPa)
R refusal
HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
D dry
M moist
W wet
Wp plastic limit
Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Borehole

Borehole ID.	BH 3
sheet:	2 of 4
project no.	GEOTLCOV25137AA
date started:	12 Jun 2014
date completed:	12 Jun 2014
logged by:	AWJ
checked by:	

client: GOSFORD CITY DEVELOPMENTS

principal:

project: 108-118 MANN STREET, GOSFORD

location: GOSFORD

position: E: 345788; N: 6300220 (MGA94 Zone 56) surface elevation : 3.50m (AHD) angle from horizontal: 90°

drill model: Geoprobe mounting: Track hole diameter : 100 mm

drilling information						material substance						
method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetro-meter (kPa) 100 200 300 400	structure and additional observations
W			SPT 1, 1, 1 N*=2	-5	9.0		SM	Silty SAND fine and medium grained, grey.	W	L - MD		ALLUVIUM
				-6								
			SPT 2, 3, 4 N*=7	-7	10.0							
					11.0					MD		
			SPT 6, 8, 5 N*=13	-8	12.0							
				-9			CH	CLAY: high plasticity, dark grey, some fine grained sand, trace wood, pockets of sand.	>Wp	S - F		
			SPT 0, 0, 0 N*=0	-10	13.0							
					14.0		CH	Sandy CLAY: high plasticity, dark grey, fine to medium grained sand.				
			SPT 0, 0, 2 N*=2	-11	15.0							
				-12								

CDF_0_9_04BA.GLB Log COF BOREHOLE NON CORED 25137AA.GPJ <<DrawingFile>> 02/07/2014 14:34

method
AD auger drilling*
AS auger screwing*
RR roller/tricone
W washbore
CT cable tool
HA hand auger
DT diatube
B blank bit
V V bit
T TC bit
* bit shown by suffix
e.g. AD/T

support
M mud N nil
C casing

penetration
no resistance ranging to refusal

water
10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
B bulk disturbed sample
D disturbed sample
E environmental sample
SS split spoon sample
U## undisturbed sample ##mm diameter
HP hand penetrometer (kPa)
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
VS vane shear; peak/remouded (kPa)
R refusal
HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
D dry
M moist
W wet
Wp plastic limit
Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Borehole

Borehole ID.	**BH 3**
sheet:	3 of 4
project no.	**GEOTLCOV25137AA**
date started:	**12 Jun 2014**
date completed:	**12 Jun 2014**
logged by:	**AWJ**
checked by:	

client: **GOSFORD CITY DEVELOPMENTS**

principal:

project: **108-118 MANN STREET, GOSFORD**

location: **GOSFORD**

position: E: 345788; N: 6300220 (MGA94 Zone 56) surface elevation : 3.50m (AHD) angle from horizontal: 90°

drill model: Geoprobe mounting: Track hole diameter : 100 mm

drilling information						material substance						
method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
W			SPT 0, 0, 0 N*=0	-13			CH	Sandy CLAY: high plasticity, pale grey mottled yellow brown, fine grained sand.	>Wp	F - St		ALLUVIUM
					17.0		CH	CLAY: high plasticity, pale grey-white mottled yellow brown and orange.		VSt		RESIDUAL SOIL
			SPT 4, 7, 11 N*=18	-14								
					18.0							
				-15								
			SPT 12/100mm HB N*=R		19.0			SANDSTONE medium grained, pale grey and brown, extremely weathered, estimated very low strength, remoulds to Sandy CLAY.				WEATHERED ROCK
				-16				Borehole BH 3 continued as cored hole				
					20.0							
				-17								
					21.0							
				-18								
					22.0							
				-19								
					23.0							
				-20								

CDF_0_9_04BA.GLB Log COF BOREHOLE: NON CORED 25137AA.GPJ <<DrawingFile>> 02/07/2014 14:34

method
AD auger drilling*
AS auger screwing*
RR roller/tricone
W washbore
CT cable tool
HA hand auger
DT diatube
B blank bit
V V bit
T TC bit
* bit shown by suffix
e.g. AD/T

support
M mud N nil
C casing

penetration
1 2 3 no resistance ranging to refusal

water
10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
B bulk disturbed sample
D disturbed sample
E environmental sample
SS split spoon sample
U## undisturbed sample ##mm diameter
HP hand penetrometer (kPa)
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
VS vane shear; peak/remoulded (kPa)
R refusal
HB hammer bouncing

classification symbol & soil description
based on Unified Classification System

moisture
D dry
M moist
W wet
Wp plastic limit
Wl liquid limit

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Cored Borehole

Borehole ID.	**BH 3**
sheet:	4 of 4
project no.	**GEOTLCOV25137AA**
date started:	**12 Jun 2014**
date completed:	**12 Jun 2014**
logged by:	**AWJ**
checked by:	

client: **GOSFORD CITY DEVELOPMENTS**

principal:

project: **108-118 MANN STREET, GOSFORD**

location: **GOSFORD**

position: E: 345788; N: 6300220 (MGA94 Zone 56) surface elevation : 3.50m (AHD) angle from horizontal: 90°

drill model: Geoprobe mounting: Track hole diameter : 100 mm

drilling information				material substance						rock mass defects		
method & support	water	RL (m)	depth (m)	graphic log	material description ROCK TYPE grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 X = axial; O = diametral VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
		-13	17.0		start coring at 19.10m						
NMLC		-14	18.0		SANDSTONE medium grained, pale grey and pale brown, distinct bedding at 10-15°.	XW MW SW	X	CORE a=0.40 d=0.20			XW Clay XW Clay JT, 50°, PL, RO, SN - Fe SM, 15°, PL, CO, clay (20mm)
		-15	19.0								
		-16	20.0		At 19.80m, becoming pale grey with distinct grey laminations.	FR	X	a=1.40 d=1.10			
		-17	21.0				X	a=2.00 d=2.20	89%		SM, 0°, PL - UN, CO, clay (3mm) CN CN
		-18	22.0				X	a=2.10 d=2.30 a=1.70 d=1.70			CN
		-19	23.0		Borehole BH 3 terminated at 22.20 m		X	a=2.60 d=2.30			
		-20									

Defects are:PT, 10 - 15°, PL, RO, SN - Fe, unless otherwise described

CDF_0_9_04BA_GLB Log COF BOREHOLE CORED 25137AA.GPJ <<DrawingFile>> 02/07/2014 14:35

method & support

DT	dialube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
W	washbore
NMLC	NMLC core (51.9 mm)
NQ	wireline core (47.6mm
HQ	wireline core (63.5mm
PQ	wireline core (85.0mm
SPT	standard penetration test

water

- 10/10/12, water level on date shown
- water inflow
- complete drilling fluid loss
- partial drilling fluid loss
- 25uL: water pressure test result (lugeons) for depth interval shown

graphic log / core recovery

- core recovered (graphic symbols indicate material)
- no core recovered

core run & RQD

- barrel withdrawn

RQD = Rock Quality Designation (%)

weathering & alteration*

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

*W replaced with A for alteration

strength

VL	very low
L	low
M	medium
H	high
VH	very high
EH	extremely high

defect type

PT	parting
JT	joint
SZ	shear zone
SS	shear surface
CS	crushed seam
SM	seam
DB	drilling break

roughness

SL	slickensided
POL	polished
SO	smooth
RO	rough
VR	very rough

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	irregular

coating

CN	clean
SN	stain
VN	veneer
CO	coating