23 April 2015

185 FIFTEENTH AVENUE, WEST HOXTON

Geotechnical Investigation for Commercial Precinct

Submitted to:
Western Sydney Parklands Trust
Level 7, 10 Valentine Avenue
Parramatta NSW 2150
Mail: PO 3064, Parramatta NSW 2124

REPORT

Report Number. 147622023_005_R_Rev0

Distribution:

Golder Associates - 1 Copy
Western Sydney Parklands Trust - 1 Copy

Golder Associates

Table of Contents

TABLES

APPENDICES

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation conducted by Golder Associates Pty Ltd (Golder) for the proposed Fifteenth Avenue Commercial Precinct at West Hoxton, which is a State Significant Development (SSD 6407) being assessed by Western Sydney Parklands Trust (WSPT).

We understand that the commercial precinct consists of Lots 345-346 DP 2475 and Lot 2 DP 307334 over an area of approximately 4 hectares. For reference, SSD 6407 spans both 185 Fifteenth Avenue and 195 Fifteenth Avenue, and is currently intended to include the following development:

Service Station:	250 sqm
Retail Pad Site:	400 sqm
Supermarket:	1,500 sqm
Large Format Retail:	1,500 sqm
Retail/commercial:	1,200 sqm
Child Care:	500 sqm
TOTAL:	5,350 sqm

A sketch of the proposed SSD provided by WSPT (Ref: 2014-4330 -u/c, dated 04/02/15) is included in this report as Figure 2.

This report describes a preliminary geotechnical investigation of 185 Fifteenth Avenue (Lot 345 DP 2475), herein referred to as 'the *Site*', which forms the eastern portion of the commercial precinct. The location of the Site in relation to the surrounding area is shown on the site location plan, included as Figure 1.

The objective of the investigation was to assess the subsurface conditions, including soil/rock profiles across the *Site*, and to provide preliminary geotechnical recommendations for development. A Preliminary Environmental Assessment of the *Site* is has also been conducted, and is described in Golder report 147622023_R_004_Rev0 dated March 2015.

Golder Associates also completed a geotechnical and environmental investigation on behalf of WSPT for the adjacent 195 Fifteenth Avenue in July 2014 (Golder report ref. 147622023_002_R_Rev0 dated 23 April 2015).

The work was conducted in accordance with our proposal 147622023-003-L-Rev0 dated 19 January 2015 as a variation to an existing contract, authorised by Tim Ireson of WSPT in an email dated 2 February 2015.

2.0 SITE CONDITIONS & GEOLOGY

The site is approximately 1.213 ha in area and almost entirely comprises a gravel or asphalt hardstand. The site is to be incorporated with the adjacent site and is to be developed as a single commercial precinct.

The site slopes west at between 5° and 7° and is predominately covered by gravel with some asphalt and concrete. A small grassed area is situated in the centre of the site. The site is surrounded by the greater Fifteenth Avenue development area to the west, Flynn Avenue to the north, Fifteenth Avenue to the south and a rural-residential property to the east.

The site has functioned as a bus depot for over 50 years and has been used primarily to store, service and wash buses. It appears some areas of the site have been filled, notably within the northern portion of the site. We understand that three underground storage tanks were removed from the site towards the end of 2014.

The 1:25000 scale Sydney Geological Map (S1 56-5) indicates that the site is underlain by rocks belonging to the Bringelly Shale Formation which generally comprises shale with some sandstone beds. Outcrops of Potts Hill Sandstone are also shown on the map in the north eastern portion of the site. The terrain appears hummocky, likely indicating areas of past placement of fill.

3.0 FIELD WORK

Field work was carried out on 9 February 2015, and comprised the following scope:

- Drilling geotechnical boreholes at six locations, BH11 to BH16, using a truck-mounted drilling rig equipped with augers and a tungsten carbide bit (TC bit). Boreholes were extended to depths ranging between 2.0 m and 5.5 m. Standard Penetration Tests (SPTs) were carried out to assess strength and gather samples for laboratory testing. Bulk and disturbed samples were also collected for geotechnical and/or environmental laboratory testing. Boreholes were terminated at target depth for environmental sampling (BH11, BH12, BH13 and BH15) or practical auger refusal on shale (BH14, BH16).
- Environmental samples were taken from each borehole location and a Photoionisation Detector (PID) was also used to detect the presence of measure airborne volatile organic compounds.
- Dynamic Cone Penetrometer (DCP) testing was undertaken adjacent to all boreholes. Upon completion, all boreholes were backfilled with the excavated material and sand provided by the driller.
- The weather was overcast during the investigation, with no rain recorded. Light rain was observed in the week prior to the commencement of the geotechnical investigation.

An engineer from Golder positioned the test locations, observed the drilling, logged the materials encountered and collected the samples. Borehole reports as well as explanation sheets used in their preparation are presented in APPENDIX A.

Each test location was positioned using a hand held GPS accurate to about ±5 m horizontally and levels were inferred from the contour plans provided. The investigation locations are shown on Figure 001 and a summary of the locations and details of the testing are provided in Table 1. The soil and rock units encountered in the boreholes are described below in Section 3.1 and summarised in Table 2.

Table 1: Summary of Field Work

Test Location	Coordinates (MGA94 zone)		Termination Depth (m)	Inferred Surface RL (m AHD)	Termination Reason	Completion Remark
BH11	299618	6244535	2.00*	92	Target Depth	Backfilled
BH12	299630	6244605	2.00*	93	Target Depth	Backfilled
BH13	299698	6244606	2.00*	95	Target Depth	Backfilled
BH14	299661	6244477	3.62	95.5	Refusal	Backfilled
BH15	299655	6244500	2.00*	94.5	Target Depth	Backfilled
BH16	299674	6244554	5.50	95	Refusal	Backfilled

* Target depth for environmental sampling.

3.1 Subsurface Conditions

The subsurface materials at the site have been classified into the following general units. These units were also used for our report on the adjacent lot in the Fifteenth Avenue Commercial Precinct. Note that Unit 2 'Colluvium' is absent from 185 Fifteenth Ave.

Unit 1b - Fill

Fill, generally comprising mixtures of gravelly sandy clay, sandy gravel and gravelly clay were encountered in the all boreholes excluding BH14 (where the asphalt surface was formed directly over a clay subgrade). The fill generally extended to depths between 0.8 and 1.2 m below the ground surface, except for BH14 encountered 0.2 m of asphalt.

Unit 3- Residual Soil

Residual soil was found at all test locations and comprised clay, inferred to be high plasticity. SPT results indicated that the stiffness ranged between firm to very stiff consistency, but generally stiff.

Unit 4 – Class V Shale

Shale was inferred to be extremely weathered and of extremely low strength.

Unit 5 – Class IV Shale

Shale was inferred to be highly weathered and of low strength.

The subsurface conditions outlined above are summarised in Table 2.

Table 2: Summary of Subsurface Conditions

Test Location	Depth Range (Thickness) (m)			
	Unit 1b - Fill	Unit 3 - Residual Soil	Unit 4 - Class V Shale	Unit 5 - Class IV Shale
BH11	0 – 0.9	0.9 – 2.0*	Not encountered	
BH12	0 – 1.2	1.2 – 2.0*	Not encountered	
BH13	0 – 0.9	0.9 – 1.2	1.2 – 2.0*	Not encountered
BH14	0 - 0.2	0.2 – 1.7	1.7 – 2.9	2.9 – 3.62*
BH15	0 – 1.2	1.2 – 2.0*	Not encountered	
BH16	0 – 0.8	0.8 – 3.5	3.5 – 4.8	4.8 – 5.5*

* Limit of investigation

Variations to the above generalised profile occur. The individual borehole reports, included in Appendix A, should be referred to for further information.

3.2 Groundwater

Groundwater was not encountered at any of the investigation locations. Groundwater conditions could change seasonally or in response to infiltration.

4.0 LABORATORY TESTING

Bulk and disturbed samples recovered from selected boreholes and test pits were forwarded to the NATA accredited, Macquarie Geotech laboratory at Alexandria for testing. Laboratory results and test certificates are attached in Appendix B.

Table 3: Results of Geotechnical Laboratory Testing

Test Location	Depth (m)	Field Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index	CBR (%)	Swell After Soaking (%)	Optimum Moisture (%)	Emerson Crumb
		AS1289 2.1.1	AS1289 3.2.1	AS1289 3.1.1	AS1289 3.3.1	AS1289 5.5.1	AS1289 5.1.1		AS1289 3.8.1
BH11	1.1-1.2	19.5	52	17	35	3.5	2.6	20.0	5
BH13	1 - 2	12.9	33	20	13	6	2.3	12.5	5

Environmental samples collected were forwarded to Envirolab at Chatswood for potential contamination testing. The results of the environmental testing are included in the Golder report 147622023_R_004_Rev0 dated March 2015.

5.0 DISCUSSION AND RECOMMENDATIONS

The subsurface conditions revealed by the boreholes are consistent with the previous investigation for the neighbouring site. Rock quality in the Bringelly Shale, is relatively variable and significant depths of poor quality rock were observed in the boreholes. The presence of extremely low to very low strength Class V and IV Shale could impact on support requirements for excavations and foundation design parameters.

No cored boreholes were completed during this stage of investigation, and additional site specific investigations will be required to further assess the soil and rock conditions once building layouts and excavation depths are known.

5.1 General Site Preparation and Earthworks

The following comments and recommendations are presented for earthworks and general site preparation:

- Prior to construction of roads or placement of compacted fill, the proposed pavement or fill areas should be stripped to remove vegetation, topsoil and root affected or other potentially deleterious material. These materials should be stockpiled and used for landscaping purposes only.
- Following stripping the exposed subgrade soils should be proof-rolled to detect any wet, cohesive or other materials that deflect excessively under rolling. All such areas should be over-excavated and backfilled with approved compacted granular fill.
- Residual soil and weathered shale may be suitable for reuse in construction of the site, but may require blending or drying and should be assessed by a geotechnical engineer prior to reuse.
- Any additional filling over currently unfilled areas on site should be placed and compacted in accordance with Liverpool City Council's engineering guidelines for filling, and as described in Australian Standards AS3798-2007 *Guidelines on Earthworks for Commercial and Residential Developments*. Filling on site should be compacted under Level 1 Monitoring and Testing as described in Australian Standards AS3798-2007.
- Most of the near-surface natural soils on site are predominantly clayey and silty in nature. Problems with site trafficability should be expected during periods of wet weather.

5.2 Excavation Conditions

Unit 1 to Unit 3 soils should be able to be excavated using relatively standard excavation equipment. The upper Unit 4 weathered shale rock should be excavatable using a hydraulic excavator or D5 bulldozer. As excavations into the Unit 5 shale rock progress, dozers fitted with a ripper may be required for economic excavation, together with rock breakers for detailed trimming, confined excavations or for ironstoner/higher strength bands within the rock mass. Contractors should be provided with the borehole logs to make their own assessment of the suitability and productivity of specific plant.

Plant used for excavation could produce vibrations with the potential to impact adjacent properties. If existing structures are near to excavations we suggest that an assessment be made of the proximity of vibration sensitive structures and the potential need for dilapidation surveys and vibration management plans.

5.3 Dewatering

Groundwater seepage was not observed during the investigation. Dewatering, if required for shallow excavations, should be able to be achieved using standard sump and pump methods.

Seepage rates and dewatering requirements for deep excavations would require specific assessment at the detailed design stage.

5.4 Excavation / Retention Requirements

We understand that the final site building arrangements have not been finalised at this stage, but that development may involve excavations up to 4 m deep for buildings. Depending on the space available on the site and the final building layout these excavations could either be formed using permanent batter slopes or using retaining structures. Recommendations for each of these are discussed below.

5.4.1 Temporary Batter Slopes

Temporary or permanent batter slopes may be required for the site. The Workcover Code of Practice (March 2000) indicates that soil excavations greater than 1.2 m deep with personnel working at the toe require lateral support, unless there is “no reasonable likelihood” that material from the excavation walls will fall.Temporary shallow excavations may be excavated with vertical sides to a maximum depth of 1.2 m and must consider the potential impact to adjacent footings or infrastructure within its zone of influence. The zone of influence behind the crest of an excavation is approximately equivalent to twice its depth. For deeper excavations open for a short period of time (i.e. a few weeks), we recommend that maximum temporary batter slopes of 1(H):1V) be adopted for the site. We also recommend that the following practices be adopted with respect to temporary batters:

- The time during which temporary excavations are open should be limited. Some loss of material may be expected from the exposed face due to wetting and drying;
- Water should be not allowed to pond at the crest or toe of the excavations. Temporary surface drainage should be installed where practical; and
- No heavy surcharge loading, such as construction plant or material stockpiles should be allowed within a distance from the crest of the batter equal to the height of the excavation.

At locations where temporary batter slopes cannot be accommodated the excavation will need to be supported by shoring/retention. The adopted approach will need to consider allowable movements behind the crest of the excavation.

5.4.2 Permanent Batter Slopes

Recommendations for permanent batter slopes are presented in Table 4, below

Table 4: Recommended Permanent Batter Slopes

Unit	Permanent Batters Angles*
Unit 1b: Fill	1V : 2H
Unit 3: Residual Soil	1V : 2H
Unit 4: Class V Shale	1V : 2H
Unit 5: Class IV Shale	1V : 1.5H

* Batters will require vegetation to reduce erosion

5.4.3 Retaining Structures

The proposed buildings may require retaining structures as part of the development. Design of temporary and permanent retention systems will need to take into account the following factors as a minimum:

- Surcharge loads from adjacent buildings;
- Wall movement induced by excavations;
- Ground movements induced by excavation; and
- An allowance for over-excavation.

Where a retaining structure is to be located in close proximity to adjacent buildings, services, pavements or other sensitive structures and facilities, consideration must be given to establishing appropriate installation procedures when selecting a suitable retaining system.

In Bringelly Shale there is also a risk that discontinuities (30° to 50° from the horizontal) daylight within batter slopes forming unstable wedges. We recommend that deep vertical excavations in shale be inspected by a geotechnical engineer, and design should allow a contingency for additional support should unstable wedges be encountered.

Suggested design parameters for retaining structures are presented in Table 5. These parameters are applicable for long term (permanent) structures and assume horizontal ground behind the wall. If an inclined slope is proposed behind the wall, or additional surcharge loads from traffic or structures are imposed during or after construction, then these additional loadings should be allowed for in the design.

Retaining structures should be designed in accordance with AS 4678-2002 “Earth-retaining structures”. Retaining walls should be designed to limit lateral movement when in close proximity to existing buildings/ structures, basements, services, pavements and transformers. For preliminary design of temporary and permanent support we recommend the following:

- For flexible walls such as cantilever walls a triangular earth pressure distribution can be used. Assuming that there are no significant constraints on tolerable ground movements, relatively flexible shoring systems may be used in the design, based on active (k_a) pressures.
- For a propped retaining wall, where adjacent buildings or movement sensitive services are not within the zone of influence, the lateral earth pressure is a uniform pressure of 4H kPa, where H is the total height of the wall in metres. Where adjacent buildings or movement sensitive services are within the zone of influence, a uniform pressure of 6H kPa should be adopted. The zone of influence may be taken as a zone lying above a plane, sloping up at 40 degrees above the horizontal from the base of the excavation.

We recommend the following geotechnical parameters for the design of retaining walls:

Table 5: Preliminary Earth Pressure Coefficients

Soil Unit	Unit 1b: Fill	Unit 3: Residual Soil	Unit 4: Class V Shale	Unit 5: Class IV Shale
At rest Earth Pressure, ko	0.53	0.53	0.6	0.8
Passive Earth Pressure, kp	2.8	2.8	3.3	4.0
Active Earth Pressure, ka	0.36	0.36	0.3	0.25

Notes:

1. These earth pressures are provided on the assumption that the ground behind the retaining wall is flat.
2. For the purposes of the assessments provided in Table 5, we have assumed no wall friction.
3. A geotechnical engineer should be consulted in the design of retaining walls using the above parameters.

Compactive effort can increase the lateral pressure on retaining structures and this may need to be accounted for in design. We recommend that hand held compaction equipment should be used within 2 m behind retaining structures.

Adequate drainage systems should be installed to prevent the possible build-up of water behind the wall due to water infiltration from the surface. It should be noted that hydrostatic pressures may still develop behind retaining walls during periods of heavy rainfall and should be accounted for in the design.

5.5 Foundations

5.5.1 Preliminary Site Classification

Structures that are lightly loaded and less sensitive to differential settlement may be supported on a slab-on-ground or shallow footings on engineered fill or residual soils. Laboratory test results indicate the residual soils on the site have a liquid limit of between 33% and 52% and a plasticity Index of between 17% and 20%. These values are indicative of a medium to highly plastic soil.

Preliminary design of lightly loaded structures supported by slabs-on-ground or shallow footings should be conducted based on a site classification of 'Class H' (highly reactive site) as defined by AS 2870-1996. Some areas of the site are also likely to be 'Class M', but this will need to be confirmed based on the location of each structure and depth of clay at each location.

Once more details of the proposed development are available it may be necessary to re-classify areas of the Site depending on actual cut and fill levels as set out in Section 2.4 of AS 2870-1996. To limit shrinkage and swelling of the foundation materials, particular care should be taken to reduce potential variations in soil moisture content, such as by the inclusion of site drainage in the design. Detailed design studies should conduct further testing for the shrink-swell potential of natural clays on the site.

5.5.2 Preliminary Foundation Options

Foundations for lightly loaded structures are expected to comprise shallow pad/ strip footings or slabs-on-ground. Heavier structures could be constructed on either shallow footings or bored piles founded in the weathered shale, depending on the depth of excavation for basements or site levelling operations. The foundations of new buildings should be founded on the same strata to reduce the potential for differential settlement. Foundation design parameters are provided in Table 6.

Table 6: Preliminary Foundation Design Parameters

Unit	Serviceability Bearing Pressure for Shallow Footings (kPa) (1, 4)	Ultimate Bearing Pressure for Bored Piles (kPa) (2, 4)	Ultimate Shaft Adhesion For Bored Piles (kPa) (2, 3, 4)	Drained Elastic Modulus, E'_s
Unit 1b - Fill	N/A	N/A	N/A	15
Unit 3 - Residual	125	N/A	30	20
Unit 4 – Class V Shale	700	2500	50	100
Unit 5 – Class IV Shale	1,000	4000	150	300

Notes:

1) Serviceability bearing pressure for shallow footings is given with a factor of safety of about 3 on ultimate pressures. This is the factor of safety generally adopted in geotechnical practice to limit settlements to an acceptable level for conventional building structures.

2) A geotechnical strength reduction factor ϕ_g of 0.55 may be adopted for preliminary assessment of the Design Geotechnical Strength of piles in accordance with AS2159. This assumes that piles are embedded at least 2 pile diameters into the founding stratum.

3) Side adhesion given assumes there is intimate contact between the pile and foundation material.

4) N/A means that contribution to design load resistance is not recommended for these materials.

Footings designed using the parameters presented in should result in settlements less than 1% of the footing width or diameter.

Better quality shale rock may be present at depths greater than investigated. Higher bearing pressures may be feasible, but additional geotechnical investigation would be needed to confirm the rock class.

An experienced geotechnical engineer should observe footings and the boring of the piles in order to assess the rock levels and to confirm the rock is suitable for the adopted design parameters.

5.6 Pavements

5.6.1 Design CBR

New access roads and pavements are likely to be required as part of the redevelopment. Based on the investigation results, the results of the laboratory tests indicate the various materials to have the following CBR values and swell: potential after soaking:

- Unit 3: Residual Soil – CBR of 3.5% (based on one sample);
- Unit 4: Class V Shale – CBR of 6% (based on one sample).

CBR test results from the adjoining site to the west (and part of the overall Fifteenth Avenue Commercial Precinct) indicated a CBR of 1% and 3% (two tests) for the Residual Soil.

Based on the lab testing results above and previous experience of residual soils derived from Bringelly Shale, we recommend that preliminary pavement design adopt a CBR value of 2% in residual soils as well as extremely weathered rock (which is likely to break-down on excavation and re-compaction). Detailed design investigations should conduct further CBR testing to refine this value.

5.6.2 Subgrade Preparation

Wet, soft or unsuitable zones comprising oversized rock or deleterious material, such as topsoil, wood and refuse, should be stripped from the pavement footprint. Footings of existing structures should also be removed.

New pavements or roads for this site will be underlain by residual soil or extremely weathered shale. Given the relatively low laboratory CBR value obtained for this material and the relatively high swelling capacity of the soil it may be possible to modify their engineering properties, prior to constructing pavements. An improvement of the subgrade conditions could be achieved through addition of lime, or alternatively subgrade replacement using a suitable granular fill.

The cohesive nature of the residual soil or extremely weathered shale makes it susceptible to moisture variations. Therefore it should be anticipated that some moisture conditioning and drying back of the subgrade may be necessary prior to compaction and placement of pavement materials. The required time period to prepare the subgrade is likely to be dependent on the prevailing weather conditions at the time of construction. Subgrade material beneath roads should be compacted to a minimum 98% Standard Maximum Dry Density (SMDD), or as required by Council or the specified pavement design.

5.6.3 Pavement Drainage

We recommend the inclusion of a network of subsurface drains around the perimeter and across the pavement subgrade, preferably below subgrade level, to control water seepages in the vicinity of proposed pavements and consequently softening and swelling of the subgrade materials.

5.7 Material Reuse

Site levelling operations may produce fill comprising topsoil, residual clay soil, weathered shale rock, or a variety of mixed soils from existing pavements and hardstands.

Topsoil and root affected or other potentially deleterious material would be unsuitable for re-use as engineered fill and should be stockpiled for use in landscaping only.

Residual soils or weathered rock will break down on compaction and provide an inferred CBR value of at least 2%, but are likely to have a moderate to high reactivity to moisture changes. While suitable for re-use as General Fill (with reference to AS3798-2007) the materials will be require close attention to moisture control during placement, and design will need to consider the potential implications of areas filled with relatively deep expansive clays. Design and construction implications of the expansive clays could be reduced by adding lime as a stabilising agent prior to re-use as fill, but stabilisation trials would need to be conducted during detailed design.

A geotechnical professional should assess the suitability of the mixed materials at the site for re-use as engineered fill.

Site won materials are considered not to be suitable as pavement base or sub-base materials. Imported granular fill for pavements should comply with AS3798-2007 Section 4. In addition, for preliminary design, Roads and Maritime Services (RMS) specifications for pavement materials would provide suitable guidance.

5.8 Soil Dispersion and Erosion

Two soil samples, one from Unit 3 Residual Soil and one from Unit 4 Class V Shale were tested for Emerson Class to assess the dispersivity of the materials present at the Site. The laboratory test results indicate that the materials have an Emerson Class number of 5. Emerson Class Number 5 constitutes non-dispersive behaviour.

Remoulding of the soil at a moisture content near optimum (i.e. excavation and re-compaction) does not increase potential for dispersive behaviour, however further breakdown of the soil may occur, by water turbulence or concentrated rapid water flow. We therefore recommend that these materials not be exposed to concentrated water flow over or through the soil profile (e.g. by lining drainage channels).

Permanent batter slopes will require vegetation to reduce erosion risk. Other slope protection measures (such as geofabrics) may also be required for temporary batters or until vegetation establishes.

5.9 Acid Sulfate Soil

Previous sampling and testing of soils in low-lying areas on the adjoining site (195 Fifteenth Ave) did not indicate the presence of acid sulfate soils (ASS), which is consistent with published ASS maps of the area. The Site is also situated at an elevation well above RL 10 m AHD and in geological setting not prone to ASS, On this basis we consider that the risk of ASS being present on Site is very low.

6.0 LIMITATIONS

Your attention is drawn to the document “Limitations”, which is included in Appendix C of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by Golder Associates, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

Report Signature Page

GOLDER ASSOCIATES PTY LTD

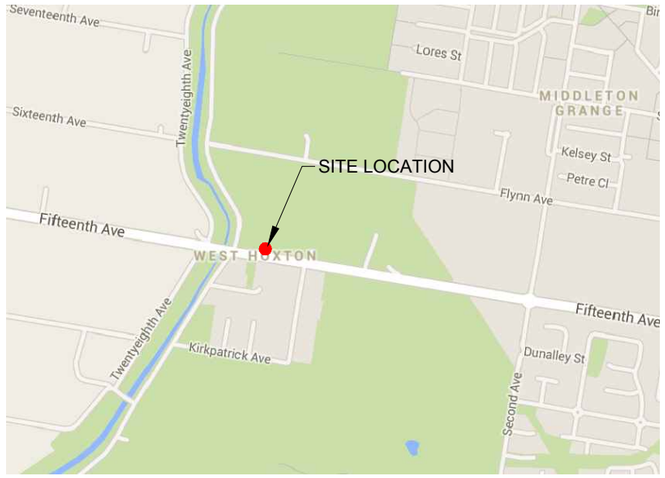
Ben Seaford
Engineering Geologist

Craig Curnow
Principal Geotechnical Engineer

BMS/CSC/bms

A.B.N. 64 006 107 857

\\golder.gds\gap\sydney\jobs\geo\2014\147622023_wspt_site gi_west hoxton\correspondence out\147622023_005_r_rev0 - geotechnical report (wspt comments).docx



LOCALITY PLAN
NOT TO SCALE

LEGEND

- BOREHOLE LOCATIONS
- EXISTING STUDY AREA FOR 185 FIFTEENTH AVE.
- PREVIOUS STUDY AREA, 195 FIFTEENTH AVE.

REFERENCE

BASE SURVEY CONTOUR TAKEN FROM TOTAL SURVEYING SOLUTION DRAWING 15060_A.DWG, RECEIVED DATED 2015-02-10

IMAGE DATED 24-05-2014
SOURCED WITH PERMISSION FROM NEARMAP ON 17-06-2014
IMAGE GEOREFERENCED BY GOLDER AND INTENDED FOR INDICATIVE PURPOSES ONLY
www.nearmap.com.au

0 50 100
1:2,000 METRES

CLIENT
WESTERN SYDNEY PARKLANDS TRUST

CONSULTANT
Golder Associates

YYYY-MM-DD	2015-04-21
PREPARED	EJJ
DESIGN	AS
REVIEW	BMS
APPROVED	CSC

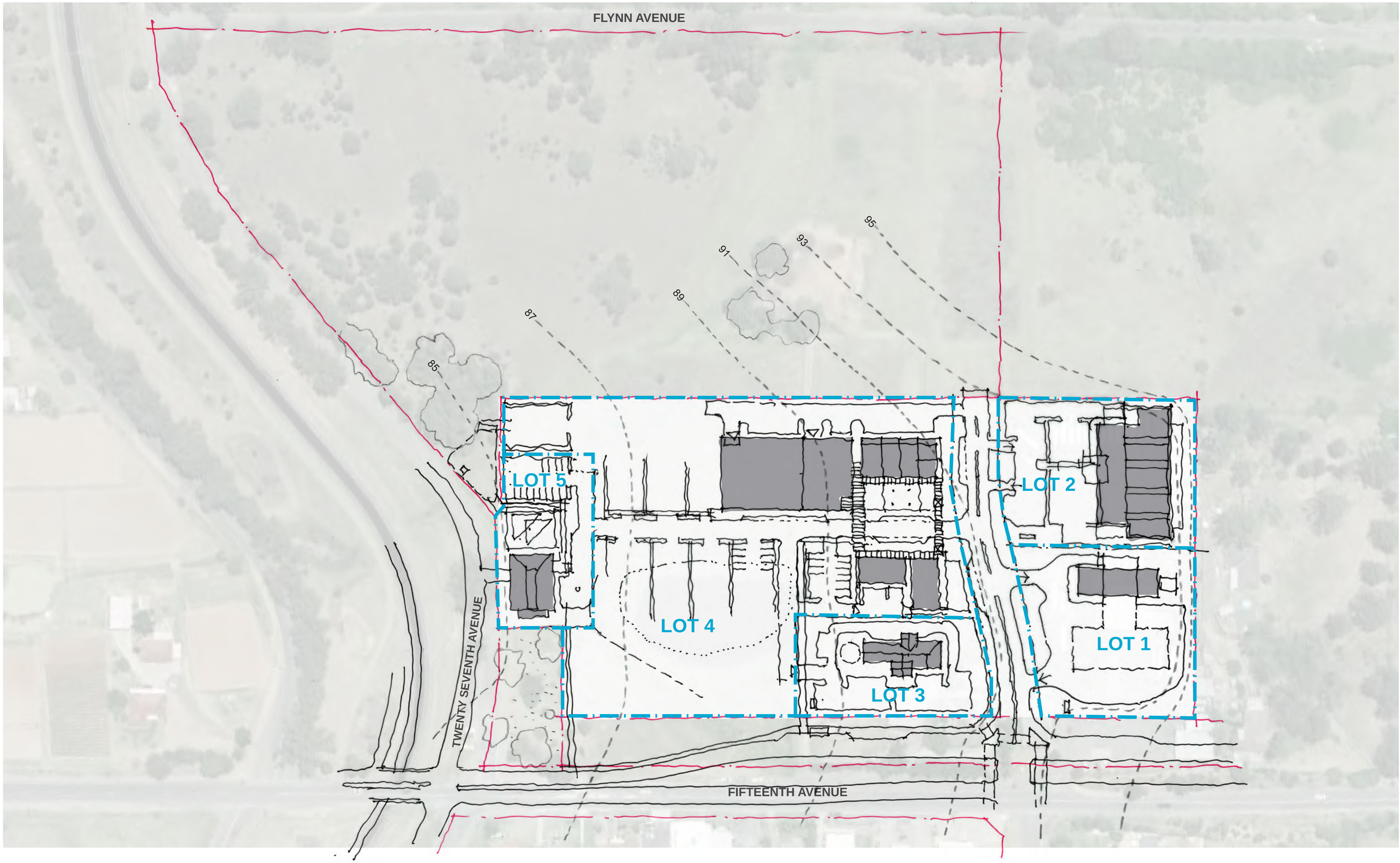
PROJECT
185 FIFTEENTH AVENUE, WEST HOXTON

TITLE
185 FIFTEENTH AVENUE, WEST HOXTON INVESTIGATION LOCATIONS

PROJECT No.	REPORT	Rev.	FIGURE
147622023	005 - R	0	FIGURE 1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A3
0 25 mm

Path: ---- | File Name: 147622023-005-R-F001-REV_.dwg



LFA (PACIFIC) PTY LIMITED

MASTERPLANNING
URBAN DESIGN
ARCHITECTURE
LANDSCAPE ARCHITECTURE
INTERIORS

SUITE 4, EDGECLIFF COURT, 2 NEW McLEAN ST, EDGECLIFF NSW 2027
M PO BOX 259, EDGECLIFF NSW 2027 T 02 9327 6822 F 02 9327 5554
E lfa@lfa.com.au W www.lfa.com.au ABN 92 830 134 905 QM ISO 9001-2008

NOMINATED ARCHITECTS ALF LESTER NO.2128 STEPHEN ANDERS NO.5764

lot pattern sketch

2014-4330 -u/c
04 february 2015

0 10 20 50 100m

Scale 1:1,000 @ A2

west hoxton

schematic

Figure 2

APPENDIX A

Borehole Logs and Explanation Sheets

EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT REPORTS

DRILLING/EXCAVATION METHOD

AS*	Auger Screwing	RD	Rotary blade or drag bit	HQ	Diamond Core - 63 mm
AD*	Auger Drilling	RT	Rotary Tricone bit	NMLC	Diamond Core - 52 mm
*V	V-Bit	RAB	Rotary Air Blast	NQ	Diamond Core - 47 mm
*T	TC-Bit, e.g. ADT	RC	Reverse Circulation	BH	Tractor Mounted Backhoe
HA	Hand Auger	PT	Push Tube	EX	Tracked Hydraulic Excavator
DTC	Diatube Coring	CT	Cable Tool Rig	EE	Existing Excavation
WB	Washbore or Bailer	JET	Jetting	HAND	Excavated by Hand Methods

PENETRATION/EXCAVATION RESISTANCE

L **Low resistance.** Rapid penetration possible with little effort from the equipment used.

M **Medium resistance.** Excavation/possible at an acceptable rate with moderate effort from the equipment used.

H **High resistance** to penetration/excavation. Further penetration is possible at a slow rate and requires significant effort from the equipment.

R **Refusal or Practical Refusal.** No further progress possible without the risk of damage or unacceptable wear to the digging implement or machine.

These assessments are subjective and are dependent on many factors including the equipment power, weight, condition of excavation or drilling tools, and the experience of the operator.

WATER

⏚	Water level at date shown	◁	Partial water loss
▷	Water inflow	◀	Complete water loss

GROUNDWATER NOT OBSERVED	The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.
GROUNDWATER NOT ENCOUNTERED	The borehole/test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

SAMPLING AND TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-1993
4,7,11 N=18	4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following 150mm seating
30/80mm	Where practical refusal occurs, the blows and penetration for that interval are reported
RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB	Hammer double bouncing on anvil
DS	Disturbed sample
BDS	Bulk disturbed sample
G	Gas Sample
W	Water Sample
FP	Field permeability test over section noted
FV	Field vane shear test expressed as uncorrected shear strength s_v
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket penetrometer test expressed as instrument reading in kPa
U63	Thin walled tube sample - number indicates nominal sample diameter in millimetres

Ranking of Visually Observable Contamination and Odour (for specific soil contamination assessment projects)

R = 0	No visible evidence of contamination	R = A	No non-natural odours identified
R = 1	Slight evidence of visible contamination	R = B	Slight non-natural odours identified
R = 2	Visible contamination	R = C	Moderate non-natural odours identified
R = 3	Significant visible contamination	R = D	Strong non-natural odours identified

ROCK CORE RECOVERY

TCR = Total Core Recovery (%)

$$= \frac{\textit{Length of core recovered}}{\textit{Length of core run}} \times 100$$

SCR = Solid Core Recovery (%)

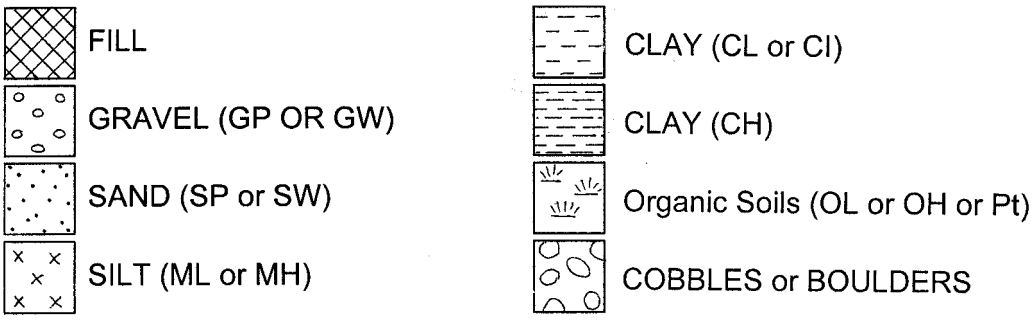
$$= \frac{\sum \textit{Length of cylindrical core recovered}}{\textit{Length of core run}} \times 100$$

RQD = Rock Quality Designation (%)

$$= \frac{\sum \textit{Axial lengths of core} > 100\ \textit{mm}}{\textit{Length of core run}} \times 100$$

METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT REPORTS

GRAPHIC LOG - TYPICAL SYMBOLS FOR SOILS



Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay.

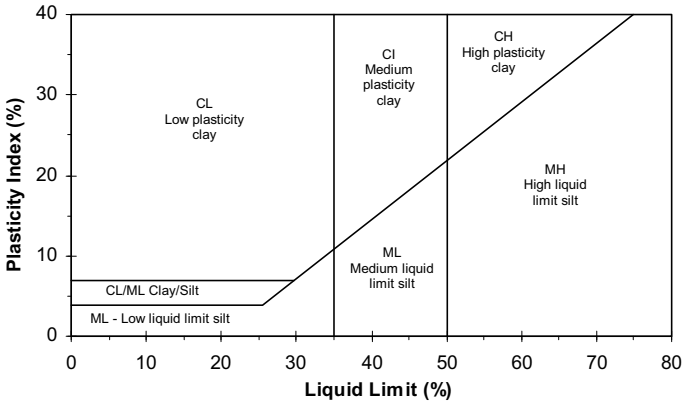
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil and Rock is classified and described in Reports of Boreholes and Test Pits using the preferred method given in AS1726 - 1993, Appendix A. The material properties are assessed in the field by visual/tactile methods.

Particle Size

Major Division	Sub Division	Particle Size
BOULDERS		> 200 mm
COBBLES		63 to 200 mm
GRAVEL	Coarse	20 to 63 mm
	Medium	6.0 to 20 mm
	Fine	2.0 to 6.0 mm
SAND	Coarse	0.6 to 2.0 mm
	Medium	0.2 to 0.6 mm
	Fine	0.075 to 0.2 mm
SILT		0.002 to 0.075 mm
CLAY		< 0.002 mm

Plasticity Properties



MOISTURE CONDITION

AS1726 - 1993

Symbol	Term	Description
D	Dry	Sands and gravels are free flowing. Clays & Silts may be brittle or friable and powdery
M	Moist	Soils are darker than in the dry condition & may feel cool. Sands and gravels tend to cohere
W	Wet	Soils exude free water. Sands and gravels tend to cohere.

CONSISTENCY AND DENSITY

AS1726 - 1993

Symbol	Term	Undrained Shear Strength
VS	Very Soft	0 to 12 kPa
S	Soft	12 to 25 kPa
F	Firm	25 to 50 kPa
St	Stiff	50 to 100 kPa
VSt	Very Stiff	100 to 200 kPa
H	Hard	above 200 kPa

Symbol	Term	Density Index %	SPT "N" #
VL	Very Loose	Less than 15	0 to 4
L	Loose	15 to 35	4 to 10
MD	Medium Dense	35 to 65	10 to 30
D	Dense	65 to 85	30 to 50
VD	Very Dense	above 85	Above 50

SPT correlations are not stated in AS1726 – 1993, and may be subject to corrections for overburden pressure and equipment type.
In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.

TERMS FOR ROCK MATERIAL STRENGTH & WEATHERING AND ABBREVIATIONS FOR DEFECT DESCRIPTIONS

STRENGTH

Symbol	Term	Point Load Index, $Is_{(50)}$ (MPa)	Field Guide
EL	Extremely Low	< 0.03	Easily remoulded by hand to a material with soil properties.
VL	Very Low	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm can be broken by finger pressure.
L	Low	0.1 to 0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
M	Medium	0.3 to 1	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
H	High	1 to 3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken with pick with a single firm blow; rock rings under hammer.
VH	Very High	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
EH	Extremely High	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

ROCK STRENGTH TEST RESULTS

▼ Point Load Strength Index, $Is_{(50)}$, Axial test (MPa)

◀ Point Load Strength Index, $Is_{(50)}$, Diametral test (MPa)

ROCK MATERIAL WEATHERING

Symbol		Term	Field Guide
RS		Residual Soil	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
EW		Extremely Weathered	Rock is weathered to such an extent that it has soil properties - i.e. it either disintegrates or can be remoulded, in water.
DW	HW	Distinctly Weathered	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
	MW		
SW		Slightly Weathered	Rock is slightly discoloured but shows little or no change of strength relative to fresh rock.
FR		Fresh	Rock shows no sign of decomposition or staining.

ABBREVIATIONS FOR DEFECT TYPES AND DESCRIPTIONS

Defect Type

B	Bedding parting
X	Foliation
L	Cleavage
J	Joint
SZ	Sheared zone (Fault)
CS	Crushed seam (Fault)
DS	Decomposed seam
IS	Infilled seam
S	Schistocity
V	Vein

Coating or Infilling

Cn	Clean
Sn	Stain
Vr	Veneer
Ct	Coating

Planarity

Pl	Planar
Un	Undulating
St	Stepped

Roughness

Sl	Slickensided
Sm	Smooth
Ro	Rough

Vertical Boreholes – The dip (inclination from horizontal) of the defect is given.
Inclined Boreholes – The inclination is measured as the acute angle to the core axis.

DRAFT REPORT OF BOREHOLE: BH11

SHEET: 1 OF 1

CLIENT: Western Sydney Parklands Trust
COORDS: 299618.0 m E 6244535.0 m N MGA94 56
DRILL RIG: Hanjin8D

PROJECT: Former Bus Depot
SURFACE RL: DATUM: AHD
CONTRACTOR: Rockwell

LOCATION: 185 Fifteenth Ave, West Hoxton
INCLINATION: -90°
LOGGED: AMS DATE: 9/2/15

JOB NO: 147622023
HOLE DEPTH: 2.00 m
CHECKED: BMS DATE: 20/2/15

Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
AST	M	GWNE	0		DS 0.00-0.10 m enviro., PID=0ppm BDS 0.20-0.90 m enviro., PID=0ppm SPT 0.50-0.95 m 4, 3, 2 N=5				FILL: Gravelly Sandy CLAY high plasticity, orange brown, with rubber bands	M (<<PL)		FILL	31 31
			1	0.90	SPT 1.00-1.45 m 1, 1, 2 N=3 BDS 1.10-2.00 m			CH	CLAY high plasticity, orange brown, with some black roots			RESIDUAL SOIL	
	L			1.50	SPT 1.50-1.95 m 2, 2, 4 N=6				becoming mottled grey red	M (c PL)	F		
			2						END OF BOREHOLE @ 2.00 m TARGET DEPTH BACKFILLED				
			3										
			4										
			5										
			6										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01h RL3

DRAFT REPORT OF BOREHOLE: BH12

SHEET: 1 OF 1

CLIENT: Western Sydney Parklands Trust
COORDS: 299630.0 m E 6244605.0 m N MGA94 56
DRILL RIG: Hanjin8D

PROJECT: Former Bus Depot
SURFACE RL: DATUM: AHD
CONTRACTOR: Rockwell

LOCATION: 185 Fifteenth Ave, West Hoxton
INCLINATION: -90°
LOGGED: AMS DATE: 9/2/15

JOB NO: 147622023
HOLE DEPTH: 2.00 m
CHECKED: BMS DATE: 20/2/15

Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
ADT	L	GWNE	0		DS 0.10-0.20 m environ., PID=0ppm BDS 0.20-1.20 m				FILL: Sandy GRAVEL crushed sandstone and sub rounded to sunangular igneous origin			FILL	augered
				0.30					FILL: Gravelly CLAY high plasticity				
			1		enviro., PID=0.3ppm SPT 0.50-0.95 m 3, 12, 9 N=21 environmental sample					M (<<PL)			DCP at high angle
					SPT 1.00-1.45 m 3, 3, 3 N=6								
				1.20				CH	CLAY high plasticity, mottled grey red		St	RESIDUAL SOIL	
					SPT 1.50-1.95 m 2, 3, 4 N=7								
			2						END OF BOREHOLE @ 2.00 m TARGET DEPTH BACKFILLED				
			3										
			4										
			5										
			6										

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

DRAFT REPORT OF BOREHOLE: BH13

SHEET: 1 OF 1

CLIENT: Western Sydney Parklands Trust
PROJECT: Former Bus Depot
LOCATION: 185 Fifteenth Ave, West Hoxton
JOB NO: 147622023

COORDS: 299698.0 m E 6244606.0 m N MGA94 56
SURFACE RL: DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 2.00 m

DRILL RIG: Hanjin8D
CONTRACTOR: Rockwell
LOGGED: AMS DATE: 9/2/15
CHECKED: BMS DATE: 20/2/15

Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
AST	L	GWNE	0	0.20	DS 0.00-0.10 m enviro.				FILL: Gravelly CLAY medium to high plasticity, grey, with some fine to medium grained, subangular igneous gravel			FILL	0 5 10 15 20 25
					BDS 0.20-0.90 m				FILL: CLAY high plasticity, brown, with traces of fine to medium grained, subangular igneous gravel	M (<<PL)			
				0.90				CH	CLAY high plasticity, pale brown		VSt	RESIDUAL SOIL	
			1	1.20	BDS 1.00-2.00 m SPT 1.00-1.45 m 4, 12, 13 N=25				SHALE pale brown extremely weathered, extremely low to very low strength			WEATHERED ROCK	
			2						END OF BOREHOLE @ 2.00 m TARGET DEPTH BACKFILLED				
			3										
			4										
			5										
			6										

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01h RL3

DRAFT REPORT OF BOREHOLE: BH14

SHEET: 1 OF 1

CLIENT: Western Sydney Parklands Trust
PROJECT: Former Bus Depot
LOCATION: 185 Fifteenth Ave, West Hoxton
JOB NO: 147622023

COORDS: 299661.0 m E 6244477.0 m N MGA94 56
SURFACE RL: DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 3.62 m

DRILL RIG: Hanjin8D
CONTRACTOR: Rockwell
LOGGED: AMS DATE: 9/2/15
CHECKED: BMS DATE: 20/2/15

Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
AST	L	GWNE	0	0.20	DS 0.00-0.10 m enviro.				FILL: GRAVEL (asphalt)			FILL	0 5 10 15 20 25
					BDS 0.30-1.00 m			CH	CLAY high plasticity, red	M (<PL)	St - VSt	RESIDUAL SOIL	
			1		enviro., PID=0ppm SPT 0.50-0.95 m 3, 5, 7 N=12 environmental sample								
				1.70					SHALE pale grey, with some iron-cemented bands extremely weathered, extremely low to very low strength			WEATHERED ROCK	
			2		SPT 2.00-2.45 m 3, 9, 15 N=24								
	M-H			2.90					SHALE pale grey, with some iron-cemented bands distinctly weathered, very low to low strength				
			3		SPT 3.50-3.62 m 16/120mm N=R				END OF BOREHOLE @ 3.62 m REFUSAL BACKFILLED				
			4										
			5										
			6										

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

DRAFT REPORT OF BOREHOLE: BH15

SHEET: 1 OF 1

CLIENT: Western Sydney Parklands Trust
COORDS: 299655.0 m E 6244500.0 m N MGA94 56
DRILL RIG: Hanjin8D

PROJECT: Former Bus Depot
SURFACE RL: DATUM: AHD
CONTRACTOR: Rockwell

LOCATION: 185 Fifteenth Ave, West Hoxton
INCLINATION: -90°
LOGGED: AMS DATE: 9/2/15

JOB NO: 147622023
HOLE DEPTH: 2.00 m
CHECKED: BMS DATE: 20/2/15

Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
ADT	L	GWNE	0	0.15	DS 0.00-0.10 m enviro., PID=0.1ppm				FILL: GRAVEL dark grey, asphalt			FILL	augered
									FILL: SANDSTONE BOULDER pale yellow				augered
					enviro., PID=0.8ppm SPT 0.50-0.95 m 2, 2, 3 N=5				FILL: CLAY brown, with some fine to medium grained igneous and ironstone gravel	M (<PL)			
			1	1.20				CH	CLAY high plasticity, red, trace ironstone gravel			RESIDUAL SOIL	
					SPT 1.40-1.85 m 2, 4, 5 N=9					M (<PL)	St		
			2						END OF BOREHOLE @ 2.00 m TARGET DEPTH BACKFILLED				
			3										
			4										
			5										
			6										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

DRAFT REPORT OF BOREHOLE: BH16

SHEET: 1 OF 1

CLIENT: Western Sydney Parklands Trust
PROJECT: Former Bus Depot
LOCATION: 185 Fifteenth Ave, West Hoxton
JOB NO: 147622023

COORDS: 299674.0 m E 6244554.0 m N MGA94 56
SURFACE RL: DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 5.50 m

DRILL RIG: Hanjin8D
CONTRACTOR: Rockwell
LOGGED: AMS DATE: 9/2/15
CHECKED: BMS DATE: 20/2/15

Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
AST	L	GWNE	0		BDS 0.10-0.50 m				FILL: Clayey SAND crushed sandstone	M		FILL	augered auguered
					enviro. SPT 0.50-0.95 m 4, 3, 2 N=5								
				0.80	BDS 0.80-1.50 m			CH	CLAY high plasticity, mottled pale grey and pale orange, with trace tree roots			RESIDUAL SOIL	
			1										
				1.40					pale grey, with trace ironstone gravel	M (c PL)			
					SPT 1.50-1.95 m 3, 3, 4 N=7								
			2										
				2.20					mottled pale grey and red		St - VSt		
					SPT 2.50-2.95 m 3, 6, 9 N=15					M (<PL)			
			3										
				3.50					SHALE pale grey and brown extremely weathered, extremely low to very low strength			WEATHERED ROCK	
					SPT 4.30-4.53 m 14, 10/80mm HB N>10								
			4										
				4.80					SHALE pale grey slightly weathered, very low to low strength				
	H		5										
									END OF BOREHOLE @ 5.50 m REFUSAL BACKFILLED				
			6										

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

APPENDIX B

Laboratory Test Certificates

SOIL CLASSIFICATION REPORT

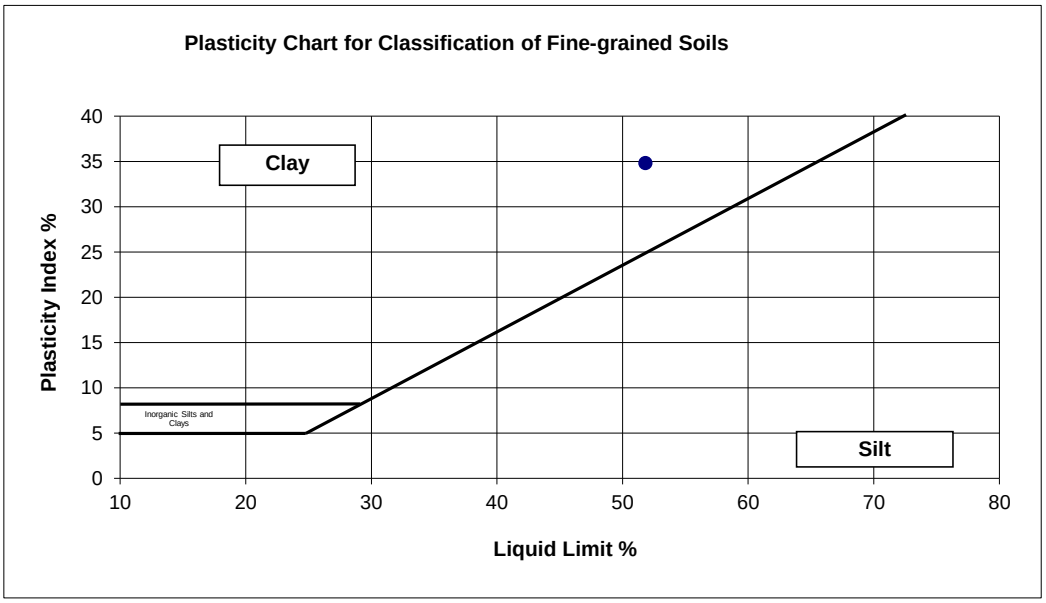
Client:	Golder Associates	**Source:**	BH11 (1.1-2.0m)
Address:	PO Box 1302, Crows Nest NSW 1585	**Sample Description:**	silty CLAY
Project:	Former Bus Depot - 185 Fifteenth Ave, West Hoxton (147622023)	**Report No:**	S2186-AL
Job No:	S15036	**Lab No:**	S2186

Test Procedure:

- ☐ AS1289 2.1.1 Soil moisture content tests (Oven drying method)
- ☐ AS1289 3.1.1 Soil classification tests - Determination of the liquid limit of a soil - Four point casagrande method
- ☑ AS1289 3.1.2 Soil classification tests - Determination of the liquid limit if a soil - One point Casagrande method (subsidiary method)
- ☑ AS1289 3.2.1 Soil classification tests - Determination of the plastic limit of a soil - Standard method
- ☑ AS1289 3.3.1 Soil classification tests - Calculation of the plasticity Index of a soil
- ☐ AS1289 3.4.1 Soil classification tests - Determination of the linear shrinkage of a soil - Standard method

Sampling:	Sampled by Client	**Date Sampled:**	Unknown
Preparation:	Prepared in accordance with the test method		

Liquid Limit (%):	52	**Linear Shrinkage (%):**	-
Plastic Limit (%):	17	**Field Moisture Content (%):**	-
Plastic Index:	35		



Soil Preparation Method: Dry Sieved
Soil History: Air Dried
Soil Condition: NA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

26/02/2015

Date:

MACQUARIE GEOTECH

Facility Name: Sydney Branch Site
Location: 8/10 Bradford St, Alexandria NSW 2015
Site No.: 22365

Facility

Macquarie Geotechnical
3 Watt Drive
Bathurst NSW 2795

CALIFORNIA BEARING RATIO REPORT

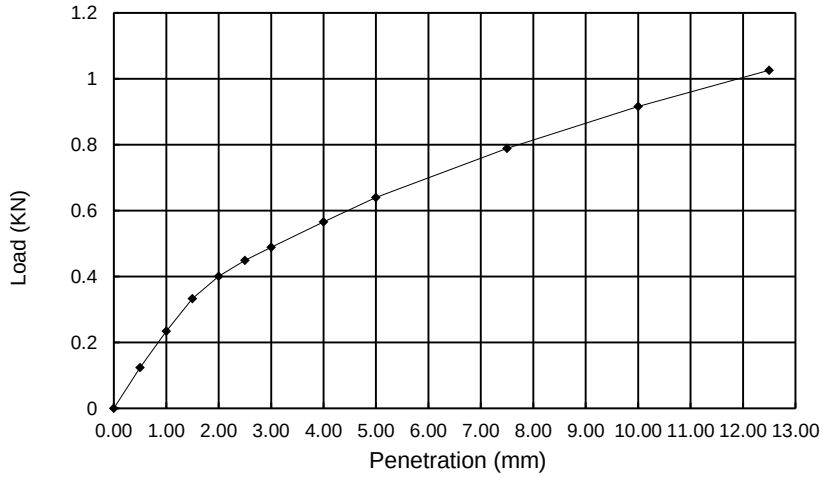
AS1289 6.1.1

Client:	Golder Associates	**Source:**	BH11 (1.1-2.0m)
Address:	PO Box 1302, Crows Nest NSW 1585	**Sample Description:**	silty CLAY
Project:	Former Bus Depot - 185 Fifteenth Ave, West Hoxton (147622023)	**Report No.:**	S2186-CBR
Job No.:	S15036	**Lab No.:**	S2186

Test Procedure:

- ☑ AS1289 6.1.1 Soil strength and consolidation tests - Determination of the California Bearing Ratio of a soil - Standard laboratory method for a remoulded specimen
- ☑ AS1289 5.1.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
- ☑ AS1289 2.1.1 Soil moisture content tests - Determination of the moisture content of a soil - Oven drying method (standard method

Sampling:	Sampled by Client	**Date Sampled:**	Unknown
Preparation:	Prepared in accordance with AS1289 1.1		



Compaction and Placement Data

Compaction Used		Standard	Dry Density				
Maximum Dry Density t/m^3		1.69	At Compaction	1.66	t/m^3	98.0	% Comp.
Optimum Moisture Content %		20.0	After Soaking	TBA	t/m^3	TBA	% Comp.
No. of Layers		3	Moisture Content				Moisture Ratio (%)
Blows per Layer		53	At Compaction		%	19.5	97
Drop of Rammer	mm	300	After Soaking		%	TBA	TBA
Mass of Rammer	kg	2.7	After Penetration (Top 30mm)		%	TBA	TBA
Surcharge Used	kg	4.5	After Penetration (Entire Depth)		%	TBA	TBA
% Ret. 19mm Sieve		0	Swell After 4 Days Soaking		%	2.6	

Note: material coarser than +19mm Sieve was discarded (as per test method)

California Bearing Ratio

CBR (4-day Soaked) = 3.5 % at 2.5 mm Penetration

Notes:

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

26/02/2015

Date:

MACQUARIE GEOTECH

Facility Name: Sydney Branch Site
Facility Location: 8/10 Bradford Street, Alexandria NSW 2015
Site No.: 22365

Macquarie Geotechnical
3 Watt Drive
BATHURST NSW 2795

EMERSON CLASS NUMBER REPORT

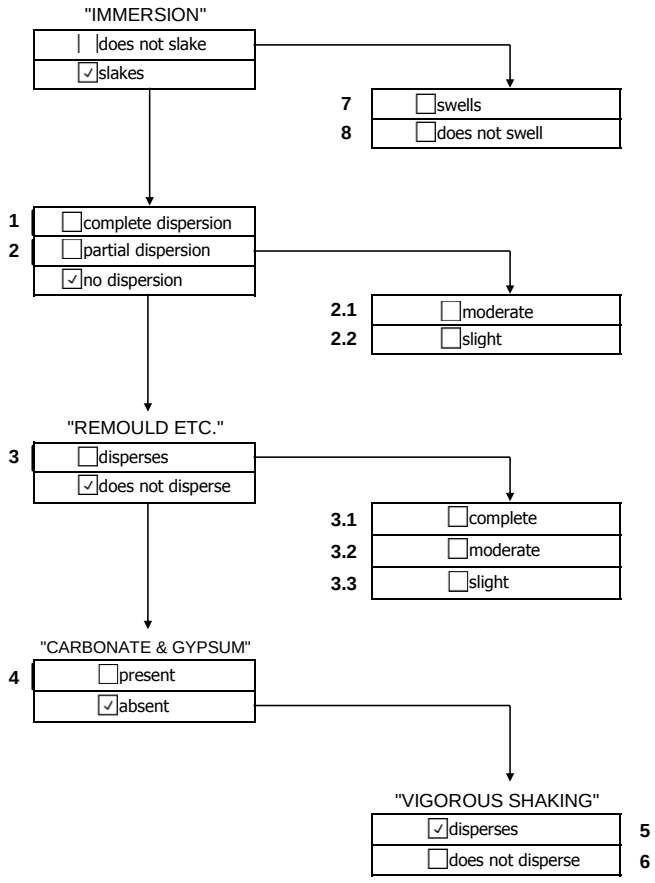
AS1289 3.8.1

Client:	Golder Associates	**Source:**	BH11 (1.1-2.0m)
Address:	PO Box 1302, Crows Nest NSW 1585	**Sample Description:**	silty CLAY
Project:	Former Bus Depot - 185 Fifteenth Ave, West Hoxton (147622023)	**Report No:**	S2186-EM
Job No:	S15036	**Lab No:**	S2186

Test Procedure: ☑ AS1289 3.8.1 Soil classification tests - Dispersion - Determination of Emerson class number of a soil

Sampling: Sampled by Client **Date Sampled:** Unknown

Preparation: Prepared in accordance with the test method



Water Type	**Distilled**
Water Temperature (°c)	**23**

RESULT:

Emerson Class No.	**5**

Authorised Signatory:

26/02/2015

NATA Accredited Laboratory Number: 14874

Chris Lloyd

Date:

Facility Name: Sydney Branch Site
Facility Location: 8/10 Bradford Street, Alexandria NSW 2015
Site No.: 22365

Macquarie Geotechnical
3 Watt Drive
BATHURST NSW 2795

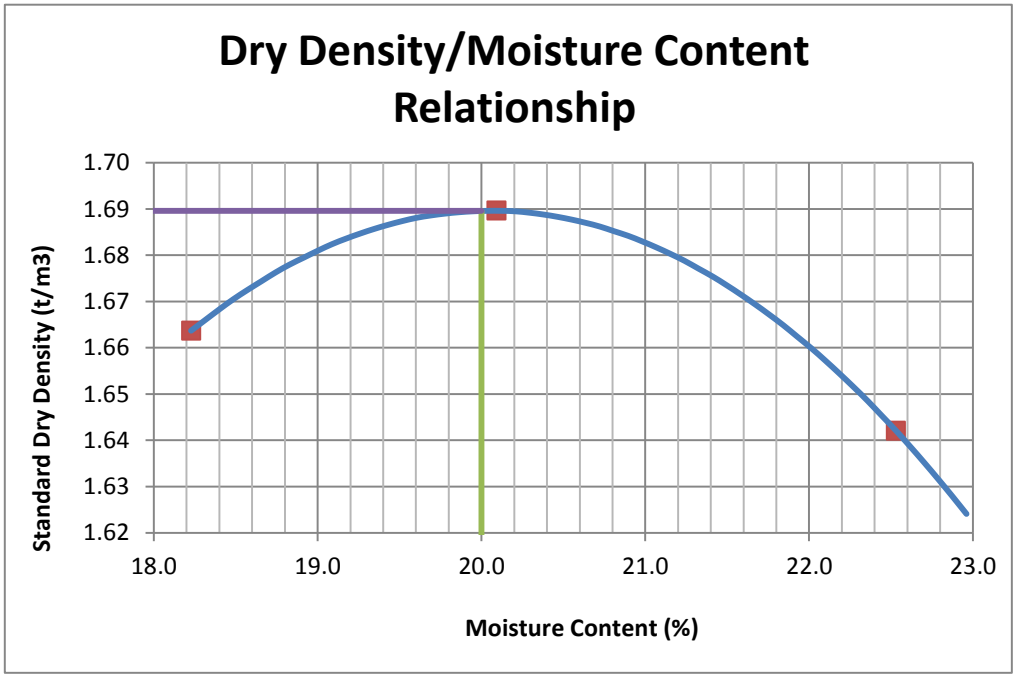
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

AS1289 5.1.1

Client:	Golder Associates	**Source:**	BH11 (1.1-2.0m)
Project:	Former Bus Depot - 185 Fifteenth Ave, West Hoxton (147622023)	**Report No:**	S2186-MDD
Address:	PO Box 1302, Crows Nest NSW 1585	**Sample Description:**	silty CLAY
Job No:	S15036	**Lab No:**	S2186

Test Procedure:
- ☑ AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
- ☑ AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	**Date Sampled:**	Unknown
Preparation:	Prepared in accordance with the test method		



Maximum Dry Density (t/m^3)	1.690
Optimum Moisture Content (%)	20.0
Percentage Oversize on 19mm sieve (%)	0
Percentage Oversize on 37.5mm sieve (%)	0

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

Date: 26/02/2015

MACQUARIE GEOTECH

Facility Name: Sydney Branch Site
Facility Location: 8/10 Bradford Street Alexandria NSW 2015
Site No.: 22365

Macquarie Geotechnical
3 Watt Drive
Bathurst NSW 2795

SOIL CLASSIFICATION REPORT

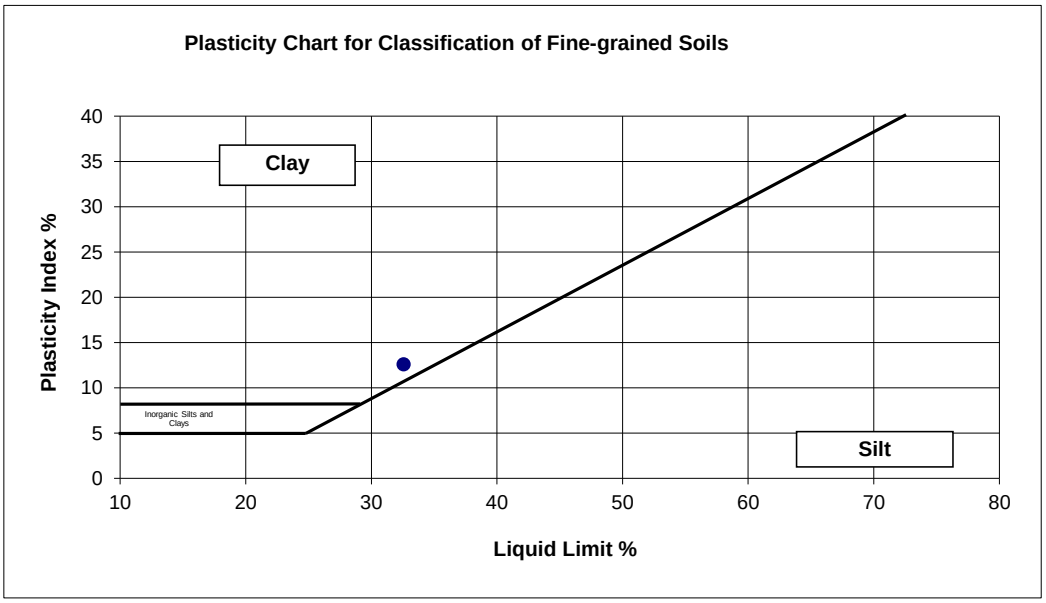
Client:	Golder Associates	**Source:**	BH13 (1.0-2.0m)
Address:	PO Box 1302, Crows Nest NSW 1585	**Sample Description:**	sandy CLAY
Project:	Former Bus Depot - 185 Fifteenth Ave, West Hoxton (147622023)	**Report No:**	S2187-AL
Job No:	S15036	**Lab No:**	S2187

Test Procedure:

- ☐ AS1289 2.1.1 Soil moisture content tests (Oven drying method)
- ☐ AS1289 3.1.1 Soil classification tests - Determination of the liquid limit of a soil - Four point casagrande method
- ☑ AS1289 3.1.2 Soil classification tests - Determination of the liquid limit if a soil - One point Casagrande method (subsidiary method)
- ☑ AS1289 3.2.1 Soil classification tests - Determination of the plastic limit of a soil - Standard method
- ☑ AS1289 3.3.1 Soil classification tests - Calculation of the plasticity Index of a soil
- ☐ AS1289 3.4.1 Soil classification tests - Determination of the linear shrinkage of a soil - Standard method

Sampling:	Sampled by Client	**Date Sampled:**	Unknown
Preparation:	Prepared in accordance with the test method		

Liquid Limit (%):	33	**Linear Shrinkage (%):**	-
Plastic Limit (%):	20	**Field Moisture Content (%):**	-
Plastic Index:	13		



Soil Preparation Method: Dry Sieved
Soil History: Oven Dried
Soil Condition: NA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

26/02/2015

Date:

MACQUARIE GEOTECH

Facility Name: Sydney Branch Site
Location: 8/10 Bradford St, Alexandria NSW 2015
Site No.: 22365

Facility

Macquarie Geotechnical
3 Watt Drive
Bathurst NSW 2795

CALIFORNIA BEARING RATIO REPORT

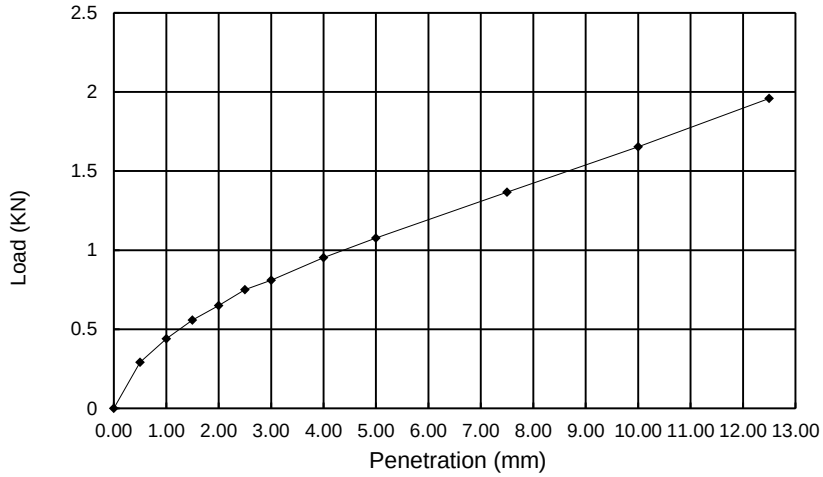
AS1289 6.1.1

Client:	Golder Associates	**Source:**	BH13 (1.0-2.0m)
Address:	PO Box 1302, Crows Nest NSW 1585	**Sample Description:**	sandy CLAY
Project:	Former Bus Depot - 185 Fifteenth Ave, West Hoxton (147622023)	**Report No.:**	S2187-CBR
Job No.:	S15036	**Lab No.:**	S2187

Test Procedure:

- ☑ AS1289 6.1.1 Soil strength and consolidation tests - Determination of the California Bearing Ratio of a soil - Standard laboratory method for a remoulded specimen
- ☑ AS1289 5.1.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
- ☑ AS1289 2.1.1 Soil moisture content tests - Determination of the moisture content of a soil - Oven drying method (standard method

Sampling:	Sampled by Client	**Date Sampled:**	Unknown
Preparation:	Prepared in accordance with AS1289 1.1		



Compaction and Placement Data

Compaction Used		Standard	Dry Density				
Maximum Dry Density t/m^3		1.86	At Compaction	1.82	t/m^3	98.0	% Comp.
Optimum Moisture Content %		12.5	After Soaking	TBA	t/m^3	TBA	% Comp.
No. of Layers		3	Moisture Content				Moisture Ratio (%)
Blows per Layer		53	At Compaction		%	12.9	103
Drop of Rammer	mm	300	After Soaking		%	TBA	TBA
Mass of Rammer	kg	2.7	After Penetration (Top 30mm)		%	TBA	TBA
Surcharge Used	kg	4.5	After Penetration (Entire Depth)		%	TBA	TBA
% Ret. 19mm Sieve		0	Swell After 4 Days Soaking		%	2.3	

Note: material coarser than +19mm Sieve was discarded (as per test method)

California Bearing Ratio

CBR (4-day Soaked) = 6.0 % at 2.5 mm Penetration

Notes:

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

NATA Accredited Laboratory Number: 14874

Authorised Signatory:

26/02/2015

Date:

MACQUARIE GEOTECH

Facility Name: Sydney Branch Site
Facility Location: 8/10 Bradford Street, Alexandria NSW 2015
Site No.: 22365

Macquarie Geotechnical
3 Watt Drive
BATHURST NSW 2795

EMERSON CLASS NUMBER REPORT

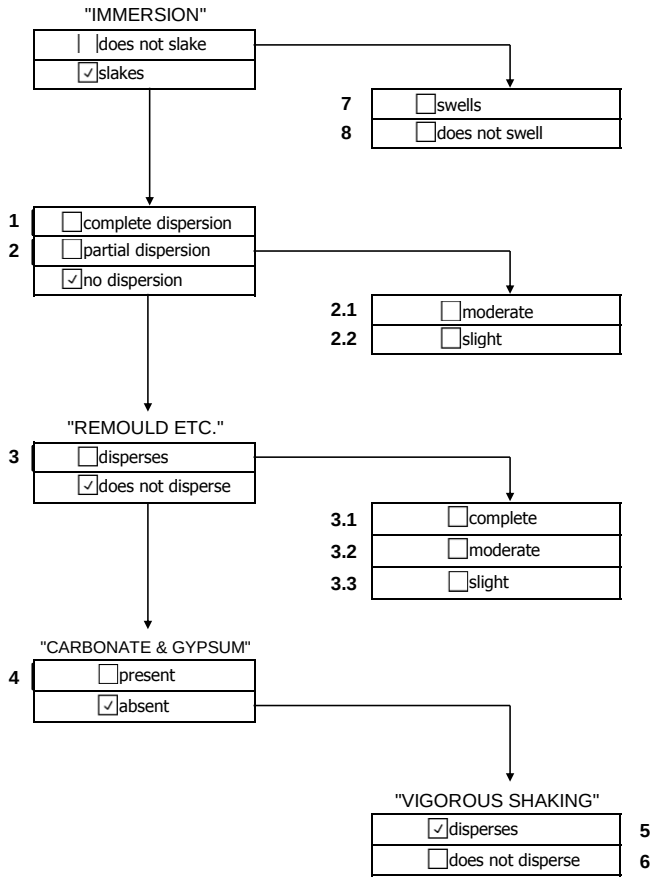
AS1289 3.8.1

Client:	Golder Associates	**Source:**	BH13 (1.0-2.0m)
Address:	PO Box 1302, Crows Nest NSW 1585	**Sample Description:**	sandy CLAY
Project:	Former Bus Depot - 185 Fifteenth Ave, West Hoxton (147622023)	**Report No:**	S2187-EM
Job No:	S15036	**Lab No:**	S2187

Test Procedure: ☑ AS1289 3.8.1 Soil classification tests - Dispersion - Determination of Emerson class number of a soil

Sampling: Sampled by Client **Date Sampled:** Unknown

Preparation: Prepared in accordance with the test method



Water Type	**Distilled**
Water Temperature (°c)	**23**

RESULT:

Emerson Class No.	**5**

Authorised Signatory:

NATA Accredited Laboratory Number: 14874

Chris Lloyd

26/02/2015

Date:

Facility Name: Sydney Branch Site
Facility Location: 8/10 Bradford Street, Alexandria NSW 2015
Site No.: 22365

Macquarie Geotechnical
3 Watt Drive
BATHURST NSW 2795

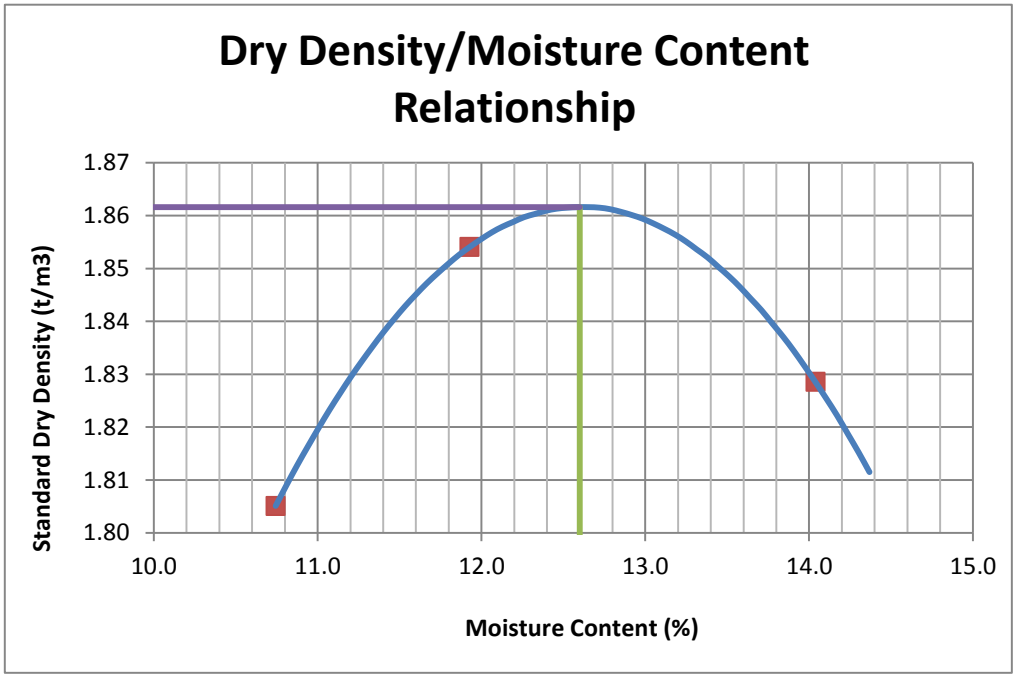
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

AS1289 5.1.1

Client:	Golder Associates	**Source:**	BH13 (1.0-2.0m)
Project:	Former Bus Depot - 185 Fifteenth Ave, West Hoxton (147622023)	**Report No:**	S2187-MDD
Address:	PO Box 1302, Crows Nest NSW 1585	**Sample Description:**	sandy CLAY
Job No:	S15036	**Lab No:**	S2187

Test Procedure:
- ☑ AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
- ☑ AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	**Date Sampled:**	Unknown
Preparation:	Prepared in accordance with the test method		



Maximum Dry Density (t/m^3)	1.862
Optimum Moisture Content (%)	12.5
Percentage Oversize on 19mm sieve (%)	0
Percentage Oversize on 37.5mm sieve (%)	0

Authorised Signatory:

26/02/2015

NATA Accredited Laboratory Number: 14874

Chris Lloyd

Date:

MACQUARIE GEOTECH

Facility Name: Sydney Branch Site
Facility Location: 8/10 Bradford Street Alexandria NSW 2015
Site No.: 22365

Macquarie Geotechnical
3 Watt Drive
Bathurst NSW 2795

APPENDIX C

Limitations

LIMITATIONS

This Document has been provided by Golder Associates Pty Ltd ("Golder") subject to the following limitations:

This Document has been prepared for the particular purpose outlined in Golder's proposal and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose.

The scope and the period of Golder's Services are as described in Golder's proposal, and are subject to restrictions and limitations. Golder did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Golder in regards to it.

Conditions may exist which were undetectable given the limited nature of the enquiry Golder was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required.

In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. Golder's opinions are based upon information that existed at the time of the production of the Document. It is understood that the Services provided allowed Golder to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

Any assessments made in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.

Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Golder for incomplete or inaccurate data supplied by others.

Golder may have retained subconsultants affiliated with Golder to provide Services for the benefit of Golder. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any direct legal recourse to, and waives any claim, demand, or cause of action against, Golder's affiliated companies, and their employees, officers and directors.

This Document is provided for sole use by the Client and is confidential to it and its professional advisers. No responsibility whatsoever for the contents of this Document will be accepted to any person other than the Client. Any use which a third party makes of this Document, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. Golder accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this Document.

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates Pty Ltd
124 Pacific Highway
St. Leonards, New South Wales 2065
Australia
T: +61 2 9478 3900

Golder Associates