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LIPMAN PTY LTD

Geotechnical Investigation

1H Hospital Road, Concord West NSW

E25996.G03
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Revision	Details	Date	Amended By
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1. Introduction

1.1 Background

At the request of Mr Jacob Nielson on behalf of Lipman Pty Ltd (the Client), EI Australia (EI) has carried out a Geotechnical Investigation (GI) for the proposed development at 1H Hospital Road, Concord West NSW (the Site).

This GI report has been prepared to provide advice and recommendations to assist in the preparation of designs for the proposed development. The investigation has been carried out in accordance with the agreed scope of works outlined in EI's proposal referenced P21305.1, dated 24 March 2023, and with the Client's signed authorisation to proceed, dated 2 June 2023.

1.2 Proposed Development

The following documents, supplied by the Client, were used to assist with the preparation of this GI report:

- Approximate Borehole Location Plan prepared by ACOR Consultants Pty Ltd;
- Ground Floor Overall Plan, drawing ref.: 221192-S-07.00 Revision 1, prepared by NBRS & Partners Pty Ltd;
- Site Layout Plan, drawing ref.: 22071-A-0200 Revision 4, prepared by NBRS & Partners Pty Ltd;
- Investigation brief provided by the client.

Based on the provided documents, EI understand the following to be the proposed development:

- The development area hereafter referred to as the 'Site' is irregular in shape, currently occupied by an existing building in part, with the remaining areas comprising car park, driveways and lawns;
- The existing building will be demolished to make wat for a new building; and
- The development is proposed to comprise a three-storey building with no basement.

1.3 Objectives

The objective of the GI was to assess site surface and subsurface conditions at seven (7) borehole locations, and to provide geotechnical advice and recommendations addressing the following:

- Building foundation options, including;
  - Appropriate foundation materials for the proposed structural footings;
  - Geotechnical parameters;
  - Foundation types, serviceability bearing pressures and settlements;
  - Earthquake loading factor in accordance with AS1170.4:2007.
- Earthworks and subgrade preparation recommendations;
- The requirement for additional geotechnical works.

1.4 Scope of Works

The scope of works for the GI included:

- Preparation of a Work Health and Safety Plan;
- Review of relevant geological maps for the project area;
- Site walkover inspection by a Geotechnical Engineer to assess topographical features and site conditions;
- Scanning of proposed borehole locations for buried conductive services using a licensed service locator with reference to Dial Before You Dig (DBYD) plans;
- Auger drilling of seven boreholes (BH1M, BH2, BH3M, BH4, BH5, BH6M and BH7) by a track-mounted drill rig using solid flight augers equipped with a 'Tungsten-Carbide' (T-C) bit. The boreholes were auger drilled to depths as shown in **Table 1-1** below:

Table 1-1 Auger Drilling and Rock Coring Depths

Borehole ID	Augering	Rock Coring
	Termination Depth (m)	Termination Depth (m)
BH1M	3.00	7.60
BH2	3.00	7.24
BH3M	2.52	6.0
BH4	2.70	6.0
BH5	3.45	6.0
BH6M	2.30	7.2
BH7	3.0	6.0

- Standard Penetration Testing (SPT) was carried out (as per AS 1289.6.3.1-2004), where possible, during auger drilling of the boreholes to assess soil strength/relative densities.
- Measurements of groundwater seepage/levels, where possible, in the augered sections of the boreholes during and shortly after completion of auger drilling;
- The strength of the bedrock in the augered sections of the boreholes was assessed by observation of the auger penetration resistance using a T-C drill bit and examination of the recovered rock cuttings. It should be noted that rock strengths assessed from augered boreholes are approximate and strength variances can be expected.
- Continuation of all boreholes using NMLC diamond rock coring techniques to termination depths shown above in **Table 1-1**. The rock core photographs are presented in **Appendix A**;
- Borehole BH1M, BH3M and BH6M were converted into groundwater monitoring wells with screen depths of between 3m to 6m in all three wells to allow for future groundwater monitoring.

- Borehole BH2, BH4, BH5, and BH7 were backfilled with drilling spoils and capped with concrete upon completion;
- Soil and rock core samples were sent to STS Geotechnics Pty Ltd (STS) and SGS Australia (SGS), which are National Australian Testing Authority (NATA) accredited laboratories, for testing and storage.
- Preparation of this GI report.

EI's Geotechnical Engineer was present full-time onsite to set out the borehole locations, direct the testing and sampling, log the subsurface conditions and record groundwater levels.

1.5 Constraints

The GI was limited by the intent of the investigation and the presence of existing site structures. The discussions and advice presented in this report are intended to assist in the preparation of initial designs for the proposed development. Further geotechnical inspections should be carried out during construction to confirm the geotechnical and groundwater models, and the design parameters provided in this report.

The presence of underground services and the need to maintain vehicle thoroughfare within the investigation area precluded positioning of boreholes at locations stipulated in the Client's investigation brief. EI have relocated boreholes (where required) to as close as possible to the intended locations.

2. Site Description

2.1 Site Description and Identification

The site identification details and associated information are presented in **Table 2-1** below while the site locality is shown on **Figure 1.** An aerial photograph of the site is presented in **Plate 1** below.

Table 2-1 Summary of Site Information

Information	Detail
Street Address	1H Hospital Road, Concord West NSW
Lot and Deposited Plan (DP) Identification	Lot 2 in DP 1280788
Brief Site Description	The site was occupied by an existing single-storey building in the southern portion of the site. The remaining areas are open space comprising lawns and asphalt surfaced car park and access roadways.
Site Area	The site area is approximately 2,706m^2

Plate 1: Aerial photograph of the site (source: SIXMaps, accessed 30/5/23)

2.2 Local Land Use

The site is situated within an area of commercial (hospital) use. Current uses on surrounding land at the time of our presence on site are described in **Table 2-2** below. For the sake of this report, the site boundary adjacent to Hospital Road shall be adopted as the northern site boundary.

Table 2-2 Summary of Local Land Use

Direction Relative to Site	Land Use Description
North	Hospital Road, a two lane, asphalt-paved road.
East	Manning Concord Hospital unit 110, a double storey brick rendered facility.
South	Jara Ward unit 112, a single storey brick building with grassy areas.
West	Concord medical education centre unit 26, a single brick rendered building.

2.3 Regional Setting

The site topography and geological information for the locality is summarised in **Table 2-3** below**.**

Table 2-3 Topographic and Geological Information

Attribute	Description
Topography	The site is located at the central portion of the Concord Hospital within gently (0° to 5°), south-west dipping topography.
Regional Geology	Information on regional sub-surface conditions, referenced from the Department of Mineral Resources Geological Map Sydney 1:100,000 Geological Series Sheet 9130 (DMR 1983) indicates the site to be underlain by Quaternary Aged Holocene deposits (Qha) associated with stream alluvial and estuarine sediments, which consists of silty to peaty quartz sand, silt, and clay, Ferruginous and humic cementation in places, and common shell layers. It is expected that the soils are underlain by Hawkesbury Sandstone. Previous geotechnical site investigations by Coffey Services Australia were carried out as part of the Phase 2 redevelopment of the hospital precinct in 2016 to 2017. The Phase 2 redevelopment footprint investigated by Coffey was located west and south-west of the subject site. The borehole encountered Ashfield Shale (Rwa) and Hawkesbury Sandstone (Rh) beneath the overburden soils. Depending on location, a residual soil profile was encountered beneath the Quaternary alluvium. Shale bedrock was encountered at depths ranging from 1.2m to 2m below ground surface levels underlain by Sandstone at depths of about 8m to 10m.

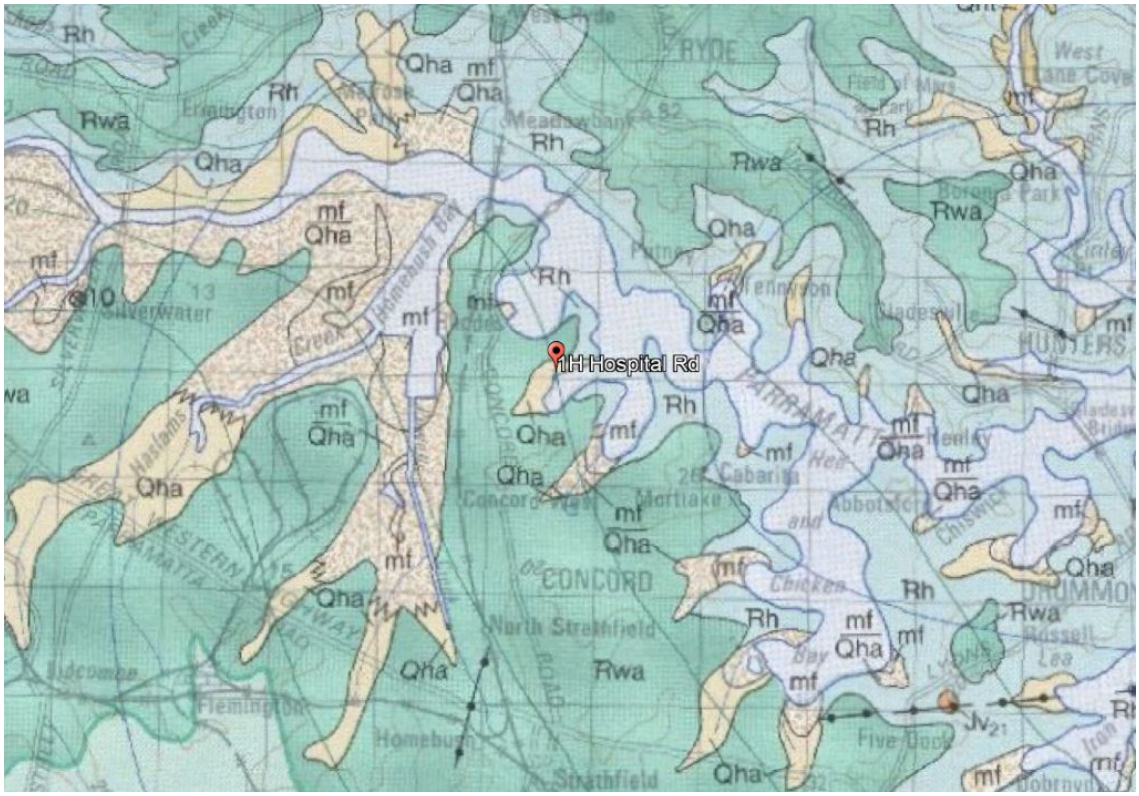


Plate 2: Excerpt of geological map showing location of site.

3. Investigation Results

3.1 Stratigraphy

For the development of a site-specific geotechnical model, the stratigraphy observed in the GI has been grouped into four geotechnical units. A summary of the subsurface conditions across the site, interpreted from the assessment results, is presented in **Table 3-1** below. More detailed descriptions of subsurface conditions at each borehole location are available on the borehole logs presented in **Appendix A**. The details of the methods of soil and rock classifications, explanatory notes and abbreviations adopted on the borehole logs are also presented in **Appendix A.**

Table 3-1 Summary of Subsurface Conditions

Unit	Material[2]	Depth to Top of Unit (m BEGL)[1]	Observed Thickness (m)	Comments
1	**Topsoil/Fill**	Surface to 0.15	0.3 to 1.6	Asphalt pavements of 100mm to 150mm thickness, underlain by well compacted Fill material comprising fine to medium grained silty sand with traces of sub-angular to sub-rounded gravels, and appeared well compacted based on our observations during drilling and SPT N value of 11 in BH6M.
2	**Residual Soil / Extremely Weathered Sandstone (Class V)**	0.3 to 1.6	1.0 to 3.6	Low to medium plasticity, stiff to hard clay, overlying extremely weathered sandstone (assess Class V Sandstone). SPT N values range from 14 to practical refusal (hammer bounding) in the overburden soils profile. The hammer bounced occurred in extremely weathered sandstone. From depths between 3.0m to 4.15m and 3.0 to 3.2m, core loss of 1150mm and 200mm was observed in BH1M and BH7 respectively. Core loss is inferred to be extremely weathered sandstone.
3a	**Class IV Sandstone**	2.52 to 4.3	0.3 to 3.11	Distinctly weathered, very low to medium strength sandstone. A layer of very low to medium strength shale was observed in BH2 from depths between 3m to 5.5m. Core losses observed in BH2, BH4M, and BH6M are inferred to be bands of decomposed or highly fractured material.
3b	**Class III Sandstone**	3.85 to 6.11	-[3]	Slightly weathered medium to high strength sandstone.

Note 1 Approximate depth and level at the time of our assessment. Depths and levels may vary across the site.
Note 2 For more detailed descriptions of the subsurface conditions, reference should be made to the borehole logs attached to **Appendix A.**
Note 3 Observed up to termination depth in all boreholes.

Table 3-2 Depth to Overburden Units and Rock Classes

Unit	Depth to top of material unit (m BEGL)						
	BH1M	BH2	BH3M	BH4	BH5	BH6M	BH7
1 – Topsoil/Fill	0.10	0.10	0.00	0.00	0.15	0.00	0.10
2 – Residual Soil/ Extremely Weathered Sandstone (Class V)	0.60	0.60	0.30	0.70	0.60	1.60	0.80
3a – Class IV Sandstone	4.15	3.00	2.52	4.30	3.55	-	4.20
3b – Class III Sandstone	6.00	6.11	4.35	5.15	3.85	4.20	4.10

3.2 Groundwater Observations

Following completion of auger drilling, groundwater monitoring wells were installed in BH1M, BH3M, and BH6M and bailed dry. The groundwater levels were then measured within the monitoring wells as per **Table 3-3** below:

Table 3-3 Groundwater Levels

Borehole ID	Groundwater Seepage Level During Auger Drilling	Monitoring Well Details		Groundwater Level After Well Development	Measurement Date
	m BEGL	Screened Zone (mBEGL)	Screen Length (m)	m BEGL	
BH1M	Not encountered	3 - 6	3.0	2.27	25-July-2023
BH3M	Not encountered	3 - 6	3.0	2.44	25-July-2023
BH6M	Not encountered	3 - 6	3.0	2.58	25-July-2023

No groundwater or significant seepage was observed during or after auger drilling of the boreholes. We note that the groundwater levels may not have become evident or stabilised in the augered boreholes within the limited observation period. Water circulation as is required for rock coring within the boreholes prevented further observations of groundwater levels within the cored section of the boreholes. No long term groundwater monitoring was carried out.

3.3 Test Results

Ten grab size soil samples and one bulk size sample were selected for laboratory testing to assess the following:

- Atterberg Limits;
- Soil Moisture Content;
- Particle Size Distribution;
- Soil aggressivity (pH, chloride and sulfate content and electrical conductivity); and
- California Bearing Ratio (CBR).

A summary of the soil test results is provided in **Table 3-4** and **Table 3-5** below. Laboratory test certificates are presented in **Appendix B**.

Table 3-4 Summary of Soil Laboratory Test Results

Test/ Sample ID		BH1M 1.5-1.65	BH7 1.5-1.8	BH5 3.0-3.45	BH4 1.5-1.85	BH5 1.5-1.68	BH3M 1.5-1.95	BH2 1.5-1.72	BH6M 1.5-1.95
Unit		2	2	2	2	2	2	2	2
Material Description [1]		Residual Soil/ Extremely Weathered Sandstone							
Aggressivity	Chloride Cl (ppm)	290	70	520	-	-	-	-	-
	Sulfate SO_4 (ppm)	160	91	170	-	-	-	-	-
	pH	5.1	5.5	4.3	-	-	-	-	-
	Electrical Conductivity (µS/cm)	240	110	480	-	-	-	-	-
	Moisture Content (%)	10.8	12.1	-	13.0	11.8	17.0	17.0	22.6
Atterberg Limits	Liquid Limit (%)	37	36	-	39	40	-	-	-
	Plastic Limit (%)	20	21	-	21	21	-	-	-
	Plasticity Index (%)	17	15	-	18	19	-	-	-
Particle Size Distribution	Gravel (%)	-	-	-	-	-	6.0	13.5	7.1
	Sand (%)	-	-	-	-	-	6.1	23.7	9.7
	Clay & Silt (%)	-	-	-	-	-	87.9	62.8	83.2

Note 1 More detailed descriptions of the subsurface conditions at each borehole location are available on the borehole logs presented in **Appendix A**.

The Atterberg Limits result on the selected clay samples indicated clays to be of medium plasticity and therefore expected to exhibit moderate shrink-swell potential.

The assessment indicated low permeability soil was present both above and below the groundwater table. In accordance with Tables 6.4.2(C) and 6.5.2(C) of AS 2159:2009 'Piling – Design and Installation', the results of the pH, chloride and sulfate content and electrical conductivity of the soil provided the following exposure classifications:

- 'Moderate' for buried concrete structural elements; and
- 'Non-Aggressive' for buried steel structural elements.

Table 3-5 Summary of CBR Test Results

Test/ Sample ID	BH6_CBR
Depth (m BEGL)	1.5-1.6
Unit	1
Material Description [1]	FILL: Sandy Clay, low to medium plasticity
CBR (4-day Soaked) (%)	8.0
Maximum Dry Density (t/m^3)	1.784
Optimum Moisture Content OMC (%)	16.4
Field Moisture Content FMC (%)	14.8
Moisture deviation from OMC	1.6% Dry

Note 1 More detailed descriptions of the subsurface conditions at each borehole location are available on the borehole logs presented in **Appendix A**.

Bulk samples of the Unit 1 silty clay fill material from BH6 was tested for standard compaction and four day soaked CBR with 9kg surcharge, yielding a CBR value of 8%.

Twenty-eight selected rock core samples were tested by STS Geotechnics Pty Ltd to estimate the Point Load Strength Index (Is_{50}) values to assist with rock strength assessment. The results of the testing are summarised on the laboratory test report and replicated in the borehole logs.

4. Recommendations

4.1 Geotechnical Considerations

Based on the results of the assessment, we consider the following to be the main geotechnical considerations for the proposed development:

- Foundation design for building loads;
- Earthworks and subgrade preparation;
- Design subgrade CBR value to inform pavement thickness design.

4.2 Site Preparation

At the time of preparing this report, the design subgrade levels for the building and subgrade levels for pavements are not known. It is assumed that the proposed building and pavements will be constructed at grade with minimal cut/fill operations.

Based on subsurface conditions encountered in all boreholes, the materials expected to be encountered within the depth of excavation / stripping for site preparation may include topsoil and fill comprising silty sand and clayey sand. Fill materials comprising sandy clay was encountered to a depth of 1.6m BEGL at the location of BH6M, although it may not be encountered during site preparation works considering that BH6M is located outside the proposed building footprint. Excavation of topsoil and fill may be readily achieved using excavators fitted with excavation buckets and if needed fitted with tiger teeth.

Following removal of all vegetation and trees (including their root balls), demolition of the existing structures, slabs and pavements, all grass, topsoil, root affected soils and any deleterious fill (if present) or contaminated soil should be stripped. Based on the results of the investigation, topsoil/root affected soil should be stripped to a nominal depth. We note that it is difficult to accurately assess the depth of topsoil and root affected soils. If considered to be an important contractual issue, we recommend that a number of shallow test pits be excavated across the site to more accurately confirm the topsoil/root affected soil stripping depth or alternatively a geotechnical inspection could be carried out after initial stripping to confirm the depth. Stripped topsoil and root affected soils should be stockpiled separately as they are considered unsuitable for reuse as engineered fill.

4.3 Foundations

At the time of preparing this report, the design building loads are not known.

The most competent foundation stratum at the site is the underlying sandstone bedrock, and in view of the relatively shallow bedrock depths and shallow groundwater levels, we recommend that the proposed building be supported on pile footings founded into the underlying sandstone bedrock. However, the option of piled stiffened raft slab footings is also provided.

We note that only one groundwater measurement visit was carried out post site investigation in the three installed groundwater monitoring wells on 25 July 2023. We recommend that additional groundwater studies may be required, including pump out testing and groundwater level measurement to understand the groundwater regime to inform recommendations on groundwater control during pile hole drilling.

4.3.1 Pile Footings

The proposed building may be supported on deep foundations, such as piles, founded into sandstone bedrock.

The recommended bearing pressures and shaft adhesion for foundation bored piles are presented in **Table 4-1**.

Table 4-1 Summary of foundation parameters for bored piles

Rock Class	Serviceability End Bearing Pressure (kPa)[3]	Ultimate Shaft Adhesion - Compression (kPa)[2]
Class V Sandstone	700	100
Class IV Sandstone	2000	500
Class III Sandstone	4000	1000

Notes:

1 More detailed descriptions of subsurface conditions are available on the borehole logs presented in **Appendix A.**

2 Side adhesion values given assume there is intimate contact between the pile and foundation material and should achieve a clean socket roughness category R2 or better. Design engineer to check both 'piston pull-out' and 'cone liftout' mechanics in accordance with AS4678-2002 Earth Retaining Structures.

3 To adopt these parameters we have assumed that:

- Footings have a nominal socket of at least 0.3m, into the relevant founding material;
- For piles, there is intimate contact between the pile and foundation material (a clean socket roughness category of R2 or better);
- Potential soil and groundwater aggressivity will be considered in the design of piles and footings;
- Piles should be drilled in the presence of a Geotechnical Engineer prior to pile construction to verify that ground conditions meet design assumptions. Where groundwater ingress is encountered during pile excavation, concrete is to be placed as soon as possible upon completion of pile excavation. Pile excavations should be pumped dry of water prior to pouring concrete, or alternatively a tremmie system could be used;
- The bases of all pile, pad and strip footing excavations are cleaned of loose and softened material and water is pumped out prior to placement of concrete;
- The concrete is poured on the same day as drilling, inspection and cleaning.
- The allowable bearing pressures given above are based on serviceability criteria of settlements at the footing base/pile toe of less than or equal to 1% of the minimum footing dimension (or pile diameter).

The shaft adhesion for uplift in sandstone bedrock may adopt 50% of that in compression for the socket length in excess of 0.5m into the material.

It must be noted that all footings should be founded on similar materials and rock class to minimise the impact of differential settlement.

At least the initial drilling of piles should be completed in the presence of a geotechnical engineer to verify that ground conditions meet design assumptions.

Where groundwater ingress is encountered during pile excavation, concrete is to be placed as soon as possible upon completion of pile excavation. Pile excavations should be pumped dry of water and sludge and cleaned using a cleaning bucket prior to pouring concrete. The use of a tremmie pipe to place concrete from the base of the open pile hole is recommended. Concrete must be poured on the same day as drilling, inspection and drilling.

The aggressivity of natural soils and groundwater (if encountered) should be taken into consideration in the design.

4.3.2 Piled Stiffened Raft Slab

Raft slabs are well suited to uniform slab conditions and building loads. Further detailed evaluation of expected performance including the evaluation of allowable bearing pressures and settlements would be required once design loads, founding level, and column layout are better known.

In the case of a piled stiffened raft slab, the piles are designed to their ultimate capacity and act as settlement reducers to the stiffened raft slab.

The subgrade preparation below any raft slabs will be important in the final performance of the raft. Detailed analysis of a piled raft would be required to estimate the settlements and the contact pressures below the raft. Further discussion regarding sub-grade preparation is provided in **Section 4.4** below. It is also recommended that a 150mm thick layer of good quality granular material such as recycled concrete or crushed rock be placed and compacted over the prepared surface, particularly at heavily loaded areas. This layer helps confine the sandy soils from disturbances and improve the compacted and density of the surface soils.

4.4 Subgrade Preparation and Engineered Fill

4.4.1 Subgrade Preparation for slabs and pavements

Earthworks recommendations provided in this report should be complemented by reference to AS3798-2007.

- Considering that the depth of existing fill materials are relatively shallow (within 0.6m of the existing ground surface) across the proposed building footprint, and the history and compaction control of that existing fill is not known, it is therefore recommended that the fill should be fully excavated down to surface of the residual soils, and stockpiled separately for further suitability assessment for potential re-use as engineered fill. Such excavation may need to be carried out with the excavation sides battered at an angle of no steeper than 1 Vertical to 3 Horizontal. The new fill must be 'keyed-in' the sides of these batters.
- The exposed subgrade at the base of the excavation should be proof rolled with a smooth drum roller (say 12 tonne) used in static or non-vibratory mode of operation. Caution is required when proof rolling near existing infrastructures and utilities (where present). The purpose of the proof rolling is to detect any soft or heaving areas, and to allow for some further improvement in strength or compaction.
- The final pass should be undertaken in the presence of an experienced geotechnician or geotechnical engineer, to detect any unstable or soft subgrade areas, and to allow for some further improvement in strength/compaction.
- If dry conditions prevail at the time of construction then any exposed alluvial clay subgrade may become desiccated or have shrinkage cracks prior to pouring any concrete slabs. If this occurs, the subgrade must be watered and rolled until the cracks disappear.
- Unstable subgrade detected during proof rolling should be locally excavated down to a sound base and replaced with engineered fill or further advice should be sought. Any fill placed to raise site levels should also be engineered fill, as per the specifications below.
- Where a raft slab is adopted, the geotechnical engineer would also need to carry out a series of Dynamic Cone Penetrometer (DCP) tests to assess the consistency of the subgrade materials. We expect that a capping layer of well graded crushed rock or recycled concrete (maximum particle size limited to 40mm) will be required to achieve adequate compaction. This granular layer will be required below the entire raft slab and would be of about 150mm thick.
- The performance of raft (including piled raft) slabs are also dependent on the whole of the design and construction team being familiar with the sensitivity of the situation. It is essential that any services which have to be placed in the subgrade are carefully positioned and an appropriate construction schedule/sequence is provided to the geotechnical engineer for approval at the planning stage.
- Disturbance of the subgrade must be minimised and kept outside the zone of influence of column or wall loads. A documented Inspection and Test Plan (ITP) should be prepared prior to construction with appropriate "hold" points in the Quality System.

4.4.2 Engineered Fill Specifications

Any fill used to backfill unstable subgrade areas, raise surface levels or backfill service trenches should be engineered fill. Materials preferred for use as engineered fill are well-graded granular materials, such as ripped or crushed sandstone, free of deleterious substances and having a maximum particle size not exceeding 75 mm. such fill should be compacted in layers not greater than 200 mm loose thickness, to a minimum density of 98% of SMDD for cohesive soils, or minimum density index of 75% for cohesionless soils.

Density tests should be regularly carried out on the fill to confirm the above specifications are achieved. The frequency of density testing should be at least one test per layer per material type per 1000 m^2 or 1 test per 200m^3 distributed reasonably evenly throughout full depth and area or 1 test per lot per layer, whichever requires the most tests, commensurate to Type 2 earthworks per Table 8.1 of AS3798-2007. We recommend that at least Level 2 control of fill compaction, as defined in AS3798-2007, be adhered to on this Site. Preferably, the geotechnical testing authority (GTA) should be engaged directly on behalf of the client and not by the earthworks subcontractor.

We recommend that the engineered fill layers extend a horizontal distance of at least 1m beyond the design geometry. The roller must extend over the edge of each placed layer in order to seal the batter surface. On completion of filling, the excess under-compacted edge fill should be trimmed back to the design geometry.

The ‘tying in’ of engineered fill to temporary cut batter slopes can be achieved by locally benching the cut slopes in no greater than 0.4m high steps. This can be carried out progressively as the height of engineered fill increases.

For backfilling confined excavations such as service trenches, a similar compaction to engineered fill should be adhered to, but if light compaction equipment is used then the layer thickness should be limited to 100mm loose thickness.

During construction of the fill, platform runoff should be enhanced by providing suitable falls to reduce ponding of water on the surface of the fill. Ponding of water may lead to softening of the fill and subsequent delays in the earthworks program. A poorly drained subgrade may become un-trafficable when wet. We recommend that if soil softening occurs, the subgrade be over-excavated to below the affected soil, and then replaced with engineered fill as specified above.

4.5 Pavement Subgrade

The design of new pavements will depend on subgrade preparation, subgrade drainage, the nature and composition of fill excavated or imported to the site, as well as vehicle loadings and use. Various alternative types of construction could be used for the pavements. Concrete construction would undoubtedly be the best in areas where heavy vehicles manoeuvre such as trucks turning and manoeuvring. Flexible pavements may have a lower initial cost, but maintenance will be higher. These factors should be considered when making the final choice.

Based on the laboratory test results, the samples collected of the existing sandy clay from BH6M returned a CBR value 8%. Additional CBR testing of subgrade materials will be required where the subgrade materials and conditions differ to that tested across proposed pavement areas.

Further soaked CBR tests may be carried out on representative samples of the subgrade to obtain a large population of values to enable a proper statistical analysis to be performed and possibly an increase in the design CBR value. However, it should be borne in mind that even with more test values being obtained there will still be isolated pavement areas where the risk of potential failure and higher maintenance will occur due to the subgrade having a lower CBR value than the statistical characteristic value opted for design purposes.

We recommend that in situ density tests be completed on the proof rolled and prepared subgrade to confirm that at least 98% Standard Maximum Dry Density (SMDD) has been achieved. If the existing fill is removed and replaced with imported fill, the CBR of the imported material may be taken into account. These design values should be confirmed by inspection and Dynamic Cone Penetration (DCP) testing of the subgrade following proof rolling.

All upper (base) course should be crushed rock to RMS QA specification 3051 (2013) unbound base and compacted to at least 100% of SMDD. All lower (sub-base) course should be crushed rock to RMS QA specification 3051 (2013) unbound base or ripped/crushed sandstone with CBR greater than 40%, maximum particle size of 60mm, well graded and Plastic Index less than 10. All lower course material should be compacted to an average of no less than 100% of SMDD, but with a minimum acceptance value of 98% of SMDD.

Concrete pavements should have a sub-base layer of at least 100mm thickness of crushed rock to RMS QA specification 3051 (2013) unbound base material (or equivalent good quality and durable fine crushed rock) which is compacted to at least 100% SMDD. Concrete pavements should be designed with an effective shear transmission of all joints by way of either doweled or keyed joints.

Careful attention to subsurface and surface drainage is required in view of the effect of moisture on the clay soils. Pavement levels will need to be graded to promote rapid removal of surface water so ponding does not occur on the surface of pavements. The drainage trenches should be excavated with a uniform longitudinal fall to appropriate discharge points so as to reduce the risk of water ponding. The capacity of the stormwater collection system from the pavement should be checked and upgraded if necessary. In order to protect the pavement edge, subsoil drains should be provided along the perimeter of all proposed new external pavement areas, particularly in those areas of cut, with invert levels of at least 200mm below subgrade level.

The long-term successful performance of the pavements is dependent on the satisfactory completion of the earthworks. In order to achieve this, the quality assurance programme should not be limited to routine compaction density testing only. Other important factors associated with the earthworks includes subgrade preparation, selection of fill materials, control of moisture content and drainage, etc.

5. Further Geotechnical Inputs

Below is a summary of the recommended additional work that may need to be carried out:

- Additional CBR tests to inform pavement thickness design, if required;
- Classification of all excavated material transported off site; and
- Geotechnical inspections of all new footings/piles by an experienced geotechnical professional before concrete or steel are placed to verify their bearing capacity and the in-situ nature of the founding strata.

We recommend that a meeting be held after initial structural design has been completed to confirm that our recommendations have been correctly interpreted. We also recommend a meeting at the commencement of construction to discuss the primary geotechnical issues and inspection requirements.

6. Statement of Limitations

This report has been prepared for the exclusive use of Craig Butler and Lipman Pty Ltd who is the only intended beneficiary of EI's work. The scope of the assessment carried out for the purpose of this report is limited to those agreed with Craig Butler and Lipman Pty Ltd

No other party should rely on the document without the prior written consent of EI, and EI undertakes no duty, or accepts any responsibility or liability, to any third party who purports to rely upon this document without EI's approval.

EI has used a degree of care and skill ordinarily exercised in similar investigations by reputable members of the geotechnical industry in Australia as at the date of this document. No other warranty, expressed or implied, is made or intended. Each section of this report must be read in conjunction with the whole of this report, including its appendices and attachments.

The conclusions presented in this report are based on a limited investigation of conditions, with specific sampling and test locations chosen to be as representative as possible under the given circumstances.

EI's professional opinions are reasonable and based on its professional judgment, experience, training and results from analytical data. EI may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified by EI.

EI's professional opinions contained in this document are subject to modification if additional information is obtained through further investigation, observations, or validation testing and analysis during construction. In some cases, further testing and analysis may be required, which may result in a further report with different conclusions.

We draw your attention to the document "Important Information", which is included in **Appendix D** 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 EI, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

Should you have any queries regarding this report, please do not hesitate to contact EI.

References

AS1289.6.3.1:2004, *Methods of Testing Soils for Engineering Purposes,* Standards Australia.

AS1726:2017, *Geotechnical Site Investigations*, Standards Australia.

AS2159:2009, *Piling – Design and Installation*, Standards Australia.

AS3600:2009, *Concrete Structures,* Standards Australia

AS3798-2007, Guidelines on Earthworks for Commercial and Residential Developments

Safe Work Australia Excavation Work Code of Practice, dated January 2020 – WorkCover NSW

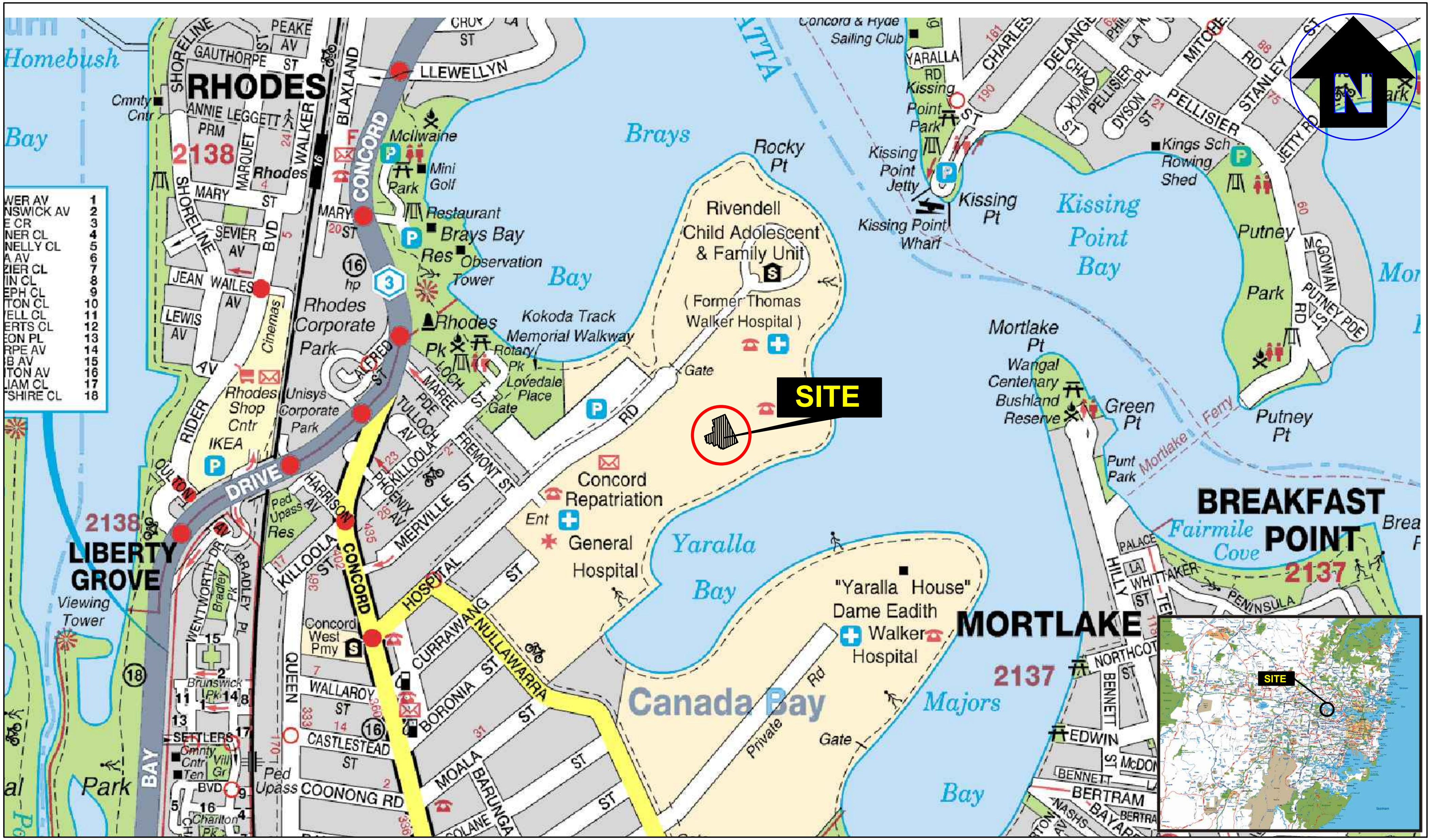
NSW Department of Finance and Service, Spatial Information Viewer, maps.six.nsw.gov.au.

NSW Department of Mineral Resources (1983) Sydney 1:100,000 Geological Series Sheet 9130 (Edition 1). Geological Survey of New South Wales, Department of Mineral Resources.

Abbreviations

AHD	Australian Height Datum
AS	Australian Standard
BEL	Bulk Excavation Level
BEGL	Below Existing Ground Level
BH	Borehole
DBYD	Dial Before You Dig
DP	Deposited Plan
EI	EI Australia
GI	Geotechnical Investigation
NATA	National Association of Testing Authorities, Australia
RL	Reduced Level
SPT	Standard Penetration Test
T-C	Tungsten-Carbide
UCS	Unconfined Compressive Strength

Figures



Drawn:	J.O.
Approved:	M.L.
Date:	8-8-2023
Scale:	Not To Scale

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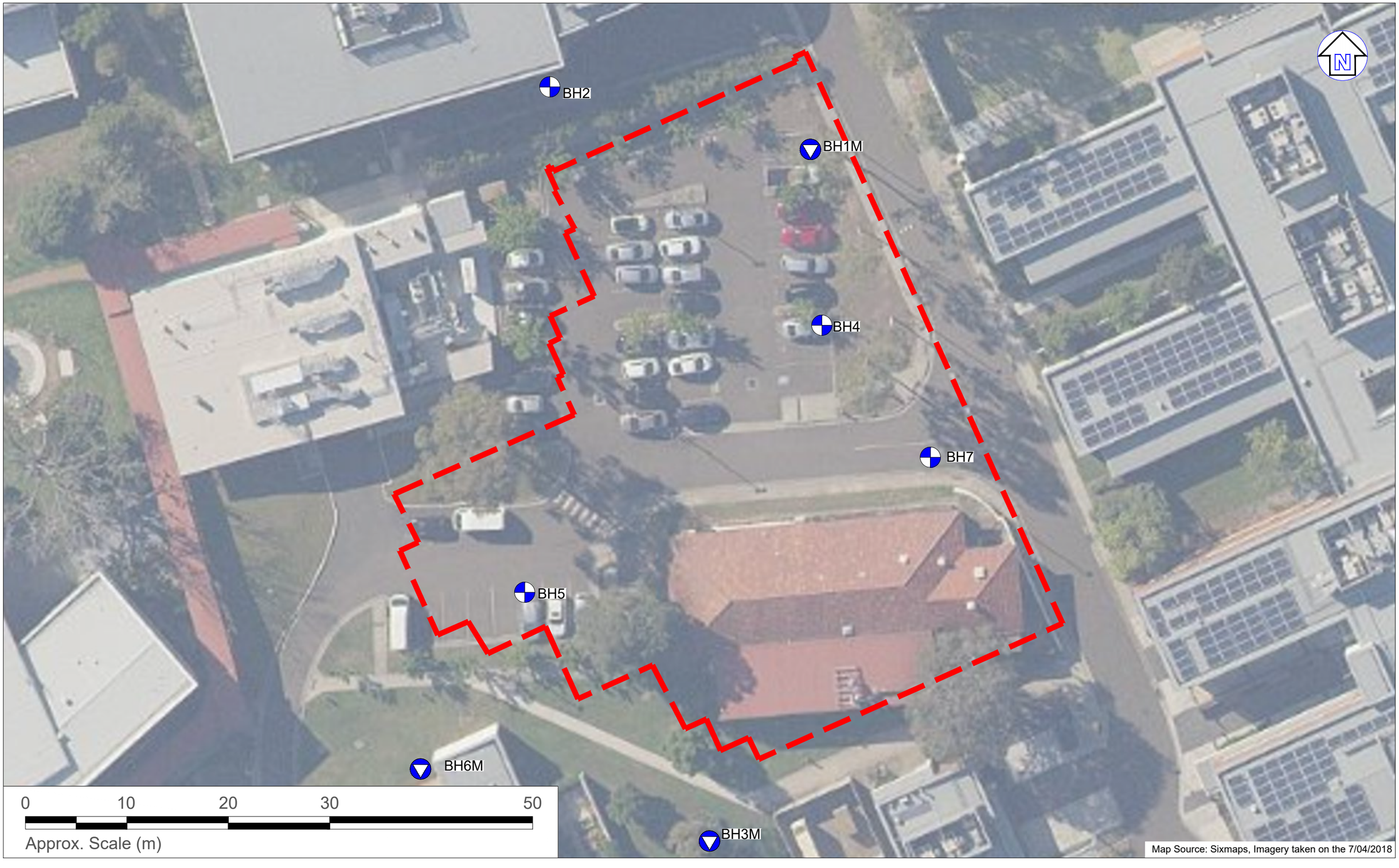
Lipman Pty Ltd
Geotechnical Investigation
1H Hospital Road, Concord, NSW
Site Locality Plan

Figure: 1

Project: E25996.G03



LEGEND (Note: All locations are approximate)

- Site boundary
- Borehole locations
- Monitoring Well locations

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Drawn:	J.O.
Approved:	M.L.
Date:	8-8-2023

Lipman Pty Ltd
Geotechnical Investigation
1H Hospital Road, Concord, NSW
Borehole Location Plan

Figure: 2

Project: E25996.G03

Appendix A – Borehole Logs And Explanatory Notes

BOREHOLE LOG

BH ID: BH1M

Location	1H Hospital Road, Concord West, NSW		**Started**	24 May 2023	
Client	Lipman Pty Ltd		**Completed**	24 May 2023	
Job No.	E25996.G03		**Logged By**	JO	**Date** 24 May 2023
Sheets	1 of 2		**Review By**	ML	**Date** 08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL** -	**Northing**	6254460.6730 (MGA 2020 Zone 56)	
Plant	Comacchio Geo 205	**Inclination** 90°	**Easting**	323863.8164 (MGA 2020 Zone 56)	

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	7/25/2023 7:10:00 AM			0			ASPHALT: 100mm thick	-	-	ASPHALT
				0.00			FILL: Silty SAND: fine to medium grained, dark brown with sub-angular to sub-rounded gravels, appears well compacted.	D	-	FILL
		BH1M_0.50-0.95 SPT 0.50-0.95 8,15,30 N=45		0.10						
				0.60			Silty CLAY: low to medium plasticity, pale grey-orange	M < PL	H	RESIDUAL SOIL
		BH1M_1.50-1.65 SPT 1.50-1.65 18/150 mm HB N=R		1						
				1.65			SANDSTONE: fine to medium grained, pale grey-orange, extremely weathered.	-	-	WEATHERED ROCK
				2						
				3			*Log continued on next page.*			
				3.00						
				4						
				5						
				6						
				7						
				8						
				9						
				10						

BOREHOLE LOG

BH ID: BH1M

Location	1H Hospital Road, Concord West, NSW			**Started**	24 May 2023
Client	Lipman Pty Ltd			**Completed**	24 May 2023
Job No.	E25996.G03			**Logged By**	JO **Date** 24 May 2023
Sheets	2 of 2			**Review By**	ML **Date** 08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL**	-	**Northing**	6254460.6730 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	323863.8164 (MGA 2020 Zone 56)

METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral (VL 0-1, L 0-3, M 1, H 3, VH 10, EH)	DISCONTINUITIES & ADDITIONAL DATA	FRACTURE SPACING (30, 100, 300, 1000, 3000)
				0			*Log continued from previous page.*				
				1							
				2							
				3			NO CORE: 1150mm thick	-			
	0% Water	0	0	4							
NMLC				4.15			SANDSTONE: fine to medium grained, pale grey-orange, thinly to medium bedded	DW	▼		
		100	57	5				SW	▼		
	90% Water			6					▼	5.91: JT 45° PR SM CN	
		100	92	7				FR	▼	7.43: JT 1° PR SM CN	
				8			Terminated at 7.60m. Target Depth Reached.				
				9							
				10							

BOREHOLE LOG

BH ID: BH1M

Location	1H Hospital Road, Concord West, NSW			**Started**	24 May 2023
Client	Lipman Pty Ltd			**Completed**	24 May 2023
Job No.	E25996.G03			**Logged By**	JO **Date** 24 May 2023
Sheets	1 of 1			**Review By**	ML **Date** 08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL**	-	**Northing**	6254460.6730 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	323863.8164 (MGA 2020 Zone 56)

WATER	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION
7/25/2023 7:10:00 AM ▼	BH1M_0.50-0.95 SPT 0.50-0.95 8,15,30 N=45	0.00			ASPHALT: 100mm thick	-
		0.10			FILL: Silty SAND: fine to medium grained, dark brown with sub-angular to sub-rounded gravels, appears well compacted.	D
		0.60			Silty CLAY: low to medium plasticity, pale grey-orange	M < PL
	BH1M_1.50-1.65 SPT 1.50-1.65 18/150 mm HB N=R	1.65			SANDSTONE: fine to medium grained, pale grey-orange, extremely weathered.	-
0% Water		3.00			NO CORE: 1150mm thick	
90% Water		4.15			SANDSTONE: fine to medium grained, pale grey-orange, thinly to medium bedded	
		7.60			Terminated at 7.60m. Target Depth Reached.	

BACKFILL DETAILS	STANDPIPE DETAILS
Grout 0.00m - 0.10m	Well Stickup =0.0m
Sand 0.10m - 2.50m	0.0m - 3.0m PVC casing (50mm Ø)
Bentonite 2.50m - 3.00m	
Sand 3.00m - 7.60m	3.0m - 6.0m PVC screen (50mm Ø)

CORE PHOTOGRAPH OF BOREHOLE: BH1M

Project	Proposed Redevelopment			**Depth Range**	3.0m to 7.60m BEGL		
Location	1H Hospital Road, Concord West, NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ -	**Drill Rig**	Comacchio GEO 205		
Job No.	E25669.G03	**Inclination**	-90°	**Logged**	JO	**Date**	24 / 05 / 2023
Client	Lipman Pty Ltd	**Box**	1 of 1	**Checked**	KX	**Date**	16 / 06 / 2023

BOREHOLE LOG

BH ID: BH2

Location	1H Hospital Road, Concord West, NSW		**Started**	24 May 2023	
Client	Lipman Pty Ltd		**Completed**	24 May 2023	
Job No.	E25996.G03		**Logged By**	JO	**Date** 24 May 2023
Sheets	1 of 2		**Review By**	ML	**Date** 08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL** -	**Northing**	6254491.6526 (MGA 2020 Zone 56)	
Plant	Comacchio Geo 205	**Inclination** 90°	**Easting**	323813.7977 (MGA 2020 Zone 56)	

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	GWNE	BH2_0.50-0.95 SPT 0.50-0.95 4,6,8 N=14		0.00 0.10			ASPHALT: 100mm thick			ASPHALT
							FILL: Silty SAND: fine to medium grained, dark brown with sub-angular to sub-rounded gravels, appears well compacted.	D	-	FILL
				0.60			Silty CLAY: low to medium plasticity, brown	M < PL	St	RESIDUAL SOIL
		BH2_1.50-1.72 SPT 1.50-1.72 7,8/75 mm HB N=R		1.72			SANDSTONE: fine to medium grained, pale grey-orange, extremely weathered.	-	-	WEATHERED ROCK
				3.00			*Log continued on next page.*			

BOREHOLE LOG

BH ID: BH2

Location	1H Hospital Road, Concord West, NSW			**Started**	24 May 2023
Client	Lipman Pty Ltd			**Completed**	24 May 2023
Job No.	E25996.G03			**Logged By**	JO **Date** 24 May 2023
Sheets	2 of 2			**Review By**	ML **Date** 08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL**	-	**Northing**	6254491.6526 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	323813.7977 (MGA 2020 Zone 56)

METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral (VL 0-1, L 0-3, M 1, H 3, VH 10, EH)	DISCONTINUITIES & ADDITIONAL DATA	FRACTURE SPACING (30, 100, 300, 1000, 3000)
				0			*Log continued from previous page.*				
NMLC	90% Water	78	31	3			SHALE: dark grey-brown, very thinly bedded	DW	▼	3.10-3.15: CS	
				4.24			NO CORE: 360mm thick	-			
		67	15	4.60			SHALE: dark grey-brown, thinly bedded	SW	▼		
				5.50			SANDSTONE: fine to medium grained, pale grey			5.50-5.59: CS	
				5.58			NO CORE: 530mm thick	-			
		100	96	6.11			SANDSTONE: fine to medium grained, pale grey, medium bedded	FR	▼		
				7			Terminated at 7.24m. Target Depth Reached.				
				10							

CORE PHOTOGRAPH OF BOREHOLE: BH2

Project	Proposed Redevelopment			**Depth Range**	3.0m to 7.24m BEGL		
Location	1H Hospital Road, Concord West, NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ -	**Drill Rig**	Comacchio GEO 205		
Job No.	E25669.G03	**Inclination**	-90°	**Logged**	JO	**Date**	24 / 05 / 2023
Client	Lipman Pty Ltd	**Box**	1-2 of 2	**Checked**	KX	**Date**	16 / 06 / 2023

BOREHOLE LOG

BH ID: BH3M

Location	1H Hospital Road, Concord West, NSW		**Started**	23 May 2023	
Client	Lipman Pty Ltd		**Completed**	23 May 2023	
Job No.	E25996.G03		**Logged By**	JO	**Date** 23 May 2023
Sheets	1 of 2		**Review By**	ML	**Date** 08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL** -	**Northing**	6254391.6565 (MGA 2020 Zone 56)	
Plant	Comacchio Geo 205	**Inclination** 90°	**Easting**	323860.6592 (MGA 2020 Zone 56)	

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	7/25/2023 7:15:00 AM ▼	BH9M_0.50-0.95 SPT 0.50-0.95 4,6,8 N=14		0.00			FILL: Clayey SAND: fine to medium grained, dark brown, appears well compacted.	D	-	FILL
				0.30			Silty CLAY: low to medium plasticity, orange-brown	M < PL	St	RESIDUAL SOIL
		BH9M_1.50-1.95 SPT 1.50-1.95 6,7,12 N=19		1.80			From 1.80m, pale grey-orange		VSt	
				2.52			*Log continued on next page.*			

BOREHOLE LOG

BH ID: BH3M

Location	1H Hospital Road, Concord West, NSW			**Started**	23 May 2023
Client	Lipman Pty Ltd			**Completed**	23 May 2023
Job No.	E25996.G03			**Logged By**	JO **Date** 23 May 2023
Sheets	2 of 2			**Review By**	ML **Date** 08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL**	-	**Northing**	6254391.6565 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	323860.6592 (MGA 2020 Zone 56)

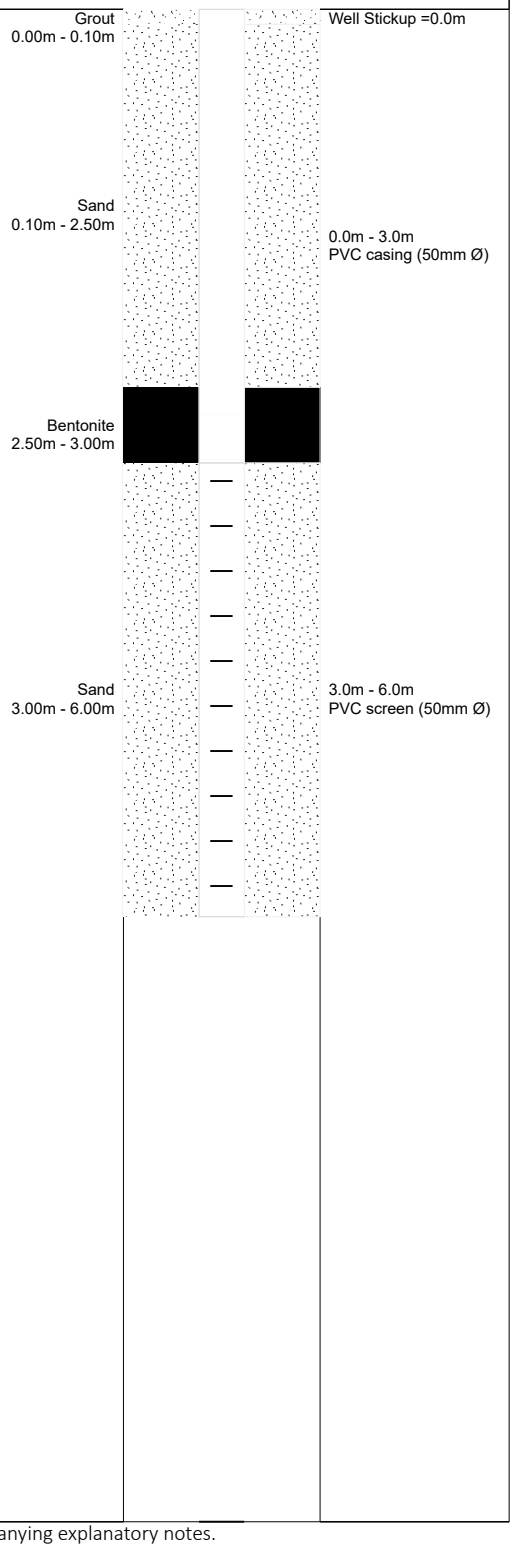
METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral (VL 0-1, L 0-3, M 1, H 3, VH 10, EH)	DISCONTINUITIES & ADDITIONAL DATA	FRACTURE SPACING (30, 100, 300, 1000, 3000)
				0			*Log continued from previous page.*				
NMLC	90%	100	26	3			SANDSTONE: fine to medium grained with iron staining and pale grey clay seams, very thinly bedded	DW			
		100	70	3.74			SANDSTONE: fine to medium grained, pale grey-brown mottled orange, very thinly bedded, with shale laminations				
				4.50			From 4.50m, pale grey-brown, thinly bedded	FR			
				6			Terminated at 6.00m. Target Depth Reached.				
				10							

BOREHOLE LOG

BH ID: BH3M

Location	1H Hospital Road, Concord West, NSW			**Started**	23 May 2023
Client	Lipman Pty Ltd			**Completed**	23 May 2023
Job No.	E25996.G03			**Logged By**	JO **Date** 23 May 2023
Sheets	1 of 1			**Review By**	ML **Date** 08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL**	-	**Northing**	6254391.6565 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	323860.6592 (MGA 2020 Zone 56)

WATER	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION
7/25/2023 7:15:00 AM ▼	BH9M_0.50-0.95 SPT 0.50-0.95 4,6,8 N=14	0.00			FILL: Clayey SAND: fine to medium grained, dark brown, appears well compacted.	D
		0.30			Silty CLAY: low to medium plasticity, orange-brown	M < PL
	BH9M_1.50-1.95 SPT 1.50-1.95 6,7,12 N=19	1.80			From 1.80m, pale grey-orange	
90%		2.52			SANDSTONE: fine to medium grained with iron staining and pale grey clay seams, very thinly bedded	
		3.74			SANDSTONE: fine to medium grained, pale grey-brown mottled orange, very thinly bedded, with shale laminations	
		4.50			From 4.50m, pale grey-brown, thinly bedded	
		6.00			Terminated at 6.00m. Target Depth Reached.	



CORE PHOTOGRAPH OF BOREHOLE: BH3M

Project	Proposed Redevelopment			**Depth Range**	2.52m to 6.0m BEGL		
Location	1H Hospital Road, Concord West, NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ -	**Drill Rig**	Comacchio GEO 205		
Job No.	E25669.G03	**Inclination**	-90°	**Logged**	JO	**Date**	23 / 05 / 2023
Client	Lipman Pty Ltd	**Box**	1 of 1	**Checked**	KX	**Date**	16 / 06 / 2023

BOREHOLE LOG

BH ID: BH4

Location	1H Hospital Road, Concord West, NSW			**Started**	23 May 2023
Client	Lipman Pty Ltd			**Completed**	23 May 2023
Job No.	E25996.G03			**Logged By**	JO **Date** 23 May 2023
Sheets	1 of 2			**Review By**	ML **Date** 08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL**	-	**Northing**	6254416.9818 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	323885.7601 (MGA 2020 Zone 56)

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	GWNE	BH4_0.50-0.95 SPT 0.50-0.95 8,6,12 N=18		0.00			FILL: Silty SAND: fine to medium grained, dark brown trace sub-angular to sub-rounded gravels, appears well compacted.	D	-	FILL
				0.70			Silty CLAY: low to medium plasticity, pale grey-orange	M < PL	VSt	RESIDUAL SOIL
		BH4_1.50-1.85 SPT 1.50-1.85 14,16,3/50 mm HB N=R		1.85			SANDSTONE: fine to medium grained, pale grey-orange extremely weathered.	-	-	WEATHERED ROCK
				2.70			*Log continued on next page.*			

BOREHOLE LOG

BH ID: BH4

Location	1H Hospital Road, Concord West, NSW			**Started**	23 May 2023
Client	Lipman Pty Ltd			**Completed**	23 May 2023
Job No.	E25996.G03			**Logged By**	JO **Date** 23 May 2023
Sheets	2 of 2			**Review By**	ML **Date** 08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL**	-	**Northing**	6254416.9818 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	323885.7601 (MGA 2020 Zone 56)

METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral (VL 0-1, L 0-3, M 1, H 3, VH 10, EH)	DISCONTINUITIES & ADDITIONAL DATA	FRACTURE SPACING (30, 100, 300, 1000, 3000)
				0			*Log continued from previous page.*				
				1							
				2							
NMLC	90% Water	96	28	3			SANDSTONE: fine to medium grained, pale grey with iron staining and clay seams, very thinly to thinly bedded	DW	▼		
				3.40			NO CORE: 900mm thick	-			
				4							
				4.30			SANDSTONE: fine to medium grained, pale grey with iron staining and clay seams, thinly to medium bedded	SW	▼	4.34-4.41: XWS	
		100	78	5				FR	▼		
				6			Terminated at 6.00m. Target depth reached.				
				7							
				8							
				9							
				10							

CORE PHOTOGRAPH OF BOREHOLE: BH4

Project	Proposed Redevelopment			**Depth Range**	2.70m to 6.0m BEGL		
Location	1H Hospital Road, Concord West, NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ -	**Drill Rig**	Comacchio GEO 205		
Job No.	E25669.G03	**Inclination**	-90°	**Logged**	JO	**Date**	23 / 05 / 2023
Client	Lipman Pty Ltd	**Box**	1 of 1	**Checked**	KX	**Date**	16 / 06 / 2023

BOREHOLE LOG

BH ID: BH5

Location	1H Hospital Road, Concord West, NSW		**Started**	23 May 2023	
Client	Lipman Pty Ltd		**Completed**	23 May 2023	
Job No.	E25996.G03		**Logged By**	JO	**Date** 23 May 2023
Sheets	1 of 2		**Review By**	ML	**Date** 08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL** -	**Northing**	6254415.7362 (MGA 2020 Zone 56)	
Plant	Comacchio Geo 205	**Inclination** 90°	**Easting**	323823.2479 (MGA 2020 Zone 56)	

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	GWNE	BH4_0.50-0.60 BH4_0.50-0.95 SPT 0.50-0.95 4,10,16 N=26		0.00 0.15 0.60 1 1.40 2 3			ASPHALT: 150mm thick	-	-	ASPHALT
							FILL: Silty SAND: fine to medium grained, brown with sub-angular to sub-rounded gravels, appears well compacted.	D	-	FILL
							Sandy CLAY: low to medium plasticity, pale grey-orange, sand is fine to medium grained	M < PL	VSt	RESIDUAL SOIL
		BH4_1.50-1.68 SPT 1.50-1.68 10,3/35 mm HB N=R					Silty CLAY: low to medium plasticity, pale grey-orange		H	
		BH4_3.00-3.45 SPT 3.00-3.45 20,16,19 N=35								
				3.45			*Log continued on next page.*			
				4 5 6 7 8 9 10						

BOREHOLE LOG

BH ID: BH5

Location	1H Hospital Road, Concord West, NSW			**Started**	23 May 2023
Client	Lipman Pty Ltd			**Completed**	23 May 2023
Job No.	E25996.G03			**Logged By**	JO **Date** 23 May 2023
Sheets	2 of 2			**Review By**	ML **Date** 08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL**	-	**Northing**	6254415.7362 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	323823.2479 (MGA 2020 Zone 56)

METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral (VL 0-1, L 0-3, M 1, H 3, VH 10, EH)	DISCONTINUITIES & ADDITIONAL DATA	FRACTURE SPACING (30, 100, 300, 1000, 3000)
				0			*Log continued from previous page.*				
				1							
				2							
				3							
NMLC	90% GWNE	100	92	4			SANDSTONE: fine to medium grained, pale grey-orange, thinly to medium bedded	DW			
				5				SW - FR			
				6			Terminated at 6.00m. Target Depth Reached.				
				7							
				8							
				9							
				10							

CORE PHOTOGRAPH OF BOREHOLE: BH5

Project	Proposed Redevelopment			**Depth Range**	3.45m to 6.0m BEGL		
Location	1H Hospital Road, Concord West, NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ -	**Drill Rig**	Comacchio GEO 205		
Job No.	E25669.G03	**Inclination**	-90°	**Logged**	JO	**Date**	23 / 05 / 2023
Client	Lipman Pty Ltd	**Box**	1 of 1	**Checked**	KX	**Date**	16 / 06 / 2023

BOREHOLE LOG

BH ID: BH6M

Location	1H Hospital Road, Concord West, NSW		**Started**	22 May 2023	
Client	Lipman Pty Ltd		**Completed**	22 May 2023	
Job No.	E25996.G03		**Logged By**	JO	**Date** 22 May 2023
Sheets	1 of 2		**Review By**	ML	**Date** 08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL** -	**Northing**	6254392.3215 (MGA 2020 Zone 56)	
Plant	Comacchio Geo 205	**Inclination** 90°	**Easting**	323853.4352 (MGA 2020 Zone 56)	

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	7/25/2023 7:20:00 AM	BH12M_0.50-0.95 SPT 0.50-0.95 4,5,6 N=11		0.00			FILL: Sandy CLAY: low to medium plasticity, brown-orange, with sub-angular to sub-rounded gravels, appears well compacted.	D	-	FILL
		BH12M_1.50-1.95 SPT 1.50-1.95 3,5,7 N=12		1.60			Silty CLAY: low to medium plasticity, pale grey-orange	M < PL	St	RESIDUAL SOIL
				2.30			*Log continued on next page.*			

BOREHOLE LOG

BH ID: BH6M

Location	1H Hospital Road, Concord West, NSW			**Started**	22 May 2023
Client	Lipman Pty Ltd			**Completed**	22 May 2023
Job No.	E25996.G03			**Logged By**	JO **Date** 22 May 2023
Sheets	2 of 2			**Review By**	ML **Date** 08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL**	-	**Northing**	6254392.3215 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	323853.4352 (MGA 2020 Zone 56)

METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral (VL 0-1, L 0-3, M 1, H 3, VH 10, EH)	DISCONTINUITIES & ADDITIONAL DATA	FRACTURE SPACING (30, 100, 300, 1000, 3000)
				0			*Log continued from previous page.*				
				1							
				2							
NMLC	0%	46	25	2.43			SANDSTONE: fine to medium grained, pale grey, thinly to medium bedded	DW		2.43-2.73: CZ	
				2.73			NO CORE: 1470mm thick	-			
				3							
				4							
				4.20			SANDSTONE: fine to medium grained, pale grey-orange, medium bedded	FR			
		100	100	5							
				6							
				7							
							Terminated at 7.20m. Target depth reached.				
				8							
				9							
				10							

BOREHOLE LOG

BH ID: BH6M

Location	1H Hospital Road, Concord West, NSW			**Started**	22 May 2023
Client	Lipman Pty Ltd			**Completed**	22 May 2023
Job No.	E25996.G03			**Logged By**	JO **Date** 22 May 2023
Sheets	1 of 1			**Review By**	ML **Date** 08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL**	-	**Northing**	6254392.3215 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	323853.4352 (MGA 2020 Zone 56)

WATER	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION
7/25/2023 7:20:00 AM	BH12M_0.50-0.95 SPT 0.50-0.95 4,5,6 N=11	0.00			FILL: Sandy CLAY: low to medium plasticity, brown-orange, with sub-angular to sub-rounded gravels, appears well compacted.	D
	BH12M_1.50-1.95 SPT 1.50-1.95 3,5,7 N=12	1.60			Silty CLAY: low to medium plasticity, pale grey-orange	M < PL
0%		2.30			SANDSTONE: fine to medium grained, pale grey, thinly to medium bedded	
		2.73			NO CORE: 1470mm thick	
		4.20			SANDSTONE: fine to medium grained, pale grey-orange, medium bedded	
		7.20			Terminated at 7.20m. Target depth reached.	

BACKFILL DETAILS

Grout 0.00m - 0.10m

Sand 0.10m - 2.50m

Bentonite 2.50m - 3.00m

Sand 3.00m - 7.20m

STANDPIPE DETAILS

Well Stickup =0.0m

0.0m - 3.0m PVC casing (50mm Ø)

3.0m - 6.0m PVC screen (50mm Ø)

CORE PHOTOGRAPH OF BOREHOLE: BH6M

Project	Proposed Redevelopment			**Depth Range**	2.3m to 7.2m BEGL		
Location	1H Hospital Road, Concord West, NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ -	**Drill Rig**	Comacchio GEO 205		
Job No.	E25669.G03	**Inclination**	-90°	**Logged**	JO	**Date**	22 / 05 / 2023
Client	Lipman Pty Ltd	**Box**	1 of 1	**Checked**	KX	**Date**	16 / 06 / 2023

BOREHOLE LOG

BH ID: BH7

Location	1H Hospital Road, Concord West, NSW	**Started**	24 May 2023		
Client	Lipman Pty Ltd	**Completed**	24 May 2023		
Job No.	E25996.G03	**Logged By**	JO	**Date**	24 May 2023
Sheets	1 of 2	**Review By**	ML	**Date**	08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL**	-	**Northing**	6254445.9364 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	323879.7716 (MGA 2020 Zone 56)

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	GWNE	BH7_0.50-0.95 SPT 0.50-0.95 5,5,13 N=18		0.00 0.10			ASPHALT: 100mm thick	-	-	ASPHALT
							FILL: Silty SAND: fine to medium grained, dark brown with sub-angular to sub-rounded gravels, appears well compacted.	D	-	FILL
				0.80 1			Silty CLAY: low to medium plasticity, brown-orange trace sub-angular to sub-rounded gravels	M < PL	VSt	RESIDUAL SOIL
		BH7_1.50-1.80 SPT 1.50-1.80 8,21/150 mm HB N=R		1.60 2			SANDSTONE: fine to medium grained, pale grey, extremely weathered.	-	-	WEATHERED ROCK
				3			*Log continued on next page.*			
				3.00 4 5 6 7 8 9 10						

BOREHOLE LOG

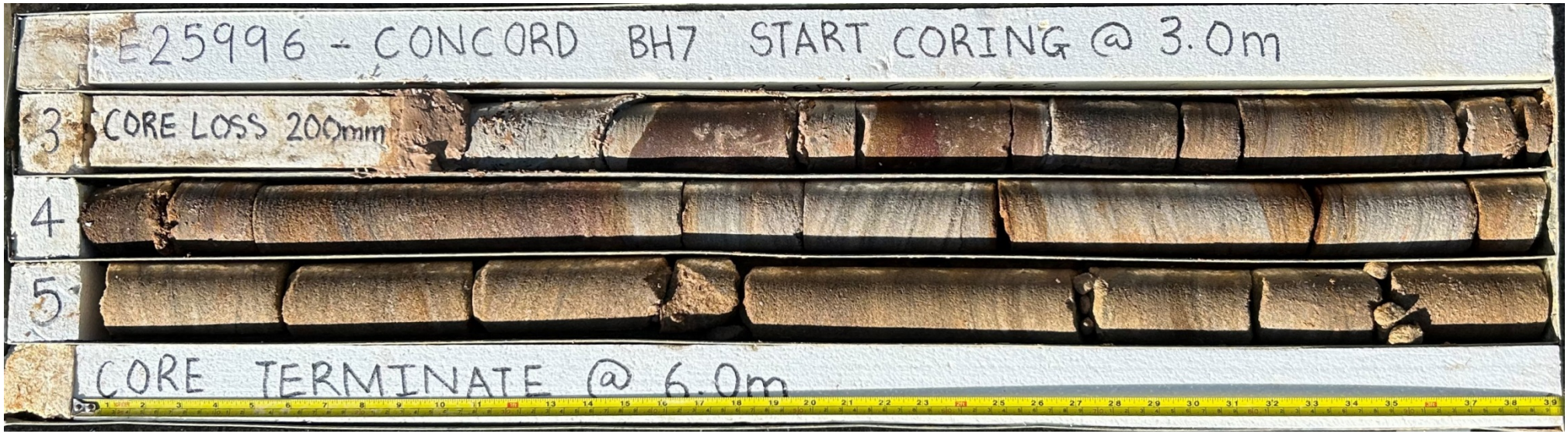
BH ID: BH7

Location	1H Hospital Road, Concord West, NSW			**Started**	24 May 2023
Client	Lipman Pty Ltd			**Completed**	24 May 2023
Job No.	E25996.G03			**Logged By**	JO **Date** 24 May 2023
Sheets	2 of 2			**Review By**	ML **Date** 08 August 2023
Drilling Contractor	Geosense Drilling Engineers	**Surface RL**	-	**Northing**	6254445.9364 (MGA 2020 Zone 56)
Plant	Comacchio Geo 205	**Inclination**	90°	**Easting**	323879.7716 (MGA 2020 Zone 56)

METHOD	Flush Return	TCR %	RQD %	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	WEATHERING	ESTIMATED STRENGTH Is(50) ▼ - Axial ▽ - Diametral (VL 0-1, L 0-3, M 1, H 3, VH 10, EH)	DISCONTINUITIES & ADDITIONAL DATA	FRACTURE SPACING (30, 100, 300, 1000, 3000)
				0			*Log continued from previous page.*				
				1							
				2							
				3			NO CORE: 200mm thick	-			
NMLC	90% Water	93	60	3.20			SANDSTONE: fine to medium grained, pale grey-brown, thinly to medium bedded	SW	▼	3.20-3.25: XWS	
				4					▼		
				5				FR	▼		
				6			Terminated at 6.00m. Target Depth Reached.				
				7							
				8							
				9							
				10							

CORE PHOTOGRAPH OF BOREHOLE: BH7

Project	Proposed Redevelopment			**Depth Range**	3.0m to 6.0m BEGL		
Location	1H Hospital Road, Concord West, NSW			**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ -	**Drill Rig**	Comacchio GEO 205		
Job No.	E25669.G03	**Inclination**	-90°	**Logged**	JO	**Date**	24 / 05 / 2023
Client	Lipman Pty Ltd	**Box**	1 of 1	**Checked**	KX	**Date**	16 / 06 / 2023



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

DRILLING/EXCAVATION METHOD

HA	Hand Auger	**ADH**	Hollow Auger	**NQ**	Diamond Core - 47 mm
DT	Diatube Coring	**RT**	Rotary Tricone bit	**NMLC**	Diamond Core - 52 mm
NDD	Non-destructive digging	**RAB**	Rotary Air Blast	**HQ**	Diamond Core - 63 mm
AD*	Auger Drilling	**RC**	Reverse Circulation	**HMLC**	Diamond Core - 63 mm
***V**	V-Bit	**PT**	Push Tube	**EX**	Tracked Hydraulic Excavator
***T**	TC-Bit, e.g. AD/T	**WB**	Washbore	**HAND**	Excavated by Hand Methods

PENETRATION RESISTANCE

L	**Low Resistance**	Rapid penetration/ excavation possible with little effort from equipment used.
M	**Medium Resistance**	Penetration/ excavation possible at an acceptable rate with moderate effort from equipment used.
H	**High Resistance**	Penetration/ excavation is possible but at a slow rate and requires significant effort from equipment used.
R	**Refusal/Practical Refusal**	No further progress possible without risk of damage or unacceptable wear to equipment used.

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

WATER

Standing Water Level — **Partial water loss**

Water Seepage — **Complete Water Loss**

GWNO	GROUNDWATER NOT OBSERVED - Observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave-in of the borehole/ test pit.
GWNE	GROUNDWATER NOT ENCOUNTERED - 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 AS1289.6.3.1-2004
4,7,11 N=18	4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following a 150mm seating drive
30/80mm	Where practical refusal occurs, the blows and penetration for that interval are reported, N is not reported
RW	Penetration occurred under the rod weight only, N<1
HW	Penetration occurred under the hammer and rod weight only, N<1
HB	Hammer double bouncing on anvil, N is not reported
Sampling	
DS	Disturbed Sample
ES	Sample for environmental testing
BDS	Bulk disturbed Sample
GS	Gas Sample
WS	Water Sample
U50	Thin walled tube sample - number indicates nominal sample diameter in millimetres
Testing	
FP	Field Permeability test over section noted
FVS	Field Vane Shear test expressed as uncorrected shear strength (sv= peak value, sr= residual value)
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket Penetrometer test expressed as instrument reading in kPa
WPT	Water Pressure tests
DCP	Dynamic Cone Penetrometer test
CPT	Static Cone Penetration test
CPTu	Static Cone Penetration test with pore pressure (u) measurement

GEOLOGICAL BOUNDARIES

———— = Observed Boundary (position known)

– – – – – – – – – – = Observed Boundary (position approximate)

– –?– –?– –?– – = Boundary (interpreted or inferred)

ROCK CORE RECOVERY

TCR=Total Core Recovery (%)

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

RQD = Rock Quality Designation (%)

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

METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT LOGS

	FILL		ORGANIC SOILS (OL, OH or Pt)		CLAY (CL, CI or CH)
	COUBLES or BOULDERS		SILT (ML or MH)		SAND (SP or SW)
	GRAVEL (GP or GW)	Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay			

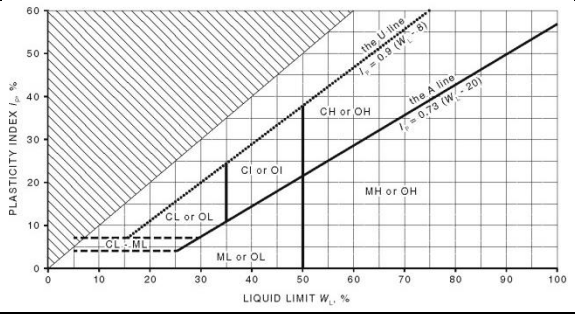
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS 1726:2017, Section 6.1 – Soil description and classification.

PARTICLE SIZE CHARACTERISTICS

Fraction	Components	Sub Division	Size mm
Oversize	BOULDERS		>200
	COBBLES		63 to 200
Coarse grained soil	GRAVEL	Coarse	19 to 63
		Medium	6.7 to 19
		Fine	2.36 to 6.7
	SAND	Coarse	0.6 to 2.36
		Medium	0.21 to 0.6
		Fine	0.075 to 0.21
Fine grained soil	SILT		0.002 to 0.075
	CLAY		<0.002

PLASTICITY PROPERTIES



GROUP SYMBOLS

Major Divisions		Symbol	Description
COARSE GRAINED SOILS More than 65% of soil excluding oversize fraction is greater than 0.075mm	GRAVEL More than 50% of coarse fraction is >2.36mm	GW	Well graded gravel and gravel-sand mixtures, little or no fines, no dry strength.
		GP	Poorly graded gravel and gravel-sand mixtures, little or no fines, no dry strength.
		GM	Silty gravel, gravel-sand-silt mixtures, zero to medium dry strength.
		GC	Clayey gravel, gravel-sand-clay mixtures, medium to high dry strength.
	SAND More than 50% of coarse fraction is <2.36 mm	SW	Well graded sand and gravelly sand, little or no fines, no dry strength.
		SP	Poorly graded sand and gravelly sand, little or no fines, no dry strength.
		SM	Silty sand, sand-silt mixtures, zero to medium dry strength.
		SC	Clayey sand, sandy-clay mixtures, medium to high dry strength.
FINE GRAINED SOILS More than 35% of soil excluding oversized fraction is less than 0.075mm	Liquid Limit less < 50%	ML	Inorganic silts of low plasticity, very fine sands, rock flour, silty or clayey fine sands, zero to medium dry strength.
		CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, medium to high dry strength.
		OL	Organic silts and organic silty clays of low plasticity, low to medium dry strength.
	Liquid Limit > than 50%	MH	Inorganic silts of high plasticity, high to very high dry strength.
		CH	Inorganic clays of high plasticity, high to very high dry strength.
		OH	Organic clays of medium to high plasticity, medium to high dry strength.
Highly Organic soil		PT	Peat muck and other highly organic soils.

MOISTURE CONDITION

Symbol	Term	Description
D	Dry	Non- cohesive and free-running.
M	Moist	Soils feel cool, darkened in colour. Soil tends to stick together.
W	Wet	Soils feel cool, darkened in colour. Soil tends to stick together, free water forms when handling.

Moisture content of cohesive soils shall be described in relation to plastic limit (PL) or liquid limit (LL) for soils with higher moisture content as follows: Moist, dry of plastic limit (w < PL); Moist, near plastic limit (w ≈ PL); Moist, wet of plastic limit (w < PL); Wet, near liquid limit (w ≈ LL), Wet, wet of liquid limit (w > LL),

CONSISTENCY

Symbol	Term	Undrained Shear Strength (kPa)	SPT "N" #
VS	Very Soft	≤ 12	≤ 2
S	Soft	>12 to ≤ 25	>2 to ≤ 4
F	Firm	>25 to ≤ 50	>4 to 8
St	Stiff	>50 to ≤ 100	>8 to 15
VSt	Very Stiff	>100 to ≤ 200	>15 to 30
H	Hard	>200	>30
Fr	Friable	-	

DENSITY

Symbol	Term	Density Index %	SPT "N" #
VL	Very Loose	≤ 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	>85	Above 50

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.
SPT correlations are not stated in AS1726:2017, and may be subject to corrections for overburden pressure, moisture content of the soil, and equipment type.

MINOR COMPONENTS

Term	Assessment Guide	Proportion by Mass
Add 'Trace'	Presence just detectable by feel or eye but soil properties little or no different to general properties of primary component	Coarse grained soils: ≤ 5% Fine grained soil: ≤ 15%
Add 'With'	Presence easily detectable by feel or eye but soil properties little or no different to general properties of primary component	Coarse grained soils: 5 - 12% Fine grained soil: 15 - 30%
Prefix soil name	Presence easily detectable by feel or eye in conjunction with the general properties of primary component	Coarse grained soils: >12% Fine grained soil: >30%

TERMS FOR ROCK MATERIAL STRENGTH AND WEATHERING

CLASSIFICATION AND INFERRED STRATIGRAPHY

Rock is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS1726 – 2017, Section 6.2 – Rock identification, description and classification.

ROCK MATERIAL STRENGTH CLASSIFICATION

Symbol	Term	Point Load Index, $Is_{(50)}$ (MPa) #	Field Guide
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)

Relationship between rock strength test result ($Is_{(50)}$) and unconfined compressive strength (UCS) will vary with rock type and strength, and should be determined on a site-specific basis. However UCS is typically 20 x $Is_{(50)}$.

ROCK MATERIAL WEATHERING CLASSIFICATION

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.
XW		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. In some environments it is convenient to subdivide into Highly Weathered and Moderately Weathered, with the degree of alteration typically less for MW.
	MW		
SW		Slightly Weathered	Rock 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 AND DESCRIPTIONS FOR ROCK MATERIAL AND DEFECTS

CLASSIFICATION AND INFERRED STRATIGRAPHY
Rock is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS1726 – 2017, Section 6.2 – Rock identification, description and classification.

DETAILED ROCK DEFECT SPACING

Defect Spacing

Spacing/width (mm)	Descriptor	Symbol
<20	Extremely Close	EC
20-60	Very Close	VC
60-200	Close	C
200-600	Medium	M
600-2000	Wide	W
2000-6000	Very Wide	VW

Bedding Thickness (Stratification)

Term	Spacing (mm)
Thinly laminated	<6
Laminated	6 – 20
Very thinly bedded	20 – 60
Thinly bedded	60 – 200
Medium bedded	200 – 600
Thickly bedded	600 – 2,000
Very thickly bedded	> 2,000

ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT TYPES

Defect Type	Abbr.	Description
Joint	JT	Surface of a fracture or parting, formed without displacement, across which the rock has little or no tensile strength. May be closed or filled by air, water or soil or rock substance, which acts as cement.
Bedding Parting	BP	Surface of fracture or parting, across which the rock has little or no tensile strength, parallel or sub-parallel to layering/ bedding. Bedding refers to the layering or stratification of a rock, indicating orientation during deposition, resulting in planar anisotropy in the rock material.
Contact	CO	The surface between two types or ages of rock.
Sheared Surface	SSU	A near planar, curved or undulating surface which is usually smooth, polished or slickensided.
Sheared Seam/ Zone (Fault)	SS/SZ	Seam or zone with roughly parallel almost planar boundaries of rock substance cut by closely spaced (often <50 mm) parallel and usually smooth or slickensided joints or cleavage planes.
Crushed Seam/ Zone (Fault)	CS/CZ	Seam or zone composed of disoriented usually angular fragments of the host rock substance, with roughly parallel near-planar boundaries. The brecciated fragments may be of clay, silt, sand or gravel sizes or mixtures of these.
Extremely Weathered Seam/ Zone	XWS/XWZ	Seam of soil substance, often with gradational boundaries, formed by weathering of the rock material in places.
Infilled Seam	IS	Seam of soil substance, usually clay or clayey, with very distinct roughly parallel boundaries, formed by soil migrating into joint or open cavity.
Vein	VN	Distinct sheet-like body of minerals crystallised within rock through typically open-space filling or crack-seal growth.

NOTE: Defects size of <100mm SS, CS and XWS. Defects size of >100mm SZ, CZ and XWZ.

ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT SHAPE AND ROUGHNESS

Shape	Abbr.	Description	Roughness	Abbr.	Description
Planar	PR	Consistent orientation	Polished	POL	Shiny smooth surface
Curved	CU	Gradual change in orientation	Slickensided	SL	Grooved or striated surface, usually polished
Undulating	UN	Wavy surface	Smooth	SM	Smooth to touch. Few or no surface irregularities
Stepped	ST	One or more well defined steps	Rough	RO	Many small surface irregularities (amplitude generally <1mm). Feels like fine to coarse sandpaper
Irregular	IR	Many sharp changes in orientation	Very Rough	VR	Many large surface irregularities, amplitude generally >1mm. Feels like very coarse sandpaper

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

ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT COATING

Coating	Abbr.	Description
Clean	CN	No visible coating or infilling
Stain	SN	No visible coating but surfaces are discoloured by staining, often limonite (orange-brown)
Veneer	VNR	A visible coating of soil or mineral substance, usually too thin to measure (< 1 mm); may be patchy

DEFECT APERTURE

Aperture	Abbr.	Description
Closed	CL	Closed.
Open	OP	Without any infill material.
Infilled	-	Soil or rock i.e. clay, silt, talc, pyrite, quartz, etc.

Appendix B – Laboratory Certificates

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

Contact	Jacky Ong
Client	EI AUSTRALIA
Address	SUITE 6.01 55 MILLER STREET PYRMONT NSW 2009
Telephone	61 2 95160722
Facsimile	(Not specified)
Email	jacky.ong@eiaustralia.com.au
Project	**E25996.G03 1H Hospital Road, Concord NSW**
Order Number	**E25996.G03**
Samples	3

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE248316 R0**
Date Received	30/5/2023
Date Reported	6/6/2023

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

SIGNATORIES

Shane MCDERMOTT

Inorganic/Metals Chemist

Soluble Anions (1:5) in Soil/Solids by Ion Chromatography [AN245] Tested: 6/6/2023

PARAMETER	UOM	LOR	BH1M_1.5-1.65 SOIL - 23/5/2023 SE248316.001	BH7_1.5-1.8 SOIL - 24/5/2023 SE248316.002	BH5_3-3.45 SOIL - 23/5/2023 SE248316.003
Chloride	mg/kg	0.25	**290**	**70**	**520**
Sulfate	mg/kg	5	**160**	**91**	**170**

pH in soil (1:5) [AN101] Tested: 5/6/2023

PARAMETER	UOM	LOR	BH1M_1.5-1.65 SOIL - 23/5/2023 SE248316.001	BH7_1.5-1.8 SOIL - 24/5/2023 SE248316.002	BH5_3-3.45 SOIL - 23/5/2023 SE248316.003
pH	pH Units	0.1	**5.1**	**5.5**	**4.3**

Conductivity and TDS by Calculation - Soil [AN106] Tested: 5/6/2023

PARAMETER	UOM	LOR	BH1M_1.5-1.65 SOIL - 23/5/2023 SE248316.001	BH7_1.5-1.8 SOIL - 24/5/2023 SE248316.002	BH5_3-3.45 SOIL - 23/5/2023 SE248316.003
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	**240**	**110**	**480**

Moisture Content [AN002] Tested: 2/6/2023

PARAMETER	UOM	LOR	BH1M_1.5-1.65 SOIL - 23/5/2023 SE248316.001	BH7_1.5-1.8 SOIL - 24/5/2023 SE248316.002	BH5_3-3.45 SOIL - 23/5/2023 SE248316.003
% Moisture	%w/w	1	**9.9**	**11.4**	**12.6**

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, sediments and sludges, an extract with water (or 0.01M CaCl2) is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos /cm or µS/cm @ 25°C. For soils, an extract of as received sample with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2510 B.
AN245	Anions by Ion Chromatography: A water sample is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO2, NO3 and SO4 are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B

FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
**	Indicative data, theoretical holding time exceeded.	NVL	Not validated.	LOR	Limit of Reporting.
***	Indicates that both * and ** apply.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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Atterberg Limits and Linear Shrinkage Report

Project: E25996.G03 - 1H Hospital Road, Concord — Project No.: 31380

Client: EI Australia Pty Ltd — Report No.: 23/1820

Address: Suite 6.01, 55 Miller Street, Pyrmont NSW 2009 — Report Date: 22/06/2023

Test Method: AS1289.3.1.2, 3.2.1, 2.1.1 — Page: 1 of 1

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

STS / Sample No.	7694D-L/2	7694D-L/4	7694D-L/5	7694D-L/7		
Sample Location	BH 01M	BH 04	BH 07	BH 05		
Material Description	Silty Sandy Clay, brown trace of gravel	Silty Clay, grey orange brown trace of gravel	Silty Clay, light grey trace of gravel	Silty Clay, light grey brown trace of gravel		
Depth (m)	1.50 - 1.65	1.50 - 1.85	1.50 - 1.80	1.50 - 1.68		
Sample Date	29/05/2023	29/05/2023	29/05/2023	29/05/2023		
Sample History	Oven Dried	Oven Dried	Oven Dried	Oven Dried		
Method of Preparation	Dry Sieved	Dry Sieved	Dry Sieved	Dry Sieved		
Liquid Limit (%)	**37**	**39**	**36**	**40**		
Plastic Limit (%)	**20**	**21**	**21**	**21**		
Plasticity Index	**17**	**18**	**15**	**19**		
Linear Shrinkage (%)	**N/A**	**N/A**	**N/A**	**N/A**		
Mould Size (mm)	N/A	N/A	N/A	N/A		
Crumbing	N/A	N/A	N/A	N/A		
Curling	N/A	N/A	N/A	N/A		

Remarks:

Approved Signatory.....

Technician: BV

Orlando Mendoza - Laboratory Manager

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NATA Accredited for Compliance with ISO/IEC 17025 - Testing No. 2750

Moisture Content of Soil and Aggregate Samples

Project: E25996.G03 - 1H Hospital Road, Concord — Project No.: 31380

Client: EI Australia Pty Ltd — Report No.: 23/1819

Address: Suite 6.01, 55 Miller Street, Pyrmont NSW 2009 — Report Date: 22/06/2023

Test Method: AS1289.2.1.1 — Page: 1 of 2

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

STS / Sample No.	7694D-L/2	7694D-L/3	7694D-L/4	7694D-L/5	7694D-L/6	7694D-L/7
Sample Location	BH 01M	BH 02	BH 04	BH 07	BH 03M	BH 05
Material Description	Silty Sandy Clay, brown trace of gravel	Silty Clay, grey orange brown with sand and gravel	Silty Clay, grey orange brown trace of gravel	Silty Clay, light grey trace of gravel	Silty Clay, pale grey orange brown trace of sand and gravel	Silty Clay, light grey brown trace of gravel
Depth (mm)	1.50 - 1.65	1.50 - 1.725	1.50 - 1.685	1.50 - 1.80	1.5 - 1.95	1.50 - 1.68
Sample Date	29/05/2023	29/05/2023	29/05/2023	29/05/2023	29/05/2023	29/05/2023
Moisture Content (%)	**10.8**	**17.0**	**13.0**	**12.1**	**17.0**	**11.8**

Remarks:

Approved Signatory..... .....

Technician: BV — Orlando Mendoza - Laboratory Manager

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Moisture Content of Soil and Aggregate Samples

Project: E25996.G03 - 1H Hospital Road, Concord — Project No.: 31380

Client: EI Australia Pty Ltd — Report No.: 23/1819

Address: Suite 6.01, 55 Miller Street, Pyrmont NSW 2009 — Report Date: 22/06/2023

Test Method: AS1289.2.1.1 — Page: 2 of 2

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

STS / Sample No.	7694D-L/8					
Sample Location	BH 06M					
Material Description	Silty Clay, pale grey orange brown trace of sand and gravel					
Depth (mm)	1.50 - 1.95					
Sample Date	29/05/2023					
Moisture Content (%)	**22.6**					

Remarks:

Approved Signatory..... .....

Technician: BV — Orlando Mendoza - Laboratory Manager

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Accredited for Compliance with ISO/IEC 17025 - Testing No. 2750

California Bearing Ratio Determination Report

Project: E25996.G03 - 1H Hospital Road, Concord
Client: EI Australia Pty Ltd
Address: Suite 6.01, 55 Miller Street, Pyrmont NSW 2009
Test Method: AS1289.6.1.1, 5.1.1, 2.1.1
No. of Days Soaked: 4

Project No.: 31380
Report No.: 23/1822
Report Date: 22/06/2023
Page: 1 of 1
Compactive Effort: Standard
Target Compaction (%): 100
Surcharge (Kg): 9

Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

STS / Sample No.		7694D-L/1					
Sample Location		BH 6					
Material Description		Silty Clay, orange red brown wih sand and gravel					
Depth of Sample (m)		1.50 - 1.60					
Sample Date		29/05/2023					
Oversize on Wet Basis +19mm (%)		3.0					
Field Moisture Content (%)		14.8					
Optimum Moisture Content (%)		16.4					
Maximum Dry Density (t/m³)		1.784					
Dry Density (t/m³)	Before Soaking	1.785					
	After Soaking	1.765					
Relative Compaction (%)	Before Soaking	100					
	After Soaking	99					
Moisture Content (%)	Before Soaking	16.6					
	After Soaking	20.5					
Moisture Ratio Before Soaking (%)		101.5					
Moisture Content after test (%)	Top 30mm	20.1					
	Entire Depth	19.5					
Swell after Soaking (%)		1.1					
CBR Value (%)		**8.0**					
Penetration (mm)		**2.5**					

Remarks: +19mm material excluded from test

Approved Signatory.....

Technician: BV

Orlando Mendoza - Laboratory Manager

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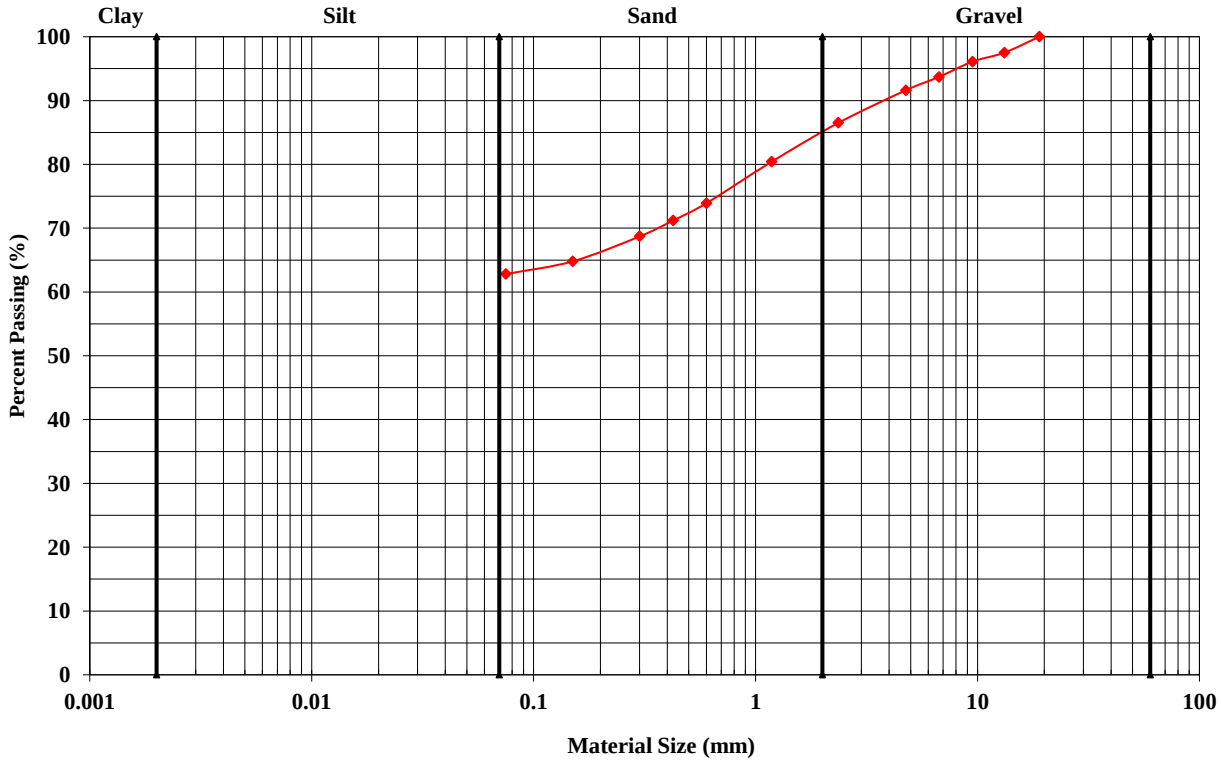
Particle Size Distribution

Project: 1H Hospital Road, Concord
Client: EI Australia Pty Ltd
Address: Suite 6.01, 55 Miller Street, Pyrmont NSW 2009
Test Method: AS1289.3.6.1, 2.1.1
Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)
Material Description: Silty Clay, grey orange brown, with sand and gravel

STS / Sample No.: 7694D-L/3
Sample Location: BH 02
Depth (m): 1.50 - 1.72
Date Sampled: 29/5/23

Project No.: 31380
Report No.: 23/1821
Report Date: 22/06/2023
Page: 1 of 3
Client Project No: E25996.G03



Sieve Size (mm)	Percent Passing (%)
19.0	100.0
13.2	97.5
9.5	96.1
6.7	93.7
4.75	91.6
2.36	86.5
1.18	80.4
0.60	73.9
0.425	71.2
0.30	68.7
0.15	64.8
0.075	62.8

Remarks:

Approved Signatory.....

Technician: BV

Orlando Mendoza - Laboratory Manager

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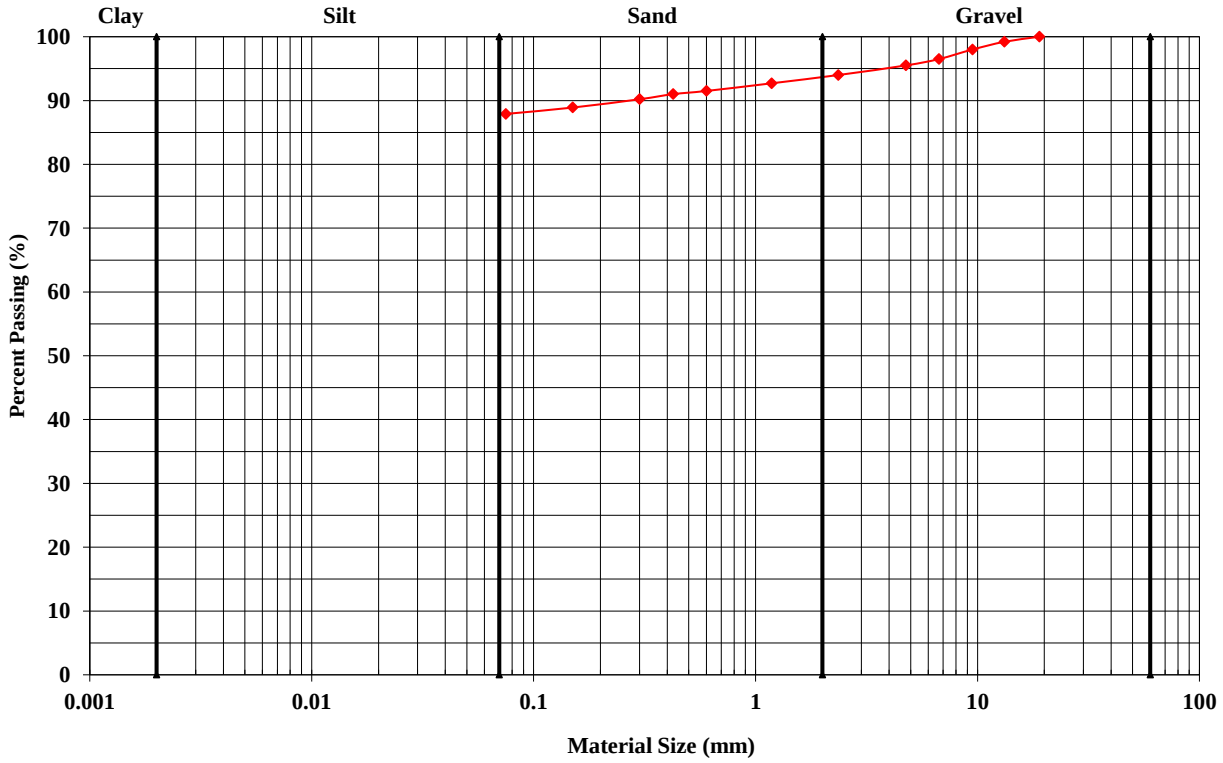
Particle Size Distribution

Project: 1H Hospital Road, Concord
Client: EI Australia Pty Ltd
Address: Suite 6.01, 55 Miller Street, Pyrmont NSW 2009
Test Method: AS1289.3.6.1, 2.1.1
Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)
Material Description: Silty Clay, pale grey orange brown, trace of sand and gravel

STS / Sample No.: 7694D-L/6
Sample Location: BH 03M
Depth (m): 1.50 - 1.95
Date Sampled: 29/5/23

Project No.: 31380
Report No.: 23/1821
Report Date: 22/06/2023
Page: 2 of 3
Client Project No: E25996.G03



Sieve Size (mm)	Percent Passing (%)
19.0	100.0
13.2	99.2
9.5	98.0
6.7	96.5
4.75	95.5
2.36	94.0
1.18	92.7
0.60	91.5
0.425	91.0
0.30	90.2
0.15	88.9
0.075	87.9

Remarks:

Approved Signatory.....

Technician: BV

Orlando Mendoza - Laboratory Manager

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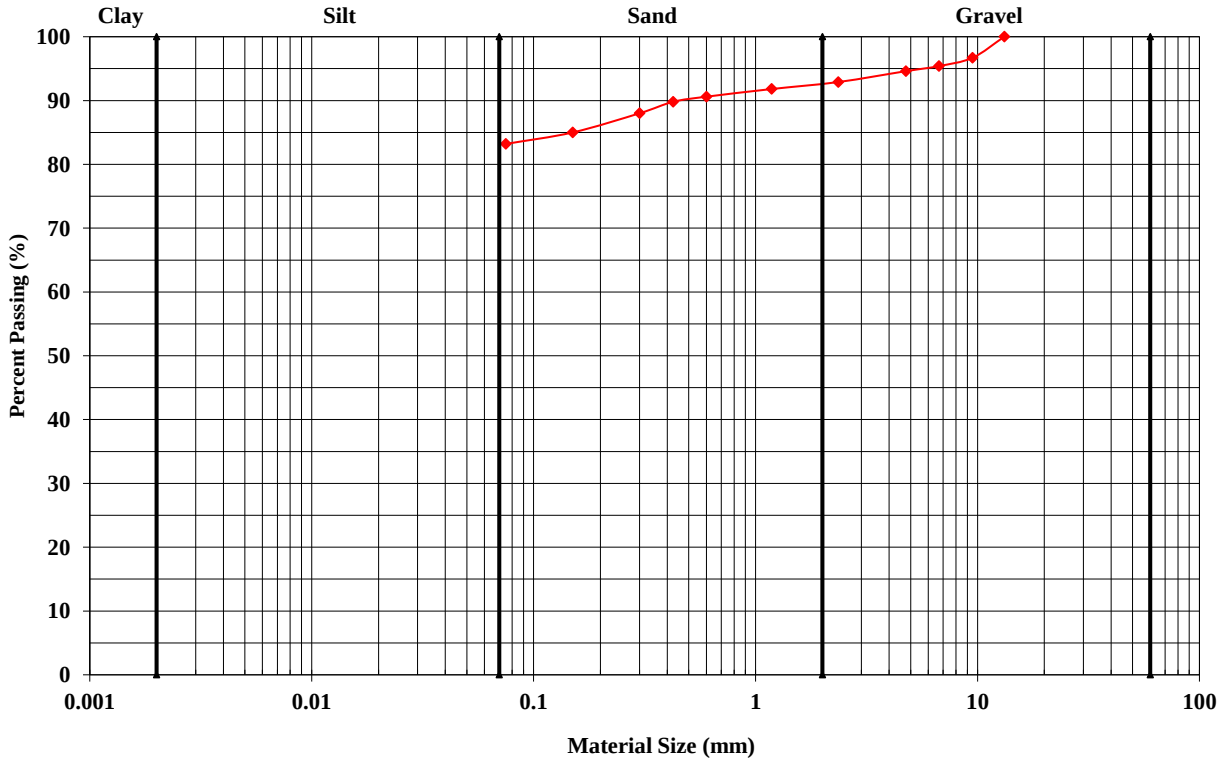
Particle Size Distribution

Project: 1H Hospital Road, Concord
Client: EI Australia Pty Ltd
Address: Suite 6.01, 55 Miller Street, Pyrmont NSW 2009
Test Method: AS1289.3.6.1, 2.1.1
Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)
Material Description: Silty Clay, pale grey orange brown, trace of sand and gravel

STS / Sample No.: 7694D-L/8
Sample Location: BH 06M
Depth (m): 1.50 - 1.95
Date Sampled: 29/5/23

Project No.: 31380
Report No.: 23/1821
Report Date: 22/06/2023
Page: 3 of 3
Client Project No: E25996.G03



Sieve Size (mm)	Percent Passing (%)
13.2	100.0
9.5	96.7
6.7	95.4
4.75	94.6
2.36	92.9
1.18	91.8
0.60	90.6
0.425	89.8
0.30	88.0
0.15	85.0
0.075	83.2

Remarks:

Technician: BV

Approved Signatory.....

Orlando Mendoza - Laboratory Manager

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NATA Accredited for Compliance with ISO/IEC 17025 - Testing No. 2750

Point Load Strength Index Report

Project: E25996.G03, 1H Hospital Road, CONCORD, NSW
Client: EI AUSTRALIA
Address: Suite 6.01, 55 Miller Street, PYRMONT
Test Method: AS 4133.4.1
Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

Project No.: 31380/7694D-L
Report No.: 23/1844
Report Date: 23/06/2023

Borehole / Sample No.	Depth (m)	Date Sampled	Date Tested	Test Type	Is (MPa)	$Is_{(50)}$ (MPa)	Rock Type	Failure Type	Moisture
BH1M	4.18	29/05/2023	22-23/06/2023	A	**0.2**	**0.2**	SH	3	M
BH1M	5.34	29/05/2023	22-23/06/2023	A	**1.4**	**1.3**	SS	3	M
BH1M	6.07	29/05/2023	22-23/06/2023	A	**1.7**	**1.7**	SS	3	M
BH1M	7.03	29/05/2023	22-23/06/2023	A	**1.6**	**1.6**	SS	3	M
BH2	3.33	29/05/2023	22-23/06/2023	A	**0.06**	**0.059**	SH	3	M
BH2	4.11	29/05/2023	22-23/06/2023	A	**0.3**	**0.31**	SS	3	M
BH2	5.13	29/05/2023	22-23/06/2023	A	**1.1**	**1.1**	SS	3	M
BH2	6.26	29/05/2023	22-23/06/2023	A	**2.9**	**2.8**	SS		
BH4	2.91	29/05/2023	22-23/06/2023	A	**0.3**	**0.3**	SS	3	M
BH4	3.32	29/05/2023	22-23/06/2023	A	**0.14**	**0.14**	SS	3	M
BH4	4.48	29/05/2023	22-23/06/2023	A	**0.49**	**0.51**	SS	3	W
BH4	5.42	29/05/2023	22-23/06/2023	A	**1.2**	**1.3**	SS	3	M
BH7	3.40	29/05/2023	22-23/06/2023	A	**2.6**	**2.7**	SS	3	M
BH7	4.15	29/05/2023	22-23/06/2023	A	**1.1**	**1.1**	SS	3	M
BH7	4.51	29/05/2023	22-23/06/2023	A	**2.2**	**2.2**	SS	3	M
BH7	5.05	29/05/2023	22-23/06/2023	A	**1.5**	**1.5**	SS	3	
BH3M	2.83	29/05/2023	22-23/06/2023	A	**0.25**	**0.25**	SS	3	M
BH3M	3.40	29/05/2023	22-23/06/2023	A	**1.5**	**1.6**	SH	3	M
BH3M	4.03	29/05/2023	22-23/06/2023	A	**0.12**	**0.12**	SH	3	M
BH3M	4.50	29/05/2023	22-23/06/2023	A	**2.7**	**2.7**	SS	3	M
BH5	3.66	29/05/2023	22-23/06/2023	A	**1.2**	**1.3**	SS	3	M
BH5	4.05	29/05/2023	22-23/06/2023	A	**0.98**	**1**	SS	3	M
BH5	4.79	29/05/2023	22-23/06/2023	A	**0.84**	**0.83**	SS	3	M
BH5	5.36	29/05/2023	22-23/06/2023	A	**1.4**	**1.4**	SS	3	M

Failure Type	Test Type	Moisure Condition	Rock Type
1 = Fracture through bedding or weak plane	A = Axial	W = Wet	SS = Sandstone
2 = Fracture along bedding	D = Diametrial	M = Moist	ST = Siltstone
3 = Fracture through rock mass	I = Irregular	D = Dry	SH = Shale
4 = Fracture influenced by natural defect or drilling	C = Cube		YS = Claystone
5 = Partial fracture or chip (invalid result)			IG = Igneous

Remarks:

Approved Signatory.....

Technician: FV

Fernando Velasquez Senior Geotechnician

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Point Load Strength Index Report

Project: E25996.G03, 1H Hospital Road, CONCORD, NSW
Client: EI AUSTRALIA
Address: Suite 6.01, 55 Miller Street, PYRMONT
Test Method: AS 4133.4.1
Sampling Procedure: Samples Supplied By Client (Not covered under NATA Scope of Accreditation)

Project No.: 31380/7694D-L
Report No.: 23/1844
Report Date: 23/06/2023

Borehole / Sample No.	Depth (m)	Date Sampled	Date Tested	Test Type	Is (MPa)	$Is_{(50)}$ (MPa)	Rock Type	Failure Type	Moisture
BH6M	4.24	29/06/2023	22-23/06/2	A	**1.6**	**1.6**	SS	3	M
BH6M	5.12	29/06/2023	22-23/06/2	A	**2.2**	**2.1**	SS	3	M
BH6M	5.90	29/06/2023	22-23/06/2	A	**1.3**	**1.3**	SS	3	M
BH6M	6.63	29/06/2023	22-23/06/2	A	**0.85**	**0.85**	SS	3	M

Failure Type
1 = Fracture through bedding or weak plane
2 = Fracture along bedding
3 = Fracture through rock mass
4 = Fracture influenced by natural defect or drilling
5 = Partial fracture or chip (invalid result)

Test Type
A = Axial
D = Diametrial
I = Irregular
C = Cube

Moisure Condition
W = Wet
M = Moist
D = Dry

Rock Type
SS = Sandstone
ST = Siltstone
SH = Shale
YS = Claystone
IG = Ig

Remarks:

Approved Signatory.....

Technician: FV

Fernando Velasquez Senior Geotechnician

Appendix C – Vibration Limits

German Standard DIN 4150 – Part 3: 1999 provides guideline levels of vibration velocity for evaluating the effects of vibration in structures. The limits presented in this standard are generally considered to be conservative.

The DIN 4150 values (maximum levels measured in any direction at the foundation, OR, maximum levels measured in (x) or (y) directions, in the plane of the uppermost floor), are summarised in **Table A** below.

It should be noted that peak vibration velocities higher than the minimum figures in **Table A** for low frequencies may be quite 'safe', depending on the frequency content of the vibration and the actual conditions of the structures.

It should also be noted that these levels are 'safe limits', up to which no damage due to vibration effects has been observed for the particular class of building. 'Damage' is defined by DIN 4150 to include even minor non-structural cracking in cement render, the enlargement of cracks already present, and the separation of partitions or intermediate walls from load bearing walls. Should damage be observed at vibration levels lower than the 'safe limits', then it may be attributed to other causes. DIN 4150 also states that when vibration levels higher than the 'safe limits' are present, it does not necessarily follow that damage will occur. Values given are only a broad guide.

Table A DIN 4150 – Structural Damage – Safe Limits for Building Vibration

Group	Type of Structure	Peak Vibration Velocity (mm/s)			
		At Foundation Level at a Frequency of:			Plane of Floor of Uppermost Storey
		Less than 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	All Frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Group 1 and 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

Note: For frequencies above 100 Hz, the higher values in the 50 Hz to 100 Hz column should be used.

Appendix D – Important Information

Important Information

SCOPE OF SERVICES

The geotechnical report ("the report") has been prepared in accordance with the scope of services as set out in the contract, or as otherwise agreed, between the Client And EI Australia ("EI"). The scope of work may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

RELIANCE ON DATA

EI has relied on data provided by the Client and other individuals and organizations, to prepare the report. Such data may include surveys, analyses, designs, maps and plans. EI has not verified the accuracy or completeness of the data except as stated in the report. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations ("conclusions") are based in whole or part on the data, EI will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to EI.

GEOTECHNICAL ENGINEERING

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared for a specific client, for a specific project and to meet specific needs, and may not be adequate for other clients or other purposes (e.g. a report prepared for a consulting civil engineer may not be adequate for a construction contractor). The report should not be used for other than its intended purpose without seeking additional geotechnical advice. Also, unless further geotechnical advice is obtained, the report cannot be used where the nature and/or details of the proposed development are changed.

LIMITATIONS OF SITE INVESTIGATION

The investigation programme undertaken is a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions. The data derived from the site investigation programme and subsequent laboratory testing are extrapolated across the site to form an inferred geological model, and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Despite investigation, the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies. The engineering logs are the subjective interpretation of subsurface conditions at a particular location and time, made by trained personnel. The actual interface between materials may be more gradual or abrupt than a report indicates.

SUBSURFACE CONDITIONS ARE TIME DEPENDENT

Subsurface conditions can be modified by changing natural forces or man-made influences. The report is based on conditions that existed at the time of subsurface exploration. Construction operations adjacent to the site, and natural events such as floods, or ground water fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report. EI should be kept appraised of any such events, and should be consulted to determine if any additional tests are necessary.

VERIFICATION OF SITE CONDITIONS

Where ground conditions encountered at the site differ significantly from those anticipated in the report, either due to natural variability of subsurface conditions or construction activities, it is a condition of the report that EI be notified of any variations and be provided with an opportunity to review the recommendations of this report. Recognition of change of soil and rock conditions requires experience and it is recommended that a suitably experienced geotechnical engineer be engaged to visit the site with sufficient frequency to detect if conditions have changed significantly.

REPRODUCTION OF REPORTS

 Where information from the accompanying report is to be included in contract documents or engineering specification for the project, the entire report should be included in order to minimize the likelihood of misinterpretation from logs.

REPORT FOR BENEFIT OF CLIENT

The report has been prepared for the benefit of the Client and no other party. EI assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of EI or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own inquiries and obtain independent advice in relation to such matters.

OTHER LIMITATIONS

EI will not be liable to update or revise the report to take into account any events or emergent circumstances or fact occurring or becoming apparent after the date of the report.