REPORT TO

ERILYAN PTY LTD

ON

GEOTECHNICAL INVESTIGATION

FOR

PROPOSED NORTHSIDE WEST STAGE 2

AT

23-27 LYTTON STREET, WENTWORTHVILLE, NSW

Date: 13 May 2021
Ref: 33969BTrpt

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ATTACHMENTS

1 INTRODUCTION

This report presents the results of a geotechnical investigation for the proposed Stage 2 Development of the Northside West Clinic, located at 23 to 27 Lytton Street, Wentworthville, NSW. The investigation was commissioned by Mr Nick Weeks of Erilyan Pty Ltd and was carried out in accordance with our proposal dated 10 March 2021, Ref: P53114BTRev1.

We have previously carried out geotechnical investigations for the Stage 1 and the previously proposed Stage 2 development of the Northside West Clinic, as detailed in our reports dated 4 April 2014 (Ref: 2318SBrpt) and 17 March 2015 (Ref: 27318SB1rpt). The current Stage 2 Development is significantly different to that proposed in 2015, however, the subsurface information obtained at that time has been incorporated within this report.

We understand from the supplied architectural drawings prepared by Team 2 Architects (Job No. 903, Drawing Nos. SK0010 to SK0015 and SK1011 to SK1020, Revision P1, dated 11 February 2021) that the Stage 2 Development will comprise the construction of a three-storey ward building in the area of the existing on-grade carpark on the southern side of the Northside West Clinic and, following demolition of the existing building in the area, a two-storey Day Programme building above an undercroft car park towards the western side of the site. The ground floor level of the proposed ward building will occupy the eastern half of the building footprint and will be at RL22.73m, which is at about the level of Lytton Street on the eastern side, but about 1.7m above the existing surface level in the north-western corner. This will require either placement of fill or suspending the building over the existing ground surface. The proposed undercroft car park on the western side of the site will be at RL19.2m which is close to the existing ground surface so will require minimal or no excavation or filling.

The purpose of the investigation was to obtain additional geotechnical information on subsurface conditions as a basis for comments and recommendations on excavation, groundwater, retention, footings and basement floor slabs.

This geotechnical investigation was carried out in conjunction with an environmental site assessment by our specialist division, JK Environments (JKE). Reference should be made to the separate report by JKE, Ref: E27318PL, for the results of the environmental site assessment.

2 INVESTIGATION PROCEDURE

2.1 Previous Investigation

Boreholes BH101 to BH104 were drilled as part of our February 2015 investigation and the borehole locations are shown on Figure 2. BH101 to BH103 were auger drilled to depths ranging from 4.05m to 5.85m and were then extended by rotary diamond coring techniques, using an NMLC core barrel with water flush, to depths ranging from 11.70m to 12.45m. BH104 was auger drilled only to a depth of 5.2m, where refusal of the auger occurred. In two of the boreholes (BH101 and BH103) PVC standpipes were installed on completion to allow for longer-term monitoring of groundwater levels.

The apparent compaction of the fill and the strength of the residual soils were assessed from Standard Penetration Test (SPT) 'N' values, augmented by hand penetrometer readings on cohesive samples returned by the SPT split tube sampler. Within the augered portions of the boreholes, the strength of the underlying rock was assessed by observation of the drilling resistance of a Tungsten Carbide (TC) bit attached to the augers, together with examination of the recovered rock chip samples and subsequent correlation with laboratory moisture content test results. The strength of the cored rock was assessed with reference to laboratory Point Load Strength Index ($I_{S(50)}$) test results, the results of which are summarised on the cored borehole logs and STS Table B.

Selected samples were returned to Soil Test Services Pty Ltd (STS) and Envirolab Services Pty Ltd, both NATA accredited laboratories, for testing to determine moisture contents, point load strength index values, pH, sulphate contents, chloride contents and electrical conductivity. The results of the laboratory testing are summarised in the STS Tables A and B and the Envirolab Certificate of Analysis No. 124328.

The previous laboratory test results and borehole logs are attached in Appendix A.

2.2 Current Investigation

The fieldwork for the current investigation was carried out on 20 April 2021 and comprised the drilling of three boreholes (BH201 to B203) in the area of the proposed Day Programme Building. One borehole (BH201) was drilled using our track-mounted JK205 drilling rig to a total depth of 11.36m below the existing ground surface. BH201 was initially advanced through the soils and upper bedrock using spiral augers fitted with a Tungsten Carbide (TC) bit to a depth of 7.1m and was then extended to the termination depth using diamond core drilling techniques involving an NMLC core barrel with water flush. BH202 and BH203 were drilled using a portable hand auger due to access constraints and were terminated at depths of 3m and 0.8m, respectively. Dynamic Cone Penetrometer (DCP) tests were carried out adjacent to the hand auger boreholes to refusal at depths ranging from 1m to 3.82m. DCP203A was carried out close to DCP203 due to the shallow refusal to see if the nearby test could be extended further.

The investigation locations, as shown on Figure 2, were set out by taped measurements from existing surface features. The approximate surface levels, as shown on the borehole logs and DCP test results, were estimated by interpolation between spot levels and contours shown on the survey plan by LTS Lockley (Ref: 40317DT, Sheets 1 and 2, dated 28 October 2013). The datum of the levels is Australian Height Datum (AHD).

The apparent compaction of the fill and the strength of the residual soils was assessed from Standard Penetration Test (SPT) 'N' values and the Dynamic Cone Penetrometer (DCP) blow counts, augmented by hand penetrometer readings on cohesive samples returned by the SPT split tube sampler and hand auger. Within the augered portion of BH201, the strength of the underlying siltstone was assessed by observation of the drilling resistance of a Tungsten Carbide (TC) bit attached to the augers, together with examination of the recovered rock chip samples and subsequent correlation with laboratory moisture content test results.

The strength of the cored siltstone was assessed with reference to laboratory Point Load Strength Index ($I_{S(50)}$) test results, the results of which are summarised on the cored borehole log and Table C.

Groundwater observations were made during and on completion of drilling of the boreholes. Measurement of groundwater levels were also made within the wells installed in BH101 and BH103.

Our geotechnical engineer, Mr Bryan Zheng, set out the investigation locations, nominated the sampling and testing locations and logged the subsurface conditions encountered. The borehole logs, and DCP test results, are attached to this report, together with a set of explanatory notes, which describe the investigation techniques, and their limitations, and define the logging terms and symbols used.

Selected samples were returned to Soil Test Services Pty Ltd (STS) and Envirolab Services Pty Ltd, both NATA accredited laboratories. STS completed testing to assess moisture contents, Atterberg limits, and linear shrinkages, the results of which are summarised in the attached STS Tables A and B. Envirolab completed a suite of soil aggression tests comprising pH, sulphate content, chloride content and resistivity, the results of which are presented in the attached Certificate of Analysis No. 264711

3 RESULTS OF INVESTIGATION

3.1 Site Description

The site is located within an area of undulating topography defined by low relief hills with maximum slopes of about 5°. The site generally slopes down towards the west at about 2° towards Finlaysons Creek which, for the section adjacent to site, comprises a concrete-lined channel.

The Stage 2 site comprises the southern and western portions of the property at No. 23-27 Lytton Street. The southern portion of the site contains an on-grade asphaltic concrete paved car park on the southern side of the existing Northside West Clinic. The asphaltic concrete pavement is in fair condition with a number of longitudinal cracks and areas of crocodile cracking observed. Around the perimeter of the carpark are garden beds containing small shrubs and trees up to about 10m in height. Single storey temporary construction buildings are located in the north-western corner of the car park. The northern side of the car park is supported by a concrete crib retaining wall, with a maximum height of about 2.2m. Where the wall could be seen it appears to be in a fair to good condition, but some differential movements between the stretchers of the wall were observed. Some backfill material between the cribs had collapsed in parts, with the material comprising clay with some bricks. Large portions of the wall are covered by vegetation and could not be inspected. At the base of the retaining wall is a concrete paved driveway and loading dock servicing the existing clinic. The driveway appears to be in good condition.

At the base of the driveway and occupying much of the western portion of the site is a two-storey brick building which appears to be in good condition. The ground floor level of this building is relatively level and appears to have been cut into the natural slope with concrete crib and brick retaining walls to a maximum of about 1.5m in height on the eastern and northern sides of the building. On the high side of the northern retaining wall is an asphalt car park.

To the east of the western brick building is the existing Northside West Clinic, which is a one and two storey concrete building. This structure is suspended on concrete piles above the site slopes at its western end adjacent to the western portion of the site.

To the east the site is Lytton Street, and to the west is Lytton Street Park. The park is a predominantly open grassed space with stands of mature trees up to about 10m in height. Surface levels across the boundary are similar. Finlaysons Creek is located within the park, about 20m to 40m west of the site. On the southern side of the site is a grassed thoroughfare providing access to the park. To the north of the site is a one storey weatherboard house.

3.2 Subsurface Conditions

The Penrith 1:100,000 Geological Series Sheet 9030 indicates that the site is mapped to be underlain by Ashfield Shale.

The summary given below includes all results from both the 2015 and 2021 investigations. We note that between each stage of the fieldwork changes were made to the standard for Geotechnical Site Investigations (AS1726:2017) resulting in variations in the logging terms used. For this project the main change is the description of shale bedrock, which is now referred to as claystone or siltstone, but is still part of the Ashfield Shale geological unit. For the purposes of this report the terms “shale” and “siltstone” are used for the same rock type and are collectively described as Ashfield Shale. Predominantly the term “siltstone” has been used within this report.

In summary, the boreholes encountered a generalised profile of pavements and fill overlying natural clays that graded into weathered siltstone bedrock. Further comments on the subsurface conditions encountered are provided below. Reference should be made to the borehole logs for detailed descriptions of the subsurface conditions encountered.

Pavements and Fill

In BH101, BH102 and BH103 and BH201, asphaltic concrete was encountered. The asphaltic concrete in the southern on-grade car park (BH101 to BH103) was 30mm thick whilst the asphalt in BH201 was 80mm thick. In BH104 concrete, with a thickness of 130mm, was encountered. The pavement surfaces were underlain by fill comprising sandy gravel or gravelly sand to depths ranging from 0.2m to 0.5m, which is likely to comprise the base and subbase layers below the pavement surfacing.

In BH102, and BH201 to BH203, deeper fill was encountered to depths ranging from 0.8m to 1.3m. The fill comprised silty clay or sand and was assessed to be poorly to moderately compacted.

Residual Silty Clay

The residual silty clay was assessed to be of medium or high plasticity. In BH101 to BH104 the silty clay was assessed to be of hard strength. In BH201, the silty clay was initially assessed to be of hard strength, becoming very stiff to hard strength below a depth of 3m. In BH202, the silty clay was assessed to be of stiff to very stiff strength.

Weathered Siltstone

In BH101 to BH104 and BH201, weathered siltstone was encountered at depths ranging from 1.4m to 4.8m. On first contact the siltstone was assessed to be extremely weathered and of 'hard soil' strength. Below depths ranging from 3.5m to 6.2m the siltstone was assessed to be slightly weathered and of medium strength. However, in BH101, a band of siltstone that was assessed to be extremely weathered to distinctly weathered and of extremely low to very low strength was encountered between depths of 10.9m and 11.3m.

Defects within the siltstone predominantly comprised extremely weathered seams and clay seams of up to 100mm thickness, and joints inclined at between 15° and 90°. In BH201, a section of no core of 0.26m thickness was encountered at a depth of 8.1m and is inferred to be an extremely weathered/clay seam which has washed out during coring.

Groundwater

No groundwater seepage was encountered during or immediately on completion of auger drilling. Within the standpipes installed in BH101 and BH103, the groundwater measurements are summarised in the table below.

Borehole	Date Drilled	10 March 2015	20 April 2021
101	23 February 2015	3.3m (RL18.5)	4.38m (RL17.4)
103	25 February 2015	3.3m (RL18.0)	3.93m (RL17.4)

3.3 Laboratory Test Results

The moisture content and point load strength index test results on samples of the siltstone generally showed reasonably good correlation with our field estimates of rock strength. The estimated Unconfined Compressive Strength of the rock core generally ranged from 4MPa to 18MPa.

The Atterberg Limits and linear shrinkage test results indicate that the residual silty clay is of medium or high plasticity and is assessed to have a moderate to high potential for shrink-swell movements with changes in moisture content.

The four-day soaked CBR test on a sample of the silty clay returned a value of 2.5%. During soaking of the sample, a swell of 1% was measured which further indicates the silty clay is reactive to variations in moisture content. The in-situ moisture content of the silty clay was 1.7% dry of its optimum moisture content.

The soil aggression tests returned pH values ranging from 5.1 to 7.3, sulphate contents ranging from 130mg/kg to 330mg/kg and chloride contents ranging from 92mg/kg to 1,500mg/kg. The resistivity ranged from 9.2ohm.m to 58ohm.m whilst the conductivity tests (which provide a value inverse to the resistivity) ranged from 300µS/cm to 440µS/cm Based on these results, the soils would be classified as having a 'Mild' exposure classification for concrete structural elements and a 'Moderate' exposure classification for steel structural elements in accordance with Tables 6.4.2(C) and 6.5.2(C) of AS2159-2009 'Piling – Design and Installation'.

4 COMMENTS AND RECOMMENDATIONS

4.1 Existing Services

We note that an existing stormwater pipe and easement are shown on the survey plan below the existing southern car park and proposed Ward Building. We are unaware if this asset is owned by City of Parramatta, Sydney Water, or another authority and we recommend that ownership be confirmed to determine which design guidelines will apply for design and construction of the development over the service or if it will need to be relocated as part of the work.

4.2 Excavation

Minimal excavation is anticipated for the proposed development as it will be at or above the existing surface levels. Local excavations may be required for lift pits and service trenches, but we do not anticipate these will exceed 1.5m depth. Excavation to these depths will encounter fill and natural silty clay soils which should be readily achievable using the buckets of hydraulic excavators.

Based on the groundwater observations within the boreholes and the limited excavation depths we do not anticipate excavations will encounter the groundwater table. However, groundwater seepage may occur into the excavation through the fill, particularly during and following heavy rainfall. Such seepage should be able to be controlled using a combination of gravity drainage and sump and pump techniques.

4.3 Earthworks

The lowest level of the proposed Ward Building will be a maximum of about 1.7m above the existing ground surface. It is unknown if fill will be placed to raise site levels, or a void left below a suspended floor slab. The following recommendations should be followed where fill is to be placed and for preparation of the subgrade below the undercroft parking on the western side of the site. Where the lowest floor slab is designed as a fully suspended floor slab no particular subgrade preparation would be required, but good practice would include stripping of any vegetation and root affected soils.

Prior to carrying out any earthworks the effect of such works on the existing crib retaining wall on the northern side of the existing car park must be considered. Any fill placed will place a surcharge load on the existing wall and a structural assessment of the wall must be carried out to assess if it can accommodate the additional surcharge load. If the wall is not adequate to accommodate the additional loads then a void should be left below the lowest slab and the slab designed as a fully suspended slab supported on piles found within the siltstone below the base opt the existing retaining wall. Alternatively, the existing wall could be replaced with a new retaining wall designed to support the full height of the fill proposed.

Fill was encountered in the boreholes to a maximum depth of 1.3m. We are unaware of any records of placement or compaction control of the fill and as such it must be considered ‘uncontrolled’. Such uncontrolled fill is not suitable for the support of floor slabs and where the slabs are to be supported on the fill it should be fully excavated and replaced by engineered fill. Within pavement areas, the fill may be left in place provided it is proof rolled and any weak areas treated. However, since the pavement areas will be below buildings this would only be appropriate where the pavements are independent of the building structure and can be repaired in the future if required. If such risks are to be reduced then all existing fill below pavement areas should also be removed and replaced with engineered fill.

The following measures should be followed where pavements are proposed or fill is placed below buildings.

- Strip the surface of vegetation, topsoil, root-affected soils, deleterious fill and grub out any tree roots encountered at the design surface level. Topsoil and root-affected soils should be stockpiled separately and may be reused within landscaped areas.
- Within building areas excavate the existing uncontrolled fill to expose the residual silty clay.
- Proof roll the exposed subgrade with at least 6 passes of a minimum 8 tonne dead weight, smooth drum roller. The final pass of the proof rolling should be carried out in the presence of a geotechnical engineer. The purpose of the proof rolling is to improve the compaction of the near surface soils and to detect any weak or unstable areas.
- Treat any unstable areas detected during proof rolling by excavation to a sound base and replacement with engineered fill.
- Place engineered fill to the required level in horizontal layers not greater than 200mm loose thickness (but of reduced thickness if light rollers are used).
- Any fill used to raise site levels or replace unstable areas must comprise engineered fill.
- Engineered fill should preferably comprise well graded granular materials, such as ripped rock or crushed sandstone, free of deleterious substances and having a maximum particle size not exceeding 75mm. Such fill should be compacted in horizontal layers of not greater than 200mm loose thickness, to a density of at least 98% of Standard Maximum Dry Density (SMDD). 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.
- Site-won clay and weathered siltstone may be used as engineered fill provided it is free of deleterious materials and particles greater than 75mm in size. Any clay fill should be compacted in 200mm loose thickness layers to a density strictly between 98% and 102% of SMDD and at moisture contents within 2% of Standard Optimum Moisture Content (SOMC). We note that although the site-won material may be re-used as engineered fill there may be environmental issues with the movement of material from one part of the site to another.
- 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 500m^2 or three

tests per visit, whichever requires the most tests. Where the fill is to support building loads it should be placed under Level 1 control, as defined by AS3798. Preferably the geotechnical testing authority should be engaged directly on behalf of the client and not by the earthworks subcontractor.

Where fill is to be placed to raise levels, but a fully suspended slab will be constructed, the fill would not need to comprise engineered fill and would only need to be nominally compacted to act as 'form fill'. However, the fill should be adequately compacted as required to accommodate construction equipment. If clay fill is used it should not be over compacted as this could lead to additional swelling of any reactive clay that could place upward pressures on the floor slabs. Void formers should be placed below the slabs to reduce such risks, but the size of the void formers will depend on the reactivity of the fill used.

4.4 Batters and Retaining Walls

The need for permanent batters and/or retaining walls as part of the proposed development will depend on whether the ground floor level of the Ward Building is constructed on an engineered fill platform or with a fully suspended floor slab. Some low-height landscaping walls may also be required in various portions of the site. Our comments below assume that the height of batters or retaining walls does not exceed 3m, and should higher batters/walls be required further advice should be sought.

Where space permits, temporary excavation batters should be no steeper than 1 Vertical in 1 Horizontal (1V:1H) within the soils. Such batters should remain stable in the short term provided all surcharge loads, including construction loads, are kept well clear of the crest of the batters.

Permanent batters should be no steeper than 1V:2H, but flatter batters of the order of 1V:3H may be preferred to allow access for maintenance. Where filled batters are created, each fill layer should extend past the final batter geometry and then the edge cut back to the final geometry. This will allow full compaction of the fill to the edge of the batter. All permanent batters should be covered with topsoil and planted with a deep-rooted runner grass, or other suitable coverings, to reduce erosion. All stormwater runoff should be directed away from all temporary and permanent batters to also reduce erosion.

Retaining walls less than 3m in height may be designed as cantilevered walls based on a triangular earth pressure distribution using an 'active' earth pressure coefficient, K_a, of 0.3 and a bulk unit weight of 20kN/m^3. This assumes that some resulting ground movements will be acceptable. For cantilever walls which will be propped by floor slabs or where movements are to be reduced, we recommend a triangular lateral earth pressure distribution using an 'at rest' earth pressure coefficient, K_0, of 0.6.

The above coefficients assume horizontal backfill surfaces and where inclined backfill is proposed the coefficients should be increased or the inclined backfill taken as a surcharge load. All surcharge loads should be allowed for in the design, i.e. inclined backfill, traffic, structures, etc. Full hydrostatic pressures should be considered unless measures are undertaken to provide complete and permanent drainage of the ground behind the wall.

The space between the temporary batters and the retaining walls will need to be carefully backfilled to reduce future settlement of the backfill. Only light compaction equipment should be used for compaction behind retaining walls so that excessive lateral pressures are not placed on the walls. This will require the backfill to be placed in thin layers, say 100mm loose thickness, appropriate to the compaction equipment being used.

4.5 Footings

Given the anticipated moderate building loads we expect that footings will need to be founded within the underlying weathered siltstone (shale) bedrock. Due to the depth to bedrock footings will need to comprise piles. Bored piles will be suitable, but as the groundwater table will likely be above the founding depth of piles seepage into the piles should be expected and will require tremie pouring method. Similarly, piles will need to be poured on the same day as drilling to reduce the risk of softening. If water is allowed to pond in the base of the pier holes, they will need to be redrilled to remove any softened material. Alternatively, grout injected (CFA) piles may be adopted which will negate the aforementioned issues.

Piers will need to also be founded below the zone of influence of any retaining walls so that additional surcharge loads are not placed on the walls. Where piers are situated within a horizontal distance of twice the wall height from the wall they must extend below the base of the retaining wall.

Footings founded within the extremely weathered siltstone may be designed based on an allowable bearing pressure of 700kPa. Where piles are drilled deeper to encounter siltstone of higher strength an allowable bearing pressure of 1000kPa may be used for siltstone of very low strength or 2000kPa where siltstone of at least low to medium strength is encountered. All piles should be founded with a nominal socket of at least 0.3m into the appropriate strength rock. For the design of sockets into the siltstone, an allowable shaft adhesion (in compression) of 10% of the above allowable bearing pressures may be adopted for the portion of the pile below the 0.3m nominal socket. For the design of piles in uplift a shaft adhesion of 5% of the above values would apply. The shaft adhesions assume that adequate socket roughness and cleanliness is maintained.

At least the initial stages of pile drilling should be inspected by a geotechnical engineer to confirm that the appropriate quality bedrock has been encountered. The need for additional inspections should be assessed by the geotechnical engineer following the initial inspection.

4.6 Pavements

Undercroft car parks are shown below both new buildings and we anticipate that these may either be supported on suspended floor slabs or will be of flexible construction separate to the overlying building structure. The following advice is for flexible pavements constructed on a soil subgrade.

Following satisfactory preparation of the subgrade, as outlined in Section 4.3 above, the proposed pavements may be designed on the basis of a soaked CBR of not greater than 2% for the natural silty clays. Where material is imported or site-won material reused as engineered fill then further testing should be completed on these materials to confirm the design CBR value. However, since the pavements will only accommodate cars the subgrade CBR value may not be critical to the design.

Due to this relatively low CBR values, consideration could be given to the use of a select layer of good quality granular material, such as crush sandstone, between the subgrade and the pavement material to reduce the thickness of the pavement materials. Any such select layers should be taken into account as part of the pavement thickness design.

Flexible pavements should be underlain by a good quality base-course layer comprising crushed rock to TfNSW QA specification 3051 unbound base material, compacted to at least 100% of SMDD.

During construction care should be taken to ensure adequate cross-falls are maintained across exposed subgrade areas to assist drainage as clay subgrades may become untrafficable if wet. We recommend that subsoil drains be placed around the perimeter of the new pavements. The subsoil drains should extend to a depth of at least 0.3m below the subgrade level and the drains should have adequate falls to reduce ponding in the drains.

5 GENERAL COMMENTS

The recommendations presented in this report include specific issues to be addressed during the construction phase of the project. As an example, special treatment of soft spots may be required as a result of their discovery during proof-rolling, etc. In the event that any of the construction phase recommendations presented in this report are not implemented, the general recommendations may become inapplicable and JK Geotechnics accept no responsibility whatsoever for the performance of the structure where recommendations are not implemented in full and properly tested, inspected and documented.

The long-term successful performance of floor slabs and pavements is dependent on the satisfactory completion of the earthworks. In order to achieve this, the quality assurance program should not be limited to routine compaction density testing only. Other critical factors associated with the earthworks may include subgrade preparation, selection of fill materials, control of moisture content and drainage, etc. The satisfactory control and assessment of these items may require judgment from an experienced engineer. Such judgment often cannot be made by a technician who may not have formal engineering qualifications and experience. In order to identify potential problems, we recommend that a pre-construction meeting be held so that all parties involved understand the earthworks requirements and potential difficulties. This meeting should clearly define the lines of communication and responsibility.

Occasionally, the subsurface conditions between the completed boreholes may be found to be different (or may be interpreted to be different) from those expected. Variation can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact this office.

This report provides advice on geotechnical aspects for the proposed civil and structural design. As part of the documentation stage of this project, Contract Documents and Specifications may be prepared based on our report. However, there may be design features we are not aware of or have not commented on for a variety of reasons. The designers should satisfy themselves that all the necessary advice has been obtained. If required, we could be commissioned to review the geotechnical aspects of contract documents to confirm the intent of our recommendations has been correctly implemented.

A waste classification is required for any soil and/or bedrock excavated from the site prior to offsite disposal. Subject to the appropriate testing, material can be classified as Virgin Excavated Natural Material (VENM), Excavated Natural Material (ENM), General Solid, Restricted Solid or Hazardous Waste. Analysis can take up to seven to ten working days to complete, therefore, an adequate allowance should be included in the construction program unless testing is completed prior to construction. If contamination is encountered, then substantial further testing (and associated delays) could be expected. We strongly recommend that this requirement is addressed prior to the commencement of excavation on site.

This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose. If there is any change in the proposed development described in this report then all recommendations should be reviewed. Copyright in this report is the property of JK Geotechnics. We have used a degree of care, skill and diligence normally exercised by consulting engineers in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report. The report shall not be reproduced except in full.

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SOIL TEST SERVICES
ABN 43 002 145 173

TABLE A
MOISTURE CONTENT, ATTERBERG LIMIT AND LINEAR SHRINKAGE TEST REPORT

Client:	JK Geotechnics	**Ref No:**	33969BT
Project:	Proposed Northside West Stage 2 Development	**Report:**	A
Location:	23-27 Lytton Street, Wentworthville, NSW	**Report Date:**	6/05/2021
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AS 1289	**TEST METHOD**	**2.1.1**	**3.1.2**	**3.2.1**	**3.3.1**	**3.4.1**
BOREHOLE NUMBER	**DEPTH m**	**MOISTURE CONTENT %**	**LIQUID LIMIT %**	**PLASTIC LIMIT %**	**PLASTICITY INDEX %**	**LINEAR SHRINKAGE %**
201	1.50 - 1.95	13.9	46	14	32	12.5
202	1.00 - 1.10	24.7	62	20	42	17.0
201	5.50 - 6.00	12.7	-	-	-	-
201	6.70 - 6.80	7.5	-	-	-	-

Notes:

- The test sample for liquid and plastic limit was air-dried & dry-sieved
- The linear shrinkage mould was 125mm
- Refer to appropriate notes for soil descriptions
- Date of receipt of sample: 26/04/2021.
- Sampled and supplied by client. Samples tested as received.

NATA

NATA Accredited Laboratory
Number:1327

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06/05/2021
Authorised Signature / Date
(D. Treweek)

115 Wicks Road
Macquarie Park, NSW 2113
PO Box 976
North Ryde, Bc 1670
Telephone: 02 9888 5000
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SOIL TEST SERVICES
ABN 43 002 145 173

TABLE B
FOUR DAY SOAKED CALIFORNIA BEARING RATIO TEST REPORT

Client:	JK Geotechnics	**Ref No:**	33969BT
Project:	Proposed Northside West Stage 2 Development	**Report:**	B
Location:	23-27 Lytton Street, Wentworthville, NSW	**Report Date:**	5/05/2021
		Page 1 of 1	

BOREHOLE NUMBER	BH 201
DEPTH (m)	1.00 - 2.00
Surcharge (kg)	4.5
Maximum Dry Density (t/m^3)	1.85 STD
Optimum Moisture Content (%)	15.6
Moulded Dry Density (t/m^3)	1.82
Sample Density Ratio (%)	98
Sample Moisture Ratio (%)	101
Moisture Contents	
Insitu (%)	13.9
Moulded (%)	15.8
After soaking and	
After Test, Top 30mm(%)	22.1
Remaining Depth (%)	18.4
Material Retained on 19mm Sieve (%)	1*
Swell (%)	1.0
C.B.R. value: @2.5mm penetration	2.5

NOTES: Sampled and supplied by client. Samples tested as received.

- Refer to appropriate Borehole logs for soil descriptions
- Test Methods : AS 1289 6.1.1, 5.1.1 & 2.1.1.
- Date of receipt of sample: 26/04/2021.
- * Denotes not used in test sample.

NATA
NATA Accredited Laboratory
Number:1327

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05/05/2021
Authorised Signature / Date
(D. Treweek)

TABLE C
POINT LOAD STRENGTH INDEX TEST REPORT

Client:	Erilyan	**Ref No:**	33969BT
Project:	Proposed Nothside West Stage 2 Development	**Report:**	C
Location:	23-27 Lytton Street, WENTWORTHVILLE, NSW	**Report Date:**	26/04/21

Page 1 of 1

BOREHOLE NUMBER	DEPTH (m)	$I_{S\ (50)}$ (MPa)	ESTIMATED UNCONFINED COMPRESSIVE STRENGTH (MPa)	TEST DIRECTION
201	7.18 - 7.20	0.6	12	A
	7.79 - 7.81	0.3	6	A
	8.35 - 8.37	0.5	10	A
	8.92 - 8.94	0.2	4	A
	9.02 - 9.04	0.3	6	A
	9.72 - 9.74	0.8	16	A
	10.18 - 10.20	0.7	14	A
	10.83 - 10.86	0.5	10	A
	11.08 - 11.10	0.2	4	A

NOTES

1. In the above table, testing was completed in test direction A for the axial direction, D for the diametral direction, B for the block test and L for the lump test.
2. The above strength tests were completed at the 'as received' moisture content.
3. Test Method: RMS T223.
4. For reporting purposes, the $I_{S(50)}$ has been rounded to the nearest 0.1MPa, or to one significant figure if less than 0.1MPa.
5. The estimated Unconfined Compressive Strength was calculated from the Point Load Strength Index based on the correlation provided in AS1726:2017 'Geotechnical Site Investigations' and rounded off to the nearest whole number: U.C.S. = 20 $I_{S(50)}$.

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CERTIFICATE OF ANALYSIS 267811

Client Details

Client	JK Geotechnics
Attention	Bryan Zheng
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**33969BT, Wentworthville**
Number of Samples	3 Soil
Date samples received	28/04/2021
Date completed instructions received	28/04/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	05/05/2021
Date of Issue	04/05/2021

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Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Client Reference: 33969BT, Wentworthville

Misc Inorg - Soil				
Our Reference		267811-1	267811-2	267811-3
Your Reference	UNITS	202	201	202
Depth		2.8-2.9	6.1-6.5	0.8-0.9
Date Sampled		20/04/2021	20/04/2021	20/04/2021
Type of sample		Soil	Soil	Soil
Date prepared	-	29/04/2021	29/04/2021	29/04/2021
Date analysed	-	29/04/2021	29/04/2021	29/04/2021
pH 1:5 soil:water	pH Units	5.2	7.3	6.5
Chloride, Cl 1:5 soil:water	mg/kg	1,500	740	92
Sulphate, SO4 1:5 soil:water	mg/kg	330	130	220
Resistivity in soil*	ohm m	9.2	20	58

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA 22nd ED 2510 and Rayment & Lyons. Resistivity is calculated from Conductivity (non NATA). Resistivity (calculated) may not correlate with results otherwise obtained using Resistivity-Current method, depending on the nature of the soil being analysed.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

Client Reference: 33969BT, Wentworthville

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			29/04/2021	[NT]	[NT]	[NT]	[NT]	29/04/2021	[NT]
Date analysed	-			29/04/2021	[NT]	[NT]	[NT]	[NT]	29/04/2021	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	109	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	111	[NT]
Resistivity in soil*	ohm m	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

Result Definitions	
NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

pH/EC

Samples were out of the recommended holding time for this analysis.

JKGeotechnics

BOREHOLE LOG

Borehole No.
201
1 / 3

Client: ERILYAN
Project: PROPOSED NORTHSIDE WEST STAGE 2 DEVELOPMENT
Location: 23-27 LYTTON STREET, WENTWORTHVILLE, NSW

Job No.: 33969BT **Method:** SPIRAL AUGER **R.L. Surface:** ~20.2 m
Date: 20/4/21 **Datum:** AHD
Plant Type: JK205 **Logged/Checked By:** B.Z./A.B.

Groundwater Record	SAMPLES ES U50 DB DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING							ASPHALTIC CONCRETE: 80mm.t				
			20			-	FILL: Gravelly sand, fine to coarse grained, dark brown, fine to coarse grained sub-angular and angular igneous gravel, with occasional cobbles, trace of ash and clay.	M			ROADBASE TYPE MATERIAL
		N = 13 4,5,8					FILL: Silty clay, medium plasticity, dark brown mottled red brown, trace of fine to medium grained sub-angular and angular igneous and ironstone gravel.	w<PL			APPEARS MODERATELY COMPACTED
			19	1		CI	Silty CLAY: medium plasticity, brown and red brown, trace of fine grained sub-angular ironstone gravel.	w~PL	Hd		RESIDUAL
		N = 26 7,12,14	18	2			as above, but grey and brown.			>600 >600 >600	
ON COMPLETION OF CORING		N = 21 5,8,13	17 16	3 4			as above, but grey, with occasional clayey silt bands.		VSt - Hd	240 320 420	
		N > 25 6,10,15/ 100mm REFUSAL					as above. but dark grey.			400 430 350	
			15	5		-	Extremely Weathered siltstone: silty CLAY, medium to high plasticity, grey, with ironstone bands.	XW	Hd	>600	ASHFIELD SHALE VERY LOW 'TC' BIT RESISTANCE BANDS
							SILTSTONE: dark grey, trace of iron indurated bands.	DW	L - M		LOW RESISTANCE
			14	6			as above, but dark grey.		M		MODERATE RESISTANCE

BOREHOLE LOG

Borehole No.
201
2 / 3

Client: ERILYAN
Project: PROPOSED NORTHSIDE WEST STAGE 2 DEVELOPMENT
Location: 23-27 LYTTON STREET, WENTWORTHVILLE, NSW

Job No.: 33969BT **Method:** SPIRAL AUGER **R.L. Surface:** ~20.2 m
Date: 20/4/21 **Datum:** AHD
Plant Type: JK205 **Logged/Checked By:** B.Z./A.B.

Groundwater Record	SAMPLES				Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
	ES	U50	DB	DS										
										SILTSTONE: as above				
						13				REFER TO CORED BOREHOLE LOG				
							8							
						12								
							9							
						11								
							10							
						10								
							11							
						9								
							12							
						8								
							13							
						7								

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CORED BOREHOLE LOG

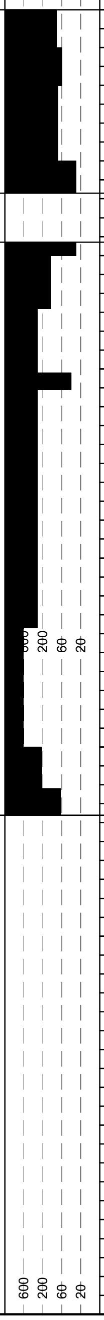
Borehole No.
201
3 / 3

Client: ERILYAN
Project: PROPOSED NORTHSIDE WEST STAGE 2 DEVELOPMENT
Location: 23-27 LYTTON STREET, WENTWORTHVILLE, NSW

Job No.: 33969BT
Core Size: NMLC
R.L. Surface: ~20.2 m
Date: 20/4/21
Inclination: VERTICAL
Datum: AHD
Plant Type: JK205
Bearing: N/A
Logged/Checked By: B.Z./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components START CORING AT 7.10m	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL -0.1 L -0.3 M -1 H -3 VH -10 EH	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness – Specific	General	Formation
90% RETURN		13	8		SILTSTONE: dark grey mottled brown, sub-horizontally laminated, with fine grained grey sandstone.	SW	M	0.60 0.30	(7.16m) XWS, 0°, 3 mm.t (7.29m) Be, 0°, Un, R, Fe Sn (7.30m) Be, 0°, Un, R, Fe Sn (7.31m) Be, 0°, Un, R, Fe Sn (7.42m) J, 71°, Ir, Vr, Fe Sn (7.51m) J, 45°, Ir, Vr, Fe Sn (7.66m) XWS, 0°, 2 mm.t (7.73m) J, 34°, Un, R, Fe Sn (7.84m) CS, 0°, 2 mm.t (7.85m) CS, 0°, 2 mm.t (7.91m) Cr, 0°, 20 mm.t (8.05m) XWS, 0°, 20 mm.t		Ashfield Shale
		12			NO CORE 0.26m						
		11 10 9	9 10 11		SILTSTONE: dark grey, sub-horizontally laminated, with fine grained grey sandstone.	SW FR	M	0.50 0.20 0.30 0.80 0.70 0.50 0.20	(8.38m) XWS, 0°, 2 mm.t (8.39m) XWS, 0°, 2 mm.t (8.53m) XWS, 0° (8.68m) J, 34°, Un, R, Clay Ct (9.02m) XWS, 0°, 2 mm.t (9.09m) XWS, 0°, 3 mm.t (9.11m) J, 51°, Ir, Vr, Cn (9.43m) XWS, 0°, 2 mm.t (9.75m) XWS, 0°, 2 mm.t (10.08m) Cr, 0°, 12 mm.t (10.30m) XWS, 0°, 14 mm.t (10.37m) XWS, 0°, 5 mm.t (11.00m) J, 38°, Un, R, Cn (11.22m) J, 40°, Un, R, Cn (11.30m) J, 28°, Un, R, Cn		Ashfield Shale
		8 7	12 13		END OF BOREHOLE AT 11.36 m						

SPACING (mm)



FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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Job No: 33969BT

Borehole No: BH201

Depth: 7.10m - 11.36m

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BOREHOLE LOG

Borehole No.
202
1 / 1

Client: ERILYAN
Project: PROPOSED NORTHSIDE WEST STAGE 2 DEVELOPMENT
Location: 23-27 LYTTON STREET, WENTWORTHVILLE, NSW

Job No.: 33969BT **Method:** HAND AUGER **R.L. Surface:** ~19.2 m
Date: 20/4/21 **Datum:** AHD
Plant Type: - **Logged/Checked By:** B.Z./A.B.

Groundwater Record	SAMPLES ES	U50	DB	DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION					REFER TO DCP TEST RESULTS	19				FILL: Sand, fine to medium grained, dark brown, with fine to medium grained sub-angular and angular igneous gravel. clay, tile and brick fragments.	M			TIMBER MULCH COVER APPEARS POORLY COMPACTED
										FILL: Silty clay, medium plasticity, dark brown mottled red brown, trace of fine grained igneous and ironstone gravel.	w<PL			
						18	1		CH	Silty CLAY: high plasticity, brown and red brown, trace of fine grained sub-angular ironstone gravel, and ash.	w>PL	St - VSt	180 190 220	RESIDUAL HP READINGS ON DISTURBED SAMPLES FROM HAND AUGER
						17	2			as above, but yellow brown and grey, without ash.	w~PL		180 190 220 180 150 210	
						16	3			END OF BOREHOLE AT 3.00 m				
						15	4							
						14	5							
						13	6							

JK 9.02.4 LIB.GLB Log JK AUGERHOLE - MASTER 33969BT WENTWORTHVILLE.GPJ <<DrawingFile>> 13/05/2021 09:26 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

BOREHOLE LOG

Borehole No.
203
1 / 1

Client: ERILYAN
Project: PROPOSED NORTHSIDE WEST STAGE 2 DEVELOPMENT
Location: 23-27 LYTTON STREET, WENTWORTHVILLE, NSW

Job No.: 33969BT **Method:** HAND AUGER **R.L. Surface:** ~19.1 m
Date: 20/4/21 **Datum:** AHD
Plant Type: - **Logged/Checked By:** B.Z./A.B.

Groundwater Record	SAMPLES				Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
	ES	U50	DB	DS										
DRY ON COMPLETION	■				REFER TO DCP TEST RESULTS	19		▨		FILL: Gravelly sand, fine to coarse grained, dark brown, fine to coarse grained sub-angular and angular igneous gravel, trace of fibre cement fragments.	M			TIMBER MULCH COVER APPEARS MODERATELY COMPACTED
	■							▨		FILL: Silty clay, medium to high plasticity, dark brown and red brown, trace of fine to medium grained igneous, sandstone and ironstone gravel.	w<PL			
							1			END OF BOREHOLE AT 0.80 m				HAND AUGER REFUSAL
						18								
							2							
						17								
							3							
						16								
							4							
						15								
							5							
						14								
							6							
						13								

JKGeotechnics

DYNAMIC CONE PENETRATION TEST RESULTS

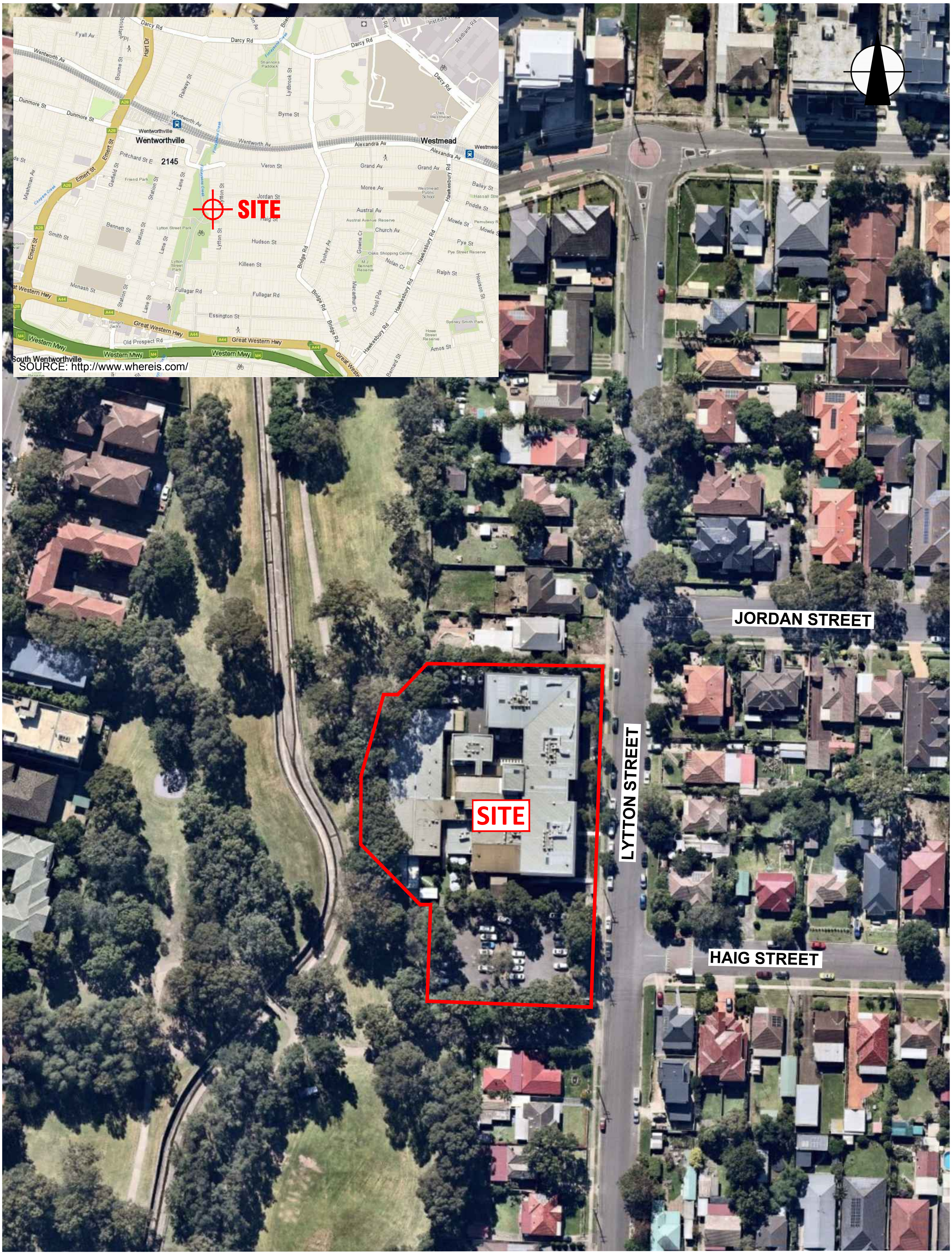
Client: ERILYAN
Project: PROPOSED NORTHSIDE WEST STAGE 2 DEVELOPMENT
Location: 23-27 LYTTON STREET, WENTWORTHVILLE, NSW

Job No. 33969BT
Date: 20-4-21
Tested By: B.Z.

Hammer Weight & Drop: 9kg/510mm
Rod Diameter: 16mm
Point Diameter: 20mm

Test Location	**202**	**203**	**203A**	Test Location	**202**		
Surface RL	≈19.2m	≈19.1m	≈19.1m	Surface RL	≈19.2m		
Depth (mm)	Blows per 100mm Penetration			Depth (mm)	Blows per 100mm Penetration		
0 - 100	5	7	8	3000-3100	3		
100 - 200	4	6	12	3100-3200	4		
200 - 300	5	5	8	3200-3300	3		
300 - 400	4	10	6	3300-3400	12		
400 - 500	5	10	9	3400-3500	10		
500 - 600	7	5	8	3500-3600	8		
600 - 700	6	6	9	3600-3700	11		
700 - 800	5	8	9	3700-3800	9		
800 - 900	4	8	7	3800-3900	10/20mm		
900 - 1000	5	8	10	3900-4000	REFUSAL		
1000 - 1100	4	5/0mm	17	4000-4100			
1100 - 1200	5	REFUSAL	22	4100-4200			
1200 - 1300	7		23	4200-4300			
1300 - 1400	6		20	4300-4400			
1400 - 1500	5		8/20mm	4400-4500			
1500 - 1600	3		REFUSAL	4500-4600			
1600 - 1700	4			4600-4700			
1700 - 1800	4			4700-4800			
1800 - 1900	3			4800-4900			
1900 - 2000	4			4900-5000			
2000 - 2100	4			5000-5100			
2100 - 2200	5			5100-5200			
2200 - 2300	4			5200-5300			
2300 - 2400	3			5300-5400			
2400 - 2500	4			5400-5500			
2500 - 2600	5			5500-5600			
2600 - 2700	5			5600-5700			
2700 - 2800	3			5700-5800			
2800 - 2900	4			5800-5900			
2900 - 3000	4			5900-6000			

Remarks:
1. The procedure used for this test is described in AS1289.6.3.2-1997 (R2013)
2. Usually 8 blows per 20mm is taken as refusal
3. Datum of levels is AHD



SOURCE: http://www.whereis.com/

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

This plan should be read in conjunction with the JK Geotechnics report.

Title:

SITE LOCATION PLAN

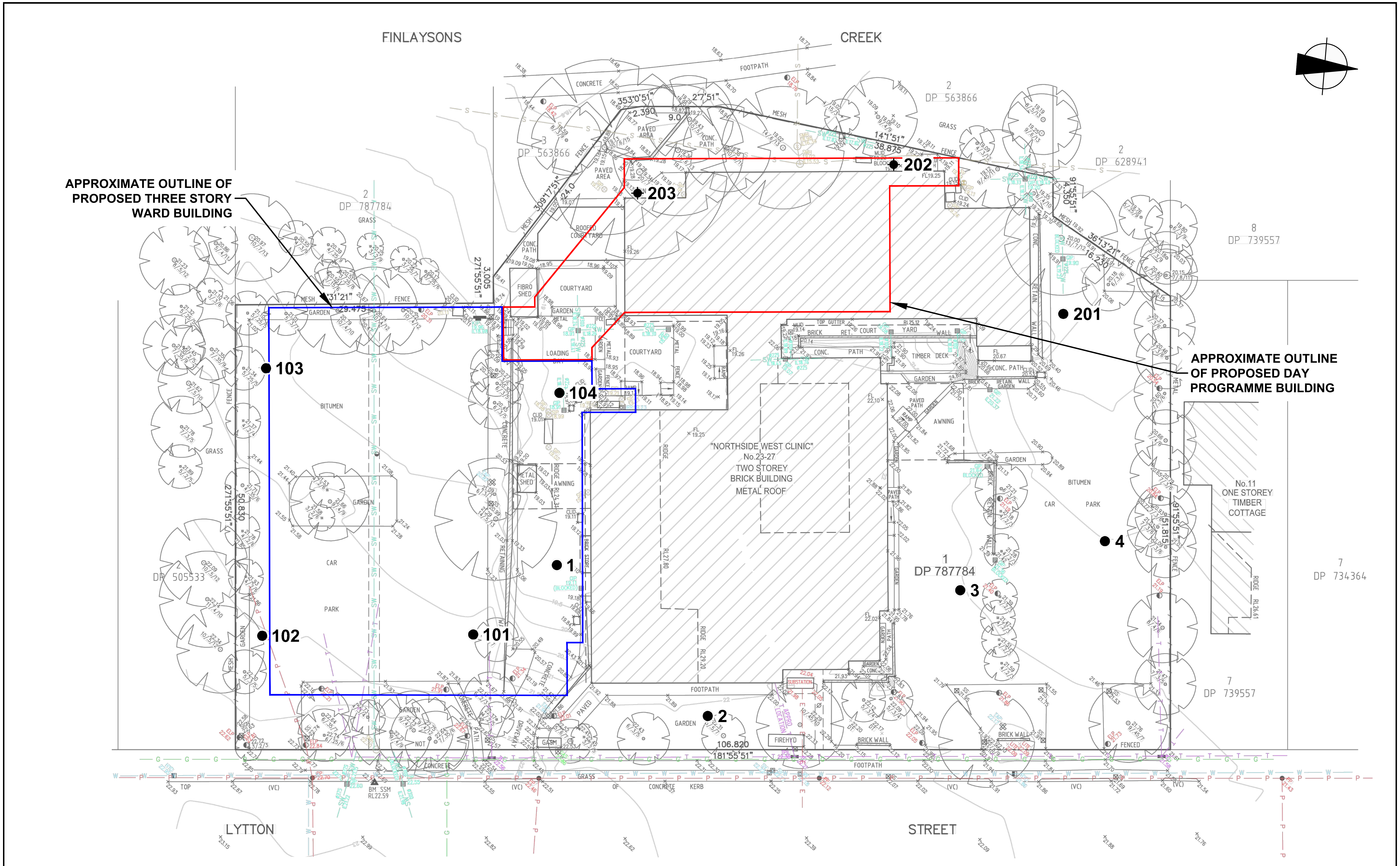
Location: 23-27 LYTTON STREET,
WENTWORTHVILLE, NSW

Report No: 33969BT

Figure No: 1

JKGeotechnics

PLOT DATE: 28/04/2021 11:45:16 AM DWG FILE: Y:\33000'S\33969BT WENTWORTHVILLE\CAD\33969BT.DWG



LEGEND

● RIG DRILLED BOREHOLE

⊕ HAND AUGER DRILLED BOREHOLE AND DCP TEST

NOTES:

1. BOREHOLES 1 TO 4 WERE DRILLED IN 2014 FOR THE STAGE 1 INVESTIGATION (Ref: 27318Brpt).
2. BOREHOLES 101 TO 104 WERE DRILLED FOR THE STAGE 2 INVESTIGATION (Ref: 27318SB1rpt).
3. BOREHOLES 201 TO 203 ARE FROM THE CURRENT INVESTIGATION.

0 4 8 12 16 20
SCALE 1:400 @A3 METRES

This plan should be read in conjunction with the JK Geotechnics report.

Title:
INVESTIGATION LOCATION PLAN

Location: 23-27 LYTTON STREET,
WENTWORTHVILLE, NSW

Report No: 33969BT

Figure No: 2

JKGeotechnics

PLOT DATE: 12/05/2021 10:43:44 AM DWG FILE: Z:\6 GEOTECHNICAL\6F GEOTECHNICAL JOBS\33000'S\33969BT WENTWORTHVILLE\CAD\33969BT.DWG

REPORT EXPLANATION NOTES

INTRODUCTION

These notes have been provided to amplify the geotechnical report in regard to classification methods, field procedures and certain matters relating to the Comments and Recommendations section. Not all notes are necessarily relevant to all reports.

The ground is a product of continuing natural and man-made processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Geotechnical engineering involves gathering and assimilating limited facts about these characteristics and properties in order to understand or predict the behaviour of the ground on a particular site under certain conditions. This report may contain such facts obtained by inspection, excavation, probing, sampling, testing or other means of investigation. If so, they are directly relevant only to the ground at the place where and time when the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726:2017 *'Geotechnical Site Investigations'*. In general, descriptions cover the following properties – soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geotechnical practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached soil classification table qualified by the grading of other particles present (eg. sandy clay) as set out below:

Soil Classification	Particle Size
Clay	< 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2.36mm
Gravel	2.36 to 63mm
Cobbles	63 to 200mm
Boulders	> 200mm

Non-cohesive soils are classified on the basis of relative density, generally from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very loose (VL)	< 4
Loose (L)	4 to 10
Medium dense (MD)	10 to 30
Dense (D)	30 to 50
Very Dense (VD)	> 50

Cohesive soils are classified on the basis of strength (consistency) either by use of a hand penetrometer, vane shear, laboratory testing and/or tactile engineering examination. The strength terms are defined as follows.

Classification	Unconfined Compressive Strength (kPa)	Indicative Undrained Shear Strength (kPa)
Very Soft (VS)	≤ 25	≤ 12
Soft (S)	> 25 and ≤ 50	> 12 and ≤ 25
Firm (F)	> 50 and ≤ 100	> 25 and ≤ 50
Stiff (St)	> 100 and ≤ 200	> 50 and ≤ 100
Very Stiff (VSt)	> 200 and ≤ 400	> 100 and ≤ 200
Hard (Hd)	> 400	> 200
Friable (Fr)	Strength not attainable – soil crumbles	

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc. Where relevant, further information regarding rock classification is given in the text of the report. In the Sydney Basin, 'shale' is used to describe fissile mudstone, with a weakness parallel to bedding. Rocks with alternating inter-laminations of different grain size (eg. siltstone/claystone and siltstone/fine grained sandstone) is referred to as 'laminite'.

SAMPLING

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

Disturbed samples taken during drilling provide information on plasticity, grain size, colour, moisture content, minor constituents and, depending upon the degree of disturbance, some information on strength and structure. Bulk samples are similar but of greater volume required for some test procedures.

Undisturbed samples are taken by pushing a thin-walled sample tube, usually 50mm diameter (known as a U50), into the soil and withdrawing it with a sample of the soil contained in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shrink-swell behaviour, strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling used are given on the attached logs.

INVESTIGATION METHODS

The following is a brief summary of investigation methods currently adopted by the Company and some comments on their use and application. All methods except test pits, hand auger drilling and portable Dynamic Cone Penetrometers require the use of a mechanical rig which is commonly mounted on a truck chassis or track base.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils and 'weaker' bedrock if it is safe to descend into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for a large excavator. Limitations of test pits are the problems associated with disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of 50mm to 100mm diameter is advanced by manually operated equipment. Refusal of the hand auger can occur on a variety of materials such as obstructions within any fill, tree roots, hard clay, gravel or ironstone, cobbles and boulders, and does not necessarily indicate rock level.

Continuous Spiral Flight Augers: The borehole is advanced using 75mm to 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights, but they can be very disturbed and layers may become mixed. Information from the auger sampling (as distinct from specific sampling by SPTs or undisturbed samples) is of limited reliability due to mixing or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table is of even lesser reliability than augering above the water table.

Rock Augering: Use can be made of a Tungsten Carbide (TC) bit for auger drilling into rock to indicate rock quality and continuity by variation in drilling resistance and from examination of recovered rock cuttings. This method of investigation is quick and relatively inexpensive but provides only an indication of the likely rock strength and predicted values may be in error by a strength order. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is usually advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be assessed from the cuttings, together with some information from "feel" and rate of penetration.

Mud Stabilised Drilling: Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilise the borehole. The term 'mud' encompasses a range of products ranging from bentonite to polymers. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (eg. from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. Provided full core recovery is achieved (which is not always possible in very low strength rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation. In rocks, NMLC or HQ triple tube core barrels, which give a core of about 50mm and 61mm diameter, respectively, is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as NO CORE. The location of NO CORE recovery is determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the bottom of the drill run.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils, as a means of indicating density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289.6.3.1–2004 (R2016) *'Methods of Testing Soils for Engineering Purposes, Soil Strength and Consolidation Tests – Determination of the Penetration Resistance of a Soil – Standard Penetration Test (SPT)'*.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63.5kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

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

  N = 13
  4, 6, 7

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

  N > 30
  15, 30/40mm

The results of the test can be related empirically to the engineering properties of the soil.

A modification to the SPT is where the same driving system is used with a solid 60° tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid Cone Penetration Test (SCPT) are shown as 'N_c' on the borehole logs, together with the number of blows per 150mm penetration.

Cone Penetrometer Testing (CPT) and Interpretation: The cone penetrometer is sometimes referred to as a Dutch Cone. The test is described in Australian Standard 1289.6.5.1–1999 (R2013) *'Methods of Testing Soils for Engineering Purposes, Soil Strength and Consolidation Tests – Determination of the Static Cone Penetration Resistance of a Soil – Field Test using a Mechanical and Electrical Cone or Friction-Cone Penetrometer'*.

In the tests, a 35mm or 44mm diameter rod with a conical tip is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with a hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the frictional resistance on a separate 134mm or 165mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are electrically connected by wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck. The CPT does not provide soil sample recovery.

As penetration occurs (at a rate of approximately 20mm per second), the information is output as incremental digital records every 10mm. The results given in this report have been plotted from the digital data.

The information provided on the charts comprise:

- Cone resistance – the actual end bearing force divided by the cross sectional area of the cone – expressed in MPa. There are two scales presented for the cone resistance. The lower scale has a range of 0 to 5MPa and the main scale has a range of 0 to 50MPa. For cone resistance values less than 5MPa, the plot will appear on both scales.
- Sleeve friction – the frictional force on the sleeve divided by the surface area – expressed in kPa.
- Friction ratio – the ratio of sleeve friction to cone resistance, expressed as a percentage.

  The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1% to 2% are commonly encountered in sands and occasionally very soft clays, rising to 4% to 10% in stiff clays and peats. Soil descriptions based on cone resistance and friction ratios are only inferred and must not be considered as exact.

Correlations between CPT and SPT values can be developed for both sands and clays but may be site specific.

Interpretation of CPT values can be made to empirically derive modulus or compressibility values to allow calculation of foundation settlements.

Stratification can be inferred from the cone and friction traces and from experience and information from nearby boreholes etc. Where shown, this information is presented for general guidance, but must be regarded as interpretive. The test method provides a continuous profile of engineering properties but, where precise information on soil classification is required, direct drilling and sampling may be preferable.

There are limitations when using the CPT in that it may not penetrate obstructions within any fill, thick layers of hard clay and very dense sand, gravel and weathered bedrock. Normally a 'dummy' cone is pushed through fill to protect the equipment. No information is recorded by the 'dummy' probe.

Flat Dilatometer Test: The flat dilatometer (DMT), also known as the Marchetti Dilometer comprises a stainless steel blade having a flat, circular steel membrane mounted flush on one side.

The blade is connected to a control unit at ground surface by a pneumatic-electrical tube running through the insertion rods. A gas tank, connected to the control unit by a pneumatic cable, supplies the gas pressure required to expand the membrane. The control unit is equipped with a pressure regulator, pressure gauges, an audio-visual signal and vent valves.

The blade is advanced into the ground using our CPT rig or one of our drilling rigs, and can be driven into the ground using an SPT hammer. As soon as the blade is in place, the membrane is inflated, and the pressure required to lift the membrane (approximately 0.1mm) is recorded. The pressure then required to lift the centre of the membrane by an additional 1mm is recorded. The membrane is then deflated before pushing to the next depth increment, usually 200mm down. The pressure readings are corrected for membrane stiffness.

The DMT is used to measure material index (I_D), horizontal stress index (K_D), and dilatometer modulus (E_D). Using established correlations, the DMT results can also be used to assess the 'at rest' earth pressure coefficient (K_o), over-consolidation ratio (OCR), undrained shear strength (C_u), friction angle (ϕ), coefficient of consolidation (C_h), coefficient of permeability (K_h), unit weight (γ), and vertical drained constrained modulus (M).

The seismic dilatometer (SDMT) is the combination of the DMT with an add-on seismic module for the measurement of shear wave velocity (V_s). Using established correlations, the SDMT results can also be used to assess the small strain modulus (G_o).

Portable Dynamic Cone Penetrometers: Portable Dynamic Cone Penetrometer (DCP) tests are carried out by driving a 16mm diameter rod with a 20mm diameter cone end with a 9kg hammer dropping 510mm. The test is described in Australian Standard 1289.6.3.2–1997 (R2013) *'Methods of Testing Soils for Engineering Purposes, Soil Strength and Consolidation Tests – Determination of the Penetration Resistance of a Soil – 9kg Dynamic Cone Penetrometer Test'*.

The results are used to assess the relative compaction of fill, the relative density of granular soils, and the strength of cohesive soils. Using established correlations, the DCP test results can also be used to assess California Bearing Ratio (CBR).

Refusal of the DCP can occur on a variety of materials such as obstructions within any fill, tree roots, hard clay, gravel or ironstone, cobbles and boulders, and does not necessarily indicate rock level.

Vane Shear Test: The vane shear test is used to measure the undrained shear strength (C_u) of typically very soft to firm fine grained cohesive soils. The vane shear is normally performed in the bottom of a borehole, but can be completed from surface level, the bottom and sides of test pits, and on recovered undisturbed tube samples (when using a hand vane).

The vane comprises four rectangular blades arranged in the form of a cross on the end of a thin rod, which is coupled to the bottom of a drill rod string when used in a borehole. The size of the vane is dependent on the strength of the fine grained cohesive soils; that is, larger vanes are normally used for very low strength soils. For borehole testing, the size of the vane can be limited by the size of the casing that is used.

For testing inside a borehole, a device is used at the top of the casing, which suspends the vane and rods so that they do not sink under self-weight into the 'soft' soils beyond the depth at which the test is to be carried out. A calibrated torque head is used to rotate the rods and vane and to measure the resistance of the vane to rotation.

With the vane in position, torque is applied to cause rotation of the vane at a constant rate. A rate of 6° per minute is the common rotation rate. Rotation is continued until the soil is sheared and the maximum torque has been recorded. This value is then used to calculate the undrained shear strength. The vane is then rotated rapidly a number of times and the operation repeated until a constant torque reading is obtained. This torque value is used to calculate the remoulded shear strength. Where appropriate, friction on the vane rods is measured and taken into account in the shear strength calculation.

LOGS

The borehole or test pit logs presented herein are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on the frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will enable the most reliable assessment, but is not always practicable or possible to justify on economic grounds. In any case, the boreholes or test pits represent only a very small sample of the total subsurface conditions.

The terms and symbols used in preparation of the logs are defined in the following pages.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than 'straight line' variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

Where groundwater levels are measured in boreholes, there are several potential problems:

- Although groundwater may be present, in low permeability soils it may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes and may not be the same at the time of construction.
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole or 'reverted' chemically if reliable water observations are to be made.

More reliable measurements can be made by installing standpipes which are read after the groundwater level has stabilised at intervals ranging from several days to perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from perched water tables or surface water.

FILL

The presence of fill materials can often be determined only by the inclusion of foreign objects (eg. bricks, steel, etc) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably assess the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density, strength and material type is much greater than with natural soil deposits. Consequently, there is an increased risk of adverse engineering characteristics or behaviour. If the volume and quality of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes.

LABORATORY TESTING

Laboratory testing is normally carried out in accordance with Australian Standard 1289 *'Methods of Testing Soils for Engineering Purposes'* or appropriate NSW Government Roads & Maritime Services (RMS) test methods. Details of the test procedure used are given on the individual report forms.

ENGINEERING REPORTS

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building) the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

Reasonable care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions – the potential for this will be partially dependent on borehole spacing and sampling frequency as well as investigation technique.
- Changes in policy or interpretation of policy by statutory authorities.
- The actions of persons or contractors responding to commercial pressures.
- Details of the development that the Company could not reasonably be expected to anticipate.

If these occur, the Company will be pleased to assist with investigation or advice to resolve any problems occurring.

SITE ANOMALIES

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

REPRODUCTION OF INFORMATION FOR CONTRACTUAL PURPOSES

Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Copyright in all documents (such as drawings, borehole or test pit logs, reports and specifications) provided by the Company shall remain the property of Jeffery and Katauskas Pty Ltd. Subject to the payment of all fees due, the Client alone shall have a licence to use the documents provided for the sole purpose of completing the project to which they relate. Licence to use the documents may be revoked without notice if the Client is in breach of any obligation to make a payment to us.

REVIEW OF DESIGN

Where major civil or structural developments are proposed or where only a limited investigation has been completed or where the geotechnical conditions/constraints are quite complex, it is prudent to have a joint design review which involves an experienced geotechnical engineer/engineering geologist.

SITE INSPECTION

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related.

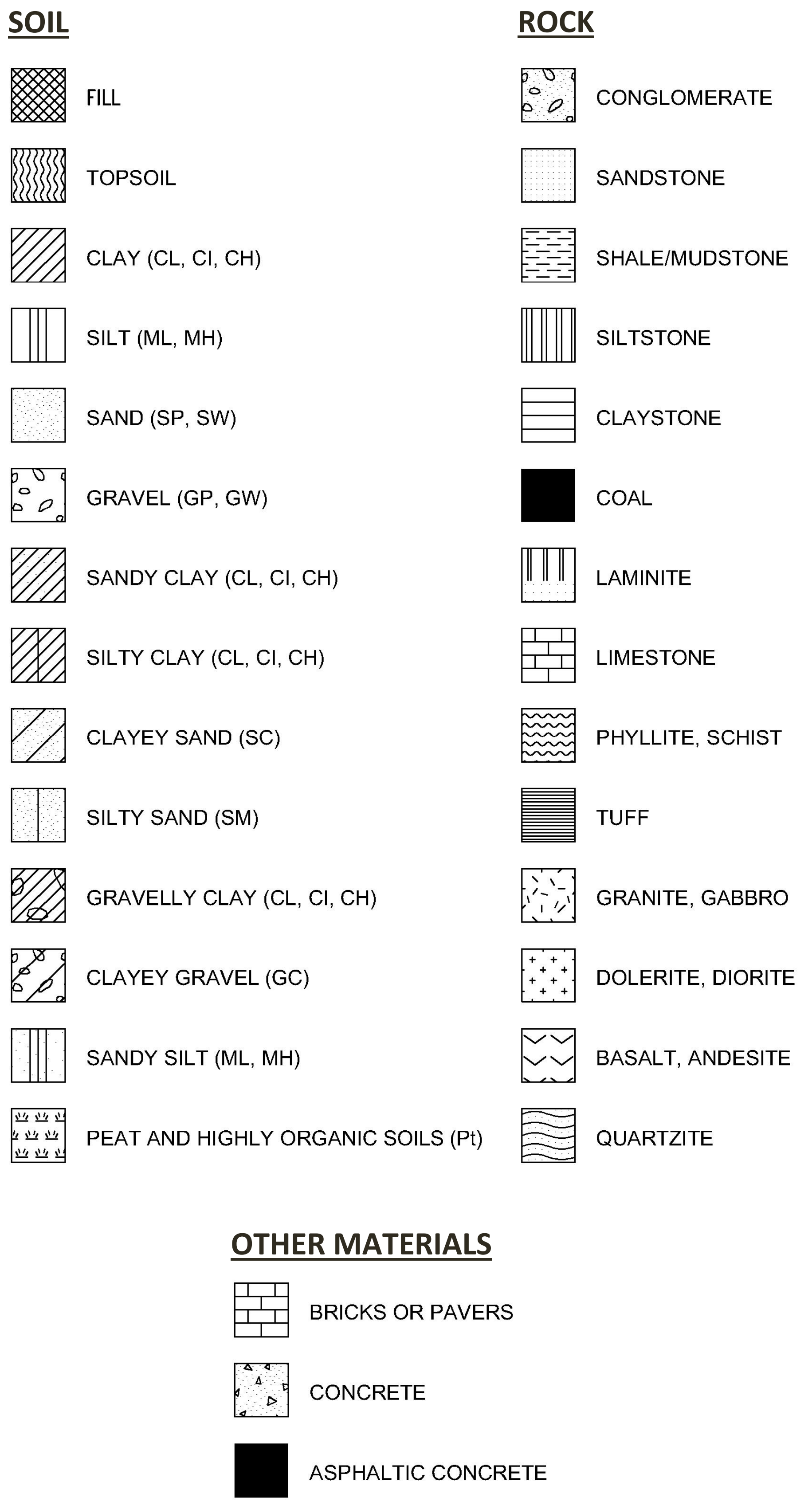
Requirements could range from:

i) a site visit to confirm that conditions exposed are no worse than those interpreted, to

ii) a visit to assist the contractor or other site personnel in identifying various soil/rock types and appropriate footing or pile founding depths, or

iii) full time engineering presence on site.

SYMBOL LEGENDS



SOIL

FILL
TOPSOIL
CLAY (CL, CI, CH)
SILT (ML, MH)
SAND (SP, SW)
GRAVEL (GP, GW)
SANDY CLAY (CL, CI, CH)
SILTY CLAY (CL, CI, CH)
CLAYEY SAND (SC)
SILTY SAND (SM)
GRAVELLY CLAY (CL, CI, CH)
CLAYEY GRAVEL (GC)
SANDY SILT (ML, MH)
PEAT AND HIGHLY ORGANIC SOILS (Pt)

ROCK

CONGLOMERATE
SANDSTONE
SHALE/MUDSTONE
SILTSTONE
CLAYSTONE
COAL
LAMINITE
LIMESTONE
PHYLLITE, SCHIST
TUFF
GRANITE, GABBRO
DOLERITE, DIORITE
BASALT, ANDESITE
QUARTZITE

OTHER MATERIALS

BRICKS OR PAVERS
CONCRETE
ASPHALTIC CONCRETE

CLASSIFICATION OF COARSE AND FINE GRAINED SOILS

Major Divisions		Group Symbol	Typical Names	Field Classification of Sand and Gravel	Laboratory Classification	
Coarse grained soil (more than 65% of soil excluding oversize fraction is greater than 0.075mm)	GRAVEL (more than half of coarse fraction is larger than 2.36mm	GW	Gravel and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 4$ $1 < C_c < 3$
		GP	Gravel and gravel-sand mixtures, little or no fines, uniform gravels	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		GM	Gravel-silt mixtures and gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	Fines behave as silt
		GC	Gravel-clay mixtures and gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	Fines behave as clay
	SAND (more than half of coarse fraction is smaller than 2.36mm)	SW	Sand and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 6$ $1 < C_c < 3$
		SP	Sand and gravel-sand mixtures, little or no fines	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		SM	Sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	N/A
		SC	Sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	

Major Divisions		Group Symbol	Typical Names	Field Classification of Silt and Clay			Laboratory Classification
				Dry Strength	Dilatancy	Toughness	% < 0.075mm
ine grained soils (more than 35% of soil excluding oversize fraction is less than 0.075mm)	SILT and CLAY (low to medium plasticity)	ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or silt with low plasticity	None to low	Slow to rapid	Low	Below A line
		CL, CI	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay	Medium to high	None to slow	Medium	Above A line
		OL	Organic silt	Low to medium	Slow	Low	Below A line
	SILT and CLAY (high plasticity)	MH	Inorganic silt	Low to medium	None to slow	Low to medium	Below A line
		CH	Inorganic clay of high plasticity	High to very high	None	High	Above A line
		OH	Organic clay of medium to high plasticity, organic silt	Medium to high	None to very slow	Low to medium	Below A line
	Highly organic soil	Pt	Peat, highly organic soil	–	–	–	–

Laboratory **Classification** Criteria

A well graded coarse grained soil is one for which the coefficient of uniformity $Cu > 4$ and the coefficient of curvature $1 < C_c < 3$. Otherwise, the soil is poorly graded. These coefficients are given by:

$$C_U = \frac{D_{60}}{D_{10}} \quad \text{and} \quad C_C = \frac{(D_{30})^2}{D_{10}\,D_{60}}$$

Where D_{10}, D_{30} and D_{60} are those grain sizes for which 10%, 30% and 60% of the soil grains, respectively, are smaller.

NOTES:

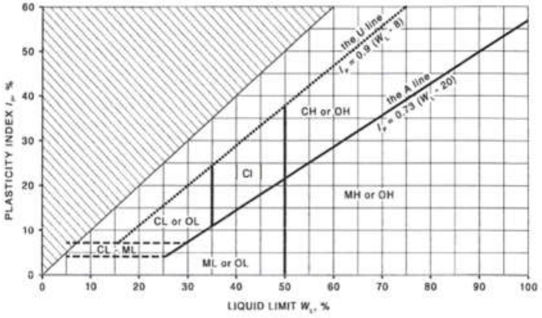
1 For a coarse grained soil with a fines content between 5% and 12%, the soil is given a dual classification comprising the two group symbols separated by a dash; for example, for a poorly graded gravel with between 5% and 12% silt fines, the classification is GP-GM.

2 Where the grading is determined from laboratory tests, it is defined by coefficients of curvature (C_c) and uniformity (C_u) derived from the particle size distribution curve.

3 Clay soils with liquid limits > 35% and ≤ 50% may be classified as being of medium plasticity.

4 The U line on the Modified Casagrande Chart is an approximate upper bound for most natural soils.

Modified Casagrande Chart for Classifying Silts and Clays according to their Behaviour



LOG SYMBOLS

Log Column	Symbol	Definition		
Groundwater Record	—▼—	Standing water level. Time delay following completion of drilling/excavation may be shown.		
	—C—	Extent of borehole/test pit collapse shortly after drilling/excavation.		
	▶—	Groundwater seepage into borehole or test pit noted during drilling or excavation.		
Samples	ES	Sample taken over depth indicated, for environmental analysis.		
	U50	Undisturbed 50mm diameter tube sample taken over depth indicated.		
	DB	Bulk disturbed sample taken over depth indicated.		
	DS	Small disturbed bag sample taken over depth indicated.		
	ASB	Soil sample taken over depth indicated, for asbestos analysis.		
	ASS	Soil sample taken over depth indicated, for acid sulfate soil analysis.		
	SAL	Soil sample taken over depth indicated, for salinity analysis.		
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration. 'Refusal' refers to apparent hammer refusal within the corresponding 150mm depth increment.		
	N_c = 5 7 3R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60° solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.		
	VNS = 25	Vane shear reading in kPa of undrained shear strength.		
	PID = 100	Photoionisation detector reading in ppm (soil sample headspace test).		
Moisture Condition (Fine Grained Soils)	w > PL	Moisture content estimated to be greater than plastic limit.		
	w ≈ PL	Moisture content estimated to be approximately equal to plastic limit.		
	w < PL	Moisture content estimated to be less than plastic limit.		
	w ≈ LL	Moisture content estimated to be near liquid limit.		
	w > LL	Moisture content estimated to be wet of liquid limit.		
(Coarse Grained Soils)	D	DRY – runs freely through fingers.		
	M	MOIST – does not run freely but no free water visible on soil surface.		
	W	WET – free water visible on soil surface.		
Strength (Consistency) Cohesive Soils	VS	VERY SOFT – unconfined compressive strength ≤ 25kPa.		
	S	SOFT – unconfined compressive strength > 25kPa and ≤ 50kPa.		
	F	FIRM – unconfined compressive strength > 50kPa and ≤ 100kPa.		
	St	STIFF – unconfined compressive strength > 100kPa and ≤ 200kPa.		
	VSt	VERY STIFF – unconfined compressive strength > 200kPa and ≤ 400kPa.		
	Hd	HARD – unconfined compressive strength > 400kPa.		
	Fr	FRIABLE – strength not attainable, soil crumbles.		
	( )	Bracketed symbol indicates estimated consistency based on tactile examination or other assessment.		
Density Index/ Relative Density (Cohesionless Soils)			**Density Index (I_D) Range (%)**	**SPT 'N' Value Range (Blows/300mm)**
	VL	VERY LOOSE	≤ 15	0 – 4
	L	LOOSE	> 15 and ≤ 35	4 – 10
	MD	MEDIUM DENSE	> 35 and ≤ 65	10 – 30
	D	DENSE	> 65 and ≤ 85	30 – 50
	VD	VERY DENSE	> 85	> 50
	( )	Bracketed symbol indicates estimated density based on ease of drilling or other assessment.		
Hand Penetrometer Readings	300 250	Measures reading in kPa of unconfined compressive strength. Numbers indicate individual test results on representative undisturbed material unless noted otherwise.		

Log Column	Symbol	Definition
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Twin pronged tungsten carbide bit.
	T_{60}	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.
	Soil Origin	The geological origin of the soil can generally be described as: RESIDUAL – soil formed directly from insitu weathering of the underlying rock. No visible structure or fabric of the parent rock. EXTREMELY WEATHERED – soil formed directly from insitu weathering of the underlying rock. Material is of soil strength but retains the structure and/or fabric of the parent rock. ALLUVIAL – soil deposited by creeks and rivers. ESTUARINE – soil deposited in coastal estuaries, including sediments caused by inflowing creeks and rivers, and tidal currents. MARINE – soil deposited in a marine environment. AEOLIAN – soil carried and deposited by wind. COLLUVIAL – soil and rock debris transported downslope by gravity, with or without the assistance of flowing water. Colluvium is usually a thick deposit formed from a landslide. The description 'slopewash' is used for thinner surficial deposits. LITTORAL – beach deposited soil.

Classification of Material Weathering

Term		Abbreviation		Definition
Residual Soil		RS		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely Weathered		XW		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
Highly Weathered	Distinctly Weathered (Note 1)	HW	DW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately Weathered		MW		The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly Weathered		SW		Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh		FR		Rock shows no sign of decomposition of individual minerals or colour changes.

NOTE 1: The term 'Distinctly Weathered' is used where it is not practicable to distinguish between 'Highly Weathered' and 'Moderately Weathered' rock. 'Distinctly Weathered' is defined as follows: *'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'*. There is some change in rock strength.

Rock Material Strength Classification

Term	Abbreviation	Uniaxial Compressive Strength (MPa)	Guide to Strength	
			Point Load Strength Index $Is_{(50)}$ (MPa)	Field Assessment
Very Low Strength	VL	0.6 to 2	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 30mm thick can be broken by finger pressure.
Low Strength	L	2 to 6	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium Strength	M	6 to 20	0.3 to 1	Scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High Strength	H	20 to 60	1 to 3	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High Strength	VH	60 to 200	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High Strength	EH	> 200	> 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Abbreviations Used in Defect Description

Cored Borehole Log Column	Symbol Abbreviation	Description
Point Load Strength Index	• 0.6	Axial point load strength index test result (MPa)
	x 0.6	Diametral point load strength index test result (MPa)
Defect Details – Type	Be	Parting – bedding or cleavage
	CS	Clay seam
	Cr	Crushed/sheared seam or zone
	J	Joint
	Jh	Healed joint
	Ji	Incipient joint
	XWS	Extremely weathered seam
– Orientation	Degrees	Defect orientation is measured relative to normal to the core axis (ie. relative to the horizontal for a vertical borehole)
– Shape	P	Planar
	C	Curved
	Un	Undulating
	St	Stepped
	Ir	Irregular
– Roughness	Vr	Very rough
	R	Rough
	S	Smooth
	Po	Polished
	Sl	Slickensided
– Infill Material	Ca	Calcite
	Cb	Carbonaceous
	Clay	Clay
	Fe	Iron
	Qz	Quartz
	Py	Pyrite
– Coatings	Cn	Clean
	Sn	Stained – no visible coating, surface is discoloured
	Vn	Veneer – visible, too thin to measure, may be patchy
	Ct	Coating ≤ 1mm thick
	Filled	Coating > 1mm thick
– Thickness	mm.t	Defect thickness measured in millimetres

APPENDIX A

115 Wicks Road
Macquarie Park, NSW 2113
PO Box 976
North Ryde, BC 1670
Telephone: 02 9888 5000
Facsimile: 02 9888 5001

SOIL TEST SERVICES
ABN 43 002 145 173

TABLE A
MOISTURE CONTENT TEST REPORT

Client:	JK Geotechnics	**Ref No:**	27318SB1
Project:	Proposed Additions to Northside West Clinic	**Report:**	A
Location:	23-27 Lytton Street, Wentworthville, NSW	**Report Date:**	9/03/2015
		Page 1 of 1	

AS 1289 **TEST METHOD** **2.1.1**

BOREHOLE NUMBER	DEPTH	MOISTURE CONTENT
	m	%
101	2.60-2.80	10.5
101	3.90-4.10	6.7
102	2.80-3.00	6.5
102	5.00-5.50	2.9
103	4.50-5.00	7.4
104	2.50-3.00	9.9
104	3.50-4.00	6.5
104	4.50-5.00	6.6

115 Wicks Road
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SOIL TEST SERVICES
ABN 43 002 145 173

TABLE B
POINT LOAD STRENGTH INDEX TEST REPORT

Client: JK Geotechnics
Project: Proposed Additions to Northside West Clinic
Location: 23-27 Lytton Street, Wentworthville, NSW

Ref No: 27318SB1
Report: B
Report Date: 2/03/2015
Page 1 of 2

BOREHOLE NUMBER	DEPTH m	$I_{S(50)}$ MPa	ESTIMATED UNCONFINED COMPRESSIVE STRENGTH (MPa)
101	5.40-5.43	0.3	6
	5.54-5.57	0.3	6
	5.88-5.91	0.4	8
	6.21-6.25	0.6	12
	6.79-6.82	0.7	14
	7.09-7.14	0.4	8
	7.81-7.85	0.9	18
	8.25-8.28	0.6	12
	8.85-8.88	0.7	14
	9.19-9.22	0.7	14
	9.85-9.88	0.6	12
	10.19-10.23	0.5	10
	10.65-10.68	0.4	8
	11.36-11.38	0.6	12
	11.67-11.70	0.4	8
102	5.74-5.78	0.6	12
	5.97-6.00	1.0	20
	6.20-6.24	0.7	14
	6.72-6.75	0.8	16
	7.16-7.19	0.6	12
	7.77-7.80	0.6	12
	8.17-8.22	0.6	12
	8.73-8.75	0.8	16
	9.18-9.22	0.7	14
	9.68-9.72	0.6	12

NOTES: See Page 2 of 2

115 Wicks Road
Macquarie Park, NSW 2113
PO Box 976
North Ryde, BC 1670
Telephone: 02 9888 5000
Facsimile: 02 9888 5001

SOIL TEST SERVICES
ABN 43 002 145 173

TABLE B
POINT LOAD STRENGTH INDEX TEST REPORT

Client: JK Geotechnics
Project: Proposed Additions to Northside West Clinic
Location: 23-27 Lytton Street, Wentworthville, NSW

Ref No: 27318SB1
Report: B
Report Date: 2/03/2015
Page 2 of 2

BOREHOLE NUMBER	DEPTH m	$I_{S(50)}$ MPa	ESTIMATED UNCONFINED COMPRESSIVE STRENGTH (MPa)
102	10.26-10.29	0.6	12
	10.77-10.81	0.5	10
	11.19-11.23	0.4	8
	11.71-11.74	0.7	14
	12.10-12.13	0.9	18
103	5.80-5.83	0.5	10
	6.20-6.25	0.7	14
	6.74-6.78	0.6	12
	7.18-7.21	0.5	10
	7.69-7.73	0.6	12
	8.22-8.25	0.5	10
	8.65-8.69	0.6	12
	9.17-9.20	0.5	10
	9.67-9.71	0.5	10
	10.21-10.25	0.5	10
	10.73-10.77	0.9	18
	11.17-11.21	0.4	8
	11.86-11.89	2.1	42
	12.19-12.23	0.6	12

NOTES:

1. In the above table testing was completed in the Axial direction.
2. The above strength tests were completed at the 'as received' moisture content.
3. Test Method: RMS T223.
4. For reporting purposes, the $I_{S(50)}$ has been rounded to the nearest 0.1MPa, or to one significant figure if less than 0.1MPa
5. The Estimated Unconfined Compressive Strength was calculated from the point load Strength Index by the following approximate relationship and rounded off to the nearest whole number :
   U.C.S. = 20 $I_{S(50)}$

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 124328

Client:
JK Geotechnics
PO Box 976
North Ryde BC
NSW 1670

Attention: M Watson

Sample log in details:

Your Reference:	**27318SB1, Wentworthville**	
No. of samples:	3 Soils	
Date samples received / completed instructions received	27/02/15	/ 27/02/15

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	6/03/15	/ 4/03/15
Date of Preliminary Report:	Not Issued	

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

ACCREDITED FOR TECHNICAL COMPETENCE

Misc Inorg - Soil				
Our Reference:	UNITS	124328-1	124328-2	124328-3
Your Reference	-------------	101	102	103
Depth	------------	0.5-0.95	3.5-3.9	1.5-1.95
Date Sampled		23/02/2015	23/02/2015	25/02/2015
Type of sample		Soil	Soil	Soil
Date prepared	-	2/03/2015	2/03/2015	2/03/2015
Date analysed	-	3/03/2015	3/03/2015	3/03/2015
pH 1:5 soil:water	pH Units	5.1	5.6	5.2
Electrical Conductivity 1:5 soil:water	µS/cm	300	440	440
Chloride, Cl 1:5 soil:water	mg/kg	210	550	520
Sulphate, SO4 1:5 soil:water	mg/kg	310	130	190

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B.

QUALITY CONTROL Misc Inorg - Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			02/03/2015	124328-1	2/03/2015 || 2/03/2015	LCS-W1	02/03/2015
Date analysed	-			03/03/2015	124328-1	3/03/2015 || 3/03/2015	LCS-W1	03/03/2015
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	124328-1	5.1 || 5.1 || RPD: 0	LCS-W1	101%
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	124328-1	300 || 310 || RPD: 3	LCS-W1	104%
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	124328-1	210 || 220 || RPD: 5	LCS-W1	104%
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	124328-1	310 || 340 || RPD: 9	LCS-W1	112%

Report Comments:

Asbestos ID was analysed by Approved Identifier: Not applicable for this job
Asbestos ID was authorised by Approved Signatory: Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

BOREHOLE LOG

Borehole No.
101
1/3

Client: ERILYAN PTY LTD

Project: PROPOSED STAGE 2 REHABILITATION CENTRE

Location: NORTHSIDE WEST CLINIC, 23 TO 27 LYTTON STREET, WENTWORTHVILLE, NSW

Job No. 27318SB1

Method: SPIRAL AUGER
JK350

R.L. Surface: ≈ 21.8m

Date: 23-2-15

Datum: AHD

Logged/Checked by: M.W./D.B.

Groundwater Record	SAMPLES ES	U50	DB	DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION OF AUGERING	■					0		-	ASPHALTIC CONCRETE: 30mm.t	D			
									FILL: Clayey sandy gravel, fine to coarse grained, igneous, fine to coarse grained sand.				
	■			■	N = 14 7,7,7			CH	SILTY CLAY: high plasticity, grey mottled red brown, trace of root fibres and coarse grained ironstone gravel.	MC<PL	H	>600 >600 >600	RESIDUAL
						1							
								-	SHALE: light grey, with red brown iron indurated bands.	XW	EL		
				■	N > 13 14,13/ 75mm REFUSAL							>600 >600	BANDED VERY LOW TO LOW 'TC' BIT RESISTANCE
						2							
ON 25/2/15 ▼				■									
						3							
▼ ON 10/3/15													
				■					SHALE: dark grey, with L strength bands.	XW-DW	EL-VL		LOW RESISTANCE
						4			REFER TO CORED BOREHOLE LOG				
						5							
						6							
						7							

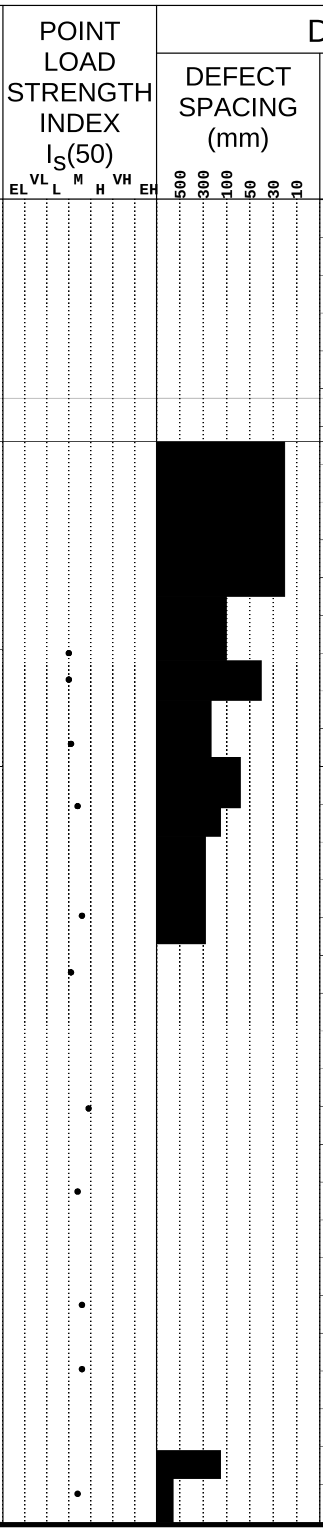
CORED BOREHOLE LOG

Borehole No.
101
2/3

Client: ERILYAN PTY LTD
Project: PROPOSED STAGE 2 REHABILITATION CENTRE
Location: NORTHSIDE WEST CLINIC, 23 TO 27 LYTTON STREET, WENTWORTHVILLE, NSW

Job No. 27318SB1
Core Size: NMLC
R.L. Surface: ≈ 21.8m
Date: 23-2-15
Inclination: VERTICAL
Datum: AHD
Drill Type: JK350
Bearing: -
Logged/Checked by: M.W./D.B.

Water Loss/Level	Barrel Lift	Depth (m)	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	DEFECT DETAILS DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific / General
		3				
		4	START CORING AT 4.05m			
			CORE LOSS 0.23m			
			SHALE: dark grey and red brown.	XW- DW	EL-VL	- FRAGMENTED ZONE, 0°, 60mm.t NUMEROUS CRUSHED SEAMS AND CLAY SEAMS 1mm TO 20mm.t AT APPROXIMATELY 20mm SPACING FROM 4.4m TO 5.1m
		5				- J, 15°, Un, R - Cr, 0°, 20mm.t
			SHALE: dark grey, with grey laminae.	DW	L-M	- Cr, 0°, 8mm.t CLAY INFILL - CS, 0°, 22mm.t - XWS, 0°, 70mm.t
		6				- J, 65°, Un, R, XW INFILL - FRAGMENTED ZONE, 130mm.t
				XW	EL	
				DW	M	- J, 60-90°, Un, R, CLAY INFILL - Cr, 0°, 10mm.t
				SW		- Cr, 0°, 10mm.t - Cr, 0°, 30mm.t
		7		FR		
95% RET- URN		8				
		9				
				SW		- J, 45°, Un, R - J, 80°, Un, R - VL-L STRENGTH BAND, 0°, 60mm.t




JK Geotechnics
JOB No. 27318SB BH101 START CORING AT 4.05m
4
CORE LOSS 0.23 m
5
6
7
8
9
10
11
EOBH AT 11.70m

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

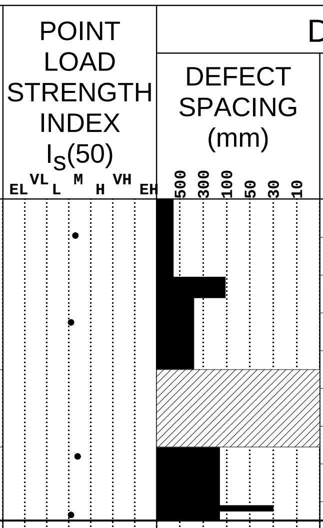
CORED BOREHOLE LOG

Borehole No.
101
3/3

Client: ERILYAN PTY LTD
Project: PROPOSED STAGE 2 REHABILITATION CENTRE
Location: NORTHSIDE WEST CLINIC, 23 TO 27 LYTTON STREET, WENTWORTHVILLE, NSW

Job No. 27318SB1
Core Size: NMLC
R.L. Surface: ≈ 21.8m
Date: 23-2-15
Inclination: VERTICAL
Datum: AHD
Drill Type: JK350
Bearing: -
Logged/Checked by: M.W./D.B.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	DEFECT DETAILS DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific	General
				SHALE: dark grey, with grey laminae.	SW	M	- L STRENGTH BAND, 20mm.t - L STRENGTH BAND, 25mm.t - L STRENGTH BAND, 18mm.t - XWS, 0°, 75mm.t - XWS, 0°, 70mm CLAY INFILL	
		11		SHALE: dark grey and grey, with clay seams.	XW-DW	EL-VL	- J, 45°, P, R - J, 35°, P, R	
				SHALE: dark grey.	SW	M	- XWS, 10°, 100mm.t - XWS, 0°, 10mm.t - XWS, 0°, 30mm.t	
				END OF BOREHOLE AT 11.70m			50mm DIA. PVC STANDPIPE INSTALLED TO 11.70m DEPTH, SLOTTED FROM 11.7m TO 2.2m, 2mm SAND FILTER PACK FROM 11.7m TO 2.0m, BENTONITE SEAL FROM 2.2m TO SURFACE, COMPLETED WITH GATIC COVER	
		12						
		13						
		14						
		15						
		16						



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BOREHOLE LOG

Borehole No.
102
1/3

Client: ERILYAN PTY LTD

Project: PROPOSED STAGE 2 REHABILITATION CENTRE

Location: NORTHSIDE WEST CLINIC, 23 TO 27 LYTTON STREET, WENTWORTHVILLE, NSW

Job No. 27318SB1
Method: SPIRAL AUGER JK350
R.L. Surface: ≈ 22.2m

Date: 23-2-15
Datum: AHD

Logged/Checked by: M.W./D.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION OF AUGERING	■					0	■	-	ASPHALTIC CONCRETE: 30mm.t	D			
	■						▨		FILL: Clayey sandy gravel, fine to coarse grained, igneous, fine to coarse grained sand.				APPEARS MODERATELY COMPACTED
				■	N = 22 9,13,9	1	▨		FILL: Sand, fine to medium grained, light orange brown, with medium to coarse grained sub rounded to rounded sandstone gravel.				
	■			■	N = 32 7,12,20	2	▧	CH	SILTY CLAY: high plasticity, light grey mottled red brown, trace of fine to medium grained ironstone gravel.	MC<PL	H	>600 >600 >600	RESIDUAL
				■			▤	-	SHALE: grey.	XW-DW	EL-VL		BANDED VERY LOW 'TC' BIT RESISTANCE
				■		3 4	▤		SHALE: dark grey, with L strength bands and clay bands.	DW	VL-L		BANDED LOW RESISTANCE
				■		5	▤		SHALE: dark grey.	SW	M		MODERATE RESISTANCE
						6 7			REFER TO CORED BOREHOLE LOG				

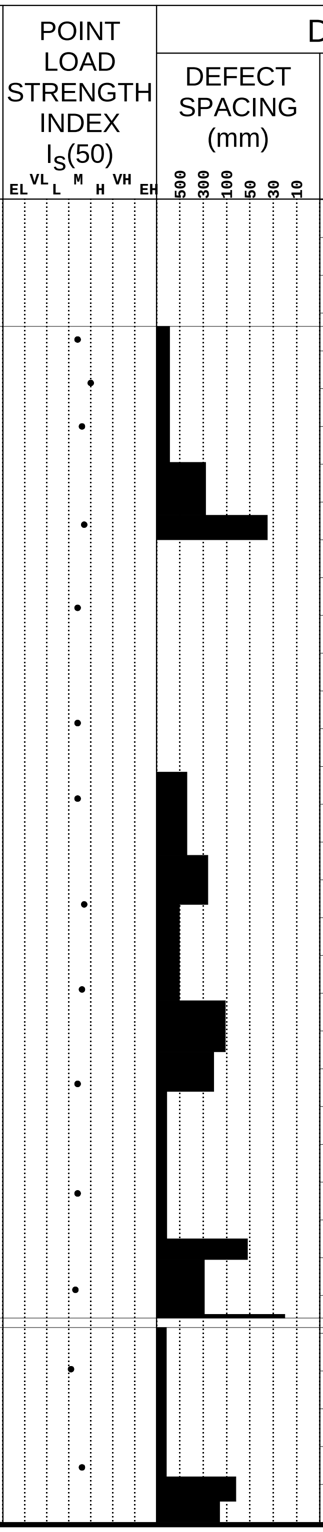
JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

CORED BOREHOLE LOG

Borehole No.
102
2/3

Client: ERILYAN PTY LTD
Project: PROPOSED STAGE 2 REHABILITATION CENTRE
Location: NORTHSIDE WEST CLINIC, 23 TO 27 LYTTON STREET, WENTWORTHVILLE, NSW

Job No. 27318SB1
Core Size: NMLC
R.L. Surface: ≈ 22.2m
Date: 23-2-15
Inclination: VERTICAL
Datum: AHD
Drill Type: JK350
Bearing: -
Logged/Checked by: M.W./D.B.



Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	DEFECT DETAILS – DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific	General
		5						
				START CORING AT 5.67m				
				SHALE: dark grey, with grey laminae.	FR	M		
		6						
							- J, 70-90°, Un, R	
							- J, 90°, P, S - XWS, 0°, 10mm.t - XWS, 0°, 10mm.t - Cr, 0°, 8mm.t	
		7						
							- L STRENGTH BAND, 45mm.t	
		8					- J, 70°, P, S	
							- Cr, 0°, 12mm.t	
							- Cr, 0°, 3mm.t	
90% RET-URN		9						
							- J, 50°, P, S - J, 40°, P, S - XWS, 0°, 10mm.t - Cr, 0°, 15mm.t	
							- J, 20°, P, S	
		10						
							- Cr, 0°, 1mm.t - Cr, 0°, 1mm.t - Cr, 0°, 1mm.t	
							- Cr, 0°, 15mm.t	
		11		CORE LOSS 0.05m				
				SHALE: dark grey, with grey laminae.	FR	M		
							- J, 30°, P, S - J, 90°, P, R, Cr INFILL - XWS, 0°, 47mm.t	


JK Geotechnics
JOB No. 27318SB1 BH102 START CORING AT 5.67m
5
6
7
8
9
10
CL
0.05
11
12
END OF BH AT 12.15m

JK Geotechnics

GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

CORED BOREHOLE LOG

Borehole No.
102
3/3

Client: ERILYAN PTY LTD

Project: PROPOSED STAGE 2 REHABILITATION CENTRE

Location: NORTHSIDE WEST CLINIC, 23 TO 27 LYTTON STREET, WENTWORTHVILLE, NSW

Job No. 27318SB1
Core Size: NMLC
R.L. Surface: ≈ 22.2m

Date: 23-2-15
Inclination: VERTICAL
Datum: AHD

Drill Type: JK350
Bearing: -
Logged/Checked by: M.W./D.B.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_S(50)$ EL VL L M H VH EH	DEFECT SPACING (mm) 500 300 100 50 30 10	DEFECT DETAILS DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific	General
			▤	SHALE: dark grey, with grey laminae.	FR	M	●	■	- XWS, 0°, 5mm.t - J, 90°, P, S	
				END OF BOREHOLE AT 12.35m						
		13								
		14								
		15								
		16								
		17								
		18								

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

BOREHOLE LOG

Borehole No.
103
1/3

Client: ERILYAN PTY LTD

Project: PROPOSED STAGE 2 REHABILITATION CENTRE

Location: NORTHSIDE WEST CLINIC, 23 TO 27 LYTTON STREET, WENTWORTHVILLE, NSW

Job No. 27318SB1

Date: 25-2-15

Method: SPIRAL AUGER
JK300

Logged/Checked by: M.W./D.B.

R.L. Surface: ≈ 21.3m

Datum: AHD

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION OF AUGERING	■					0		-	ASPHALTIC CONCRETE: 30mm.t	D			
								CH	FILL: Clayey sandy gravel, fine to medium grained, igneous, fine to coarse grained sand.	MC<PL	H		
				■	N = 19 6,8,11				SILTY CLAY: high plasticity, orange brown mottled red brown, trace of root fibres, ash and fine to medium grained ironstone gravel.			>600 >600 >600	RESIDUAL
						1			SILTY CLAY: high plasticity, grey and light grey mottled red brown and orange brown, trace of root fibres.				
				■	N = 12 4,5,7							>600 480 >600	
				■		2		-	SHALE: light grey and grey, with L strength bands and iron indurated bands.	XW-DW	EL-VL		BANDED VERY LOW TO LOW 'TC' BIT RESISTANCE
AFTER 3 HRS ▼ ▼ ON 10/3/15						3			as above, but dark grey, with EL strength bands.	DW	VL-L		HYDROCARBON ODOUR IN GROUNDWATER ON 10/3/15
				■		4							
				■		5							
									SHALE: dark grey.	SW	M		MODERATE RESISTANCE WITH VERY LOW TO LOW BANDS
						6			REFER TO CORED BOREHOLE LOG				
						7							

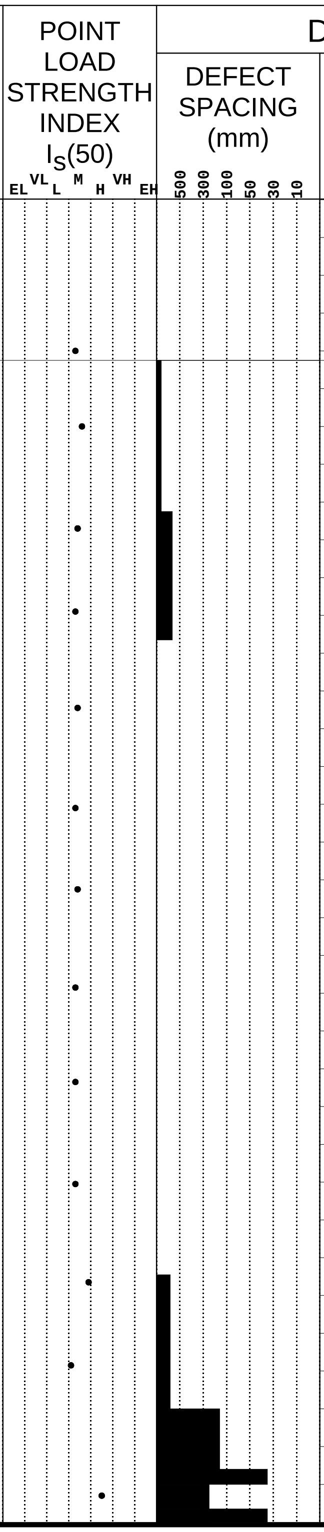
CORED BOREHOLE LOG

Borehole No.
103
2/3

Client: ERILYAN PTY LTD
Project: PROPOSED STAGE 2 REHABILITATION CENTRE
Location: NORTHSIDE WEST CLINIC, 23 TO 27 LYTTON STREET, WENTWORTHVILLE, NSW

Job No. 27318SB1
Core Size: NMLC
R.L. Surface: ≈ 21.3m
Date: 25-2-15
Inclination: VERTICAL
Datum: AHD
Drill Type: JK300
Bearing: -
Logged/Checked by: M.W./D.B.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	DEFECT DETAILS – DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific	General
		5						
				START CORING AT 5.85m				
		6		SHALE: dark grey, with grey laminae.	FR	M		
							- Cr, 0°, 15mm.t	
		7						
							- Cr, 0°, 2mm.t	
		8						
FULL RET-URN		9						
							- J, 50°, P, R	
		10						
							- J, 45-90°, Un, R, Cr INFILL	
		11						
							- J, 75°, P, S	
							- J, 80°, P, S	
							- J, 30°, P, R, Cr, INFILL - Cr, 0°, 6mm.t - J, 90°, P, S	

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JOB No. 27318SBI BH103 START CORING AT 5.85m.
5
6
7
8
9
10
11
12
END OF BH AT 12.45m

CORED BOREHOLE LOG

Borehole No.
103
3/3

Client: ERILYAN PTY LTD

Project: PROPOSED STAGE 2 REHABILITATION CENTRE

Location: NORTHSIDE WEST CLINIC, 23 TO 27 LYTTON STREET, WENTWORTHVILLE, NSW

Job No. 27318SB1
Core Size: NMLC
R.L. Surface: ≈ 21.3m

Date: 25-2-15
Inclination: VERTICAL
Datum: AHD

Drill Type: JK300
Bearing: -
Logged/Checked by: M.W./D.B.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_S(50)$ EL VL L M H VH EH	DEFECT DETAILS: DEFECT SPACING (mm) 500 300 100 50 30 10	DEFECT DETAILS: DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific General
FULL RET-URN				SHALE: dark grey.	FR	M	●		- J, 45°, Un, R - J, 40°, Un, R, Cr INFILL - J, 30°, P, S
				END OF BOREHOLE AT 12.45m					50mm DIA. PVC STANDPIPE INSTALLED TO 12m DEPTH, SLOTTED FROM 12m TO 3m, 2mm SAND FILTER PACK FROM 2.1m TO 2.4m, BENTONITE SEAL FROM 2.4m TO SURFACE, COMPLETED WITH GATIC COVER
		13							
		14							
		15							
		16							
		17							
		18							

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

BOREHOLE LOG

Borehole No.
104
1/1

Client: ERILYAN PTY LTD

Project: PROPOSED STAGE 2 REHABILITATION CENTRE

Location: NORTHSIDE WEST CLINIC, 23 TO 27 LYTTON STREET, WENTWORTHVILLE, NSW

Job No. 27318SB1

Method: SPIRAL AUGER
JK300

R.L. Surface: ≈ 19.0m

Date: 25-2-15

Datum: AHD

Logged/Checked by: M.W./D.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION OF AUGER-ING						0			CONCRETE: 130mm.t				5mm DIA. REINFORCEMENT, 90mm TOP COVER
	■						☒	-	FILL: Clayey sandy gravel, fine to coarse grained, igneous, fine to coarse grained sand.	W			
	■			■	N = 20 6,9,11		▨	CL-CH	SILTY CLAY: medium to high plasticity, light grey mottled orange brown, trace of root fibres and fine to coarse grained ironstone gravel.	MC<PL	H	>600 >600 >600	WATER INTRODUCED DURING DIATUBING
						1	▨						
				■	N > 22 8,13, 9/75mm REFUSAL		▨					>600 >600 >600	
						2	▨						
				■			☰	-	SHALE: dark grey and grey, with L strength bands and iron indurated bands.	XW-DW	EL-VL		BANDS OF VERY LOW TO LOW 'TC' BIT RESISTANCE
						3	☰						
				■			☰		SHALE: dark grey.	SW	M		MODERATE RESISTANCE
				■		4	☰						
				■		5	☰				M-H		MODERATE TO HIGH RESISTANCE
									END OF BOREHOLE AT 5.2m				'TC' BIT REFUSAL
						6							
						7							