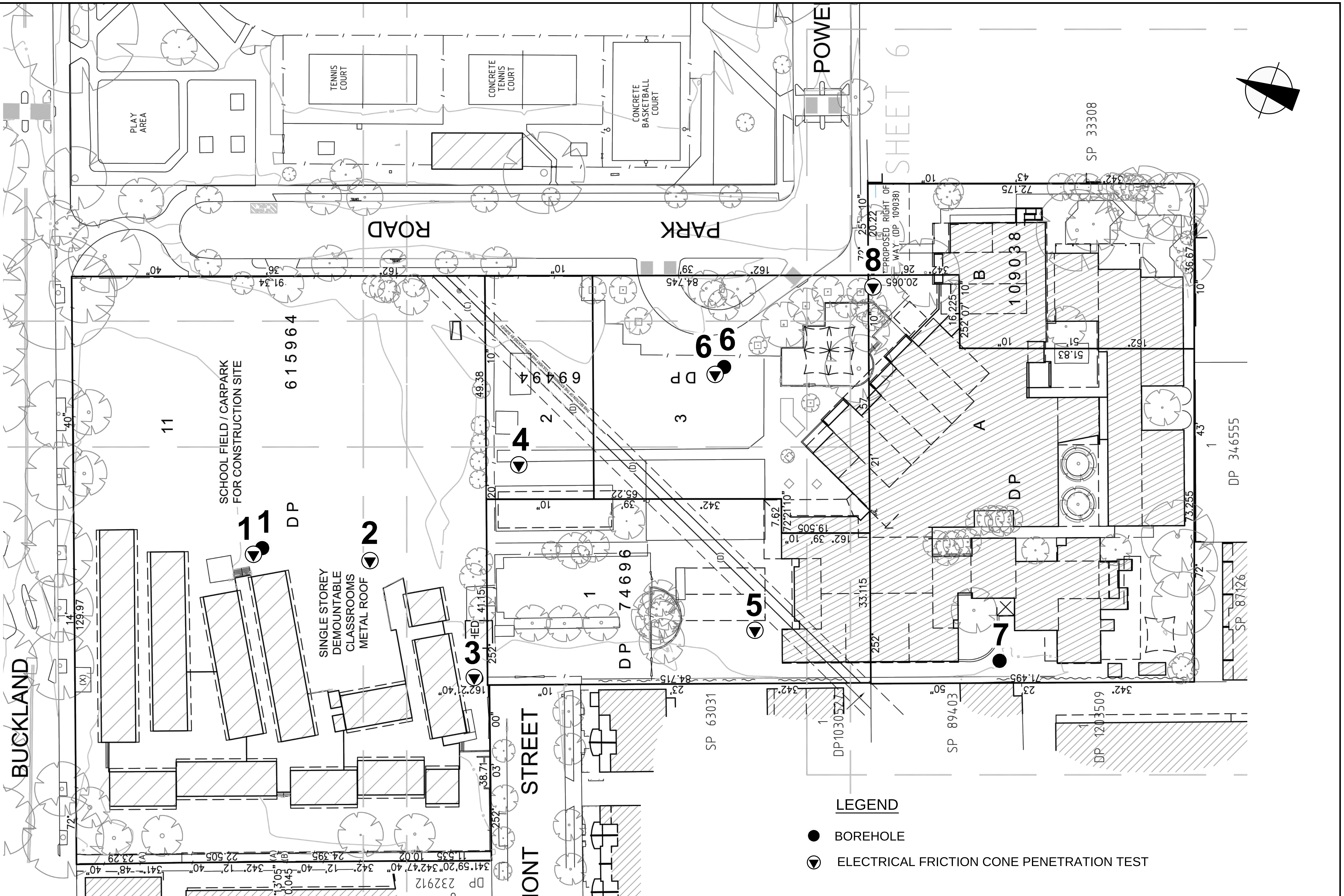

LEGEND

- BOREHOLE
- ELECTRICAL FRICTION CONE PENETRATION TEST

0 8 16 24 32 40
SCALE 1:800 @A3 METRES

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

Title:	**TEST LOCATION PLAN**
Location:	ALEXANDRIA PARK COMMUNITY SCHOOL ALEXANDRIA, NSW
Report No: 30907Z	Figure No: 2

JK **Geotechnics**

REPORT TABLES

EIS

TABLE A
SUMMARY OF LABORATORY RESULTS - ACID SULFATE SOIL ANALYSIS (sPOCAS)

		Analysis	pH_{KCL}	TAA pH 6.5	pH_{ox}	TPA pH 6.5	TSA pH 6.5	S_{POS} %w/w	Liming Rate kg $CaCO_3$/tonne
Action Criteria[1]		Coarse Textured Soil	pH 5.0	18molH+/ tonne	pH 5.0	18molH+/ tonne	18molH+/ tonne	0.03% w/w	
Sample Reference	**Sample Depth (m)**	**Sample Description**							
BH1	2.0-2.5	Sand	6.5	LPQL	4.9	LPQL	LPQL	0.009	<0.75
BH1	4.0-4.5	Sand	5.9	LPQL	4.2	44	42	0.007	<0.75
BH1	5.5-6.0	Sand	6.2	LPQL	6.8	LPQL	LPQL	LPQL	<0.75
BH1	10.5-11.0	Clay	4.2	38	4.0	65	28	0.04	4.8
BH7	1.5-1.95	Sand	9.3	LPQL	7.6	LPQL	LPQL	LPQL	<0.75
BH7	3.5-4.0	Sand	6.8	LPQL	5.2	LPQL	LPQL	LPQL	<0.75
BH7	4.2-4.65	Sand	6.7	LPQL	5.5	LPQL	LPQL	LPQL	<0.75
BH7	7.2-7.65	Sand	5.9	LPQL	5.2	LPQL	LPQL	LPQL	<0.75
BH7	8.7-9.15	Sand	4.6	18	2.2	440	420	0.2	11
Total Number of Samples			9	9	9	9	9	9	2
Minimum Value			4.2	18	2.2	44	28	0.007	4.8
Maximum Value			9.3	38	7.6	440	420	0.2	11

Explanation:

[1] The Action criteria have been adopted from the Acid Sulfate Soil Manual (1998).

Values Exceeding Action Criteria **VALUE**

Abbreviations:

pH_{KCL} : pH of filtered 1:20, 1M KCL extract, shaken overnight

TAA pH 6.5 : Total Actual Acidity in 1M KCL extract titrated to pH6.5

pH_{ox} : pH filtered 1:20 1M KCl after peroxide digestion

TPA : Total Potential Acidity, 1M KCL peroxide digest titrated to pH6.5

TSA: Total Sulfide Acidity

SPOS: Peroxide oxidisable Sulfur (SP - SKCL)

Appendix A: Information on Acid Sulfate Soils

INFORMATION ON ACID SULFATE SOILS

Background

Acid Sulfate Soil (ASS) is formed from iron rich alluvial sediments and sulfate (found in seawater) in the presence of sulfate reducing bacteria and plentiful organic matter. These conditions are generally found in mangroves, salt marsh vegetation or tidal areas and at the bottom of coastal rivers and lakes. These soils include those that are producing acid (termed actual ASS) and those that can become acid producing (termed potential ASS or 'PASS'). PASS are naturally occurring soils and sediment that contain iron sulfides (pyrite) which, when exposed to oxygen generate sulfuric acid.

The ASS Management Advisory Committee (ASSMAC)

The NSW government in 1994 formed the ASSMAC to coordinate a response to ASS issues. In 1998 this group released the Acid Sulfate Soil Manual[7] providing best practice advice for planning, assessment, management, laboratory methods, drainage, groundwater and the preparation of ASS management plans (ASSMP).

In 1997 the Department of Land and Soil Conservation (now part of the Office of Environment and Heritage[8]) developed two series of maps with respect to ASS for use by council and technical staff implementing the ASS Manual 1998:

- ASS Planning Maps – issued to councils and government units; and
- ASS Risk Maps – issued to interested parties.

The ASS Planning Maps

The ASS planning maps provide an indication of the relative potential for disturbance of ASS to occur at locations within the council area. These maps do not provide an indication of the actual occurrence of ASS at a site or the likely severity of the conditions.

The maps are divided into five classes dependent upon the type of activities/works that if undertaken, may represent an environmental risk through the development of acidic conditions associated with ASS:

Table 1: Risk Classes

Risk Class	Description
Class 1	All works.
Class 2	All works below existing ground level and works by which the water table is likely to be lowered.

[7] Acid Sulfate Soils Management Advisory Committee (ASSMAC), (1998). *Acid Sulfate Soils Manual* (ASS Manual 1998)
[8] http://www.environment.nsw.gov.au/acidsulfatesoil/index.htm

Risk Class	Description
Class 3	Works at depths beyond 1m below existing ground level or works by which the water table is likely to be lowered beyond 1m below existing ground level.
Class 4	Works at depths beyond 2m below existing ground level or works by which the water table is likely to be lowered beyond 2m below existing ground level.
Class 5	Works within 500m of adjacent Class 1,2,3,4 land which are likely to lower the water table below 1m AHD on the adjacent land.

The ASS Risk Maps

The ASS risk maps provide an indication of the probability of occurrence of PASS at a particular location based on interpretation from geological and soil landscape maps. The maps provide classes based on high probability, low probability, no known occurrence and areas of disturbed terrain (site specific assessment necessary) and the likely depth at which ASS are likely to be encountered.

Investigation and Laboratory Testing for ASS

The ASS Manual 1998 includes information on assessment of the likelihood of PASS, the need for an ASSMP, and the development of mitigation measures for a proposed development located in PASS risk areas.

The ASS Manual 1998 recommends a minimum of four sampling locations for a site with an area up to 1ha. For sites greater than 4ha, the manual recommends the use of a reduced density of two locations per hectare subject to the proposed development. For lineal investigations, the manual recommends sampling every 50-100m.

The sampling locations should include all areas where significant disturbance of soils will occur and/or areas with a high environmental sensitivity. In some instances a varied sampling plan may be more suitable, particularly for sites less than 1,000m^2 in area.

The depth of investigation should extend to at least 1m beyond the depth of proposed excavation/disturbance or estimated drop in water table height, or to a minimum of 2m below existing ground level, whichever is greatest.

Standard methods for the laboratory analysis of samples are presented in the Australian Standard AS4969-2008/09[9] (part 1 to 14). The principal analytical method is suspension Peroxide Oxidation Combined Acidity and Sulfur (sPOCAS).

[9] Standards Australia, (2008/2009). *Analysis of acid sulfate soil – Dried samples – Methods of test, Parts 1 to 14.* (AS4969-2008/09)

The sPOCAS method specified in AS4969-2008/09 supersedes the POCAS method specified in the ASS Manual 1998. When S_{POS} (peroxide oxidisable sulfur) values are close to the action criteria confirmation of the result can be undertaken by the chromium reducible sulfur (S_{CR}) method.

The endpoint for the pH titration in AS4969-2008/09 is pH6.5 as opposed to pH5.5 adopted in the ASS Manual. Therefore the values for Total Actual Acidity (TAA), Total Sulfide Acidity (TSA) and Total Potential Acidity (TPA) will more conservative when analysed using the sPOCAS method specified in AS4969-2008/09.

Appendix B: Borehole Logs

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

Borehole No.
BH1
1 / 3

BOREHOLE LOG

Client: TKD ARCHITECTS
Project: PROPOSED SCHOOL BUILDING
Location: ALEXANDRIA PARK COMMUNITY SCHOOL, ALEXANDRIA, NSW

Job No.: 30907Z **Method:** SPIRAL AUGER **R.L. Surface:** ~13.3 m
Date: 3/10/17 **Datum:** AHD
Plant Type: JK308 **Logged/Checked By:** A.F./A.Z.

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
			13				FILL: Silty sand, fine to medium grained, trace of fine grained igneous gravel and root fbres.				GRASS COVER
			12	1			FILL: Silty clay, medium to high plasticity, orange brown, trace of ironstone and sandstone gravel an fine to coarse grained sand.	MC>PL			
			11, 10, 9, 8, 7	2, 3, 4, 5, 6		SP	SAND: fine to medium grained, dark brown, trace of silt fines.				ALLUVIAL
							as above, but yellow brown, without silt fines.				

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

Borehole No.
BH1

BOREHOLE LOG

Client: TKD ARCHITECTS
Project: PROPOSED SCHOOL BUILDING
Location: ALEXANDRIA PARK COMMUNITY SCHOOL, ALEXANDRIA, NSW

Job No.: 30907Z **Method:** SPIRAL AUGER **R.L. Surface:** ~13.3 m
Date: 3/10/17 **Datum:** AHD
Plant Type: JK308 **Logged/Checked By:** A.F./A.Z.

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
	ES, DS		6				SAND: fine to medium grained, yellow brown.				ALLUVIAL
			5	8							
	ES, DS		4	9							
	ES, DS					CL	SILTY CLAY: medium plasticity, grey brown.	MC>PL	(F - St)		
			3	10							
	ES, DS									70 90 110	
			2	11							
			1	12							
			0	13							

JK_LIB_CURRENT - V8.00.GLB Log J & K AUGERHOLE - MASTER 30907Z ALEXANDRIA.GPJ <<DrawingFile>> 19/10/2017 11:28 Produced by gINT Professional, Developed by Datgel

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Borehole No.
BH1

BOREHOLE LOG

Client: TKD ARCHITECTS
Project: PROPOSED SCHOOL BUILDING
Location: ALEXANDRIA PARK COMMUNITY SCHOOL, ALEXANDRIA, NSW

Job No.: 30907Z **Method:** SPIRAL AUGER **R.L. Surface:** ~13.3 m
Date: 3/10/17 **Datum:** AHD
Plant Type: JK308 **Logged/Checked By:** A.F./A.Z.

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
						-1, -2, -3	15, 16		CL	SILTY CLAY: medium plasticity, grey brown. *(continued)*	MC>PL	(F - St)		ALLUVIAL
						-4	17			SANDSTONE: fine to medium grained, light grey.	(DW)	(VL)		VERY LOW 'TC' BIT RESISTANCE
						-5, -6, -7	18, 19, 20			END OF BOREHOLE AT 17.50 m				

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Borehole No.
BH6
1 / 1

BOREHOLE LOG

Client: TKD ARCHITECTS
Project: PROPOSED SCHOOL BUILDING
Location: ALEXANDRIA PARK COMMUNITY SCHOOL, ALEXANDRIA, NSW

Job No.: 30907Z **Method:** SPIRAL AUGER **R.L. Surface:** ~13.1 m
Date: 4/10/17 **Datum:** AHD
Plant Type: JK308 **Logged/Checked By:** A.F./A.Z.

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
						13	0			FILL: Silty sand, fine to coarse grained, brown, trace of fine to medium grained sandstone gravel and root fibres.				GRASS COVER
						12	1		SP	SAND: fine to medium grained, brown, trace of silt fines.				ALLUVIAL
ON COMPLETION & AFTER 48 HRS (approx. 3.0 m)						11–10	2–3			as above, but yellow brown, without silt fines.				
						9–8	4–5							GROUNDWATER MONITORING WELL INSTALLED TO 6.0m, MACHINE SLOTTED 50mm PVC STANDPIPE 3.0m TO 6.0m, CASING 0m TO 3.0m, 2mm SAND FILTER PACK 2.0m TO 6.0m, BENTONITE SEAL 1.5m TO 2.0m, BACKFILLED WITH SAND TO SURFACE AND COMPLETED WITH A CONCRETED GATIC COVER
						7	6			END OF BOREHOLE AT 6.00 m				

JK_LIB_CURRENT - V8.00.GLB Log J & K AUGERHOLE - MASTER 30907Z ALEXANDRIA.GPJ <<DrawingFile>> 19/10/2017 11:28 Produced by gINT Professional, Developed by Datgel

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Borehole No.
BH7

BOREHOLE LOG

Client: TKD ARCHITECTS
Project: PROPOSED SCHOOL BUILDING
Location: ALEXANDRIA PARK COMMUNITY SCHOOL, ALEXANDRIA, NSW

Job No.: 30907Z **Method:** SPIRAL AUGER **R.L. Surface:** ~13 m
Date: 3/10/17 **Datum:** AHD
Plant Type: JK308 **Logged/Checked By:** A.F./A.Z.

Groundwater Record	Field Tests	RL (m AHD)	Depth (m)	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
					ASPHALTIC CONCRETE: 40mm.t	M			
	N = 15 4,8,7				FILL: Gravelly sand, fine to coarse grained, grey brown, fine to coarse grained igneous and sandstone gravel, trace of clay and silt.				APPEARS MODERATELY COMPACTED
		12	1						
	N = 6 3,3,3				FILL: Sand, fine to medium grained, orange brown, trace of fine to medium grained sandstone gravel. and silt fines.				APPEARS POORLY COMPACTED
		11	2						
				SP	SAND: fine to medium grained, brown, trace of silty fines.	M	VL		ALLUVIAL
ON COMPLETION	N = 4 2,2,2				as above, but orange brown.				
		10	3						
					as above, but without silt fines.	W			
		9	4						
	N = 26 8,12,14						MD		
		8	5						
	N = 39 12,18,21						D		COMMENCE WASHBORE DRILLING
		7	6						

SAMPLES: ES, U50, DB, DS

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BOREHOLE LOG

Borehole No.
BH7

Client: TKD ARCHITECTS
Project: PROPOSED SCHOOL BUILDING
Location: ALEXANDRIA PARK COMMUNITY SCHOOL, ALEXANDRIA, NSW

Job No.: 30907Z **Method:** SPIRAL AUGER **R.L. Surface:** ~13 m
Date: 3/10/17 **Datum:** AHD
Plant Type: JK308 **Logged/Checked By:** A.F./A.Z.

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
	■			■	N = 29 5,12,17					SAND: fine to medium grained, orange brown.	W	MD		
						5	8			as above, but grey brown, with peat bands.				
	■			■	N = 28 6,13,15	4	9							
						3	10							
									CL	SILTY CLAY: medium plasticity, grey brown.	MC>PL	(F - St)		
						2	11							
					N = 6 2,2,4	1	12							
						0	13							

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

Borehole No.
BH7

BOREHOLE LOG

Client: TKD ARCHITECTS
Project: PROPOSED SCHOOL BUILDING
Location: ALEXANDRIA PARK COMMUNITY SCHOOL, ALEXANDRIA, NSW

Job No.: 30907Z **Method:** SPIRAL AUGER **R.L. Surface:** ~13 m
Date: 3/10/17 **Datum:** AHD
Plant Type: JK308 **Logged/Checked By:** A.F./A.Z.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
									CL	SILTY CLAY: medium plasticity, grey brown. *(continued)*	MC>PL	(F - St)		
										as above, but red brown, with fine to coarse grained ironstone gravel.				
	■			■	N = 13 4,7,6	-2	15				MC>PL	VSt		
						-3	16			as above, but with sand bands.				
						-4	17							
						-5	18							
						-6	19			SANDSTONE				
										END OF BOREHOLE AT 19.20 m				
						-7	20							

EXPLANATORY NOTES – ENVIRONMENTAL LOGS

INTRODUCTION

These notes have been provided to supplement the environmental report with regards to drilling and field logging. Not all notes are necessarily relevant to all reports. Where geotechnical borehole logs are utilised for environmental purpose, reference should also be made to the explanatory notes included in the geotechnical report. Environmental logs are not suitable for geotechnical purposes.

The ground is a product of continuing natural and manmade processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Environmental studies involve gathering and assimilating limited facts about these characteristics and properties in order to understand the ground on a particular site under certain conditions. These conditions 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, the SAA Site Investigation Code. 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 Unified Soil Classification Table qualified by the grading of other particles present (e.g. sandy clay) as set out below (note that unless stated in the report, the soil classification is based on a qualitative field assessment, not laboratory testing):

Soil Classification	Particle Size
Clay	less than 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2mm
Gravel	2 to 60mm

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	less than 4
Loose	4 – 10
Medium dense	10 – 30
Dense	30 – 50
Very Dense	greater than 50

Cohesive soils are classified on the basis of strength (consistency) either by use of hand penetrometer, laboratory testing or engineering examination. The strength terms are defined as shown in the following table:

Classification	Unconfined Compressive Strength kPa
Very Soft	less than 25
Soft	25 – 50
Firm	50 – 100
Stiff	100 – 200
Very Stiff	200 – 400
Hard	Greater than 400
Friable	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 thinly bedded to laminated siltstone.

DRILLING OR EXCAVATION METHODS

The following is a brief summary of drilling and excavation methods currently adopted by the Company, and some comments on their use and application. All except test pits and hand auger drilling require the use of a mechanical drilling rig.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descend into the pit. The depth of penetration is limited to approximately 3m for a backhoe and up to 6m for an excavator. Limitations of test pits include problems associated with disturbance and difficulty of reinstatement; and the consequent effects on nearby structures. Care must be taken if construction is to be carried out near test pit locations to either properly re-compact 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. Premature refusal of the hand augers can occur on a variety of materials such as fill, hard clay, gravel or ironstone, 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 in-situ 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 relatively lower 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 fragments. 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 determined 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 such as Revert or Biogel. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (e.g. 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, an NMLC triple tube core barrel, which gives a core of about 50mm diameter, 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 CORE LOSS. The locations of losses are determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the top end 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, "Methods of Testing Soils for Engineering Purposes" – Test F3.1.

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 63kg 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. Occasionally, the drop hammer is used to drive 50mm diameter thin walled sample tubes (U50) in clays. In such circumstances, the test results are shown on the borehole logs in brackets.

A modification to the SPT test 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 "Nc" on the borehole logs, together with the number of blows per 150mm penetration.

LOGS

The borehole or test pit logs presented herein are an 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 attached explanatory notes define the terms and symbols used in preparation of the logs.

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; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole or 'reverted' chemically if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read after stabilising 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 (e.g. bricks, concrete, plastic, slag/ash, 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 determine 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. 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 has not been undertaken to confirm the soil classifications and rocks strengths indicated on the environmental logs unless noted in the report.

SITE ANOMALIES

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, EIS should be notified immediately.

GRAPHIC LOG SYMBOLS FOR SOIL AND ROCKS