coffey geotechnics
SPECIALISTS MANAGING THE EARTH

NORTH EAST BUSINESS PARK

NE-Business Park
Geotechnical Interpretative Report /Appendices

GEOTNATH18367AB - K
08 January 2007

Coffey Geotechnics Pty Ltd ABN 93 056 929 483
53B Fairlawn Street Nathan QLD 4111 Australia

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

08 January 2007

NE-Business Park
292 Water Street
Fortitude Valley 4006

Attention: Mr Jeffrey Smith

Dear Jeff

RE: Geotechnical Interpretative Report

Coffey Geotechnics has been commissioned to undertake geotechnical studies for the proposed development at Farry Road, Burpengary This report presents the results of outlines the methodology and discusses the results of the field investigations. Not all laboratory testing was finalised at the time of writing. Once all laboratory results are finalised these will be included in a revision of this report.

Your attention is drawn to the document “Important Information about your Coffey Report” which is included in Appendix B.

If you have any questions or require any further information, please contact Theo Gerritsen or the undersigned at our Brisbane office.

For and on behalf of Coffey Geotechnics Pty Ltd

Jacob Dunstan

Associate Engineer – Brisbane Manager

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1 INTRODUCTION

Coffey Geotechnics Pty Ltd (Coffey) was engaged by Jeffrey Smith from North East Business Park to carry out geotechnical studies at North East Business Park (NE-Business Park). We refer to our proposal B18367-AB-C dated 30 August 2006. This report presents the results of the desk study, Acid Sulphate field investigation and marina geotechnical field investigation. The geotechnical investigation for the marina area was submitted as a separate proposal, B18367-AC-A, submitted 2 November 2006. The report outlines the adopted methodology, objective and discusses the results of the field investigations. The last section contains recommendations and suggestions for further works.

2 BRIEF AND SCOPE

The brief and scope of the investigations are outlined in the aforementioned proposals and includes:

- Develop a preliminary understanding of the presence of soils with the potential for acid sulphate (ASS) contamination
- Regional geology across the site
- Establish likely geotechnical conditions across the site such as presence of soft clay
- Establish geotechnical issues that may be a constraint to the development and likely to have an impact on the future development plans
- Preliminary use of suitability of site soils for use as fill
- Advise on potential foundation types and quay wall retaining structures for conceptual design purposes

The works include a desk study, aerial photo interpretation, site walkover and preliminary field investigation.

The extend of the works and number of field investigation locations were selected to form a “broad brush” covering at least the different geomorphological features of the site. The results of this “broad brush” approach enables a better understanding of the extend of the ASS on the subject site and allow to estimate the extent of field investigations required to adhere to the requirements set out by Queensland Acid Sulphate Soils Investigations Team (QASSIT).

A variation of the works was requested relating to foundation aspects in the marina area. A number of boreholes were carried out in the marina area. The aim of this investigation was to establish geotechnical parameters for the foundations of multi-story developments.

The adopted methodology and objective of the works are outlined in the next section.

3 INVESTIGATION METHODOLOGY

On of the objectives of the works is to gain an understanding for the potential for ASS in the subject site. The subject site measures approximately 760 ha. The guidelines set out by QASSIT suggest 2 sampling holes per hectare for sites bigger then 4ha, requiring approximately 1500 boreholes for the subject site. At this early stage of the development the expenditure associated with an investigation of

this magnitude was undesirable. Also, an investigation of this nature, at this stage would provide no significant benefit in terms of reduction of environmental or geotechnical risks associated with the proposed development.

Based on these arguments an approach better reflecting the expenditure and geotechnical related to this stage of the development was required. To achieve this the following, staged, approach was adopted.

1. Aerial photo interpretation identifying distinct geomorphological features of the site combined with a site walkover establishing different soil types and verifying the photo interpretation.
2. Classification of different landforms versus soil types, likely to have similar or comparable geotechnical properties.
3. From the landform–soil type classification a limited number of Areas were identified. These Areas can now be individually targeted by field investigations. Factors taken into consideration with regards to sampling density and location were: nature and timeframe of proposed development, topographical location, soil type, area characteristics, available historical information and ecological, conservational and environmental constraints.

From a development perspective the approach described above allows for distinguishing areas with potentially higher geotechnical or ASS risk from areas with potentially limited geotechnical or ASS risk. This distinction is based on the factors previously mentioned. From the landform area classification an estimate of the appropriate level of field investigations for specific areas can be established. This would result in a more focused and possibly more detailed ASS field investigation per area whilst reducing the magnitude or sampling density required for an overall field investigation.

From an environmental perspective the approach creates an extra level of confidence with the use of the landform-soil type area identification. Each specific area would have been subjected to some ASS field investigation and as such by using the results of preliminary “broad brush” field investigation preliminary boundary conditions can be established. This will, at a later stage, allow the development of a more focused and possibly more detailed ASS field investigation per Area creating a higher level of certainty both per Area and for the subject site overall.

The information from the field investigation, laboratory testing, interpretation and external information will be summarized in a Geotechnical Constraints Table. The Geotechnical Constraints table includes the information per Area required to assess Geotechnical risk, ASS related risk, constraints related to future stages of the development and possible solutions related to those constraints. The Geotechnical Constraints Table is presented in Section 9 of this report.

4 AVAILABLE INFORMATION

4.1 External Information

The following information was used in the geotechnical and ASS assessment of the subject site:

- Aerial photos - Department of Natural Resources, Mines and Water.
- Geological Map, Sheet 9443, Caboolture, Geological Survey of Queensland 1919.

- "Guidelines for Sampling and Analysis of Lowland Acid Sulphate Soils (ASS) in Queensland 1998". Queensland Acid Sulphate Soils Investigations Team (QASSIT), Department of Natural Recourses, RSC, Indooroopilly – October 1998, Revision 4.
- "Report on Acid Sulphate Soil and preliminary geotechnical investigation 2-32 and 34 Nolan Drive, Morayfield". Douglas Partners Pty Ltd – February 2004.
- "Geological Report on Caboolture Marina Site for Noosa Events Pty Ltd". J.E. Siemon – September 2005.

Table 4.1 summarizes the external borehole information used in the geotechnical and ASS assessment of the subject site. Some of the borehole identification has been changed to concur with the identification used by Coffey Geotechnics for the purpose of this report.

The locations of the boreholes are shown on Figure 208. The borehole logs obtained from external information are included in Appendix A.

Table 4.1: Summary of borehole information

Source	Date	Borehole Identification
Douglas Partners	July 2003	TP5, TP6, TP13 – TP17, TP20 – TP37
Noosa Events Pty Ltd	unknown	P1 – P22
Pacific Silica Pty Ltd	unknown	SPS403 – SPS406, SPS414 – SPS418
Department of Natural Resources and Mines	unknown	CS477, CS478, CS505, CS506, CS508
Department of Natural Resources and Mines	unknown	D1043

4.2 Information provided by NE-Business Park

The following information was provided by NE-Business Park Pty Ltd:

- "Initial Advice Statement North East Business Park, Nolan Drive, Burpengary". PMM Group – May 2006.
- "Draft Terms of Reference for an Environmental Impact Statement". The Coordinator-General – August 2006.
- "North East Business Park EPBCA Referral Submission". PMM Group – June 2006.
- Email September 2006 containing Figures showing Proposed Land use and Roads
- CD-Rom received October 2006 containing proposed land use and topographical survey information. The topographical survey also included the approximate Q100 level. This level has partially been used to select boundaries between different landforms.
- Fax received December 2004 indicating revised proposed cut and fill areas.

Figure 218 shows the site location including site boundaries. Figure 214 shows the proposed land use as suggested by NE-Business Park. The land use as shown is included as basis for the ASS and geotechnical interpretation. This investigation focuses predominantly on the Business Park and the Marin Area.

5 CURRENT INVESTIGATION

5.1 Site Walkover by Coffey Geotechnics

Coffey Geotechnical carried out a site walk over in October 2006. The purpose of the walkover was to confirm the results of the geomorphological aspects of the Aerial Photo interpretation and to identify the different soil types present on the site. The results of the site walkover are presented in Figure 219. The site walkover forms the basis of the soil type classification used in the landform area identification.

5.2 Terrain Mapping

The aerial photo interpretation and previously mentioned site walkover resulted in the identification of 5Nos Soil types and 7Nos Landforms. This would potentially allow for 35Nos different Areas. Based on the topographical survey information and analysis of borehole information the number of Soil types was reduced to 4Nos and the number of Landforms was reduced to 6Nos. The soil descriptions were also modified based on the borehole information from the field investigation by Coffey Geotechnics. Table 5.1 and Table 5.2 below the Soil Classification descriptions and Landform descriptions. The landform identification was carried out using the aerial photo interpretation. The boundaries of the different landforms was refined at a later stage based on the topographical survey information and the Q100 line. The elevation of the Q100 line was provided by NE-Business Park and was defined as RL3.5.

Table 5.1: Soil Classification

Cat	Soil Classification	Description
2	Dune Sand	Fine to medium grained, greyish white, well sorted, sand
3	Sand or clayey or silty sand	Pale brown or reddish brown, silty sand or brownish grey dry silty sand
4	Clay – predominantly dry	Reddish brown, stiff, dry sandy silty clay
5	Clay – predominantly saturated	Dark brown to black, soft, plastic, clay or silty clay

Table 5.2: Landform Classification

Cat	Landform	Description
B	Hill slopes	Ground sloping towards higher altitude areas.
C	Plains – predominantly Dry	Generally flat, with some areas uneven or undulating surface. Areas have no
D	Plains – predominantly Wet	Generally flat, with some areas uneven or undulating. Areas may have standing
E	Streams, banks, river terraces	Small streams or tributaries. Areas adjacent to river likely to flood
F	Mangrove, oxbows, swampy or extremely wet	Mangrove areas, abandoned river channels likely lower lying, swampy areas
G	Dunes, sandy plains	Aeolian deposits, predominantly as dunes but small areas relatively flat

Using the landform descriptions shown in the Table 5.2, each of the landforms was assigned a typical or predominant soil type according to the descriptions in Table 5.1. As mentioned previously the soil types were identified during the site walkover.

The results of assigning the soil type to the specific landforms is graphically shown in Table 5.3, in Matrix form. The classification resulted in 10Nos different Areas, classed by Soil type-Landform Area combinations. Table 5.3 shows the matrix with the Landform – Soil type combinations identified on the subject site. The colour coding of the matrix, representing a specific Landform Area, concurs with the colours used to identify Landform Areas in the Figures. Figure 213 shows the results of the Terrain Mapping.

Table 5.3: Soil – Landform Category Matrix

LANDFORM CATEGORY					
	G				
	F				
	E				
	D				
	C				
	B				
		2	3	4	5
		SOIL CATEGORY			

5.3 Trial Pits and Boreholes for Soil Classification and ASS Investigation

As stated in Section 2 one of the objectives of the works was to identify areas with the potential for ASS and establish an estimate of the extend of ASS in those areas. Based the landform-soil type classification 10Nos Areas were identified. Each of these areas was analysed looking at the following factors: external ASS related borehole information and laboratory test results, proposed land use and environmental and ecological constraints.

The field investigation carried out by Coffey Geotechnics, for the purpose of ASS, comprised 9Nos boreholes (identified as LBH1 – LBH9) and 38 trial pits (identified as TPC1 – TPC38). Boreholes LBH1 to LBH9 were carried out using a Edson 3000 tracked rig. The trial pits TPC1 to TPC38 were excavated using a 30T, 800SE KATO with 450 toothed bucket.

Figure 205 shows the boreholes locations LBH1 – LBH9 and Figure 206 shows the trial pit locations TPC1 – TPC38 relative to the Landform Areas. An additional 11Nos trial pits (identified as TPK101 – TPK111) were excavated to confirm earlier results and obtain an understanding of the ASS in the proposed cut and fill areas. The locations of TPK101 – TPK111 and the proposed cut and fill areas are shown in Figure 207.

Borehole and trial pit locations carried out at previous investigations are shown in Figure 208.

Samples were taken from the boreholes LBH and from the trial pits TPC and TPK and send for ASS screening tests. Undisturbed samples were taken from the first 3 meter of the LBH. Disturbed samples were taken from the trial pits TPC and TPK and the representative depth of the samples was estimated. The borehole logs for LBH1 – LBH9, TPC1 – TPC38 and TPK101 – TPK111 are included in Appendix A. The laboratory test results are discussed in Section 6.

5.4 Boreholes in Marina Area

NE-Business Park requested a variation on the field investigation targeting specifically the marina area. The focus of this variation of the field investigation was to obtain geotechnical parameters relevant to foundation design for high rise buildings. The boreholes should also provide a more accurate understanding of the geological profile at the marina basin area. An additional 9Nos boreholes (identified as MBH1 – MBH10) were drilled around the proposed marina basin. These boreholes were drilled to bedrock including and a minimum of 3m coring was carried out. The borehole locations for MBH are shown on Figure 204. SPT and U50 samples were taken and send for laboratory testing. The borehole logs MBH1 – MBH10 are included in Appendix A. The laboratory tests are discussed in Section 6.

6 LABORATORY TESTING

6.1 Acid Sulphate Testing

The sampling from the boreholes was carried out according to the QASSIT guidelines. Samples were taken at least at 0.5m intervals and to a minimum depth of 2m below ground level or 1m below extraction depth. As mentioned in Section 5.2 sample depths from samples taken from TPC and TPK trial pits were estimated. All samples obtained from the LBH boreholes and TPC and TPK trial pits were send for pH_f (pH – Fox) screen testing. Depending on the results of those tests selected samples were send for SPOCAS testing. Table 6.1 below summarizes the ASS laboratory testing results. The ASS laboratory test results are included in Appendix C.

Table 6.1: ASS Sampling and Testing Summary

Test Location Identification	Nos of Samples collected	Samples tested pH_f	Samples tested SPOCAS	Samples tested SPOCAS positive
LBH	96	85	14	2
TPC	21	26	8	3
TPK	11	11	5	Results still outstanding

6.2 Geotechnical Testing

Selected samples obtained from the MBH1-MBH10, LBH1-LBH9 and TPC1-TPC38 were send for geotechnical laboratory testing. The geotechnical testing carried out is summarised in Table 6.2 below.

Table 6.2: Summary of Laboratory Testing

Type of Test		Moisture Content	Atterberg Limits	Sieve Analysis	Triaxial (UU)	Shrink Swell	Comp	CBR	Cons
Number of tests per Borehole	MBH	18	9	18		3	-	-	3
	LBH				-				
	TPC	7	11	5		-	6	7	-
	TP							4	4

At the time of writing the geotechnical laboratory tests for MBH. LBH and TPC are still outstanding. Once finalised the results will be presented in a revision of this report. The laboratory test results for the TP sample locations are included in Appendix C. It should be noted that these tests are external information and have not been carried out by Coffey Geotechnics. The TP sample locations, TP26, TP28, TP35 and TP37 fall entirely with the proposed cut and fill area No1.

7 GEOLOGICAL AND GEOTECHNICAL INTERPRETATION

7.1 Site Description

The site comprises approximately 760Ha east of the Bruce Highway and south of the Caboolture river. The elevation varies from approximately RL15m to RL20m along the western boundary, Noland Drive, and parts of the southern boundary to RL1 towards the river. At the time of the field investigations parts of the site were ploughed and de-vegetated. Protected and environmentally sensitive areas were vegetated. The areas to the north west of the site, towards the river, were wet with groundwater at surface.

7.2 Regional Geology

The subject site is underlain by Triassic – Jurrassic Landsborough Sandstone. The Landsborough sandstone follows a sequence of sandstone, siltstone shale and conglomerate. Overlying the Landsborough Sandstone is a sequence of sandy Quaternary units which is overlain, at specific locations, by sand dune deposits. The Quaternary units comprise varying proportions of sand, clay and silt. The sand dune deposit on the site, **Landform Area G2** (see Figure 213)**,** is thought to have been formed during the last ice age. The borehole information, both external and from the Coffey field investigations indicates the site is generally overlain by ***silty sands or clayey sands*** (from GL to 0.5m BGL) and ***inorganic clays*** followed by ***clayey sands or inorganic clays*** (from 0.5m BGL to 2.0m BGL. Coffee Rock has been encountered in some areas of the site. Coffee Rock is a hard cemented organic sand to loamy sand with high iron content.

The presence of Coffee Rock can sometimes be associated with ASS. Coffee Rock can appear hard when encountered by drilling or excavating but may behave brittle or decomposes when exposed to oxygen and water. The presence of Coffee Rock may present a constraint when piling or excavating. Table 7.1 summarises the regional geology based on the borehole and trial pit information. The soil sequence has been presented per landform area.

Table 7.1: Summary of soil type per land form area

Landform	RL (m)	Soil	Thickness	Depth Below Ground level
B3	5.5 - 17.5	Silty Sand (SM)	0.2m - 0.8m	0.0 - 0.8
		Clayey Sand (SC)	0.6m - 3.2m	1.4 - 4.0
		Clay (CL)	0.4m - 3.0m	3.6 - 6.2
C3	2 - 3	Clay (CL)	2.5m - 5.0m	0.0 - 2.5
		Clayey Sand (SC)	1.8m - 6.4m	0.0 - 6.4
		Clay (CH)	approx 2.0m	5.0 - 8.5
C4	2 - 5	Clay (CH)	0.8m - 5.0m	0.0 - 5.0
		Clayey Sand (SC)	0.6m - 4.5m	1.0 - 4.5
		Clay (CH)	0.8m - 7.0m	0.0 - 7.6
C5	2 - 5	Silty Sand (SM)	0.4m - 0.6m	0.0 - 1.0
		Clay (CH)	0.6m - 2.0m	0.4 - 3.0
		Clayey Sand (SC)	0.4m - 1.6m	1.0 - 3.4
D3	2 - 5	Clay (CL)	0.2m - 0.4m	0.0 - 0.4
		Clay (CH)	1.2m - 10m	0.2 - 2.8
		Clayey Sand (SC)	approx 4.0m	10 - 14.6
D5	1.5 - 2.5	Clay (CL)	1.0m - 1.8m	0.0 - 1.6
		Clayey Sand (SC)	1.0m - 3.4m	0.4 - 4.6
		Clay (CH)	0.6m - 4.4m	0.4 - 6.6
E5	1 - 3.5	Clayey Sand (SC)	0.4m - 1.8m	0.0 - 1.8
		Clay (CL)	1.0m - 2.6m	0.4 - 4.6
F5	2 - 3	Clay (CH)	1.0m - 3.0m	0.0 - 3.0
		Clayey Sand (SC)	0.6m - 2.8m	1.6 - 4.6
		Clay (CL)	1.0m - 2.6m	0.6 - 7.4
G2	1.5 - 3.5	Sand (SP)	0.2m - 2.2m	0.0 - 2.0
		Coffee Rock	0.4m - 0.6m	1.2 - 2.8
		Clay (CH)	0.6m - 4.4m	2.4 - 9.0
D4	2 - 3.5			

7.3 Geology Marina Area

Figure 209 shows the proposed marina area, relative to the Landform Areas, including the available borehole and trial pit information.

The elevation of the proposed marina area is approximately between RL 0.5 and RL 2. The bottom of the basin is proposed at RL -6. The proposed marina area includes **Landform Areas G2, D5 and C4** (see Figure 213). The soil profile of the northern part of the marina area comprises soft grey-black clay overlying sequences of sand, clayey sand and clay.

Depth to bedrock varies from approximately 9m below surface at the western side to 13m below surface at the eastern side of the proposed marine basin. The soil profile at the eastern side of the proposed marine basin comprises 2m to 3m of dune sand overlying medium to high plasticity clay. Groundwater at the marina area has been encountered between 0.5m and 1.5m BGL.

At the western side of the proposed marina basing the soil profile comprise almost entirely of clay. Cross sections showing typical soil profiles of the proposed marina area are included in Figure 209.

7.4 Geotechnical interpretation marina area

Three geotechnical aspects of the proposed marina area are addressed. Firstly the foundation aspects for multi story buildings around the permitter of the proposed marina basin and secondly the quay walls or batter of proposed marina basin. Regarding the quay walls, NE-Business Park advised Coffey Geotechnics that the preferable construction method for the marina basin is the use of sheet piles. The third aspect is the excavation method of the marina basin.

7.4.1 Geotechnical Parameters of the marina area

Table 7.2 gives a summary of the soil parameters from a generalised soil profile of the proposed marina area. It should be noted that the parameters are estimated based on soil descriptions from borehole logs. Interpretations based on the laboratory tests will be included in a revision of this report.

Table 7.2: Preliminary estimate of soil properties marina area

Soil Type	Depth (m)	Plasticity	Effective Cohesion	Effective Friction Angle	m_v	Presumed Bearing Value (kPa)
Sand	0.0 – 2.5	-	-	32-37		150-500
Clay	3 – 9	Medium to High	1-5	17-25	0.15-0.3	75-125
Sandy Clay	2 – 4 & 6 – 8	Medium to High	0-5	26-32	>1.5	75-125
Sandstone	9 - 12	Sandstone varies form extremely highly weathered to moderately weathered sandstone. Estimated Presumed Bearing Value from 2000kN/m^2 – 8000kN/^{2}				

Note: The values presented above are estimates based on soil descriptions. The estimates are obtained from different literature.

7.4.2 Foundations for multi story development at marina perimeter

Based on the estimated soil properties presented in Table 7.1, the likely soil profile and the foundation requirements for the proposed multi-storey development at the perimeter of the proposed marina, piling is likely the most appropriate foundation solution. The presence of sand layers would make driven piles the most desirable method. Alternatively bored pile systems can be used but, because of the aforementioned sand layers, would require casing. Piles should be driven onto bedrock to refusal. Bedrock level at the proposed marina area varies from approximately 9m BGL to 13m BGL.

7.4.3 Quay wall design considerations

As stated in the previous section NE-Business Park informed Coffey Geotechnics the preferred design for marina quay wall is sheet piles. The marina basin invert level is proposed at RL-6. This would put the invert level of the basin generally in ***medium to high plasticity clay, sandy clay***. Towards the southern part of the marina basin the invert level would be in highly weathered sandstone. The soil profile varies along the perimeter of the proposed basin. Along the eastern border 2m to 3m of dune sand is overlying approximately 1m of gravel followed by clay. Along the southern and western border the soil profile comprises mostly ***high plasticity clay*** with, what could be, occasional ***fine to coarse grained sand*** lenses. Along the northern boundary the profile comprises ***black plastic clay*** overlying ***very loose well graded sand*** overlying ***high plasticity clay.*** Coffee Rock has been encountered in the marina area, see section 7.2. Ground water levels have been observed between 0.5m to 1.5m below ground level.

Based on the soil profile and as requested by NE-Business Park, the considered design for the quay wall is anchored sheet piles. The required end-depth of the conjectured sheet pile wall depends on the passive resistance provided by the relevant soil strata and can be established during the detailed design phase of the marina area. It is possible that sections of the quay wall will be founded in bedrock. As stated, bedrock comprises highly weathered to extremely weathered sandstone. SPT values taken near the soil–rock interface are indicated as “refusal”. It is possible that sheet piles can not be driven to the required depth based on the available information on the bedrock. Where the application of sheet piles is restricted alternatives solutions can be elevating the proposed invert level of the marina basin above bedrock or the use of an alternative quay wall methods such as contiguous bored piles.

With regard to the anchoring of the quay wall an important issue is the presence of the loose to very loose sand layer. During earthworks the sand will most likely behave as running sand which could undercut overlying soil layers if left exposed.

The most suitable anchor type, configuration and strength should be established during the detailed design stage and depends on the preferred quay wall option.

The most efficient construction method and sequence should be determined during the detailed design stage taking into account the aforementioned issues.

Figure 209 shows cross sections of the marina area including the approximate invert level of the marina basin.

7.4.4 Earthworks in the marina basin

The invert level of the marina basin is proposed at RL-6. Ground level varies from approximately RL1 to RL3. Along the western side of the basin area bedrock is estimated to be more or less at constant level at approximately RL-5.

Along the eastern side of the basin bedrock level fluctuates from approximately RL-10 to RL-5. Along the southern side of the marina basin bedrock level varies from RL-5 to RL-8. Based on the elevation of the ground level in the marina basin area and the proposed invert level, earthworks volumes for the different soil types have been estimated. Table 7.2 below summarised the earthworks volumes based on the current borehole information. For detailed soil description refer to Appendix A, borehole logs and Figure 209, cross sections and borehole locations in the marina area.

Table 7.2: Earthworks volumes marina basin area

Soil Type	Estimated Volume (m^3)	Description	Excavation Method
Dune Sand	360,000	Loose to very loose	dredge / excavate
Sand / Gravely Sand	275,000	Very loose to Very Dense	dredge / excavate
Sandy Clay / Gravely sandy clay	1,100,000	Medium plasticity to High Plasticity; Soft to Very Stiff	excavate
Clay	1,400,000	Medium plasticity to High Plasticity; Soft to Very Stiff	excavate
Sand Stone	300,000	Medium weathered to extremely highly weathered	excavate

8 PRESENCE OF ACID SULPHATE SOILS

8.1 General discussion ASS

Acid sulphate soils are soils containing iron sulphide and exist in an anaerobic state. Upon exposure to oxygen the iron sulphide is converted to iron sulphate, simultaneously releasing acid. Soils can be considered problematic in terms or ASS when they have the potential to release unacceptable quantities of acid due to the oxidation of sulphide upon exposure to oxygen.

The requirements followed in preparation of this report are the ASS sampling and testing guidelines by QASSIT (See also section 4). Following the guidelines, samples have been collected at 0.5m intervals and to 2m below surface.The sample depth for the latter has been estimated. After collection the samples have been stored in dry ice containers. The samples selected for testing have been send to an accredited laboratory for screening tests and, after a second stage of selection, SPOCAS testing.

To establish the extent of ASS on the subject site 9Nos boreholes (LBH), 38 trial pits (TPC) and an additional 11Nos trial pits (TPK) were drilled and excavated by Coffey Geotechnics (see also Section 5.2). The logs for the trial pits and boreholes are included in Appendix A. External borehole information relating to ASS has been included in the analysis. Figure 212 shows both internal and external borehole and trial pit locations relating to ASS. The external trial pit locations are identified by prefix TP and were carried out by Douglas Partners in July 2003.

The locations where samples were taken and subsequently tested positive for ASS are marked with a red circle. The borehole locations and results per borehole are included in Figure 212. Table 8.1 below summarizes the sample locations, screening tests, SPOCAS tests and positive SPOCAS tests per landform.

Table 8.1: Summary ASS testing

	LANDFORM AREA										
	B3	C3	C4	C5	D3	D4	D5	E5	F5	G2	
	B3	C3	C4	C5	D3	D4	D5	E5	F5	G2	
Test location per landform	19	2	12	24	10	0	4	3	4	5	83
ASS Screen testes	6	2	8	20	8	0	4	3	4	4	59
SPOCAS TESTED	1	1	4	11	0	0	1	2	2	0	22
SPOCAS positive	0	0	1	8	0	0	0	2	1	0	12
% TESTED	32%	100%	67%	83%	80%	0%	100%	100%	100%	80%	
% TESTED POSITIVE	0%	0%	8%	33%	0%	0%	0%	67%	25%	0%	

From the test results it appears that, based on the “broad brush” approach, Landform Areas C4, C5, E5 and F5 contain ASS. Taking into account the sampling density, it is possible that Landform Areas B3 and G2 and D3 are less likely to contain ASS. Although samples taken from Landform Areas C3 and D5 did not test positive for ASS the sample density would suggest additional screening should be carried out before the presence of ASS can be concluded in those areas.

The primary focus of this investigation is on the business park area and marina area. Taking the objective of this investigation into consideration two important findings are presented. Firstly the Landform Area B3 east of Noland Drive, which approximately follows the boundary of the proposed business park area, does not appear to have ASS. Secondly, the proposed marina area, covering parts of Landform Area D5, C4, F5 and G2 does contain ASS.

No ASS was recorded in Landform area B3 and this is likely to be the result of this landform area, landform “B”, being defined as higher altitude areas, approximately >RL4 (see section 5.1). It should be noted that as a rule soil texture, in this case soil category “3” , can not be taken as an indication of presence of non-presence of ASS.

The majority of the proposed marina area falls in Landform Area C4. Within the proposed marina area Landform Area F5, landform “F” defined as “mangrove, oxbow, swampy or extremely wet”, will almost certainly contain ASS throughout. Landform Area D5, within the proposed marina area, has not shown ASS in this investigation. However, because of its proximity to the river, possible oxbow and mangrove areas and relatively low elevation it is suggested that additional testing is carried out, focussing on the area affected by the marina development.

Given the variable nature of the geology in the marina area, see also Section 7.2, additional sampling and testing is required. The additional sampling should be focussing on the area within Landform Area C4 affected by the development of the proposed marina.

Landform Area G2 and Landform Area D5 do not show ASS based on the results of this investigation. Landform Area C4 requires further investigation into the extend of the ASS present within the area affected by the proposed marina area.

The results of the ASS investigations are summarised in the Geotechnical Constraints Table presented in Section 9.

8.2 ASS relating to proposed cut and fill areas.

Figure 210 shows the proposed cut and fill areas. The areas are approximate and are estimated from information provided by NE-Business Park. Based on the information available to date Cut and Fill area No1 falls within landform areas C4 which is confirmed as a landform area with a higher potential for ASS. Also, one sample location within Cut and Fill area No1 is confirmed as containing ASS.

Cut and Fill area No2 covers landform areas F5, D5, B3, E5 and D3. No sample locations within Cut and fill area No2 has been tested positive for containing ASS. However, landform areas E5, F5 and C5 have been confirmed as areas with a higher potential for ASS.

Cut and Fill area No3 does not contain sample locations that have tested positive for ASS. Cut and Fill area No3 does fall within landform area C5 which has been confirmed as a landform area with a higher potential for ASS.

9 GEOTECHNICAL CONSTRAINTS TABLE

The Geotechnical Constraints Table is presented in Table 9.1 overleaf. The table summarises the interpretation of the geotechnical and environmental information available to date. It is envisaged that the table will be updated if and when new geotechnical or environmental information becomes available. The basis of the table is the proposed land use suggested by NE-Business Park as shown in Figure 214. The main variable of the table are the Landform Area definitions established by the terrain mapping and interpretation of trial pits and borehole logs. Table 9.2 summarizes the number of boreholes and boreholes source per land use area.

10 FURTHER STUDIES AND RECOMMENDATIONS

Recommendation regarding further works can be separated in the following aspects of the development at NE-Business Park:

- Recommendations and further works regarding the risk associated with ASS
- Recommendations and further works related to the proposed marina area
- Recommendations and further works developments within NE-Business Park.

10.1 Recommendations related to ASS

Further works related to the presence and related risk of ASS should be based on the landform area model that has been developed and outlined in this report. The landform area approach allows differentiation between areas with potentially high risk for ASS and areas with potentially low risk for ASS. The adopted approach allows for the preparation of an ASS management plan for each individual landform area or for each proposed land use and its related landform area(s).

The level of further investigation required depends on the preliminary risk profile established with the field investigations outlined in this report. It is envisaged that, depending on the proposed development and associated land form area(s) the amount of required investigation locations can be reduced whilst still achieving an acceptable level of confidence in relation to the potential risk for ASS.

Further works should aim to increase the accuracy of the boundaries of the landform areas and increase the accuracy of the general geological profile of the different landform areas. These works can be staged and carried out prior to commencement of the individual proposed developments.

The focus of the further works should be governed by the proposed land use, i.e. is the particular area going to be developed and risk for ASS of the surrounding land form areas based on the preliminary investigations.

Further investigations should provide an indication of the potential volumes of ASS in specific areas and could possibly lead to recommendations to allow for alternative land use of specific areas.

10.2 Recommendations related to the proposed marina area

Further works in relation to the proposed marina area should comprise further development of the geological profile across the marina area. The current investigation provides information on bedrock levels around the marina basin perimeter. At present limited information is available inside the marina basin. Further works should establish a more precise profile of the marina basin area for purposes of earthworks design and excavation methods.

Minor differentiation in soil profile could have significant impact on the geotechnical parameters related to the integrity of the quay wall. Therefore further works should be carried out along the perimeter of the marina basin close to or along the quay wall alignment.

Further works should also include development specific field investigations and will depend on the nature, location and size and extend of proposed structures.

10.3 Recommendations related the general development

Further works within the subject site will depend on the proposed developments at specific locations or areas within the site. Further field investigations will be required and can be staged prior to commencement of development of specific land use area. The level of field investigations and the details of further investigations will be based on preferred design and layout of roads and structures.

Figures

Appendix A

Available Borehole Logs

Borehole Logs – LBH Series

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Engineering Log - Borehole

Borehole No. **LBH1**

Sheet 1 of 2

Project No: **GEONATH18367AB**

Client: **NORTH EAST BUSINESS PARK**

Principal: **NORTH EAST BUSINESS PARK**

Project: **NORTH EAST BUSINESS PARK**

Borehole Location: **AS PER MAP**

Date started: **30.10.2006**

Date completed: **30.10.2006**

Logged by: **LH**

Checked by: KL

drill model and mounting: Edson 3000, 4WD Truck Mounted hole diameter: 100 mm Northing easting: slope: -90° bearing: R.L. Surface: datum:

drilling information

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres
AD		N		ASS		1
				ASS		
				ASS		
				ASS		
				ASS		
				ASS		
				ASS		2
				ASS		
				ASS		
				ASS		
				ASS		3
T			NOT MEASURED	SPT 3,7,11 N*=18		
						4
				SPT 3,5,6 N*=13		5
						6

material substance

graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa (100, 200, 300, 400)	structure and additional observations
		TOPSOIL	M	F		TOPSOIL
	CH	**SANDY CLAY:** high plasticity, grey and brown, fine to medium grained sand.				RESIDUAL SOIL
	CH	**SANDY CLAY:** high plasticity, red to brown, fine to medium grained sand, some 2mm size gravel.				
	CH	**SANDY CLAY:** high plasticity, grey and orange, fine to medium grained sand.		St		
		...some gravel of quartzitic sandstone (<20mm).				
		...grey, orange and brown.				
	CH	**SANDY CLAY:** medium plasticity, grey, coarse grained sand.				
		...grey and red				
	CH	**SANDY CLAY:** high plasticity, grey, fine to medium grained sand.		F		
	CL-CH	**SANDY CLAY:** high plasticity, grey and red, medium grained sand.				
		...red				
		...grey				

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	**LBH1**
Sheet	2 of 2
Project No:	**GEONATH18367AB**
Date started:	**30.10.2006**
Date completed:	**30.10.2006**
Logged by:	**LH**
Checked by:	

Client: **NORTH EAST BUSINESS PARK**

Principal: **NORTH EAST BUSINESS PARK**

Project: **NORTH EAST BUSINESS PARK**

Borehole Location: **AS PER MAP**

drill model and mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
T		N	NOT MEASURED	SPT 4,5,6 N*=11		7		CL-CH	**SANDY CLAY:** high plasticity, grey and red, medium grained sand. *(continued)*	M	F		
								CH	**SANDY CLAY:** high plasticity clay, grey and red, coarse grained sand; some fine gravel (1-2mm).		St-VSt		
				SPT 30/60mm N*=R		8		SC	**CLAYEY SAND:** medium to coarse grained, red and grey, high plasticity clay.		VD		EXTREMELY WEATHERED SANDSTONE
				SPT 30/60mm N*=R		9							
						10			Borehole LBH1 terminated at 10m				
						11							
						12							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

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Engineering Log - Borehole

Borehole No.	LBH2
Sheet	1 of 2
Project No:	GEONATH18367AB
Date started:	30.10.2006
Date completed:	30.10.2006
Logged by:	LH
Checked by:	

Client: NORTH EAST BUSINESS PARK

Principal: NORTH EAST BUSINESS PARK

Project: NORTH EAST BUSINESS PARK

Borehole Location: AS PER MAP

drill model and mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		C	▼	ASS		0		CL	**SANDY CLAY:** medium plasticity, brown, medium to coarse grained sand, trace subrounded quartzitic gravel up to 4mm.	M	F-St		ALLUVIAL SOIL
				ASS									
				ASS									
				ASS		1							
				ASS									
				ASS									
				ASS				CL	**SANDY CLAY:** high plasticity, black, coarse grained sand 1-2mm in size, trace gravel up to 2mm in size.	W	S-F		
				ASS		2							
				ASS				CL	**CLAY:** high plasticity, grey, some medium grained sand, trace gravel of 8-10mm of argillaceous origin.		St		RESIDUAL SOIL
				ASS				CL	**CLAY:** high plasticity, orange and grey, trace of fine to medium grained sand.		VSt		
T		M		ASS		3							
				SPT 3,4,7 N*=11							St		
						4							
											VSt		
				U_{50}							H		
						5		CH	**CLAY:** high plasticity, grey, trace fine to medium grained sand.	M		×	PP=440kPa
									...orange and brown, some fine to medium grained sand.				
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: ▼ 10/1/98 water level on date shown; ► water inflow; ◄ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

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Engineering Log - Borehole

Client:	NORTH EAST BUSINESS PARK
Principal:	NORTH EAST BUSINESS PARK
Project:	NORTH EAST BUSINESS PARK
Borehole Location:	AS PER MAP

Borehole No.	LBH2
Sheet	2 of 2
Project No:	GEONATH18367AB
Date started:	30.10.2006
Date completed:	30.10.2006
Logged by:	LH
Checked by:	IC

drill model and mounting: Edson 3000, 4WD Truck Mounted — Easting: — slope: -90° — R.L. Surface:

hole diameter: 100 mm — Northing — bearing: — datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa (100 200 300 400)	structure and additional observations
T		M		SPT 7, 30/120mm N*=R		7		CH	**CLAY:** high plasticity, grey, trace fine to medium grained sand. *(continued)*	M	H		
								CL	**SANDY CLAY:** medium plasticity, grey and orange, fine to medium grained sand.		VSt		
				SPT 30/120mm N*=R		8		CH	**CLAY:** high plasticity, grey, some fine to medium grained sand. ...orange/red		H		
				SPT 6,11,13 N*=24		9		CL	**SANDY CLAY:** medium plasticity, grey, medium to coarse grained sand, trace of quartzitic gravel up to 4mm in size. ...coarse grained sand, trace of fine gravel 2-4mm in size. ...some fine to medium grained sand.		VSt		Gravel content increases with depth.
				U_{50}		10		CL	**SANDY CLAY:** medium plasticity, grey and orange, fine to medium grained sand.		H		20mm retrieved very stiff-hard clay layer.
												×	PP>>500kPa
						11			Borehole LBH2 terminated at 10.5m				
						12							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud — N nil — C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

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Engineering Log - Borehole

Borehole No. **LBH3**
Sheet 1 of 2
Project No: **GEONATH18367AB**
Date started: **30.10.2006**
Date completed: **30.10.2006**
Logged by: **LH**
Checked by: KL

Client: **NORTH EAST BUSINESS PARK**
Principal: **NORTH EAST BUSINESS PARK**
Project: **NORTH EAST BUSINESS PARK**
Borehole Location: **AS PER MAP**

drill model and mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:
hole diameter: 100 mm | Northing | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		C	▼	ASS		0		CH	**SANDY CLAY:** high plasticity, black and brown, coarse grained sand.	M	St		ALLUVIAL SOIL
				ASS									
				ASS									
				ASS									
				ASS		1							
				ASS									
				ASS				CH	**SANDY CLAY:** high plasticity, black and brown, coarse grained sand.	W	F		
				ASS									
				ASS		2							
				ASS									
				ASS									
				ASS									
				ASS									
T	M			SPT 0,1,1 N*=2		3		SC	**CLAYEY SAND:** coarse grained, black and brown, high plasticity clay.		VL		
								GP	**CLAYEY SANDY GRAVEL:** fine grained, quartzitic gravel 1-3mm, grey, high plasticity clay, coarse sand.		L-MD		RESIDUAL SOIL
						4		CH	**CLAY:** high plasticity, grey and red.	M	F		
				SPT 2,4,5 N*=9									
						5			...grey and red to brown.				
								CH	**SANDY CLAY:** high plasticity, grey, medium to coarse grained sand.				"Very sticky"
						6							

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

support
M mud N nil
C casing

penetration
1 2 3 4
no resistance ranging to refusal

water
▼ 10/1/98 water level on date shown
► water inflow
◄ water outflow

notes, samples, tests
U_{50} undisturbed sample 50mm diameter
U_{63} undisturbed sample 63mm diameter
D disturbed sample
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
V vane shear (kPa)
P pressuremeter
Bs bulk sample
E environmental sample
R refusal

classification symbols and soil description
based on unified classification system

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

consistency/density index

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

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Engineering Log - Borehole

Client:	NORTH EAST BUSINESS PARK
Principal:	NORTH EAST BUSINESS PARK
Project:	NORTH EAST BUSINESS PARK
Borehole Location:	AS PER MAP

Borehole No.	LBH3
Sheet	2 of 2
Project No:	GEONATH18367AB
Date started:	30.10.2006
Date completed:	30.10.2006
Logged by:	LH
Checked by:	KL

drill model and mounting: Edson 3000, 4WD Truck Mour Easting: slope: -90° R.L. Surface:

hole diameter: 100 mm Northing bearing: datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
T		M		SPT 6,6,11 N*=17		7		CH	**SANDY CLAY:** high plasticity, grey, medium to coarse grained sand. *(continued)*	M	F		
									...coarse grained sand.				
								CH	**GRAVELLY CLAY:** high plasticity, red and grey, gravel of argillaceous and quartzitic origin ranging in size 2mm-15mm, some coarse grained sand.		VSt		
				SPT 30/30mm N*=R		8		SP	**GRAVELLY CLAYEY SAND:** coarse grained, red, high plasticity clay, some gravel up to 6mm in size.		VD		EXTREMELY WEATHERED SANDSTONE
									...grey and dark red				
									...grey				
									...red				
								SP	**GRAVELLY CLAYEY SAND:** coarse grained, grey and red, fine gravel of 1-3mm, high plasticity clay.				
						9		CH	**CLAY:** high plasticity, grey.		H		
				SPT 10,17,21 N*=38				CH	**SANDY CLAY:** high plasticity, grey, red and orange, medium grained sand.				
						10			Borehole LBH3 terminated at 10m				
						11							
						12							

method

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

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

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Engineering Log - Borehole

Borehole No.	LBH4
Sheet	1 of 2
Project No:	GEONATH18367AB
Date started:	30.10.2006
Date completed:	30.10.2006
Logged by:	LH
Checked by:	

Client: NORTH EAST BUSINESS PARK

Principal: NORTH EAST BUSINESS PARK

Project: NORTH EAST BUSINESS PARK

Borehole Location: AS PER MAP

drill model and mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		C		ASS				CL-CH	**TOPSOIL: SILTY CLAY:** medium plasticity, brown.	M	F		TOPSOIL
				ASS				CH	**SANDY CLAY:** high plasticity, grey and black, medium grained sand.				ALLUVIAL SOIL
				ASS		1							
				ASS									
				ASS									
				ASS									
				ASS		2							
				ASS									
				ASS									
T			▼	ASS						W			
				ASS									
				ASS		3							
	M			SPT 2,3,6 N*=9				CH	**CLAY:** high plasticity, grey, some fine grained sand.	M			RESIDUAL SOIL
						4							
				SPT 4,5,5 N*=10				SC	**CLAYEY SAND:** coarse grained, grey, high plasticity clay, some fine quartzitic gravel up to 4mm im size.				Sand is of quartzitic origin and poorly graded.
						5							
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: ▼ 10/1/98 water level on date shown; ► water inflow; ◄ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Client:	NORTH EAST BUSINESS PARK
Principal:	NORTH EAST BUSINESS PARK
Project:	NORTH EAST BUSINESS PARK
Borehole Location:	AS PER MAP

Borehole No.	LBH4
Sheet	2 of 2
Project No:	GEONATH18367AB
Date started:	30.10.2006
Date completed:	30.10.2006
Logged by:	LH
Checked by:	KL

drill model and mounting: Edson 3000, 4WD Truck Mour Easting: slope: -90° R.L. Surface:

hole diameter: 100 mm Northing bearing: datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
F		M		SPT 5,11,14 N*=25				SC		M	F		
								CL-CH	**CLAY:** high plasticity, grey, some fine grained sand, trace angular quartzitic gravel up to 20mm.		MD		
						7		CL-CH	**CLAY:** high plasticity, grey.		MD		
									...some medium grained sand		VSt		
				SPT 21,29,30/145mm N*=R		8			...trace quartzitic gravel.		H		EXTREMELY WEATHERED SANDSTONE
				SPT 7,11,18 N*=29		9							
						10			Borehole LBH4 terminated at 10m				
						11							
						12							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

PROJECT FILE: GEONATH 18367 EXISTING STUFF.GPJ. LIBRARY FILE: COFGEOTECHVER7REV1.GLB. TEMPLATE FILE: COFFEY.GDT FRAME TITLE: BOREHOLE. DATE: 13.12.06

Form GED 5.3 Issue 3 Rev.2

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Engineering Log - Borehole

Borehole No.	LBH5
Sheet	1 of 2
Project No:	GEONATH18367AB
Date started:	30.10.2006
Date completed:	30.10.2006
Logged by:	LH
Checked by:	

Client: NORTH EAST BUSINESS PARK

Principal: NORTH EAST BUSINESS PARK

Project: NORTH EAST BUSINESS PARK

Borehole Location: AS PER MAP

drill model and mounting: Edson 3000, 4WD Truck Mounted Easting: slope: -90° R.L. Surface:

hole diameter: 100 mm Northing bearing: datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		C	▼	ASS		0		CH	**CLAY:** high plasticity, black.	W	S		ALLUVIAL SOIL
				ASS									
				ASS									
				ASS									
				ASS		1							
				ASS				CL	**SANDY CLAY:** high plasticity, black, medium to coarse grained.				
				ASS									
				ASS				SC	**CLAYEY SAND:** coarse grained, black, some sub angular gravel 5mm size of quartzitic origin.		L-MD		
				ASS		2							
				ASS									
				ASS									
				ASS									
				ASS									
T		M		N*=0		3		SC	**GRAVELLY CLAYEY SAND:** coarse grained, black, quartizitic angular gravel up to 5mm in size, high plasticity black clay.				H_2S odour Sand of quartzitic origin
						4							
				SPT 1,4,6 N*=10				CL	**SANDY CLAY:** medium plasticity, grey, fine grained sand.	M	F		RESIDUAL SOIL
						5		CL	**CLAY:** low plasticity, grey and orange, trace coarse sand, trace angular quartzitic gravel 6-7mm size.				
								CL	**SANDY CLAY:** low plasticity, grey, fine grained sand, trace quartzitic angular gravel up to 6-7mm in size.		VSt		
						6							

NOT MEASURED

BOREHOLE GEONATH 18367 EXISTING STUFF.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	dialube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

▼ 10/1/98 water level on date shown

► water inflow

◄ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Client:	NORTH EAST BUSINESS PARK	Borehole No.	LBH5
Principal:	NORTH EAST BUSINESS PARK	Sheet	2 of 2
Project:	NORTH EAST BUSINESS PARK	Project No:	GEONATH18367AB
Borehole Location:	AS PER MAP	Date started:	30.10.2006
		Date completed:	30.10.2006
		Logged by:	LH
		Checked by:	KL

drill model and mounting: Edson 3000, 4WD Truck Mount | Easting: | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
T		M	NOT MEASURED	SPT 6,9,10 N*=19		7		CL		M	VSt		
								CL	**CLAY:** low plasticity, grey and orange to brown, some fine grained sand.		St		
				SPT 5,7,8 N*=15		8		CH	**CLAY:** high plasticity, grey, orange and brown.				
						9		CL	**CLAY:** low plasticity, grey and orange-brown.				
				SPT 6,10,13 N*=23		10		SC	**CLAYEY SAND:** medium to coarse grained, grey and orange-brown, medium plasticity clay.		M		
						11			Borehole LBH5 terminated at 10m				
						12							

BOREHOLE GEONATH 18367 EXISTING STUFF.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

method

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

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

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Engineering Log - Borehole

Borehole No.	**LBH6**
Sheet	1 of 2
Project No:	**GEONATH18367AB**
Date started:	**2.11.2006**
Date completed:	**2.11.2006**
Logged by:	**LH**
Checked by:	

Client: **NORTH EAST BUSINESS PARK**

Principal: **NORTH EAST BUSINESS PARK**

Project: **NORTH EAST BUSINESS PARK**

Borehole Location: **AS PER MAP**

drill model and mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
AD		C		ASS				CH	**CLAY:** high plasticity, brown.	M	S-F		ALLUVIAL SOIL
				ASS				CH	**SANDY CLAY:** high plasticity, grey, medium to coarse grained sand.				
				ASS		1		SC	**CLAYEY SAND:** medium to coarse grained, grey, high plasticity clay.		L		
				ASS									
			▼	ASS						W			
				ASS		2							
				ASS									
				ASS									
				ASS									
T		M		SPT 0,0,0 N*=0		3			...some quartzitic gravel up to 5mm in size.				
						4		SC	**GRAVELLY CLAYEY SAND:** medium to coarse grained, quartzitic gravel up to 15mm, but predominantly 2-3mm, high plasticity clay.		VSt		
				SPT 7,8,15 N*=23				CH	**SANDY CLAY:** high plasticity, pale grey, medium to coarse grained sand.	M			RESIDUAL SOIL
								CH	**CLAY:** high plasticity, pale grey.				
						5		CL	**CLAY:** medium plasticity, pale grey, some coarse sand, some quartzitic gravel 2-3mm, in size.				
									...pale grey and orange red.				
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: ▼ 10/1/98 water level on date shown; ► water inflow; ◄ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

PROJECT FILE: GEONATH 18367 EXISTING STUFF.GPJ. LIBRARY FILE: COFGEOTECHVER7REV1.GLB. TEMPLATE FILE: COFFEY.GDT FRAME TITLE: BOREHOLE. DATE: 13.12.06

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Engineering Log - Borehole

Client:	NORTH EAST BUSINESS PARK
Principal:	NORTH EAST BUSINESS PARK
Project:	NORTH EAST BUSINESS PARK
Borehole Location:	AS PER MAP

Borehole No.	LBH6
Sheet	2 of 2
Project No:	GEONATH18367AB
Date started:	2.11.2006
Date completed:	2.11.2006
Logged by:	LH
Checked by:	KL

drill model and mounting: Edson 3000, 4WD Truck Mounted | easting: | slope: -90° | R.L. Surface:
hole diameter: 100 mm | Northing | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
T		M		U_{50}		7		CL	**CLAY:** medium plasticity, pale grey, some coarse sand, some quartzitic gravel 2-3mm, in size. *(continued)*	M	VSt		160mm recovered PP>>500kPa
									...fine quartzitic gravel up to 3mm				EXTREMELY WEATHERED SANDSTONE
				SPT 16, 30/80mm N*=R		8			...trace coarse sand. ...trace gravel 40mm in size		H		
								CL	**GRAVELLY CLAY:** low plasticity, grey, quartizitic gravel, well graded up to 5mm in size.				
				SPT 30/120mm N*=R		9		CL	**SANDY CLAY:** low plasticity, grey and red, coarse grained sand, trace quartzitic gravel 5mm in size.				
						10			Borehole LBH6 terminated at 10m				
						11							
						12							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Client:	NORTH EAST BUSINESS PARK
Principal:	NORTH EAST BUSINESS PARK
Project:	NORTH EAST BUSINESS PARK
Borehole Location:	AS PER MAP

Borehole No.	LBH7
Sheet	1 of 3
Project No:	GEONATH18367AB
Date started:	27.10.2006
Date completed:	27.10.2006
Logged by:	LH
Checked by:	KL

drill model and mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		N	NOT OBSERVED			0		CL	**CLAY:** medium plasticity, brown to black, trace coarse grained sand, trace quartzitic gravel 3mm in size.	M	F		TOPSOIL
								CH	**CLAY:** high plasticity, red to brown, trace coarse grained sand.				RESIDUAL SOIL
				SPT 4,5,4 N*=9		1							
								CL	**SANDY CLAY:** high plasticity, red, coarse grained sand of quartzitic origin, some quartzitic gravel 2mm in size.				
						2			...gravel content increasing with depth.				
T				SPT 7,14,19 N*=33		3		CL	**SANDY CLAY:** high plasticity, red and white, coarse grained quartzitic sand, some 2-3mm quartzitic gravel.		St		
									...gravel content increasing with depth.				
						4							
				SPT 13,17,15 N*=32		5		GC	**CLAYEY GRAVEL:** medium grained, white and grey, high plasticity clay.		D		
									...grading in parts into extremely weathered sandstone.				
								CH	**GRAVELLY CLAY:** high plasticity, grey to white, 2-4mm quartzitic gravel, pockets of very weathered red sandstone.		St		
						6							

PROJECT FILE: GEONATH 18367 EXISTING STUFF.GPJ. LIBRARY FILE: COFGEOTECHVER7REV1.GLB. TEMPLATE FILE: COFFEY.GDT FRAME TITLE: BOREHOLE. DATE: 13.12.06

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method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Client:	NORTH EAST BUSINESS PARK
Principal:	NORTH EAST BUSINESS PARK
Project:	NORTH EAST BUSINESS PARK
Borehole Location:	AS PER MAP

Borehole No.	LBH7
Sheet	2 of 3
Project No:	GEONATH18367AB
Date started:	27.10.2006
Date completed:	27.10.2006
Logged by:	LH
Checked by:	KL

drill model and mounting: Edson 3000, 4WD Truck Mounted Bearing: slope: -90° R.L. Surface:

hole diameter: 100 mm Northing bearing: datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
T		N		SPT 4,5,8 N*=13				CH	**SANDY CLAY:** high plasticity, white, coarse sand, some fine quartzitic gravel up to 3mm in size.	M	St		
						7		CH	**CLAY:** high plasticity, red and white, some coarse grained sand.				
				SPT 6,10,10 N*=20		8		CH	**CLAY:** high plasticity, white, some coarse sand. ...red		VSt		
				SPT 4,6,8 N*=14		9		CH	**SANDY CLAY:** high plasticity, red and white, coarse grained sand.		St		
	W					10			...orange-red				
				SPT 5,5,7 N*=12		11							
						12							

NOT OBSERVED

method

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

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Client:	NORTH EAST BUSINESS PARK
Principal:	NORTH EAST BUSINESS PARK
Project:	NORTH EAST BUSINESS PARK
Borehole Location:	AS PER MAP

Borehole No.	LBH7
Sheet	3 of 3
Project No:	GEONATH18367AB
Date started:	27.10.2006
Date completed:	27.10.2006
Logged by:	LH
Checked by:	

drill model and mounting: Edson 3000, 4WD Truck Mounted — Easting: — slope: -90° — R.L. Surface:

hole diameter: 100 mm — Northing — bearing: — datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
T		W	NOT OBSERVED	SPT 7,14,16 N*=30		13		SC	**CLAYEY SAND:** coarse grained, red to brown, high plasticity clay, some quartzitic gravel 1-3mm in size.	M	D		EXTREMELY WEATHERED SANDSTONE
				SPT 8,13,24 N*=37		14			Borehole LBH7 terminated at 13.95m				
						15							
						16							
						17							
						18							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/fricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

PROJECT FILE: GEONATH 18367 EXISTING STUFF.GPJ. LIBRARY FILE: COFGEOTECHVER7REV1.GLB. TEMPLATE FILE: COFFEY.GDT FRAME TITLE: BOREHOLE. DATE: 13.12.06

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Engineering Log - Borehole

Client:	NORTH EAST BUSINESS PARK
Principal:	NORTH EAST BUSINESS PARK
Project:	NORTH EAST BUSINESS PARK
Borehole Location:	AS PER MAP

Borehole No.	LBH9
Sheet	1 of 3
Project No:	GEONATH18367AB
Date started:	26.10.2006
Date completed:	26.10.2006
Logged by:	LH
Checked by:	KL

drill model and mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		N		ASS				SM	**SILTY SAND:** fine to medium grained, brown to grey.	D M	S		TOPSOIL
				ASS				SC	**CLAYEY SAND:** medium grained, grey, medium plasticity clay.		F		RESIDUAL SOIL
				ASS		1							Clay content increases with depth
				ASS									
				ASS									
				ASS									
				ASS				CL	**SANDY CLAY:** medium plasticity, grey, some fine grained sand.	D	VSt		
				ASS		2							
				ASS				CH	**SANDY CLAY:** high plasticity, grey, some medium to coarse grained sand.				
				ASS									Sand possibly quartzitic in origin.
				ASS									
				ASS		3							
T				SPT 2,20,30/135mm N*=R							H		
								CH	**CLAY:** high plasticity, red.				
						4							
								CH	**SANDY CLAY:** high plasticity, grey, medium to coarse grained sand.	M	St		
								CH	**SANDY CLAY:** high plasticity, grey, coarse grained sand, some finely graded quartzitic gravel.				
				SPT 5,7,9 N*=16		5							Sand content increasing with depth.
				DS				CH	**SANDY CLAY:** high plasticity, red, coarse grained sand.				
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

PROJECT FILE: GEONATH 18367 EXISTING STUFF.GPJ LIBRARY FILE: COFGEOTECHVER7REV1.GLB TEMPLATE FILE: COFFEY.GDT FRAME TITLE: BOREHOLE DATE: 13.12.06

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Client:	NORTH EAST BUSINESS PARK
Principal:	NORTH EAST BUSINESS PARK
Project:	NORTH EAST BUSINESS PARK
Borehole Location:	AS PER MAP

Borehole No.	LBH9
Sheet	2 of 3
Project No:	GEONATH18367AB
Date started:	26.10.2006
Date completed:	26.10.2006
Logged by:	LH
Checked by:	

drill model and mounting: Edson 3000, 4WD Truck Mount | Easting: | slope: -90° | R.L. Surface:
hole diameter: 100 mm | Northing | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
T		N		SPT 9,17,21 N*=38		6		CH	**CLAY:** high plasticity, grey.	M	H		
								GP	**CLAYEY GRAVEL:** rounded quartzitic gravel of 1-3mm. grey, high plasticity clay.		D-VD		
						7		CL	**CLAY:** medium plasticity, red to brown, some medium grained sand.		H		
				SPT 30/110mm N*=R				GP	**CLAYEY GRAVEL:** rounded gravel of 5-8mm size of argillaceous material, red to brown, high plasticity clay.				
						8		SC	**CLAYEY SAND:** fine to medium grained, red to brown, high plasticity clay.				EXTREMELY WEATHERED SANDSTONE
				SPT 30/110mm N*=R		9			...gravel is speckled black (coal), white grey quartz with red to brown soil clumps. ...coarse grained, red to brown high plasticity clay, some subrounded gravel of 1-2mm in size of argillaceous and quartzitic origin.				Water regeneration is fast
						10			Borehole LBH9 continued as cored hole				
						11							
						12							

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

support
M mud
C casing
N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests
U_{50} undisturbed sample 50mm diameter
U_{63} undisturbed sample 63mm diameter
D disturbed sample
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
V vane shear (kPa)
P pressuremeter
Bs bulk sample
E environmental sample
R refusal

classification symbols and soil description based on unified classification system

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

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

PROJECT FILE: GEONATH 18367 EXISTING STUFF.GPJ. LIBRARY FILE: COFGEOTECHVER7REV1.GLB. TEMPLATE FILE: COFFEY.GDT FRAME TITLE: BOREHOLE. DATE: 13.12.06

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Client:	NORTH EAST BUSINESS PARK
Principal:	NORTH EAST BUSINESS PARK
Project:	NORTH EAST BUSINESS PARK
Borehole Location:	AS PER MAP

Borehole No.	LBH10
Sheet	1 of 3
Project No:	GEONATH18367AB
Date started:	26.10.2006
Date completed:	26.10.2006
Logged by:	LH
Checked by:	

drill model and mounting: Edson 3000, 4WD Truck Mounted — hole diameter: 100 mm — Easting: — Northing — slope: -90° — bearing: — R.L. Surface: — datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		N	NOT MEASURED					CH	**CLAY:** high plasticity, brown to grey.	M	F-St		ALLUVIAL SOIL
						1			...red to brown.				
				SPT 3,6,9 N*=15					...mottled red to brown, grey.				
						2			...blue grey.		St		
T				SPT 4,8,8 N*=16		3			....red to brown, grey and black.				
						4			...dark red to brown and black				
				SPT 5,8,9 N*=17		5			...red brown and black.				
						6			...red brown and grey.				

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description: based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No. **LBH10**
Sheet 2 of 3
Project No: **GEONATH18367AB**

Client: **NORTH EAST BUSINESS PARK**
Principal: **NORTH EAST BUSINESS PARK**
Project: **NORTH EAST BUSINESS PARK**
Borehole Location: **AS PER MAP**

Date started: **26.10.2006**
Date completed: **26.10.2006**
Logged by: **LH**
Checked by:

drill model and mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:
hole diameter: 100 mm | Northing | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
F		N		SPT 4,5,7 N*=12		7		CH	**CLAY:** high plasticity, brown to grey. *(continued)*	M	St		
				SPT 5,8,9 N*=17		8		CH	**SANDY CLAY:** medium plasticity, grey, fine grained sand.		VSt		
				U_{50}		9						X	PP=440kPa
				SPT 11,22,24 N*=46		10		SC	**CLAYEY SAND:** fine grained, red to brown, high plasticity clay.	D			RESIDUAL SOIL
						11			...some sub-angular and sub-rounded gravel of quartzitic origin up to 12mm by 4mm by 4mm.				
						12		SC					

NOT MEASURED

PROJECT FILE: GEONATH 18367 EXISTING STUFF.GPJ. LIBRARY FILE: COFGEOTECHVER7REV1.GLB. TEMPLATE FILE: COFFEY.GDT FRAME TITLE: BOREHOLE. DATE: 13.12.06

Form GEO 5.3 Issue 3 Rev.2

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

support
M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water
10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests
U_{50} undisturbed sample 50mm diameter
U_{63} undisturbed sample 63mm diameter
D disturbed sample
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
V vane shear (kPa)
P pressuremeter
Bs bulk sample
E environmental sample
R refusal

classification symbols and soil description based on unified classification system

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

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

coffey geotechnics

Engineering Log - Borehole

Client:	NORTH EAST BUSINESS PARK
Principal:	NORTH EAST BUSINESS PARK
Project:	NORTH EAST BUSINESS PARK
Borehole Location:	AS PER MAP

Borehole No.	LBH10
Sheet	3 of 3
Project No:	GEONATH18367AB
Date started:	26.10.2006
Date completed:	26.10.2006
Logged by:	LH
Checked by:	

drill model and mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
T		N	NOT MEASURED	SPT 3,15,10/20mm N*=R		13		SC	**CLAYEY SAND:** coarse grained, grey, high plasticity clay, some fine to medium grained angular and sub rounded gravel of argillaceous and quartzitic origin up to 10x10x4mm in size. *(continued)*	M	VD		Hammer bouncing
													EXTREMELY WEATHERED SANDSTONE
						14			...gravel size increasing with depth				No SPT as last SPT was very difficult but clay still present so too soft to core.
									...clay present				
									Borehole LBH10 terminated at 14.5m				
						15							
						16							
						17							
						18							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

PROJECT FILE: GEONATH 18367 EXISTING STUFF.GPJ. LIBRARY FILE: C:\OFFICE\TECHVER7\REV1.GLB. TEMPLATE FILE: COFFEY.GDT FRAME TITLE: BOREHOLE. DATE: 13.12.06

Form GEO 5.3 Issue 3 Rev.2

Test Pit Logs – TPK Series

coffey geotechnics

Engineering log - Excavation

Excavation No. **TPK101**

Sheet 1 of 1

Project No: **GEOTNATH18367AC**

Client: **NORTHEAST BUSINESS PARK**

Date started: **11.12.2003**

Principal: **NORTHEAST BUSINESS PARK - LAING O'ROURKE**

Date completed: **11.12.2006**

Project: **MARINA GEOTECHNICAL INVESTIGATION**

Logged by: **KKM**

Test pit location: **TP101**

Checked by:

equipment type and model: | Pit Orientation: | Easting: 498748 m | R.L. Surface: NOT MEASURED

excavation dimensions: m long m wide | Northing: 7002119 m | datum:

excavation information						material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	depth RL / metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N	NON OBSERVED		0.0		ML	**SANDY SILT:** low plasticity, pale grey brown, low organic content.	D	S/F		TOPSOIL
					0.5							
				Bs/PASS	1.0		CH	**CLAY:** high plasticity, pale yellow brown, mottled blue grey.	M	St/Vst		ALLUVIUM
					1.5							
					2.0							
					2.5							
					3.0			Test pit TPK101 terminated at 2.7m				
					3.5							
					4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

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

coffey geotechnics

Engineering log - Excavation

Excavation No. **TPK102**

Sheet 1 of 1

Project No: **GEOTNATH18367AC**

Client: **NORTHEAST BUSINESS PARK**

Date started: **11.12.2006**

Principal: **NORTHEAST BUSINESS PARK - LAING O'ROURKE**

Date completed: **11.12.2006**

Project: **MARINA GEOTECHNICAL INVESTIGATION**

Logged by: **KKM**

Test pit location: **TP102**

Checked by:

equipment type and model:

Pit Orientation:

Easting: 499527 m

R.L. Surface: NOT MEASURED

excavation dimensions: m long m wide

Northing: 7001588 m

datum:

excavation information						material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL / depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
BH		N	▼		0.5		ML	**SANDY SILT:** low plasticity, dark brown, high organic content.	M	S		TOPSOIL
				Bs/PASS	1.0		CH	**SANDY CLAY:** high plasticity, yellow brown, mottled blue grey, some fine grained sand.	M/W	St		ALLUVIUM
					1.5							
					2.0		SW	**SAND:** fine to medium grained, blue grey.	W	VL		
					2.5							
					3.0			Collapse of alluvial sand pre cludes further excavation. Test pit TPK102 terminated at 2.5m				
					3.5							
					4.0							

Sketch

method

N	natural exposure
X	existing excavation
BH	backhoe bucket
B	bulldozer blade
R	ripper
E	excavator

support

S shoring N nil

penetration

1 2 3 4 — no resistance ranging to refusal

water

water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
V	vane shear (kPa)
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering log - Excavation

Excavation No. **TPK103**

Sheet 1 of 1

Project No: **GEOTNATH18367AC**

Client: **NORTHEAST BUSINESS PARK**

Principal: **NORTHEAST BUSINESS PARK - LAING O'ROURKE**

Project: **MARINA GEOTECHNICAL INVESTIGATION**

Test pit location: **TP103**

Date started: **11.12.2006**

Date completed: **11.12.2006**

Logged by: **KKM**

Checked by:

equipment type and model:

Pit Orientation:

Easting: 499521 m

R.L. Surface: NOT MEASURED

excavation dimensions: m long m wide

Northing: 7001416 m

datum:

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	depth RL / metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
BH		N	NON OBSERVED		0.5		SM	**SILTY SAND:** fine grained, dark brown, high organic content.	D	L		TOPSOIL
					1.0		CH	**SILTY CLAY:** high plasticity, grey mottled orange brown.	M	F/St		ALLUVIUM, strong H2S odour.
				Bs/PASS	1.5		SC	**CLAYEY SAND:** fine grained, orange brown, moderate plasticity clay.	M	MD		RESIDUAL SOIL Landsborough sandstone.
					2.0							
					2.5			Test pit TPK103 terminated at 2.7m				
					3.0							
					3.5							
					4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

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

coffey geotechnics

Engineering log - Excavation

Excavation No. **TPK104**

Sheet 1 of 1

Project No: **GEOTNATH18367AC**

Client: **NORTHEAST BUSINESS PARK**

Principal: **NORTHEAST BUSINESS PARK - LAING O'ROURKE**

Project: **MARINA GEOTECHNICAL INVESTIGATION**

Test pit location: **TP104**

Date started: **11.12.2006**

Date completed: **11.12.2006**

Logged by: **KKM**

Checked by:

equipment type and model:

Pit Orientation:

Easting: 499874 m

R.L. Surface: NOT MEASURED

excavation dimensions: m long m wide

Northing: 7001421 m

datum:

excavation information						material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL / depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N	NON OBSERVED	Bs/PASS	0.5		SM	**SILTY SAND:** fine grained, dark brown, high organic content.	D/M	L		TOPSOIL
					1.0		CH	**SANDY CLAY:** high plasticity, pale blue grey, trace fine sand.	M/W	S		ALLUVIUM
					1.5		SP	**GRAVELLY CLAYEY SAND:** fine to medium grained, blue grey, some moderate plasticity clay and gravel.	W	L		
					2.0		CL	**SANDY CLAY:** moderate plasticity, orange brown, trace fine to medium sand.	M	MD		RESIDUAL SOIL Landsborough Sandstone.
					2.5			Test pit TPK104 terminated at 2.3m				
					3.0							
					3.5							
					4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

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

coffey geotechnics

Engineering log - Excavation

Excavation No. **TPK105**

Sheet 1 of 1

Project No: **GEOTNATH18367AC**

Client: **NORTHEAST BUSINESS PARK**

Principal: **NORTHEAST BUSINESS PARK - LAING O'ROURKE**

Project: **MARINA GEOTECHNICAL INVESTIGATION**

Test pit location: **TP105**

Date started: **11.12.2006**

Date completed: **11.12.2006**

Logged by: **KKM**

Checked by:

equipment type and model:

Pit Orientation:

Easting: 500036 m

R.L. Surface: NOT MEASURED

excavation dimensions: m long m wide

Northing: 7001404 m

datum:

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
BH		N				0.0		SM	**SILTY SAND:** fine grained, dark brown, high organic content.	D	L		TOPSOIL
						0.5		SC	**SANDY CLAY:** high plasticity, blue grey mottled orange brown, some fine to medium grained sand.	M/W	F/St		ALLUVIUM
				Bs/PASS		1.0							
						1.5		GP	**SANDY GRAVEL:** medium to coarse grained, blue grey.	W	VL		
						2.0			Collapse of alluvial sand pre cludes further excavation. Test pit TPK105 terminated at 2m				
						2.5							
						3.0							
						3.5							
						4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

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

coffey geotechnics

Engineering log - Excavation

Excavation No. **TPK106**

Sheet 1 of 1

Project No: **GEOTNATH18367AC**

Client: **NORTHEAST BUSINESS PARK**

Principal: **NORTHEAST BUSINESS PARK - LAING O'ROURKE**

Project: **MARINA GEOTECHNICAL INVESTIGATION**

Test pit location: **TP106**

Date started: **11.12.2006**

Date completed: **11.12.2006**

Logged by: **KKM**

Checked by:

equipment type and model:

excavation dimensions: m long m wide

Pit Orientation:

Easting: 500163 m

Northing: 7001638 m

R.L. Surface: NOT MEASURED

datum:

excavation information						material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL / depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
BH		N			0.5		CH	**CLAY:** high plasticity, orange brown.	W	S		ALLUVIUM
				Bs/PASS	1.0		CH	**CLAY:** high plasticity, blue grey, becoming sandy with depth.		VS		
					1.5							
					2.0							
					2.5							
					3.0							
					3.5			Test pit TPK106 terminated at 3.2m				
					4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

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

coffey geotechnics

Engineering log - Excavation

Excavation No. **TPK107**

Sheet 1 of 1

Project No: **GEOTNATH18367AC**

Client: **NORTHEAST BUSINESS PARK**

Date started: **11.12.2006**

Principal: **NORTHEAST BUSINESS PARK - LAING O'ROURKE**

Date completed: **11.12.2006**

Project: **MARINA GEOTECHNICAL INVESTIGATION**

Logged by: **KKM**

Test pit location: **TP107**

Checked by:

equipment type and model:

Pit Orientation:

Easting: 499370 m

R.L. Surface: NOT MEASURED

excavation dimensions: m long m wide

Northing: 7000774 m

datum:

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
BH		N				0.5		SM	**SILTY SAND:** fine grained, dark brown, high organic content.	D	L		TOPSOIL
						1.0		CH	**SANDY CLAY:** high plasticity, orange brown, some fine to medium grained sand.	W	F		ALLUVIUM
				Bs/PASS		1.5		SW	**SAND:** fine to medium grained, blue grey.		L		
			▶			2.0			...becomes dark brown.		D		
						2.5			...becomes pale yellow brown.		VL		...weakly cemented
						3.0			Test pit TPK107 terminated at 2.5m				
						3.5							
						4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration
1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description
based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

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

coffey geotechnics

Engineering log - Excavation

Excavation No. **TPK108**

Sheet 1 of 1

Project No: **GEOTNATH18367AC**

Client: **NORTHEAST BUSINESS PARK**

Date started: **11.12.2006**

Principal: **NORTHEAST BUSINESS PARK - LAING O'ROURKE**

Date completed: **11.12.2006**

Project: **MARINA GEOTECHNICAL INVESTIGATION**

Logged by: **KKM**

Test pit location: **TP108**

Checked by:

equipment type and model:

Pit Orientation:

Easting: 499132 m

R.L. Surface: NOT MEASURED

excavation dimensions: m long m wide

Northing: 7000952 m

datum:

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
BH		N	NON OBSERVED	Bs/PASS		0.5		CL	**SANDY CLAY:** low plasticity, pale brown, moderate organic content.	D	F		TOPSOIL
						1.0		SW	**SAND:** fine to medium grained, yellow brown.		L		AEOLIAN DUNE SAND
						1.5		SC	**CLAYEY SAND:** fine to medium grained, orange brown mottled blue grey, moderate plasticity clay.		D		RESIDUAL SOIL Landsborough sandstone.
						2.0			Pit terminated on the rock exposure. Test pit TPK108 terminated at 2m				
						2.5							
						3.0							
						3.5							
						4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

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

coffey geotechnics

Engineering log - Excavation

Excavation No. **TPK109**

Sheet 1 of 1

Project No: **GEOTNATH18367AC**

Client: **NORTHEAST BUSINESS PARK**

Date started: **11.12.2006**

Principal: **NORTHEAST BUSINESS PARK - LAING O'ROURKE**

Date completed: **11.12.2006**

Project: **MARINA GEOTECHNICAL INVESTIGATION**

Logged by: **KKM**

Test pit location: **TP109**

Checked by:

equipment type and model: | Pit Orientation: | Easting: 498963 m | R.L. Surface: NOT MEASURED

excavation dimensions: m long m wide | Northing: 7001047 m | datum:

excavation information						material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL / depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
BH		N	NON OBSERVED	Bs/PASS	0.5		SW	**SAND:** fine to medium grained, pale brown grey.	D	VL		AEOLIAN DUNE SAND
					1.0		SC	**CLAYEY SAND:** fine to medium grained, orange brown, moderate plasticity clay content.		D		RESIDUAL SOIL Landsborough sandstone
					1.5			Termination of test pit on HW rock Test pit TPK109 terminated at 1.5m				
					2.0							
					2.5							
					3.0							
					3.5							
					4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

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

coffey geotechnics

Engineering log - Excavation

Excavation No. **TPK110**

Sheet 1 of 1

Project No: **GEOTNATH18367AC**

Client: **NORTHEAST BUSINESS PARK**

Date started: **11.12.2006**

Principal: **NORTHEAST BUSINESS PARK - LAING O'ROURKE**

Date completed: **11.12.0206**

Project: **MARINA GEOTECHNICAL INVESTIGATION**

Logged by: **KKM**

Test pit location: **TP110**

Checked by:

equipment type and model:

Pit Orientation:

Easting: 501183 m

R.L. Surface: NOT MEASURED

excavation dimensions: m long m wide

Northing: 7000222 m

datum:

excavation information						material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
BH		N			0.0		SM	**SILTY SAND:** fine grained, dark brown, high organic content.	D	L		TOPSOIL
					0.5		CL	**GRAVELLY SANDY CLAY:** moderate plasticity, dark brown, some fine to medium grained sand and gravel.	W	F		ALLUVIUM
			►	Bs/PASS	1.0		SW	**SAND:** fine to medium grained, blue grey.		VL		Strong H2S odour.
					1.5							
					2.0			Test pit TPK110 terminated at 2m				
					2.5							
					3.0							
					3.5							
					4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

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

coffey geotechnics

Engineering log - Excavation

Excavation No. **TPK111**

Sheet 1 of 1

Project No: **GEOTNATH18367AC**

Client: **NORTHEAST BUSINESS PARK**

Date started: **11.12.2006**

Principal: **NORTHEAST BUSINESS PARK - LAING O'ROURKE**

Date completed: **11.12.2006**

Project: **MARINA GEOTECHNICAL INVESTIGATION**

Logged by: **KKM**

Test pit location: **TP111**

Checked by:

equipment type and model:

Pit Orientation:

Easting: 501111 m

R.L. Surface: NOT MEASURED

excavation dimensions: m long m wide

Northing: 7000710 m

datum:

excavation information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
BH		N				0.0		SM	**SLITY SAND:** fine grained, dark brown, high organic content.	D	L		TOPSOIL
						0.5		ML	**CLAYEY SILT:** moderate plasticity, orange brown.		F		ALLUVIUM
				Bs/PASS		1.0		SW	**SAND:** fine to medium grained, yellow brown.	W	VL		
						1.5							
						2.0			Test pit TPK111 terminated at 1.9m				
						2.5							
						3.0							
						3.5							
						4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

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

Test Pit Logs – TPC Series

Borehole Logs – MBH Series

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH1
Sheet	1 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	22.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	22.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	KM
Borehole Location:	AS PER MAP
Checked by:	

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500149 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 7000600 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD						1		SW	**SAND:** fine to medium grained, pale brown grey.	W	VL		AEOLIAN DUNE SAND Becoming less clayey with depth
		C		SPT 30 N*=R		2		SP	**GRAVELLY SAND:** fine to medium grained, dark brown, weakly cemented.		D-VD	×	RESIDUAL SOIL Coffee Rock PP=100kPa
TB				SPT 2,2,4 N*=6		3						×	PP=300kPa
				U_{50}		4		CL	**SANDY CLAY:** medium plasticity, green grey.		S-F	×	PP=400kPa
						5						×	PP=500kPa
						6		CL	**CLAY:** medium plasticity, pale blue grey.		L-MD		Sand/Clay 50/50

BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH1
Sheet	2 of 3
Project No:	GEOTNATH18367AC
Date started:	22.11.2006
Date completed:	22.11.2006
Logged by:	KM
Checked by:	

Client: NORTHEAST BUSINESS PARK

Principal: NORTHEAST BUSINESS PARK - LAING O'ROURKE

Project: MARINA GEOTECHNICAL INVESTIGATION

Borehole Location: AS PER MAP

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500149 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 7000600 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
TB		C		SPT 2,3,5 N*=8		7		CL	**CLAY:** medium plasticity, pale blue grey. *(continued)*	W	L-MD	× PP=260kPa × PP=500kPa	
				SPT 6,11,20 N*=31		8		CL	**CLAY:** medium plasticity, pale grey, some fine grained sand.		MD	× PP=400kPa	
				SPT 16 N*=R		9			**GRAVELLY CLAY:** medium plasticity, pale grey - white; coarse grained with some fine grained sand.		VL		
						10			Borehole MBH1 continued as cored hole				
						11							
						12							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Borehole No.	**MBH1**
Sheet	**3 of 3**
Project No:	**GEOTNATH18367AC**
Client:	**NORTHEAST BUSINESS PARK**
Date started:	**22.11.2006**
Principal:	**NORTHEAST BUSINESS PARK - LAING O'ROURKE**
Date completed:	**22.11.2006**
Project:	**MARINA GEOTECHNICAL INVESTIGATION**
Logged by:	**KM**
Borehole Location:	**AS PER MAP**
Checked by:	KL

drill model & mounting: JACRO 200 TRACK RIG | Easting: 500149 | slope: -90° | R.L. Surface:

hole diameter: 100 mm Drilling fluid: | Northing: 7000600 | bearing: | datum:

drilling information					material substance						rock mass defects			
method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering / alteration	estimated strength: VL L M H VH EH	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm: 30 100 300 1000 3000	defect description: type, inclination, planarity, roughness, coating, thickness — particular		general
						Continued from non-cored borehole								
						SANDSTONE: fine to medium grained, yellow and grey, massive.	HW							
				10		**SANDSTONE:** fine grained,grey with iron staining, massive.								
						SANDSTONE: fine grained, dark grey, massive.	MW					—PT, 0°, PL, SO, CN		
						SANDSTONE: fine to medium grained, grey, massive.						—PT, 0°, PL, SO, CN		
				11		**SANDSTONE:** fine to medium grained, grey, massive, with siltstone gravel ranging 4-40mm inclusions.						PT, 0°, PL, SO, CN		
						MBH1 terminated at 11.4m						PT, 0°, PL, SO, CN		
				12								PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
				13								PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
				14								PT, 0°, UN, SO, CN		
												PT, 0°, UN, SO, CN		
												PT, 0°, UN, SO, CN		
												PT, 0°, UN, SO, CN		
												PT, 0°, UN, SO, CN		
												PT, 0°, UN, SO, CN		
				15								PT, 0°, UN, SO, CN		

CORED BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.5 Issue 3 Rev. 3

method
DT diatube
AS auger screwing
AD auger drilling
RR roller/tricone
CB claw or blade bit
NMLC NMLC core
NQ, HQ, PQ wireline core

core-lift
casing used
barrel withdrawn

graphic log/core recovery
core recovered - graphic symbols indicate material
no core recovered

water
10/1/98 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss
25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh
SW slightly weathered
MW moderately weathered
HW highly weathered
XW extremely weathered
DW distinctly weathered (covers MW and HW)

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

defect type
JT joint
PT parting
SM seam
SZ sheared zone
SS sheared surface
CS crushed seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR irregular

roughness
VR very rough
RO rough
SO smooth
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH2
Sheet	1 of 2
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	23.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	23.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	KL

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500097 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm | Northing 7000469 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
ADT		C	▶			1		SW	**SAND:** fine to coarse grained, grey white.	M	MD		MARINE SOIL (quartzitic material)
				SPT 5,8,10 N*=18				SC	**CLAYEY SAND:** coarse grained, dark grey.		D		RESIDUAL SOIL
						2		CH	**CLAY:** high plasticity, yellow, some fine grained sand.		St-Vst		coffee rock
								SC	**CLAYEY SAND:** medium to coarse grained, grey brown.	W	MD		
⊢		M		SPT 6,7,7 N*=14		3		CH	**CLAY:** high plasticity, grey and yellow, trace of fine grained sand, some quartzitic sub angular gravel up to 4mm in length	M	F		
								CH	**SANDY CLAY:** high plasticity, yellow and grey.				
						4		SC	**CLAYEY SAND:** fine to medium grained, yellow and grey, some argillaceous rounded and subangular gravel up to 12mm in length.		D-VD		
				SPT 8,16,26 N*=42				CH	**CLAY:** high plasticity, grey, some sand.		VSt		small decaying rootlets
						5		CH	**SANDY CLAY:** high plasticity, grey and yellow, fine grained sand.				
						6							

BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

▼ 10/1/98 water level on date shown
► water inflow
◄ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Borehole No.	MBH2		
Sheet	2 of 2		
Project No:	GEOTNATH18367AC		
Client:	NORTHEAST BUSINESS PARK	Date started:	23.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Date completed:	23.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION	Logged by:	LH
Borehole Location:	AS PER MAP	Checked by:	JCL

drill model & mounting: JACRO 200 TRACK RIG | Easting: 500097 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm Drilling fluid: | Northing: 7000469 | bearing: | datum:

drilling information					material substance						rock mass defects		
method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering / alteration	estimated strength (VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm (30 100 300 1000 3000)	defect description: type, inclination, planarity, roughness, coating, thickness (particular / general)
						Continued from non-cored borehole						
						CORE LOSS						
				7		**SANDSTONE:** fine grained, yellow and grey, massive.	XW					PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN
				8		**SANDY CLAY:** high plasticity, grey and yellow, fine grained sand.						PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 5°, UN, SO, CN
				9		**SAND:** coarse grained, red-white and brown, material is quartzitic and argillaceous in origin.						
				10		**SANDSTONE:** fine grained, yellow grey, massive.						
						SAND: coarse grained, brown red and white, trace high plasticity clay.						
				11		**SANDSTONE:** coarse grained, grey brown and yellow, massive.						PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN
						SANDSTONE: fine grained, pale red and grey.						PT, 0°, PL, SO, CN PT, 0°, UN, SO, CN PT, 0°, UN, SO, CN PT, 0°, PL, SO, CN
				12		MBH2 terminated at 11.5m						

CORED BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.5 Issue 3 Rev: 3

method
DT diatube
AS auger screwing
AD auger drilling
RR roller/tricone
CB claw or blade bit
NMLC NMLC core
NQ, HQ, PQ wireline core

core-lift
casing used
barrel withdrawn

graphic log/core recovery
core recovered - graphic symbols indicate material
no core recovered

water
10/1/98 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss
25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh
SW slightly weathered
MW moderately weathered
HW highly weathered
XW extremely weathered
DW distinctly weathered (covers MW and HW)

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

defect type
JT joint
PT parting
SM seam
SZ sheared zone
SS sheared surface
CS crushed seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR irregular

roughness
VR very rough
RO rough
SO smooth
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH3
Sheet	1 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	23.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	23.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500127 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm | Northing 7000289 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
ADT		C				0		SW	**SAND:** fine to medium grained, grey brown, trace of high plasticity clay, trace of quartzitic gravel up to 3mm, trace of argillaceous gravel up to 5mm in size.	M	MD		MARINE SOIL
						1		SC	**CLAYEY SAND:** coarse grained, dark brown, with high plasticity clay.		D		strong sweet organic odour, decomposed plant matter (possibly reeds)
				SPT 9,7,3 N*=10		2							
T		M		SPT 2,3,4 N*=7		3		CH	**CLAY:** high plasticity, yellow grey, some fine grained sand.	W	St	×	ALLUVIAL SOIL PP=100kPa
												×	PP=120kPa
												×	PP=150kPa
						4			...clay content increasing			×	PP=180kPa
				U_{50}		5		CH	**CLAY:** high plasticity, grey and yellow.	M		×	PP=145kPa
						6							

BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev 2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH3
Sheet	2 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	23.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	23.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500127 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm | Northing 7000289 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
T		M		SPT 4,5,12 N*=17				GC	**CLAYEY SANDY GRAVEL:** fine grained, white grey, high plasticity clay, fine grained sand.	M	MD		gravel ranging in size from 2mm to 5mm of quartzitic and argillaceous origin all well rounded.
								GP	**GRAVEL:** fine grained, brown, some high plasticity clay, some fine grained sand.				
								CH	**CLAY:** high plasticity, grey yellow, some argillaceous gravel up to 5mm, some coarse grained sand. Secondary elements increase in size with depth.		VSt-H		RESIDUAL SOIL
						7							
				SPT 20,30/35mm N*=R				SP	**SAND:** coarse grained, brown red, some quartzitic gravel to 5mm				
								GP					
								CH	**SAND:** fine grained, white.				
						8			**CLAY:** high plasticity, grey.		H		
								CH	**CLAY:** high plasticity, yellow and grey.		VSt		
				SPT 30/70mm N*=R		9							
									Borehole MBH3 continued as cored hole				
						10							
						11							
						12							

BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Client:	NORTHEAST BUSINESS PARK	Borehole No.	MBH3
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Sheet	3 of 3
Project:	MARINA GEOTECHNICAL INVESTIGATION	Project No:	GEOTNATH18367AC
Borehole Location:	AS PER MAP	Date started:	23.11.2006
		Date completed:	23.11.2006
		Logged by:	LH
		Checked by:	KL

drill model & mounting: JACRO 200 TRACK RIG | Easting: 500127 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm | Drilling fluid: | Northing: 7000289 | bearing: | datum:

depth metres	material (rock type; grain characteristics, colour, structure, minor components)	weathering alteration	defect description (type, inclination, planarity, roughness, coating, thickness)
	Continued from non-cored borehole		
	CORE LOSS		
10			
	SANDSTONE: fine to medium grained, grey-brown and red, massive.	HW	PT, 0°, PL, SO, CN (×17)
	...grey		
11			
	SANDSTONE: fine to medium grained, grey, massive.	HW-MW	
	...undulating layers of 1-4mm of coal		PT, 0°, UN, SO, CN (×8)
12			
	SANDSTONE: fine grained, grey, massive.		
13			
	LOSS OF CORE		
	MBH3 terminated at 13.1m		
14			
15			

method: DT diatube; AS auger screwing; AD auger drilling; RR roller/tricone; CB claw or blade bit; NMLC NMLC core; NQ, HQ, PQ wireline core

core-lift: casing used; barrel withdrawn

graphic log/core recovery: core recovered - graphic symbols indicate material; no core recovered

water: 10/1/98 water level on date shown; water inflow; partial drill fluid loss; complete drill fluid loss; water pressure test result (lugeons) for depth interval shown

weathering: FR fresh; SW slightly weathered; MW moderately weathered; HW highly weathered; XW extremely weathered; DW distinctly weathered (covers MW and HW)

strength: VL very low; L low; M medium; H high; VH very high; EH extremely high

defect type: JT joint; PT parting; SM seam; SZ sheared zone; SS sheared surface; CS crushed seam

planarity: PL planar; CU curved; UN undulating; ST stepped; IR irregular

roughness: VR very rough; RO rough; SO smooth; SL slickensided

coating: CN clean; SN stained; VN veneer; CO coating

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH4
Sheet	1 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	27.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	27.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	KL

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500255 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm | Northing 7000235 | bearing: | datum:

drilling information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
ADT		N				0		SP	**SAND:** medium to coarse grained, grey brown, some quartzitic gravel up to 3mm in size.	M	D		MARINE SOIL small tree rootlets up to 5mm in diameter
						1				W			rotten egg odour
				SPT 12,9,6 N*=15									possible tree roots
						2		SP	**SAND:** medium plasticity, black, some black clay.		MD		
								CH	**CLAY:** high plasticity, green and grey, some coarse grained sand.	M	F		
								SP	**SAND:** grey.	W	D		
				SPT 2,6,16 N*=22		3							RESIDUAL SOIL
								CH	**SANDY CLAY:** high plasticity, grey, medium to coarse grained sand, trace of quartzitic gravel up to 3mm.	M	St	×	PP=200kPa
						4			...some dark red angular arenitic gravel of up to 5mm in size.		VSt-H		
				SPT 00,13,21 N*=34					...angular arenitic gravel up to 10mm; subrounded quartzitic gravel up to 4mm.				
		W				5		CH	**SANDY CLAY:** high plasticity, grey and red, fine to medium grained sand.			×	PP=500kPa Residual soil
						6							

BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

method

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

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH4
Sheet	2 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	27.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	27.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500255 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm | Northing 7000235 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
ADT		W		SPT 14,14,30 N*=44		7		CH	**SANDY CLAY:** high plasticity, grey and red, fine to medium grained sand. *(continued)*	M	VSt-H		Layers of dark red and grey material. Grey material softer than red. Layers of material differ in strength...
				SPT 14,30/105mm N*=R		8							
						9							
						10			Borehole MBH4 continued as cored hole				
						11							
						12							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Client:	NORTHEAST BUSINESS PARK	Borehole No.	MBH4
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Sheet	3 of 3
Project:	MARINA GEOTECHNICAL INVESTIGATION	Project No:	GEOTNATH18367AC
Borehole Location:	AS PER MAP	Date started:	27.11.2006
		Date completed:	27.11.2006
		Logged by:	LH
		Checked by:	

drill model & mounting: JACRO 200 TRACK RIG | Easting: 500255 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm Drilling fluid: | Northing: 7000235 | bearing: | datum:

drilling information					material substance					rock mass defects		
method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering alteration	estimated strength (VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm (30 100 300 1000 3000)	defect description: type, inclination, planarity, roughness, coating, thickness (particular / general)
						Continued from non-cored borehole						
						SANDSTONE: fine grained, grey, massive.	XW / HW					
						SANDSTONE: fine to medium grained, brown, massive, clay layer from 9.46-9.52.						
						SANDSTONE: fine grained, grey and yellow, massive.						
				10		**SANDSTONE:** coarse grained, dark brown, massive.						
						CONGLOMERATE SANDSTONE & SILTSTONE GRAVEL: brown, grey, dark red, massive.						11xPT, 0°, UN, RO, CN 11xPT, 0°, UN, RO, CN 11xPT, 0°, UN, RO, CN 10.5-10.7-11xPT, 0°, UN, RO, CN
						SANDSTONE: fine grained, dark grey, massive.						PT, 0°, PL, SO, CN
				11		**SANDSTONE:** fine to medium grained, brown and grey, massive. Coal layer of 20mm						PT, 0°, PL, SO, CN
												PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN
												PT, 0°, PL, SO, CN
				12		MBH4 terminated at 11.8m						
				13								
				14								
				15								

COREDBOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.5 Issue 3 Rev. 3

method

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
NMLC	NMLC core
NQ, HQ, PQ	wireline core

core-lift

- casing used
- barrel withdrawn

graphic log/core recovery

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

water

- 10/1/98 water level on date shown
- water inflow
- partial drill fluid loss
- complete drill fluid loss
- 25 water pressure test result (lugeons) for depth interval shown

weathering

FR	fresh
SW	slightly weathered
MW	moderately weathered
HW	highly weathered
XW	extremely weathered
DW	distinctly weathered (covers MW and HW)

strength

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

defect type

JT	joint
PT	parting
SM	seam
SZ	sheared zone
SS	sheared surface
CS	crushed seam

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	irregular

roughness

VR	very rough
RO	rough
SO	smooth
SL	slickensided

coating

CN	clean
SN	stained
VN	veneer
CO	coating

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH5
Sheet	1 of 3
Project No:	GEOTNATH18367AC
Date started:	27.11.2006
Date completed:	27.11.2006
Logged by:	LH
Checked by:	

Client: NORTHEAST BUSINESS PARK

Principal: NORTHEAST BUSINESS PARK - LAING O'ROURKE

Project: MARINA GEOTECHNICAL INVESTIGATION

Borehole Location: AS PER MAP

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500406 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 700015 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		C						SC	**TOPSOIL: CLAY:** high plasticity, brown.	M	F		TOPSOIL
								SC	**SANDY CLAY:** medium to coarse grained, brown.				MARINE SOIL
						1		SP	**SAND:** coarse grained, grey, some high plasticity clay, some subrounded quartzitic gravel up to 3mm in size.		MD		
			▶	SPT 2,2,5 N*=7						W			Sample has organic odour
						2		CH	**CLAY:** high plasticity, brown and yellow.		F		
								SC	**CLAYEY SAND:** medium to coarse grained, grey, medium plasticity clay. ...high plasticity.		F/MD		Organic odour
T-B		M		SPT 3,3,4 N*=7		3							
								CH	**CLAY:** high plasticity, brown and yellow, trace of coarse grained sand. ....grey, yellow and brown, some quartzitic gravel of 3mm in size, argillaceous gravel to 5mm; some coarse sand.				ALLUVIAL SOIL
						4			...grey and yellow.		St-VSt		
				U_{50}									Too hard to push U50 to depth
						5			...some of grey clay material has PP=500, rest is >>500		H		PP>>500kPa
								CL	**SANDY CLAY:** low to medium plasticity, grey and dark red, coarse grained sand, some dark red arenitic material in form of well graded gravel ranging in size from 2 to 4mm.	M			RESIDUAL SOIL Extremely weathered LANDSBOROUGH SANDSTONE
				SPT 2,16,30/120mm N*=R		6		CL	**CLAY:** medium plasticity, grey and yellow.				COFFEE ROCK
						7							Iron staining
				SPT 11,12,13 N*=25				CH	**CLAY:** high plasticity, grey and red, some medium to coarse grained sand.				
						8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

▼ 10/1/98 water level on date shown

▶ water inflow

◀ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH5
Sheet	2 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	27.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	27.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	IC

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500406 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 700015 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
T-B		M				9		CH	**CLAY:** high plasticity, grey and red, some medium to coarse grained sand. *(continued)* ...Red material has some medium grained sand. ...Grey material high plasticity clay.	M	H		PP=400kPa PP=460kPa PP=460kPa PP=500kPa
				SPT 6,11,15 N*=26		10							
		N						CL	**SANDY CLAY:** high plasticity, grey and red, some medium grained sand; trace dark red arenitic angular gravel up to 3mm.				Layers of material vary in consistency from VSt-H Rock fabric visible
				SPT 30/100mm N*=R		11					VSt H		
						12		CL	**SANDY CLAY:** medium to high plasticity, yellow, fine grained sand.				
									Borehole MBH5 continued as cored hole				
						13							
						14							
						15							
						16							

method

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

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Borehole No.	MBH5		
Sheet	3 of 3		
Project No:	GEOTNATH18367AC		
Client:	NORTHEAST BUSINESS PARK	Date started:	27.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Date completed:	27.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION	Logged by:	LH
Borehole Location:	AS PER MAP	Checked by:	

drill model & mounting: JACRO 200 TRACK RIG | Easting: 500406 | slope: -90° | R.L. Surface:

hole diameter: 100 mm Drilling fluid: | Northing: 700015 | bearing: | datum:

drilling information | **material substance** | **rock mass defects**

method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering alteration	estimated strength (VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm (30 100 300 1000 3000)	defect description: type, inclination, planarity, roughness, coating, thickness — particular / general
						Continued from non-cored borehole						
						SANDSTONE: fine to medium grained, brown to red and grey, massive.	HW					PT, 0°, PL, SO, CN, 1mm
												PT, 0°, PL, SO, CN, 1mm
				13		**SANDSTONE:** fine to medium grained, grey, massive.	SW					PT, 0°, PL, SO, CN, 1mm
												PT, 0°, PL, SO, CN, 1mm
												PT, 0°, PL, SO, CN, 1mm
				14								PT, 0°, PL, SO, CN, 1mm
												PT, 0°, PL, SO, CN, 1mm
												PT, 0°, PL, SO, CN, 1mm
				15								
						MBH5 terminated at 15.2m						
				16								
				17								
				18								
				19								
				20								

method
DT diatube; AS auger screwing; AD auger drilling; RR roller/tricone; CB claw or blade bit; NMLC NMLC core; NQ, HQ, PQ wireline core

core-lift
casing used; barrel withdrawn

graphic log/core recovery
core recovered - graphic symbols indicate material; no core recovered

water
10/1/98 water level on date shown; water inflow; partial drill fluid loss; complete drill fluid loss; 25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh; SW slightly weathered; MW moderately weathered; HW highly weathered; XW extremely weathered; DW distinctly weathered (covers MW and HW)

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

defect type
JT joint; PT parting; SM seam; SZ sheared zone; SS sheared surface; CS crushed seam

planarity
PL planar; CU curved; UN undulating; ST stepped; IR irregular

roughness
VR very rough; RO rough; SO smooth; SL slickensided

coating
CN clean; SN stained; VN veneer; CO coating

Form GEO 5.5 Issue 3 Rev. 3 CORED BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH6
Sheet	1 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	20.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	20.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	KL

drill model and mounting: EDSON 3000 | Easting: 500625 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 7000050 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT		N				0		CL	**TOPSOIL: SANDY CLAY:** low plasticity, black to brown.	M	F		TOPSOIL
								CH	**CLAY:** high plasticity, grey to yellow, trace fine grained sand.				ALLUVIAL SOIL
						1							
								CH	**CLAY:** high plasticity, grey, some fine to medium grained sand.				
TB				U_{50}					...grey, red and orange.	W	St		330mm recovery
						2			...red			×	PP=140kPa
				U_{50}		3					VSt		450mm recovery
												×	PP=295kPa
				U_{50}		4			...grey				
									...grey, yellow and red				
						5		CH	**CLAY:** high plasticity, grey and red. [grey Ch=VSt-H Red CH=VSt]				×PP>>500kPa Grey material is very stiff to hard Red material is very stiff.
									...Red clay decreases with depth				
						6							RESIDUAL SOIL ×PP>>500kPa

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH6
Sheet	2 of 3
Project No:	GEOTNATH18367AC
Date started:	20.11.2006
Date completed:	20.11.2006
Logged by:	LH
Checked by:	

Client: NORTHEAST BUSINESS PARK

Principal: NORTHEAST BUSINESS PARK - LAING O'ROURKE

Project: MARINA GEOTECHNICAL INVESTIGATION

Borehole Location: AS PER MAP

drill model and mounting: EDSON 3000 | Easting: 500625 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 7000050 | bearing: | datum:

drilling information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
TB		N		U_{50}		7		CL	**CLAY:** medium plasticity, grey to brown and red to brown, trace of medium grained sand.	W	H		230mm Recovery U50 pushed approximately 200mm as material too hard.
									...grey				
				SPT 30/130mm N*=R		8			...some coarse grained sand			×	PP>>500kPa
						9		CL	**SANDY CLAY:** medium plasticity, grey, fine and coarse grained sand; some flat angular gravel of up to 4mm in length.			×	PP>>500kPa
				SPT 30/100mm N*=R				SC	**CLAYEY SAND:** coarse grained, grey, medium plasticity clay. Sand content increases with depth.				Extremely weathered SANDSTONE
B						10		SC	**CLAYEY SAND:** coarse grained, grey.				
						11			Borehole MBH6 continued as cored hole				
						12							

BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Client:	NORTHEAST BUSINESS PARK	Borehole No.	MBH6
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Sheet	3 of 3
Project:	MARINA GEOTECHNICAL INVESTIGATION	Project No:	GEOTNATH18367AC
Borehole Location:	AS PER MAP	Date started:	20.11.2006
		Date completed:	20.11.2006
		Logged by:	LH
		Checked by:	K—

drill model & mounting: EDSON 3000 | Easting: 500625 | slope: -90° | R.L. Surface:

hole diameter: 100 mm Drilling fluid: | Northing: 7000050 | bearing: | datum:

drilling information					material substance					rock mass defects		
method	core-lift	water	RL	depth metres	graphic log core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering alteration	estimated strength VL L M H VH EH	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm 30 100 300 1000 3000	defect description: type, inclination, planarity, roughness, coating, thickness — particular / general
						Continued from non-cored borehole						
				11		**SANDSTONE:** fine grained, yellow, massive.	XW					
				12		Clay seam						
				13								
				14		MBH6 terminated at 13.61m						
				15								
				16								

CORED BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.5 Issue 3 Rev. 3

method

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
NMLC	NMLC core
NQ, HQ, PQ	wireline core

core-lift

casing used

barrel withdrawn

graphic log/core recovery

core recovered - graphic symbols indicate material

no core recovered

water

10/1/98 water level on date shown

water inflow

partial drill fluid loss

complete drill fluid loss

25 water pressure test result (lugeons) for depth interval shown

weathering

FR	fresh
SW	slightly weathered
MW	moderately weathered
HW	highly weathered
XW	extremely weathered
DW	distinctly weathered (covers MW and HW)

strength

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

defect type

JT	joint
PT	parting
SM	seam
SZ	sheared zone
SS	sheared surface
CS	crushed seam

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	irregular

roughness

VR	very rough
RO	rough
SO	smooth
SL	slickensided

coating

CN	clean
SN	stained
VN	veneer
CO	coating

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH7
Sheet	1 of 3
Project No:	GEOTNATH18367AC
Date started:	20.11.2006
Date completed:	20.11.2006
Logged by:	LH
Checked by:	

Client: NORTHEAST BUSINESS PARK

Principal: NORTHEAST BUSINESS PARK - LAING O'ROURKE

Project: MARINA GEOTECHNICAL INVESTIGATION

Borehole Location: AS PER MAP

drill model and mounting: EDSON 3000 | Easting: 500672 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 7000224 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		N						CH	**CLAY:** high plasticity, grey to brown, yellow.	M	F		ALLUVIAL SOIL
								CH	**CLAY:** high plasticity, grey.	W			
TB				U_{50}		1							
						2		SC	**CLAYEY SAND:** medium grained, orange, high plasticity clay.		MD	×	PP=100kPa
				U_{50}		3		CH	**SANDY CLAY:** high plasticity, red and grey, coarse grained sand; some gravel of up to 4mm in size.		St-VSt	×	PP=300kPa
				U_{50}		4		CH	**CLAY:** high plasticity, red and grey, some medium grained sand. ...dark red and grey, some coarse grained sand and fine gravel up to 6mm in size.				
						5		CH	**CLAY:** high plasticity, grey and red, some coarse grained sand.		VSt-H	×	G=400kPa R>>500kPa
								CH	**CLAY:** high plasticity, grey and dark red. Dark red material is hard high plasticity clay. Grey material is stiff-very stiff high plasticity clay.	M			
						6		CL	**CLAY:** medium plasticity, grey and red, some medium to coarse grained sand; trace of angular gravel up to 4mm in size.				

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH7
Sheet	2 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	20.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	20.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	IC

drill model and mounting: EDSON 3000 | Easting: 500672 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 7000224 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
TB		N		U_{50}				CL	**CLAY:** medium plasticity, grey and red, some medium to coarse grained sand; trace of angular gravel up to 4mm in size. *(continued)* ...clays of different strength.	M	VSt-H		PP=260kPa grey clay PP=500kPa red clay
						7		SC	**CLAYEY SAND:** fine to coarse grained, grey and red, medium plasticity clay.				RESIDUAL SOIL
				U_{50}		8						*	PP=400kPa
								SC	**SANDY CLAY:** coarse grained, grey and yellow, high plasticity clay.		D/VSt		
				SPT 11,16,30/100mm N*=R		9			...yellow, some gravel up to 3mm in size.				Extremely weathered SANDSTONE
									Borehole MBH7 continued as cored hole				
						10							
						11							
						12							

BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

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

support
M mud N nil
C casing

penetration
1 2 3 4 no resistance ranging to refusal

water
10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests
U_{50} undisturbed sample 50mm diameter
U_{63} undisturbed sample 63mm diameter
D disturbed sample
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
V vane shear (kPa)
P pressuremeter
Bs bulk sample
E environmental sample
R refusal

classification symbols and soil description
based on unified classification system

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

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Borehole No.	MBH7		
Sheet	3 of 3		
Project No:	GEOTNATH18367AC		
Client:	NORTHEAST BUSINESS PARK	Date started:	20.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Date completed:	20.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION	Logged by:	LH
Borehole Location:	AS PER MAP	Checked by:	

drill model & mounting: EDSON 3000 | Easting: 500672 | slope: -90° | R.L. Surface:

hole diameter: 100 mm Drilling fluid: | Northing: 7000224 | bearing: | datum:

drilling information | **material substance** | **rock mass defects**

method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering alteration	estimated strength (VL L M H VH EH)	Is(50) MPa D-diametral A-axial	RQD %	defect spacing mm (30 100 300 1000 3000)	defect description: type, inclination, planarity, roughness, coating, thickness (particular / general)
						Continued from non-cored borehole						
				10		**SANDSTONE:** fine to medium grained, grey-yellow, massive.	XW					PT, 0°, PL, SO, CN
												PT, 0°, PL, SO, CN
												PT, 0°, PL, SO, CN
												PT, 0°, PL, SO, CN
						SANDSTONE: fine to coarse grained, yellow and grey, massive.	HW					PT, 0°, PL, SO, CN
						CONGLOMERATE SANDSTONE WITH SILTSTONE GRAVEL & COBBLES: fine to coarse grained, grey and brown.						PT, 0°, PL, SO, CN
				11								PT, 0°, PL, RO, CN
												PT, 0°, PL, RO, CN
												PT, 0°, PL, RO, CN
												11.54-11.74-PT, 5°, PL, RO, CN
				12		**SANDSTONE:** fine grained, grey and yellow, massive.	XW					PT, 0°, PL, SO, CN
												PT, 0°, PL, SO, CN
				13								PT, 0°, PL, SO, CN
						MBH7 terminated at 13m						
				14								
				15								

CORED BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.5 Issue 3 Rev. 3

method
DT diatube
AS auger screwing
AD auger drilling
RR roller/tricone
CB claw or blade bit
NMLC NMLC core
NQ, HQ, PQ wireline core

core-lift
casing used
barrel withdrawn

graphic log/core recovery
core recovered - graphic symbols indicate material
no core recovered

water
10/1/98 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss
25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh
SW slightly weathered
MW moderately weathered
HW highly weathered
XW extremely weathered
DW distinctly weathered (covers MW and HW)

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

defect type
JT joint
PT parting
SM seam
SZ sheared zone
SS sheared surface
CS crushed seam

roughness
VR very rough
RO rough
SO smooth
SL slickensided

planarity
PL planar
CU curved
UN undulating
ST stepped
IR irregular

coating
CN clean
SN stained
VN veneer
CO coating

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH8
Sheet	1 of 3
Project No:	GEOTNATH18367AC
Date started:	21.11.2006
Date completed:	21.11.2006
Logged by:	LH
Checked by:	

Client: NORTHEAST BUSINESS PARK

Principal: NORTHEAST BUSINESS PARK - LAING O'ROURKE

Project: MARINA GEOTECHNICAL INVESTIGATION

Borehole Location: AS PER MAP

drill model and mounting: EDSON 3000 | Easting: 500697 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 7000358 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		C	▶			1		CH	**CLAY:** high plasticity, grey to brown.	M	F		ALLUVIAL SOIL
				U_{50}		2			....grey and yellow, some fine grained sand.		St	×	PP=180kPa
								CL	**SANDY CLAY:** medium plasticity, grey, fine grained sand.		F		
								CH	**SANDY CLAY:** high plasticity, yellow, fine grained sand.		St-VSt		
								CH	**CLAY:** high plasticity, grey, some fine grained sand.				
				U_{50}		3		CL	**CLAY:** high plasticity, grey, some fine grained sand.				pushed 170mm
												×	PP>>500kPa
						4			...grey and red, trace of gravel up to 3-4mm in size.				
				SPT 11,30/140mm N*=R					...dark grey and dark red.		H or Fb		
TB		N				5		CL	**CLAY:** low plasticity, dark grey, some fine grained sand.				Possibly a RESIDUAL SOIL extremely weathered SANDSTONE.
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

▼ 10/1/98 water level on date shown

▶ water inflow

◀ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH8
Sheet	2 of 3
Project No:	GEOTNATH18367AC
Date started:	21.11.2006
Date completed:	21.11.2006
Logged by:	LH
Checked by:	

Client: NORTHEAST BUSINESS PARK

Principal: NORTHEAST BUSINESS PARK - LAING O'ROURKE

Project: MARINA GEOTECHNICAL INVESTIGATION

Borehole Location: AS PER MAP

drill model and mounting: EDSON 3000 | Easting: 500697 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 7000358 | bearing: | datum:

drilling information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
TB		N		SPT 12,22,28 N*=50		7		CL	**CLAY:** low plasticity, dark grey, some fine grained sand. *(continued)*	M	H or Fb		
				SPT 19,30/130mm N*=R		8		CL	**CLAY:** low plasticity, pale grey, some fine to medium grained sand; some gravel ranging in size from 2mm to 4mm. ...pale grey, dark grey, yellow and red.				Material less hard than material above Pushed to refusal approximately 20mm
				SPT 10,13,18 N*=31		9		CL	**CLAY:** medium plasticity, pale grey to dark grey, pale grey material high plasticity clay, dark grey material low plasticity clay, some fine and medium grained sand; some gravel up to 6mm in size.				PP=260kPa PP=300kPa PP=340kPa PP=400kPa PP>500kPa
				SPT 27,30/70mm N*=R		10		CH	**CLAY:** high plasticity, yellow, pale grey, dark grey and orange.		VSt-H		
						11			Borehole MBH8 continued as cored hole				
						12							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Client:	NORTHEAST BUSINESS PARK
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Project:	MARINA GEOTECHNICAL INVESTIGATION
Borehole Location:	AS PER MAP

Borehole No.	MBH8
Sheet	3 of 3
Project No:	GEOTNATH18367AC
Date started:	21.11.2006
Date completed:	21.11.2006
Logged by:	LH
Checked by:	

drill model & mounting: EDSON 3000 | Easting: 500697 | slope: -90° | R.L. Surface:

hole diameter: 100 mm Drilling fluid: | Northing: 7000358 | bearing: | datum:

drilling information					material substance						rock mass defects			
method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering alteration	estimated strength VL L M H VH EH	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm 30 100 300 1000 3000	defect description: type, inclination, planarity, roughness, coating, thickness — particular		general
						Continued from non-cored borehole								
						SANDSTONE: medium to coarse grained, red, massive.	HW					PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
				12		**SANDSTONE:** medium to coarse grained, grey brown and white, massive.						PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
												PT, 5°, PL, SO, CN		
				13								PT, 0°, UN, SO, CN		
												PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
				14		**SANDSTONE:** fine to medium grained, grey, massive.	MW					PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
						MBH8 terminated at 14.2m								
				15										
				16										
				17										

CORED BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.5 Issue 3 Rev. 3

method

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
NMLC	NMLC core
NQ, HQ, PQ	wireline core

core-lift

- casing used
- barrel withdrawn

graphic log/core recovery

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

water

- 10/1/98 water level on date shown
- water inflow
- partial drill fluid loss
- complete drill fluid loss
- 25 water pressure test result (lugeons) for depth interval shown

weathering

FR	fresh
SW	slightly weathered
MW	moderately weathered
HW	highly weathered
XW	extremely weathered
DW	distinctly weathered (covers MW and HW)

strength

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

defect type

JT	joint
PT	parting
SM	seam
SZ	sheared zone
SS	sheared surface
CS	crushed seam

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	irregular

roughness

VR	very rough
RO	rough
SO	smooth
SL	slickensided

coating

CN	clean
SN	stained
VN	veneer
CO	coating

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH9		
Sheet	1 of 3		
Project No:	GEOTNATH18367AC		
Client:	NORTHEAST BUSINESS PARK	Date started:	22.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Date completed:	22.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION	Logged by:	LH
Borehole Location:	AS PER MAP	Checked by:	

drill model and mounting:	EDSON 3000	Easting:	500702	slope:	-90°	R.L. Surface:	NOT MEASURED
hole diameter:	100 mm	Northing	7000454	bearing:		datum:	

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
AD		C				1		CH	**SANDY CLAY:** high plasticity, dark grey, fine grained sand.	M	F		ALLUVIAL SOIL
TB				U_{50}						W			
						2			...grey and red		F-St	x	PP= 80kPa
								CH	**CLAY:** high plasticity, red and grey. Red material is a low plasticity clay.				Red material increasing in quantity with depth.
		N		SPT 30/700mm N*=R		3		CH	**SANDY CLAY:** high plasticity, grey, coarse grained sand; some gravel of quartzitic origin up to 3mm in size.	M	D		
								SC	**CLAYEY SAND:** coarse grained, grey, high plasticity clay; some quartzitic gravel up to 3mm in size. ...red.		VD		
						4		CL/ML	**CLAY:** dark grey, pieces of red indurated sand of up to 5mm in size.		H		
				SPT 17,30/145mm N*=R		5		CL	**CLAY:** low plasticity, dark grey.				
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH9
Sheet	2 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	22.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	22.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	

drill model and mounting: EDSON 3000 | Easting: 500702 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm | Northing 7000454 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
TB		N		SPT 18,30/148mm N*=R				CL	**CLAY:** low plasticity, dark grey. *(continued)* ...pale grey and red.	M	H		
						7			Borehole MBH9 continued as cored hole				
						8							
						9							
						10							
						11							
						12							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Client:	NORTHEAST BUSINESS PARK	Borehole No.	MBH9
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Sheet	3 of 3
Project:	MARINA GEOTECHNICAL INVESTIGATION	Project No:	GEOTNATH18367AC
Borehole Location:	AS PER MAP	Date started:	22.11.2006
		Date completed:	22.11.2006
		Logged by:	LH
		Checked by:	JC

drill model & mounting: EDSON 3000 | Easting: 500702 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm Drilling fluid: | Northing: 7000454 | bearing: | datum:

drilling information | **material substance** | **rock mass defects**

method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering alteration	estimated strength (VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm (30 100 300 1000 3000)	defect description: type, inclination, planarity, roughness, coating, thickness (particular / general)
						Continued from non-cored borehole						
				7		**SANDSTONE:** fine to coarse grained, grey, massive.	XW					PT, 1°, UN, RO, CN
												PT, 1°, UN, RO, CN
												PT, 1°, UN, RO, CN
												PT, 1°, UN, RO, CN
												PT, 0°, UN, RO, CN
				8								PT, 0°, UN, RO, CN
												PT, 0°, UN, RO, CN
												PT, 0°, UN, RO, CN
												PT, 0°, UN, RO, CN
						SANDSTONE: fine to coarse grained, pale grey, massive.						PT, 0°, UN, RO, CN
				9								PT, 0°, UN, RO, CN
						SANDSTONE: fine to coarse grained, pale grey and red, massive.						PT, 0°, UN, RO, CN
												PT, 0°, UN, RO, CN
												PT, 0°, UN, RO, CN
						MBH9 terminated at 9.6m						
				10								
				11								
				12								

method
DT diatube; AS auger screwing; AD auger drilling; RR roller/tricone; CB claw or blade bit; NMLC NMLC core; NQ, HQ, PQ wireline core

core-lift
casing used; barrel withdrawn

graphic log/core recovery
core recovered - graphic symbols indicate material; no core recovered

water
10/1/98 water level on date shown; water inflow; partial drill fluid loss; complete drill fluid loss; 25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh; SW slightly weathered; MW moderately weathered; HW highly weathered; XW extremely weathered; DW distinctly weathered (covers MW and HW)

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

defect type
JT joint; PT parting; SM seam; SZ sheared zone; SS sheared surface; CS crushed seam

planarity
PL planar; CU curved; UN undulating; ST stepped; IR irregular

roughness
VR very rough; RO rough; SO smooth; SL slickensided

coating
CN clean; SN stained; VN veneer; CO coating

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH10
Sheet	1 of 6
Project No:	GEONATH18367AB
Client:	NORTH EAST BUSINESS PARK
Date started:	2.11.2006
Principal:	NORTH EAST BUSINESS PARK
Date completed:	2.11.2006
Project:	NORTH EAST BUSINESS PARK
Logged by:	LH
Borehole Location:	MARINA (NORTH OF TRACK, ELEVATED DUNE)
Checked by:	KL

drill model and mounting: Edson 3000, 4WD Truck Mounted Testing: slope: -90° R.L. Surface:

hole diameter: mm Northing bearing: datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		C		ASS		1		SP	**SAND:** medium to coarse grained, white and grey.	M	MD		AEOLIAN DUNE SAND
				ASS									
				ASS									
				ASS									
				ASS									
				ASS									
				ASS									
				ASS		2							
				ASS				CH	**CLAY:** high plasticity, grey.		F		
				ASS				SP	**SAND:** medium to coarse grained, white and grey, some high plasticity clay.	W	MD		
				ASS									
T		M	NOT MEASURED	SPT 3,3,6 N*=9		3		CL	**CLAY:** low plasticity, pale grey, some coarse grained sand. ...trace quartzitic gravel up to 4mm in size.		F		RESIDUAL SOIL
						4							
				SPT 2,2,4 N*=6							S		
						5		CL	**CLAY:** medium plasticity, pale grey, some coarse quartzitic sand.				
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

BOREHOLE GEONATH 18367 EXISTING STUFF.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH10
Sheet	2 of 6
Project No:	GEONATH18367AB
Date started:	2.11.2006
Date completed:	2.11.2006
Logged by:	LH
Checked by:	KL

Client: NORTH EAST BUSINESS PARK

Principal: NORTH EAST BUSINESS PARK

Project: NORTH EAST BUSINESS PARK

Borehole Location: MARINA (NORTH OF TRACK, ELEVATED DUNE)

drill model and mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: - -90° | R.L. Surface:

hole diameter: mm | Northing | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
T		M	NOT MEASURED	SPT 3,5,7 N*=12		7		CL	**CLAY:** medium plasticity, pale grey, some coarse quartzitic sand. *(continued)*	W	S		
				SPT 3,6,8 N*=14		8		CL	**SANDY CLAY:** medium plasticity, grey and brown, coarse grained sand.		VSt		Sand content increasing with depth.
				SPT 30/100mm N*=R		9		CL	**GRAVELLY CLAY:** medium plasticity, grey, fine grained angular quarzitic gravel up to 4mm in size.				EXTREMELY WEATHERED SANDSTONE
				SPT 30/100mm N=R		10			...grey & red to brown				
						11			...grey.				
						12							

BOREHOLE GEONATH 18367 EXISTING STUFF.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Borehole No.	**MBH10**
Sheet	**3 of 6**
Project No:	**GEONATH18367AB**
Client:	**NORTH EAST BUSINESS PARK**
Date started:	**2.11.2006**
Principal:	**NORTH EAST BUSINESS PARK**
Date completed:	**2.11.2006**
Project:	**NORTH EAST BUSINESS PARK**
Logged by:	**LH**
Borehole Location:	**MARINA (NORTH OF TRACK, ELEVATED DUNE)**
Checked by:	

drill model & mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:

hole diameter: mm | Drilling fluid: | Northing: | bearing: | datum:

drilling information | **material substance** | **rock mass defects**

method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering / alteration	estimated strength (VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm (30 100 300 1000 3000)	defect description: type, inclination, planarity, roughness, coating, thickness (particular / general)
T		NOT MEASURED				**GRAVELLY CLAY:** medium plasticity, grey, fine grained angular quarzitic gravel up to 4mm in size. *(continued)*						
						CLAY: medium plasticity, pale grey, some fine to medium grained sand.						
				13		**GRAVELLY CLAY:** medium plasticity, brown, fine grained angular gravel of argillaceous origin of 2-4mm in size.						
						CLAY: medium plasticity, pale grey, some fine to medium grained sand.						
				14								
				15								
				16								
						SANDY CLAY: medium plasticity, pale grey, fine to medium grained sand, some black angular gravel of argillaceous origin up to 3mm in size.						
				17								
				18								

method

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
NMLC	NMLC core
NQ, HQ, PQ	wireline core

core-lift

- casing used
- barrel withdrawn

graphic log/core recovery

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

water

- 10/1/98 water level on date shown
- water inflow
- partial drill fluid loss
- complete drill fluid loss
- 25 water pressure test result (lugeons) for depth interval shown

weathering

FR	fresh
SW	slightly weathered
MW	moderately weathered
HW	highly weathered
XW	extremely weathered
DW	distinctly weathered (covers MW and HW)

strength

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

defect type

JT	joint
PT	parting
SM	seam
SZ	sheared zone
SS	sheared surface
CS	crushed seam

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	irregular

roughness

VR	very rough
RO	rough
SO	smooth
SL	slickensided

coating

CN	clean
SN	stained
VN	veneer
CO	coating

coffey geotechnics

Engineering Log - Borehole

Client:	NORTH EAST BUSINESS PARK	Borehole No.	MBH10
Principal:	NORTH EAST BUSINESS PARK	Sheet	4 of 6
Project:	NORTH EAST BUSINESS PARK	Project No:	GEONATH18367AB
Borehole Location:	MARINA (NORTH OF TRACK, ELEVATED DUNE)	Date started:	2.11.2006
		Date completed:	2.11.2006
		Logged by:	LH
		Checked by:	IC

drill model and mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:

hole diameter: mm | Northing | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
T		M	NOT MEASURED			19		CL	**SANDY CLAY:** medium plasticity, pale grey, fine to medium grained sand, some black angular gravel of argillaceous origin up to 3mm in size. *(continued)* ...black sand.	W			Layer of harder material
						20		CL	**CLAY:** medium plasticity, pale grey, some fine to medium grained sand. ...increase in black argillaceous material.				Harder material Black material easily broken with fingers. Possible carbonaceous.
						21		CL	**GRAVELLY CLAY:** medium plasticity, pale grey, fine black angular gravel of argillaceous origin.				Increase in argillaceous material with depth. Sand quartzitic in origin.
						22		CL	**CLAY:** medium plasticity, pale grey, some fine to coarse grained sand, trace black argillaceous material up to 2mm in size.				
						23							
						24							

BOREHOLE GEONATH 18367 EXISTING STUFF.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

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

support
M mud N nil
C casing

penetration
1 2 3 4
no resistance ranging to refusal

water
10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests
U_{50} undisturbed sample 50mm diameter
U_{63} undisturbed sample 63mm diameter
D disturbed sample
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
V vane shear (kPa)
P pressuremeter
Bs bulk sample
E environmental sample
R refusal

classification symbols and soil description
based on unified classification system

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

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

coffey geotechnics

Engineering Log - Cored Borehole

Borehole No.	MBH10
Sheet	5 of 6
Project No:	GEONATH18367AB
Client:	NORTH EAST BUSINESS PARK
Date started:	2.11.2006
Principal:	NORTH EAST BUSINESS PARK
Date completed:	2.11.2006
Project:	NORTH EAST BUSINESS PARK
Logged by:	LH
Borehole Location:	MARINA (NORTH OF TRACK, ELEVATED DUNE)
Checked by:	

drill model & mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:

hole diameter: mm | Drilling fluid: | Northing: | bearing: | datum:

drilling information | **material substance** | **rock mass defects**

method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering alteration	estimated strength (VL L M H VH EH)	$Is_{(50)}$ MPa D-diametral A-axial	RQD %	defect spacing mm (30 100 300 1000 3000)	defect description: type, inclination, planarity, roughness, coating, thickness (particular / general)
T		NOT MEASURED		25		**CLAY:** medium plasticity, pale grey, some fine to coarse grained sand, trace black argillaceous material up to 2mm in size. *(continued)*						
						CLAY: high plasticity, pale grey, some fine grained sand.						
				26		**SANDY GRAVELLY CLAY:** high plasticity, pale grey, medium to coarse grained sand, trace quartzitic gravel, trace black argillaceous material up to 1-2mm.						
				27								
				28								
				29								
				30								

method
DT diatube
AS auger screwing
AD auger drilling
RR roller/tricone
CB claw or blade bit
NMLC NMLC core
NQ, HQ, PQ wireline core

core-lift
casing used
barrel withdrawn

graphic log/core recovery
core recovered - graphic symbols indicate material
no core recovered

water
10/1/98 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss
25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh
SW slightly weathered
MW moderately weathered
HW highly weathered
XW extremely weathered
DW distinctly weathered (covers MW and HW)

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

defect type
JT joint
PT parting
SM seam
SZ sheared zone
SS sheared surface
CS crushed seam

roughness
VR very rough
RO rough
SO smooth
SL slickensided

planarity
PL planar
CU curved
UN undulating
ST stepped
IR irregular

coating
CN clean
SN stained
VN veneer
CO coating

coffey geotechnics

Engineering Log - Cored Borehole

Client:	NORTH EAST BUSINESS PARK	Borehole No.	MBH10
Principal:	NORTH EAST BUSINESS PARK	Sheet	6 of 6
Project:	NORTH EAST BUSINESS PARK	Project No:	GEONATH18367AB
Borehole Location:	MARINA (NORTH OF TRACK, ELEVATED DUNE)	Date started:	2.11.2006
		Date completed:	2.11.2006
		Logged by:	LH
		Checked by:	

drill model & mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:

hole diameter: mm | Drilling fluid: | Northing: | bearing: | datum:

drilling information | **material substance** | **rock mass defects**

method	core-lift	water	RL	depth metres	graphic log core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering alteration	estimated strength (VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm (30 100 300 1000 3000)	defect description: type, inclination, planarity, roughness, coating, thickness (particular / general)
T		NOT MEASURED		31		**SANDY GRAVELLY CLAY:** high plasticity, pale grey, medium to coarse grained sand, trace quartzitic gravel, trace black argillaceous material up to 1-2mm. *(continued)*						
				32								
						CLAY: medium plasticity, pale grey, some fine grained sand.						
				33								
				34								
				35								
						MBH10 terminated at 35m						
				36								

CORED BOREHOLE GEONATH 18367 EXISTING STUFF.GPJ COFFEY.GDT 9.1.07

Form GEO 5.5 Issue 3 Rev. 3

method

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
NMLC	NMLC core
NQ, HQ, PQ	wireline core

core-lift

casing used

barrel withdrawn

graphic log/core recovery

core recovered - graphic symbols indicate material

no core recovered

water

10/1/98 water level on date shown

water inflow

partial drill fluid loss

complete drill fluid loss

25 water pressure test result (lugeons) for depth interval shown

weathering

FR	fresh
SW	slightly weathered
MW	moderately weathered
HW	highly weathered
XW	extremely weathered
DW	distinctly weathered (covers MW and HW)

strength

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

defect type

JT	joint
PT	parting
SM	seam
SZ	sheared zone
SS	sheared surface
CS	crushed seam

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	irregular

roughness

VR	very rough
RO	rough
SO	smooth
SL	slickensided

coating

CN	clean
SN	stained
VN	veneer
CO	coating

Borehole Logs – MBH Series

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH1
Sheet	1 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	22.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	22.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	KM
Borehole Location:	AS PER MAP
Checked by:	

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500149 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 7000600 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD						1		SW	**SAND:** fine to medium grained, pale brown grey.	W	VL		AEOLIAN DUNE SAND Becoming less clayey with depth
		C		SPT 30 N*=R		2		SP	**GRAVELLY SAND:** fine to medium grained, dark brown, weakly cemented.		D-VD	×	RESIDUAL SOIL Coffee Rock PP=100kPa
TB				SPT 2,2,4 N*=6		3						×	PP=300kPa
				U_{50}		4		CL	**SANDY CLAY:** medium plasticity, green grey.		S-F	×	PP=400kPa
						5						×	PP=500kPa
						6		CL	**CLAY:** medium plasticity, pale blue grey.		L-MD		Sand/Clay 50/50

BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH1
Sheet	2 of 3
Project No:	GEOTNATH18367AC
Date started:	22.11.2006
Date completed:	22.11.2006
Logged by:	KM
Checked by:	

Client: NORTHEAST BUSINESS PARK

Principal: NORTHEAST BUSINESS PARK - LAING O'ROURKE

Project: MARINA GEOTECHNICAL INVESTIGATION

Borehole Location: AS PER MAP

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500149 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 7000600 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
TB		C		SPT 2,3,5 N*=8		7		CL	**CLAY:** medium plasticity, pale blue grey. *(continued)*	W	L-MD	× PP=260kPa × PP=500kPa	
				SPT 6,11,20 N*=31		8		CL	**CLAY:** medium plasticity, pale grey, some fine grained sand.		MD	× PP=400kPa	
				SPT 16 N*=R		9			**GRAVELLY CLAY:** medium plasticity, pale grey - white; coarse grained with some fine grained sand.		VL		
						10			Borehole MBH1 continued as cored hole				
						11							
						12							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Borehole No.	**MBH1**
Sheet	**3 of 3**
Project No:	**GEOTNATH18367AC**
Client:	**NORTHEAST BUSINESS PARK**
Date started:	**22.11.2006**
Principal:	**NORTHEAST BUSINESS PARK - LAING O'ROURKE**
Date completed:	**22.11.2006**
Project:	**MARINA GEOTECHNICAL INVESTIGATION**
Logged by:	**KM**
Borehole Location:	**AS PER MAP**
Checked by:	KL

drill model & mounting: JACRO 200 TRACK RIG | Easting: 500149 | slope: -90° | R.L. Surface:

hole diameter: 100 mm Drilling fluid: | Northing: 7000600 | bearing: | datum:

drilling information					material substance						rock mass defects			
method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering / alteration	estimated strength: VL L M H VH EH	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm: 30 100 300 1000 3000	defect description: type, inclination, planarity, roughness, coating, thickness — particular		general
						Continued from non-cored borehole								
						SANDSTONE: fine to medium grained, yellow and grey, massive.	HW							
				10		**SANDSTONE:** fine grained,grey with iron staining, massive.								
						SANDSTONE: fine grained, dark grey, massive.	MW					—PT, 0°, PL, SO, CN		
						SANDSTONE: fine to medium grained, grey, massive.						—PT, 0°, PL, SO, CN		
				11		**SANDSTONE:** fine to medium grained, grey, massive, with siltstone gravel ranging 4-40mm inclusions.						PT, 0°, PL, SO, CN		
						MBH1 terminated at 11.4m						PT, 0°, PL, SO, CN		
				12								PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
				13								PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
				14								PT, 0°, UN, SO, CN		
												PT, 0°, UN, SO, CN		
												PT, 0°, UN, SO, CN		
												PT, 0°, UN, SO, CN		
												PT, 0°, UN, SO, CN		
												PT, 0°, UN, SO, CN		
				15								PT, 0°, UN, SO, CN		

CORED BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.5 Issue 3 Rev. 3

method
DT diatube
AS auger screwing
AD auger drilling
RR roller/tricone
CB claw or blade bit
NMLC NMLC core
NQ, HQ, PQ wireline core

core-lift
casing used
barrel withdrawn

graphic log/core recovery
core recovered - graphic symbols indicate material
no core recovered

water
10/1/98 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss
25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh
SW slightly weathered
MW moderately weathered
HW highly weathered
XW extremely weathered
DW distinctly weathered (covers MW and HW)

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

defect type
JT joint
PT parting
SM seam
SZ sheared zone
SS sheared surface
CS crushed seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR irregular

roughness
VR very rough
RO rough
SO smooth
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH2
Sheet	1 of 2
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	23.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	23.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	KL

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500097 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm | Northing 7000469 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
ADT		C	▶			1		SW	**SAND:** fine to coarse grained, grey white.	M	MD		MARINE SOIL (quartzitic material)
				SPT 5,8,10 N*=18				SC	**CLAYEY SAND:** coarse grained, dark grey.		D		RESIDUAL SOIL
						2		CH	**CLAY:** high plasticity, yellow, some fine grained sand.		St-Vst		coffee rock
								SC	**CLAYEY SAND:** medium to coarse grained, grey brown.	W	MD		
⊢		M		SPT 6,7,7 N*=14		3		CH	**CLAY:** high plasticity, grey and yellow, trace of fine grained sand, some quartzitic sub angular gravel up to 4mm in length	M	F		
								CH	**SANDY CLAY:** high plasticity, yellow and grey.				
						4		SC	**CLAYEY SAND:** fine to medium grained, yellow and grey, some argillaceous rounded and subangular gravel up to 12mm in length.		D-VD		
				SPT 8,16,26 N*=42				CH	**CLAY:** high plasticity, grey, some sand.		VSt		small decaying rootlets
						5		CH	**SANDY CLAY:** high plasticity, grey and yellow, fine grained sand.				
						6							

BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

▼ 10/1/98 water level on date shown
► water inflow
◄ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Borehole No.	MBH2		
Sheet	2 of 2		
Project No:	GEOTNATH18367AC		
Client:	NORTHEAST BUSINESS PARK	Date started:	23.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Date completed:	23.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION	Logged by:	LH
Borehole Location:	AS PER MAP	Checked by:	JCL

drill model & mounting: JACRO 200 TRACK RIG | Easting: 500097 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm Drilling fluid: | Northing: 7000469 | bearing: | datum:

drilling information					material substance						rock mass defects		
method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering / alteration	estimated strength (VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm (30 100 300 1000 3000)	defect description: type, inclination, planarity, roughness, coating, thickness (particular / general)
						Continued from non-cored borehole						
						CORE LOSS						
				7		**SANDSTONE:** fine grained, yellow and grey, massive.	XW					PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN
				8		**SANDY CLAY:** high plasticity, grey and yellow, fine grained sand.						PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 5°, UN, SO, CN
				9		**SAND:** coarse grained, red-white and brown, material is quartzitic and argillaceous in origin.						
				10		**SANDSTONE:** fine grained, yellow grey, massive.						
						SAND: coarse grained, brown red and white, trace high plasticity clay.						
				11		**SANDSTONE:** coarse grained, grey brown and yellow, massive.						PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN
						SANDSTONE: fine grained, pale red and grey.						PT, 0°, PL, SO, CN PT, 0°, UN, SO, CN PT, 0°, UN, SO, CN PT, 0°, PL, SO, CN
				12		MBH2 terminated at 11.5m						

CORED BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.5 Issue 3 Rev: 3

method
DT diatube
AS auger screwing
AD auger drilling
RR roller/tricone
CB claw or blade bit
NMLC NMLC core
NQ, HQ, PQ wireline core

core-lift
casing used
barrel withdrawn

graphic log/core recovery
core recovered - graphic symbols indicate material
no core recovered

water
10/1/98 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss
25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh
SW slightly weathered
MW moderately weathered
HW highly weathered
XW extremely weathered
DW distinctly weathered (covers MW and HW)

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

defect type
JT joint
PT parting
SM seam
SZ sheared zone
SS sheared surface
CS crushed seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR irregular

roughness
VR very rough
RO rough
SO smooth
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH3
Sheet	1 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	23.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	23.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500127 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm | Northing 7000289 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
ADT		C				0		SW	**SAND:** fine to medium grained, grey brown, trace of high plasticity clay, trace of quartzitic gravel up to 3mm, trace of argillaceous gravel up to 5mm in size.	M	MD		MARINE SOIL
						1		SC	**CLAYEY SAND:** coarse grained, dark brown, with high plasticity clay.		D		strong sweet organic odour, decomposed plant matter (possibly reeds)
				SPT 9,7,3 N*=10		2							
T		M		SPT 2,3,4 N*=7		3		CH	**CLAY:** high plasticity, yellow grey, some fine grained sand.	W	St	×	ALLUVIAL SOIL PP=100kPa
												×	PP=120kPa
												×	PP=150kPa
						4			...clay content increasing			×	PP=180kPa
				U_{50}		5		CH	**CLAY:** high plasticity, grey and yellow.	M		×	PP=145kPa
						6							

BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev 2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH3
Sheet	2 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	23.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	23.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500127 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm | Northing 7000289 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
T		M		SPT 4,5,12 N*=17				GC	**CLAYEY SANDY GRAVEL:** fine grained, white grey, high plasticity clay, fine grained sand.	M	MD		gravel ranging in size from 2mm to 5mm of quartzitic and argillaceous origin all well rounded.
								GP	**GRAVEL:** fine grained, brown, some high plasticity clay, some fine grained sand.				
								CH	**CLAY:** high plasticity, grey yellow, some argillaceous gravel up to 5mm, some coarse grained sand. Secondary elements increase in size with depth.		VSt-H		RESIDUAL SOIL
						7							
				SPT 20,30/35mm N*=R				SP	**SAND:** coarse grained, brown red, some quartzitic gravel to 5mm				
								GP					
								CH	**SAND:** fine grained, white.				
						8			**CLAY:** high plasticity, grey.		H		
								CH	**CLAY:** high plasticity, yellow and grey.		VSt		
				SPT 30/70mm N*=R		9							
									Borehole MBH3 continued as cored hole				
						10							
						11							
						12							

BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Borehole No. **MBH3**

Sheet **3 of 3**

Project No: **GEOTNATH18367AC**

Client:	*NORTHEAST BUSINESS PARK*	Date started:	**23.11.2006**
Principal:	*NORTHEAST BUSINESS PARK - LAING O'ROURKE*	Date completed:	**23.11.2006**
Project:	*MARINA GEOTECHNICAL INVESTIGATION*	Logged by:	**LH**
Borehole Location:	*AS PER MAP*	Checked by:	KL

drill model & mounting: JACRO 200 TRACK RIG | Easting: 500127 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm | Drilling fluid: | Northing: 7000289 | bearing: | datum:

depth metres	graphic log	material (rock type; grain characteristics, colour, structure, minor components)	weathering alteration	defect description (type, inclination, planarity, roughness, coating, thickness)
		Continued from non-cored borehole		
		CORE LOSS		
10				
	sandstone	SANDSTONE: fine to medium grained, grey-brown and red, massive.	HW	PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN
		...grey		
11				
	sandstone	SANDSTONE: fine to medium grained, grey, massive.	HW-MW	PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN
		...undulating layers of 1-4mm of coal		
12				PT, 0°, UN, SO, CN PT, 0°, UN, SO, CN PT, 0°, UN, SO, CN
	sandstone	SANDSTONE: fine grained, grey, massive.		PT, 0°, UN, SO, CN PT, 0°, UN, SO, CN PT, 0°, UN, SO, CN PT, 0°, UN, SO, CN PT, 0°, UN, SO, CN
13		LOSS OF CORE		
		MBH3 terminated at 13.1m		
14				
15				

method
DT diatube
AS auger screwing
AD auger drilling
RR roller/tricone
CB claw or blade bit
NMLC NMLC core
NQ, HQ, PQ wireline core

core-lift
casing used
barrel withdrawn

graphic log/core recovery
core recovered - graphic symbols indicate material
no core recovered

water
10/1/98 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss
25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh
SW slightly weathered
MW moderately weathered
HW highly weathered
XW extremely weathered
DW distinctly weathered (covers MW and HW)

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

defect type
JT joint
PT parting
SM seam
SZ sheared zone
SS sheared surface
CS crushed seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR irregular

roughness
VR very rough
RO rough
SO smooth
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH4
Sheet	1 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	27.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	27.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	KL

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500255 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm | Northing 7000235 | bearing: | datum:

drilling information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
ADT		N				0		SP	**SAND:** medium to coarse grained, grey brown, some quartzitic gravel up to 3mm in size.	M	D		MARINE SOIL small tree rootlets up to 5mm in diameter
						1				W			rotten egg odour
				SPT 12,9,6 N*=15									possible tree roots
						2		SP	**SAND:** medium plasticity, black, some black clay.		MD		
								CH	**CLAY:** high plasticity, green and grey, some coarse grained sand.	M	F		
								SP	**SAND:** grey.	W	D		
				SPT 2,6,16 N*=22		3							RESIDUAL SOIL
								CH	**SANDY CLAY:** high plasticity, grey, medium to coarse grained sand, trace of quartzitic gravel up to 3mm.	M	St	×	PP=200kPa
						4			...some dark red angular arenitic gravel of up to 5mm in size.		VSt-H		
				SPT 00,13,21 N*=34					...angular arenitic gravel up to 10mm; subrounded quartzitic gravel up to 4mm.				
		W				5		CH	**SANDY CLAY:** high plasticity, grey and red, fine to medium grained sand.			×	PP=500kPa Residual soil
						6							

BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

method

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

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH4
Sheet	2 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	27.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	27.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500255 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm | Northing 7000235 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
ADT		W		SPT 14,14,30 N*=44		7		CH	**SANDY CLAY:** high plasticity, grey and red, fine to medium grained sand. *(continued)*	M	VSt-H		Layers of dark red and grey material. Grey material softer than red. Layers of material differ in strength...
				SPT 14,30/105mm N*=R		8							
						9							
						10			Borehole MBH4 continued as cored hole				
						11							
						12							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Client:	NORTHEAST BUSINESS PARK	Borehole No.	MBH4
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Sheet	3 of 3
Project:	MARINA GEOTECHNICAL INVESTIGATION	Project No:	GEOTNATH18367AC
Borehole Location:	AS PER MAP	Date started:	27.11.2006
		Date completed:	27.11.2006
		Logged by:	LH
		Checked by:	

drill model & mounting: JACRO 200 TRACK RIG | Easting: 500255 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm Drilling fluid: | Northing: 7000235 | bearing: | datum:

drilling information					material substance					rock mass defects		
method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering alteration	estimated strength (VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm (30 100 300 1000 3000)	defect description: type, inclination, planarity, roughness, coating, thickness (particular / general)
						Continued from non-cored borehole						
						SANDSTONE: fine grained, grey, massive.	XW / HW					
						SANDSTONE: fine to medium grained, brown, massive, clay layer from 9.46-9.52.						
						SANDSTONE: fine grained, grey and yellow, massive.						
				10		**SANDSTONE:** coarse grained, dark brown, massive.						
						CONGLOMERATE SANDSTONE & SILTSTONE GRAVEL: brown, grey, dark red, massive.						11xPT, 0°, UN, RO, CN 11xPT, 0°, UN, RO, CN 11xPT, 0°, UN, RO, CN 10.5-10.7-11xPT, 0°, UN, RO, CN
						SANDSTONE: fine grained, dark grey, massive.						PT, 0°, PL, SO, CN
				11		**SANDSTONE:** fine to medium grained, brown and grey, massive. Coal layer of 20mm						PT, 0°, PL, SO, CN
												PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN PT, 0°, PL, SO, CN
												PT, 0°, PL, SO, CN
				12		MBH4 terminated at 11.8m						
				13								
				14								
				15								

COREDBOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.5 Issue 3 Rev. 3

method

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
NMLC	NMLC core
NQ, HQ, PQ	wireline core

core-lift

- casing used
- barrel withdrawn

graphic log/core recovery

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

water

- 10/1/98 water level on date shown
- water inflow
- partial drill fluid loss
- complete drill fluid loss
- 25 water pressure test result (lugeons) for depth interval shown

weathering

FR	fresh
SW	slightly weathered
MW	moderately weathered
HW	highly weathered
XW	extremely weathered
DW	distinctly weathered (covers MW and HW)

strength

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

defect type

JT	joint
PT	parting
SM	seam
SZ	sheared zone
SS	sheared surface
CS	crushed seam

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	irregular

roughness

VR	very rough
RO	rough
SO	smooth
SL	slickensided

coating

CN	clean
SN	stained
VN	veneer
CO	coating

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH5
Sheet	1 of 3
Project No:	GEOTNATH18367AC
Date started:	27.11.2006
Date completed:	27.11.2006
Logged by:	LH
Checked by:	

Client: NORTHEAST BUSINESS PARK

Principal: NORTHEAST BUSINESS PARK - LAING O'ROURKE

Project: MARINA GEOTECHNICAL INVESTIGATION

Borehole Location: AS PER MAP

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500406 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 700015 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		C						SC	**TOPSOIL: CLAY:** high plasticity, brown.	M	F		TOPSOIL
								SC	**SANDY CLAY:** medium to coarse grained, brown.				MARINE SOIL
						1		SP	**SAND:** coarse grained, grey, some high plasticity clay, some subrounded quartzitic gravel up to 3mm in size.		MD		
			▶	SPT 2,2,5 N*=7						W			Sample has organic odour
						2		CH	**CLAY:** high plasticity, brown and yellow.		F		
								SC	**CLAYEY SAND:** medium to coarse grained, grey, medium plasticity clay. ...high plasticity.		F/MD		Organic odour
T-B		M		SPT 3,3,4 N*=7		3							
								CH	**CLAY:** high plasticity, brown and yellow, trace of coarse grained sand. ....grey, yellow and brown, some quartzitic gravel of 3mm in size, argillaceous gravel to 5mm; some coarse sand.				ALLUVIAL SOIL
						4			...grey and yellow.		St-VSt		
				U_{50}									Too hard to push U50 to depth
						5			...some of grey clay material has PP=500, rest is >>500		H		PP>>500kPa
								CL	**SANDY CLAY:** low to medium plasticity, grey and dark red, coarse grained sand, some dark red arenitic material in form of well graded gravel ranging in size from 2 to 4mm.	M			RESIDUAL SOIL Extremely weathered LANDSBOROUGH SANDSTONE
				SPT 2,16,30/120mm N*=R		6		CL	**CLAY:** medium plasticity, grey and yellow.				COFFEE ROCK
						7							Iron staining
				SPT 11,12,13 N*=25				CH	**CLAY:** high plasticity, grey and red, some medium to coarse grained sand.				
						8							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

▼ 10/1/98 water level on date shown

▶ water inflow

◀ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH5
Sheet	2 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	27.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	27.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	IC

drill model and mounting: JACRO 200 TRACK RIG | Easting: 500406 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 700015 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
T-B		M				9		CH	**CLAY:** high plasticity, grey and red, some medium to coarse grained sand. *(continued)* ...Red material has some medium grained sand. ...Grey material high plasticity clay.	M	H		PP=400kPa PP=460kPa PP=460kPa PP=500kPa
				SPT 6,11,15 N*=26		10							
		N						CL	**SANDY CLAY:** high plasticity, grey and red, some medium grained sand; trace dark red arenitic angular gravel up to 3mm.				Layers of material vary in consistency from VSt-H Rock fabric visible
				SPT 30/100mm N*=R		11					VSt H		
						12		CL	**SANDY CLAY:** medium to high plasticity, yellow, fine grained sand.				
									Borehole MBH5 continued as cored hole				
						13							
						14							
						15							
						16							

method

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

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Borehole No.	MBH5		
Sheet	3 of 3		
Project No:	GEOTNATH18367AC		
Client:	NORTHEAST BUSINESS PARK	Date started:	27.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Date completed:	27.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION	Logged by:	LH
Borehole Location:	AS PER MAP	Checked by:	

drill model & mounting: JACRO 200 TRACK RIG | Easting: 500406 | slope: -90° | R.L. Surface:

hole diameter: 100 mm Drilling fluid: | Northing: 700015 | bearing: | datum:

drilling information | **material substance** | **rock mass defects**

method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering alteration	estimated strength (VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm (30 100 300 1000 3000)	defect description: type, inclination, planarity, roughness, coating, thickness — particular / general
						Continued from non-cored borehole						
						SANDSTONE: fine to medium grained, brown to red and grey, massive.	HW					PT, 0°, PL, SO, CN, 1mm
												PT, 0°, PL, SO, CN, 1mm
				13		**SANDSTONE:** fine to medium grained, grey, massive.	SW					PT, 0°, PL, SO, CN, 1mm
												PT, 0°, PL, SO, CN, 1mm
												PT, 0°, PL, SO, CN, 1mm
				14								PT, 0°, PL, SO, CN, 1mm
												PT, 0°, PL, SO, CN, 1mm
												PT, 0°, PL, SO, CN, 1mm
				15								
						MBH5 terminated at 15.2m						
				16								
				17								
				18								
				19								
				20								

method
DT diatube; AS auger screwing; AD auger drilling; RR roller/tricone; CB claw or blade bit; NMLC NMLC core; NQ, HQ, PQ wireline core

core-lift
casing used; barrel withdrawn

graphic log/core recovery
core recovered - graphic symbols indicate material; no core recovered

water
10/1/98 water level on date shown; water inflow; partial drill fluid loss; complete drill fluid loss; 25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh; SW slightly weathered; MW moderately weathered; HW highly weathered; XW extremely weathered; DW distinctly weathered (covers MW and HW)

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

defect type
JT joint; PT parting; SM seam; SZ sheared zone; SS sheared surface; CS crushed seam

planarity
PL planar; CU curved; UN undulating; ST stepped; IR irregular

roughness
VR very rough; RO rough; SO smooth; SL slickensided

coating
CN clean; SN stained; VN veneer; CO coating

Form GEO 5.5 Issue 3 Rev. 3 CORED BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH6
Sheet	1 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	20.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	20.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	KL

drill model and mounting: EDSON 3000 | Easting: 500625 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 7000050 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
ADT		N				0		CL	**TOPSOIL: SANDY CLAY:** low plasticity, black to brown.	M	F		TOPSOIL
								CH	**CLAY:** high plasticity, grey to yellow, trace fine grained sand.				ALLUVIAL SOIL
						1							
								CH	**CLAY:** high plasticity, grey, some fine to medium grained sand.				
TB				U_{50}					...grey, red and orange.	W	St		330mm recovery
						2			...red			×	PP=140kPa
				U_{50}		3					VSt		450mm recovery
												×	PP=295kPa
				U_{50}		4			...grey				
									...grey, yellow and red				
						5		CH	**CLAY:** high plasticity, grey and red. [grey Ch=VSt-H Red CH=VSt]				×PP>>500kPa Grey material is very stiff to hard Red material is very stiff.
									...Red clay decreases with depth				
						6							RESIDUAL SOIL ×PP>>500kPa

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH6
Sheet	2 of 3
Project No:	GEOTNATH18367AC
Date started:	20.11.2006
Date completed:	20.11.2006
Logged by:	LH
Checked by:	

Client: NORTHEAST BUSINESS PARK

Principal: NORTHEAST BUSINESS PARK - LAING O'ROURKE

Project: MARINA GEOTECHNICAL INVESTIGATION

Borehole Location: AS PER MAP

drill model and mounting: EDSON 3000 | Easting: 500625 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 7000050 | bearing: | datum:

drilling information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
TB		N		U_{50}		7		CL	**CLAY:** medium plasticity, grey to brown and red to brown, trace of medium grained sand.	W	H		230mm Recovery U50 pushed approximately 200mm as material too hard.
									...grey				
				SPT 30/130mm N*=R		8			...some coarse grained sand			×	PP>>500kPa
						9		CL	**SANDY CLAY:** medium plasticity, grey, fine and coarse grained sand; some flat angular gravel of up to 4mm in length.			×	PP>>500kPa
				SPT 30/100mm N*=R				SC	**CLAYEY SAND:** coarse grained, grey, medium plasticity clay. Sand content increases with depth.				Extremely weathered SANDSTONE
B						10		SC	**CLAYEY SAND:** coarse grained, grey.				
						11			Borehole MBH6 continued as cored hole				
						12							

BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Client:	NORTHEAST BUSINESS PARK	Borehole No.	MBH6
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Sheet	3 of 3
Project:	MARINA GEOTECHNICAL INVESTIGATION	Project No:	GEOTNATH18367AC
Borehole Location:	AS PER MAP	Date started:	20.11.2006
		Date completed:	20.11.2006
		Logged by:	LH
		Checked by:	K—

drill model & mounting: EDSON 3000 | Easting: 500625 | slope: -90° | R.L. Surface:

hole diameter: 100 mm Drilling fluid: | Northing: 7000050 | bearing: | datum:

drilling information					material substance					rock mass defects		
method	core-lift	water	RL	depth metres	graphic log core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering alteration	estimated strength VL L M H VH EH	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm 30 100 300 1000 3000	defect description: type, inclination, planarity, roughness, coating, thickness — particular / general
						Continued from non-cored borehole						
				11		**SANDSTONE:** fine grained, yellow, massive.	XW					
				12		Clay seam						
				13								
				14		MBH6 terminated at 13.61m						
				15								
				16								

CORED BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.5 Issue 3 Rev. 3

method

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
NMLC	NMLC core
NQ, HQ, PQ	wireline core

core-lift

casing used

barrel withdrawn

graphic log/core recovery

core recovered - graphic symbols indicate material

no core recovered

water

10/1/98 water level on date shown

water inflow

partial drill fluid loss

complete drill fluid loss

25 water pressure test result (lugeons) for depth interval shown

weathering

FR	fresh
SW	slightly weathered
MW	moderately weathered
HW	highly weathered
XW	extremely weathered
DW	distinctly weathered (covers MW and HW)

strength

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

defect type

JT	joint
PT	parting
SM	seam
SZ	sheared zone
SS	sheared surface
CS	crushed seam

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	irregular

roughness

VR	very rough
RO	rough
SO	smooth
SL	slickensided

coating

CN	clean
SN	stained
VN	veneer
CO	coating

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH7
Sheet	1 of 3
Project No:	GEOTNATH18367AC
Date started:	20.11.2006
Date completed:	20.11.2006
Logged by:	LH
Checked by:	

Client: NORTHEAST BUSINESS PARK

Principal: NORTHEAST BUSINESS PARK - LAING O'ROURKE

Project: MARINA GEOTECHNICAL INVESTIGATION

Borehole Location: AS PER MAP

drill model and mounting: EDSON 3000 | Easting: 500672 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 7000224 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		N						CH	**CLAY:** high plasticity, grey to brown, yellow.	M	F		ALLUVIAL SOIL
								CH	**CLAY:** high plasticity, grey.	W			
TB				U_{50}		1							
						2		SC	**CLAYEY SAND:** medium grained, orange, high plasticity clay.		MD	×	PP=100kPa
				U_{50}		3		CH	**SANDY CLAY:** high plasticity, red and grey, coarse grained sand; some gravel of up to 4mm in size.		St-VSt	×	PP=300kPa
				U_{50}		4		CH	**CLAY:** high plasticity, red and grey, some medium grained sand. ...dark red and grey, some coarse grained sand and fine gravel up to 6mm in size.				
						5		CH	**CLAY:** high plasticity, grey and red, some coarse grained sand.		VSt-H	×	G=400kPa R>>500kPa
								CH	**CLAY:** high plasticity, grey and dark red. Dark red material is hard high plasticity clay. Grey material is stiff-very stiff high plasticity clay.	M			
						6		CL	**CLAY:** medium plasticity, grey and red, some medium to coarse grained sand; trace of angular gravel up to 4mm in size.				

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH7
Sheet	2 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	20.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	20.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	IC

drill model and mounting: EDSON 3000 | Easting: 500672 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 7000224 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
TB		N		U_{50}				CL	**CLAY:** medium plasticity, grey and red, some medium to coarse grained sand; trace of angular gravel up to 4mm in size. *(continued)* ...clays of different strength.	M	VSt-H		PP=260kPa grey clay PP=500kPa red clay
						7		SC	**CLAYEY SAND:** fine to coarse grained, grey and red, medium plasticity clay.				RESIDUAL SOIL
				U_{50}		8						*	PP=400kPa
								SC	**SANDY CLAY:** coarse grained, grey and yellow, high plasticity clay.		D/VSt		
				SPT 11,16,30/100mm N*=R		9			...yellow, some gravel up to 3mm in size.				Extremely weathered SANDSTONE
									Borehole MBH7 continued as cored hole				
						10							
						11							
						12							

BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

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

support
M mud N nil
C casing

penetration
1 2 3 4 no resistance ranging to refusal

water
10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests
U_{50} undisturbed sample 50mm diameter
U_{63} undisturbed sample 63mm diameter
D disturbed sample
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
V vane shear (kPa)
P pressuremeter
Bs bulk sample
E environmental sample
R refusal

classification symbols and soil description
based on unified classification system

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

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Borehole No.	MBH7		
Sheet	3 of 3		
Project No:	GEOTNATH18367AC		
Client:	NORTHEAST BUSINESS PARK	Date started:	20.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Date completed:	20.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION	Logged by:	LH
Borehole Location:	AS PER MAP	Checked by:	

drill model & mounting: EDSON 3000 | Easting: 500672 | slope: -90° | R.L. Surface:

hole diameter: 100 mm Drilling fluid: | Northing: 7000224 | bearing: | datum:

drilling information | **material substance** | **rock mass defects**

method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering alteration	estimated strength (VL L M H VH EH)	Is(50) MPa D-diametral A-axial	RQD %	defect spacing mm (30 100 300 1000 3000)	defect description: type, inclination, planarity, roughness, coating, thickness (particular / general)
						Continued from non-cored borehole						
				10		**SANDSTONE:** fine to medium grained, grey-yellow, massive.	XW					PT, 0°, PL, SO, CN
												PT, 0°, PL, SO, CN
												PT, 0°, PL, SO, CN
												PT, 0°, PL, SO, CN
						SANDSTONE: fine to coarse grained, yellow and grey, massive.	HW					PT, 0°, PL, SO, CN
						CONGLOMERATE SANDSTONE WITH SILTSTONE GRAVEL & COBBLES: fine to coarse grained, grey and brown.						PT, 0°, PL, SO, CN
				11								PT, 0°, PL, RO, CN
												PT, 0°, PL, RO, CN
												PT, 0°, PL, RO, CN
												11.54-11.74-PT, 5°, PL, RO, CN
				12		**SANDSTONE:** fine grained, grey and yellow, massive.	XW					PT, 0°, PL, SO, CN
												PT, 0°, PL, SO, CN
				13								PT, 0°, PL, SO, CN
						MBH7 terminated at 13m						
				14								
				15								

CORED BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.5 Issue 3 Rev. 3

method
DT diatube
AS auger screwing
AD auger drilling
RR roller/tricone
CB claw or blade bit
NMLC NMLC core
NQ, HQ, PQ wireline core

core-lift
casing used
barrel withdrawn

graphic log/core recovery
core recovered - graphic symbols indicate material
no core recovered

water
10/1/98 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss
25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh
SW slightly weathered
MW moderately weathered
HW highly weathered
XW extremely weathered
DW distinctly weathered (covers MW and HW)

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

defect type
JT joint
PT parting
SM seam
SZ sheared zone
SS sheared surface
CS crushed seam

roughness
VR very rough
RO rough
SO smooth
SL slickensided

planarity
PL planar
CU curved
UN undulating
ST stepped
IR irregular

coating
CN clean
SN stained
VN veneer
CO coating

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH8
Sheet	1 of 3
Project No:	GEOTNATH18367AC
Date started:	21.11.2006
Date completed:	21.11.2006
Logged by:	LH
Checked by:	

Client: NORTHEAST BUSINESS PARK

Principal: NORTHEAST BUSINESS PARK - LAING O'ROURKE

Project: MARINA GEOTECHNICAL INVESTIGATION

Borehole Location: AS PER MAP

drill model and mounting: EDSON 3000 | Easting: 500697 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 7000358 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		C	▶			1		CH	**CLAY:** high plasticity, grey to brown.	M	F		ALLUVIAL SOIL
				U_{50}		2			....grey and yellow, some fine grained sand.		St	×	PP=180kPa
								CL	**SANDY CLAY:** medium plasticity, grey, fine grained sand.		F		
								CH	**SANDY CLAY:** high plasticity, yellow, fine grained sand.		St-VSt		
								CH	**CLAY:** high plasticity, grey, some fine grained sand.				
				U_{50}		3		CL	**CLAY:** high plasticity, grey, some fine grained sand.				pushed 170mm
												×	PP>>500kPa
						4			...grey and red, trace of gravel up to 3-4mm in size.				
				SPT 11,30/140mm N*=R					...dark grey and dark red.		H or Fb		
TB		N				5		CL	**CLAY:** low plasticity, dark grey, some fine grained sand.				Possibly a RESIDUAL SOIL extremely weathered SANDSTONE.
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

▼ 10/1/98 water level on date shown

▶ water inflow

◀ water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH8
Sheet	2 of 3
Project No:	GEOTNATH18367AC
Date started:	21.11.2006
Date completed:	21.11.2006
Logged by:	LH
Checked by:	

Client: NORTHEAST BUSINESS PARK

Principal: NORTHEAST BUSINESS PARK - LAING O'ROURKE

Project: MARINA GEOTECHNICAL INVESTIGATION

Borehole Location: AS PER MAP

drill model and mounting: EDSON 3000 | Easting: 500697 | slope: -90° | R.L. Surface:

hole diameter: 100 mm | Northing 7000358 | bearing: | datum:

drilling information							material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
TB		N		SPT 12,22,28 N*=50		7		CL	**CLAY:** low plasticity, dark grey, some fine grained sand. *(continued)*	M	H or Fb		
				SPT 19,30/130mm N*=R		8		CL	**CLAY:** low plasticity, pale grey, some fine to medium grained sand; some gravel ranging in size from 2mm to 4mm. ...pale grey, dark grey, yellow and red.				Material less hard than material above Pushed to refusal approximately 20mm
				SPT 10,13,18 N*=31		9		CL	**CLAY:** medium plasticity, pale grey to dark grey, pale grey material high plasticity clay, dark grey material low plasticity clay, some fine and medium grained sand; some gravel up to 6mm in size.				PP=260kPa PP=300kPa PP=340kPa PP=400kPa PP>500kPa
				SPT 27,30/70mm N*=R		10		CH	**CLAY:** high plasticity, yellow, pale grey, dark grey and orange.		VSt-H		
						11			Borehole MBH8 continued as cored hole				
						12							

BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description

based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Client:	NORTHEAST BUSINESS PARK
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Project:	MARINA GEOTECHNICAL INVESTIGATION
Borehole Location:	AS PER MAP

Borehole No.	MBH8
Sheet	3 of 3
Project No:	GEOTNATH18367AC
Date started:	21.11.2006
Date completed:	21.11.2006
Logged by:	LH
Checked by:	

drill model & mounting: EDSON 3000 | Easting: 500697 | slope: -90° | R.L. Surface:

hole diameter: 100 mm Drilling fluid: | Northing: 7000358 | bearing: | datum:

drilling information					material substance						rock mass defects			
method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering alteration	estimated strength VL L M H VH EH	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm 30 100 300 1000 3000	defect description: type, inclination, planarity, roughness, coating, thickness — particular		general
						Continued from non-cored borehole								
						SANDSTONE: medium to coarse grained, red, massive.	HW					PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
				12		**SANDSTONE:** medium to coarse grained, grey brown and white, massive.						PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
												PT, 5°, PL, SO, CN		
				13								PT, 0°, UN, SO, CN		
												PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
				14		**SANDSTONE:** fine to medium grained, grey, massive.	MW					PT, 0°, PL, SO, CN		
												PT, 0°, PL, SO, CN		
						MBH8 terminated at 14.2m								
				15										
				16										
				17										

CORED BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

Form GEO 5.5 Issue 3 Rev. 3

method

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
NMLC	NMLC core
NQ, HQ, PQ	wireline core

core-lift

- casing used
- barrel withdrawn

graphic log/core recovery

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

water

- 10/1/98 water level on date shown
- water inflow
- partial drill fluid loss
- complete drill fluid loss
- 25 water pressure test result (lugeons) for depth interval shown

weathering

FR	fresh
SW	slightly weathered
MW	moderately weathered
HW	highly weathered
XW	extremely weathered
DW	distinctly weathered (covers MW and HW)

strength

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

defect type

JT	joint
PT	parting
SM	seam
SZ	sheared zone
SS	sheared surface
CS	crushed seam

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	irregular

roughness

VR	very rough
RO	rough
SO	smooth
SL	slickensided

coating

CN	clean
SN	stained
VN	veneer
CO	coating

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH9		
Sheet	1 of 3		
Project No:	GEOTNATH18367AC		
Client:	NORTHEAST BUSINESS PARK	Date started:	22.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Date completed:	22.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION	Logged by:	LH
Borehole Location:	AS PER MAP	Checked by:	

drill model and mounting:	EDSON 3000	Easting:	500702	slope:	-90°	R.L. Surface:	NOT MEASURED
hole diameter:	100 mm	Northing	7000454	bearing:		datum:	

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		C				1		CH	**SANDY CLAY:** high plasticity, dark grey, fine grained sand.	M	F		ALLUVIAL SOIL
TB				U_{50}						W			
						2			...grey and red		F-St	x	PP= 80kPa
								CH	**CLAY:** high plasticity, red and grey. Red material is a low plasticity clay.				Red material increasing in quantity with depth.
		N		SPT 30/700mm N*=R		3		CH	**SANDY CLAY:** high plasticity, grey, coarse grained sand; some gravel of quartzitic origin up to 3mm in size.	M	D		
						4		SC	**CLAYEY SAND:** coarse grained, grey, high plasticity clay; some quartzitic gravel up to 3mm in size. ...red.		VD		
				SPT 17,30/145mm N*=R		5		CL/ML	**CLAY:** dark grey, pieces of red indurated sand of up to 5mm in size.		H		
								CL	**CLAY:** low plasticity, dark grey.				
						6							

BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 8.1.07

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration

1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH9
Sheet	2 of 3
Project No:	GEOTNATH18367AC
Client:	NORTHEAST BUSINESS PARK
Date started:	22.11.2006
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE
Date completed:	22.11.2006
Project:	MARINA GEOTECHNICAL INVESTIGATION
Logged by:	LH
Borehole Location:	AS PER MAP
Checked by:	

drill model and mounting: EDSON 3000 | Easting: 500702 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm | Northing 7000454 | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
TB		N		SPT 18,30/148mm N*=R				CL	**CLAY:** low plasticity, dark grey. *(continued)* ...pale grey and red.	M	H		
						7			Borehole MBH9 continued as cored hole				
						8							
						9							
						10							
						11							
						12							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil
C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description
based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Client:	NORTHEAST BUSINESS PARK	Borehole No.	MBH9
Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Sheet	3 of 3
Project:	MARINA GEOTECHNICAL INVESTIGATION	Project No:	GEOTNATH18367AC
Borehole Location:	AS PER MAP	Date started:	22.11.2006
		Date completed:	22.11.2006
		Logged by:	LH
		Checked by:	JC

drill model & mounting: EDSON 3000 | Easting: 500702 | slope: -90° | R.L. Surface: NOT MEASURED

hole diameter: 100 mm Drilling fluid: | Northing: 7000454 | bearing: | datum:

drilling information | **material substance** | **rock mass defects**

method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering alteration	estimated strength (VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm (30 100 300 1000 3000)	defect description: type, inclination, planarity, roughness, coating, thickness (particular / general)
						Continued from non-cored borehole						
				7		**SANDSTONE:** fine to coarse grained, grey, massive.	XW					PT, 1°, UN, RO, CN
												PT, 1°, UN, RO, CN
												PT, 1°, UN, RO, CN
												PT, 1°, UN, RO, CN
												PT, 0°, UN, RO, CN
				8								PT, 0°, UN, RO, CN
												PT, 0°, UN, RO, CN
												PT, 0°, UN, RO, CN
												PT, 0°, UN, RO, CN
						SANDSTONE: fine to coarse grained, pale grey, massive.						PT, 0°, UN, RO, CN
				9								PT, 0°, UN, RO, CN
						SANDSTONE: fine to coarse grained, pale grey and red, massive.						PT, 0°, UN, RO, CN
												PT, 0°, UN, RO, CN
												PT, 0°, UN, RO, CN
						MBH9 terminated at 9.6m						
				10								
				11								
				12								

method
DT diatube; AS auger screwing; AD auger drilling; RR roller/tricone; CB claw or blade bit; NMLC NMLC core; NQ, HQ, PQ wireline core

core-lift
casing used; barrel withdrawn

graphic log/core recovery
core recovered - graphic symbols indicate material; no core recovered

water
10/1/98 water level on date shown; water inflow; partial drill fluid loss; complete drill fluid loss; 25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh; SW slightly weathered; MW moderately weathered; HW highly weathered; XW extremely weathered; DW distinctly weathered (covers MW and HW)

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

defect type
JT joint; PT parting; SM seam; SZ sheared zone; SS sheared surface; CS crushed seam

planarity
PL planar; CU curved; UN undulating; ST stepped; IR irregular

roughness
VR very rough; RO rough; SO smooth; SL slickensided

coating
CN clean; SN stained; VN veneer; CO coating

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH10
Sheet	1 of 6
Project No:	GEONATH18367AB
Client:	NORTH EAST BUSINESS PARK
Date started:	2.11.2006
Principal:	NORTH EAST BUSINESS PARK
Date completed:	2.11.2006
Project:	NORTH EAST BUSINESS PARK
Logged by:	LH
Borehole Location:	MARINA (NORTH OF TRACK, ELEVATED DUNE)
Checked by:	KL

drill model and mounting: Edson 3000, 4WD Truck Mounted Testing: slope: -90° R.L. Surface:

hole diameter: mm Northing bearing: datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
AD		C		ASS		1		SP	**SAND:** medium to coarse grained, white and grey.	M	MD		AEOLIAN DUNE SAND
				ASS									
				ASS									
				ASS									
				ASS									
				ASS									
				ASS									
				ASS		2							
				ASS				CH	**CLAY:** high plasticity, grey.		F		
				ASS				SP	**SAND:** medium to coarse grained, white and grey, some high plasticity clay.	W	MD		
				ASS									
T		M	NOT MEASURED	SPT 3,3,6 N*=9		3		CL	**CLAY:** low plasticity, pale grey, some coarse grained sand. ...trace quartzitic gravel up to 4mm in size.		F		RESIDUAL SOIL
						4							
				SPT 2,2,4 N*=6							S		
						5		CL	**CLAY:** medium plasticity, pale grey, some coarse quartzitic sand.				
						6							

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support: M mud, C casing, N nil

penetration: 1 2 3 4 — no resistance ranging to refusal

water: 10/1/98 water level on date shown; water inflow; water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

BOREHOLE GEONATH 18367 EXISTING STUFF.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

coffey geotechnics

Engineering Log - Borehole

Borehole No.	MBH10
Sheet	2 of 6
Project No:	GEONATH18367AB
Date started:	2.11.2006
Date completed:	2.11.2006
Logged by:	LH
Checked by:	KL

Client: NORTH EAST BUSINESS PARK

Principal: NORTH EAST BUSINESS PARK

Project: NORTH EAST BUSINESS PARK

Borehole Location: MARINA (NORTH OF TRACK, ELEVATED DUNE)

drill model and mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: - -90° | R.L. Surface:

hole diameter: mm | Northing | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
T		M	NOT MEASURED	SPT 3,5,7 N*=12		7		CL	**CLAY:** medium plasticity, pale grey, some coarse quartzitic sand. *(continued)*	W	S		
				SPT 3,6,8 N*=14		8		CL	**SANDY CLAY:** medium plasticity, grey and brown, coarse grained sand.		VSt		Sand content increasing with depth.
				SPT 30/100mm N*=R		9		CL	**GRAVELLY CLAY:** medium plasticity, grey, fine grained angular quarzitic gravel up to 4mm in size.				EXTREMELY WEATHERED SANDSTONE
				SPT 30/100mm N=R		10			...grey & red to brown				
						11			...grey.				
						12							

BOREHOLE GEONATH 18367 EXISTING STUFF.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

method

AS	auger screwing*
AD	auger drilling*
RR	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
B	blank bit
V	V bit
T	TC bit

*bit shown by suffix e.g. ADT

support

M mud N nil

C casing

penetration 1 2 3 4 — no resistance ranging to refusal

water

10/1/98 water level on date shown

water inflow

water outflow

notes, samples, tests

U_{50}	undisturbed sample 50mm diameter
U_{63}	undisturbed sample 63mm diameter
D	disturbed sample
N	standard penetration test (SPT)
N*	SPT - sample recovered
Nc	SPT with solid cone
V	vane shear (kPa)
P	pressuremeter
Bs	bulk sample
E	environmental sample
R	refusal

classification symbols and soil description based on unified classification system

moisture

D	dry
M	moist
W	wet
Wp	plastic limit
W_L	liquid limit

consistency/density index

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

coffey geotechnics

Engineering Log - Cored Borehole

Borehole No.	**MBH10**
Sheet	**3 of 6**
Project No:	**GEONATH18367AB**
Client:	**NORTH EAST BUSINESS PARK**
Date started:	**2.11.2006**
Principal:	**NORTH EAST BUSINESS PARK**
Date completed:	**2.11.2006**
Project:	**NORTH EAST BUSINESS PARK**
Logged by:	**LH**
Borehole Location:	**MARINA (NORTH OF TRACK, ELEVATED DUNE)**
Checked by:	

drill model & mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:

hole diameter: mm | Drilling fluid: | Northing: | bearing: | datum:

drilling information | **material substance** | **rock mass defects**

method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering / alteration	estimated strength (VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm (30 100 300 1000 3000)	defect description: type, inclination, planarity, roughness, coating, thickness (particular / general)
T		NOT MEASURED				**GRAVELLY CLAY:** medium plasticity, grey, fine grained angular quarzitic gravel up to 4mm in size. *(continued)*						
						CLAY: medium plasticity, pale grey, some fine to medium grained sand.						
				13		**GRAVELLY CLAY:** medium plasticity, brown, fine grained angular gravel of argillaceous origin of 2-4mm in size.						
						CLAY: medium plasticity, pale grey, some fine to medium grained sand.						
				14								
				15								
				16								
						SANDY CLAY: medium plasticity, pale grey, fine to medium grained sand, some black angular gravel of argillaceous origin up to 3mm in size.						
				17								
				18								

method

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
NMLC	NMLC core
NQ, HQ, PQ	wireline core

core-lift

- casing used
- barrel withdrawn

graphic log/core recovery

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

water

- 10/1/98 water level on date shown
- water inflow
- partial drill fluid loss
- complete drill fluid loss
- 25 water pressure test result (lugeons) for depth interval shown

weathering

FR	fresh
SW	slightly weathered
MW	moderately weathered
HW	highly weathered
XW	extremely weathered
DW	distinctly weathered (covers MW and HW)

strength

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

defect type

JT	joint
PT	parting
SM	seam
SZ	sheared zone
SS	sheared surface
CS	crushed seam

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	irregular

roughness

VR	very rough
RO	rough
SO	smooth
SL	slickensided

coating

CN	clean
SN	stained
VN	veneer
CO	coating

coffey geotechnics

Engineering Log - Borehole

Client:	NORTH EAST BUSINESS PARK	Borehole No.	MBH10
Principal:	NORTH EAST BUSINESS PARK	Sheet	4 of 6
Project:	NORTH EAST BUSINESS PARK	Project No:	GEONATH18367AB
Borehole Location:	MARINA (NORTH OF TRACK, ELEVATED DUNE)	Date started:	2.11.2006
		Date completed:	2.11.2006
		Logged by:	LH
		Checked by:	IC

drill model and mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:

hole diameter: mm | Northing | bearing: | datum:

drilling information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
T		M	NOT MEASURED			19		CL	**SANDY CLAY:** medium plasticity, pale grey, fine to medium grained sand, some black angular gravel of argillaceous origin up to 3mm in size. *(continued)* ...black sand.	W			Layer of harder material
						20		CL	**CLAY:** medium plasticity, pale grey, some fine to medium grained sand. ...increase in black argillaceous material.				Harder material Black material easily broken with fingers. Possible carbonaceous.
						21		CL	**GRAVELLY CLAY:** medium plasticity, pale grey, fine black angular gravel of argillaceous origin.				Increase in argillaceous material with depth. Sand quartzitic in origin.
						22		CL	**CLAY:** medium plasticity, pale grey, some fine to coarse grained sand, trace black argillaceous material up to 2mm in size.				
						23							
						24							

BOREHOLE GEONATH 18367 EXISTING STUFF.GPJ COFFEY.GDT 9.1.07

Form GEO 5.3 Issue 3 Rev.2

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

support
M mud N nil
C casing

penetration
1 2 3 4
no resistance ranging to refusal

water
10/1/98 water level on date shown
water inflow
water outflow

notes, samples, tests
U_{50} undisturbed sample 50mm diameter
U_{63} undisturbed sample 63mm diameter
D disturbed sample
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
V vane shear (kPa)
P pressuremeter
Bs bulk sample
E environmental sample
R refusal

classification symbols and soil description
based on unified classification system

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

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

coffey geotechnics

Engineering Log - Cored Borehole

Borehole No.	MBH10
Sheet	5 of 6
Project No:	GEONATH18367AB
Client:	NORTH EAST BUSINESS PARK
Date started:	2.11.2006
Principal:	NORTH EAST BUSINESS PARK
Date completed:	2.11.2006
Project:	NORTH EAST BUSINESS PARK
Logged by:	LH
Borehole Location:	MARINA (NORTH OF TRACK, ELEVATED DUNE)
Checked by:	

drill model & mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:

hole diameter: mm | Drilling fluid: | Northing: | bearing: | datum:

drilling information | **material substance** | **rock mass defects**

method	core-lift	water	RL	depth metres	graphic log / core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering alteration	estimated strength (VL L M H VH EH)	$Is_{(50)}$ MPa D-diametral A-axial	RQD %	defect spacing mm (30 100 300 1000 3000)	defect description: type, inclination, planarity, roughness, coating, thickness (particular / general)
T		NOT MEASURED		25		**CLAY:** medium plasticity, pale grey, some fine to coarse grained sand, trace black argillaceous material up to 2mm in size. *(continued)*						
						CLAY: high plasticity, pale grey, some fine grained sand.						
				26		**SANDY GRAVELLY CLAY:** high plasticity, pale grey, medium to coarse grained sand, trace quartzitic gravel, trace black argillaceous material up to 1-2mm.						
				27								
				28								
				29								
				30								

method
DT diatube
AS auger screwing
AD auger drilling
RR roller/tricone
CB claw or blade bit
NMLC NMLC core
NQ, HQ, PQ wireline core

core-lift
casing used
barrel withdrawn

graphic log/core recovery
core recovered - graphic symbols indicate material
no core recovered

water
10/1/98 water level on date shown
water inflow
partial drill fluid loss
complete drill fluid loss
25 water pressure test result (lugeons) for depth interval shown

weathering
FR fresh
SW slightly weathered
MW moderately weathered
HW highly weathered
XW extremely weathered
DW distinctly weathered (covers MW and HW)

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

defect type
JT joint
PT parting
SM seam
SZ sheared zone
SS sheared surface
CS crushed seam

roughness
VR very rough
RO rough
SO smooth
SL slickensided

planarity
PL planar
CU curved
UN undulating
ST stepped
IR irregular

coating
CN clean
SN stained
VN veneer
CO coating

coffey geotechnics

Engineering Log - Cored Borehole

Client:	NORTH EAST BUSINESS PARK	Borehole No.	MBH10
Principal:	NORTH EAST BUSINESS PARK	Sheet	6 of 6
Project:	NORTH EAST BUSINESS PARK	Project No:	GEONATH18367AB
Borehole Location:	MARINA (NORTH OF TRACK, ELEVATED DUNE)	Date started:	2.11.2006
		Date completed:	2.11.2006
		Logged by:	LH
		Checked by:	

drill model & mounting: Edson 3000, 4WD Truck Mounted | Easting: | slope: -90° | R.L. Surface:

hole diameter: mm | Drilling fluid: | Northing: | bearing: | datum:

drilling information | **material substance** | **rock mass defects**

method	core-lift	water	RL	depth metres	graphic log core recovery	material: rock type; grain characteristics, colour, structure, minor components	weathering alteration	estimated strength (VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	defect spacing mm (30 100 300 1000 3000)	defect description: type, inclination, planarity, roughness, coating, thickness (particular / general)
T		NOT MEASURED		31		**SANDY GRAVELLY CLAY:** high plasticity, pale grey, medium to coarse grained sand, trace quartzitic gravel, trace black argillaceous material up to 1-2mm. *(continued)*						
				32								
						CLAY: medium plasticity, pale grey, some fine grained sand.						
				33								
				34								
				35								
						MBH10 terminated at 35m						
				36								

CORED BOREHOLE GEONATH 18367 EXISTING STUFF.GPJ COFFEY.GDT 9.1.07

Form GEO 5.5 Issue 3 Rev. 3

method

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
NMLC	NMLC core
NQ, HQ, PQ	wireline core

core-lift

casing used

barrel withdrawn

graphic log/core recovery

core recovered - graphic symbols indicate material

no core recovered

water

10/1/98 water level on date shown

water inflow

partial drill fluid loss

complete drill fluid loss

25 water pressure test result (lugeons) for depth interval shown

weathering

FR	fresh
SW	slightly weathered
MW	moderately weathered
HW	highly weathered
XW	extremely weathered
DW	distinctly weathered (covers MW and HW)

strength

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

defect type

JT	joint
PT	parting
SM	seam
SZ	sheared zone
SS	sheared surface
CS	crushed seam

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	irregular

roughness

VR	very rough
RO	rough
SO	smooth
SL	slickensided

coating

CN	clean
SN	stained
VN	veneer
CO	coating

Appendix B

Important Information about your Coffey Report

Appendix B

Important Information about your Coffey Report

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Important information about your **Coffey** Report

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

Your report is based on project specific criteria

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

Subsurface conditions can change

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

Interpretation of factual data

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

Your report will only give preliminary recommendations

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

Your report is prepared for specific purposes and persons

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

Appendix C

Laboratory test results

California Bearing Ratio Test Results

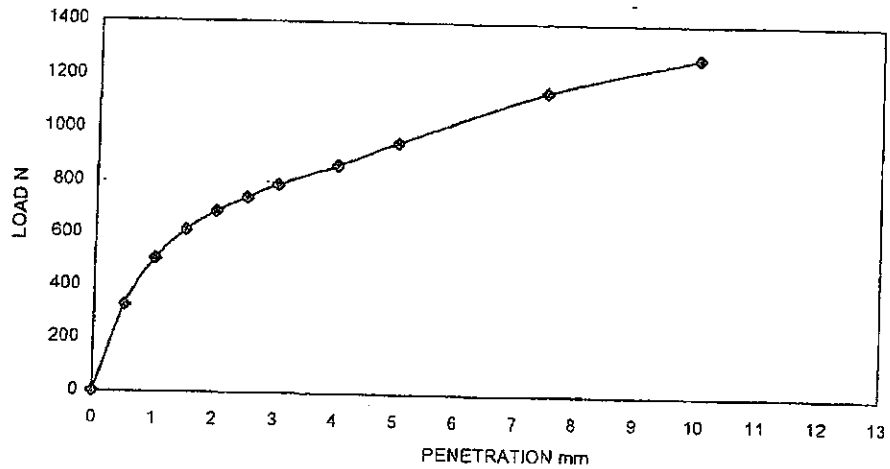
TP Series (Douglas Partners)

RESULT OF CALIFORNIA BEARING RATIO TEST

CLIENT : LENSWORTH GROUP LTD
PROJECT : ASS & PRELIMINARY GEOTECHNICAL INVESTIGATION
LOCATION : 2 - 32 & 34 NOLAN DRIVE, MORAYFIELD
TEST LOCATION : TP26

DATE : 21/7/03
PROJECT No. : 33454A
DATE OF TESTING: 14/7/03
DEPTH : 0.5-0.8 m

CBR TEST



DESCRIPTION : SANDY SILTY CLAY

PREPARATION : Remoulded to approximate 100% Standard Maximum Dry Density and Optimum Moisture Content and soaked for 4 days.

LEVEL OF COMPACTION: 100.3 % SURCHARGE : 4.5 kg SWELL: 0.9%

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m3
At compaction		17.7	1.74
After soaking		19.6	1.72
After test	Top 30 mm	20.2	-
	Total sample	19.4	-
Field values		17.4	-
Standard compaction		18.0	1.73

RESULTS		
TYPE	PENETRATION	CBR
TOP	- 2.5 mm	6
	- 5.0 mm	5
BOTTOM	- 2.5 mm	-
	- 5.0 mm	-

TEST METHOD: AS1289 6.1.1. CBR Test.
AS1289.2.1.1 Oven Moisture Content

TESTED BY: SJ
CHECKED BY: DE

LABORATORY - Brisbane 1289

REPORT No: B03-444

SIGNED:

D.A.ELDER

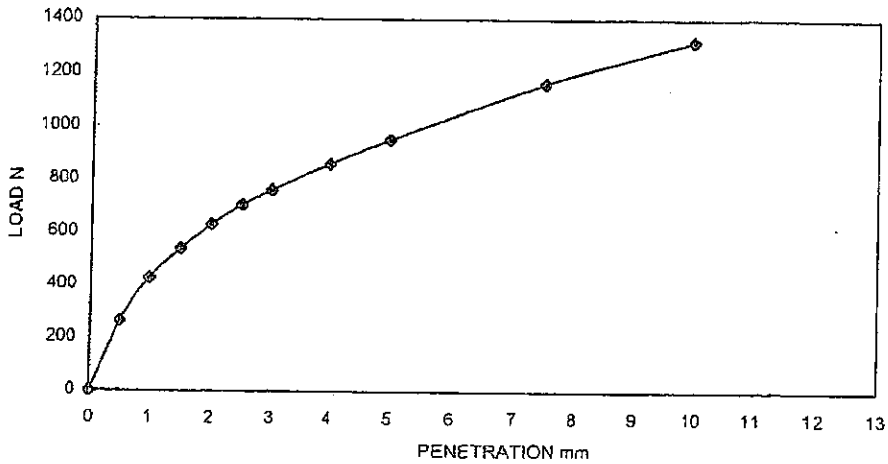
Douglas Partners
Geotechnics · Environment · Groundwater

RESULT OF CALIFORNIA BEARING RATIO TEST

CLIENT : LENSWORTH GROUP LTD
PROJECT : ASS & PRELIMINARY GEOTECHNICAL INVESTIGATION
LOCATION : 2 - 32 & 34 NOLAN DRIVE, MORAYFIELD
TEST LOCATION : TP28

DATE : 21/7/03
PROJECT No. : 33454A
DATE OF TESTING: 14/7/03
DEPTH : 0.4-0.8 m

CBR TEST



DESCRIPTION : SILTY CLAY

PREPARATION : Remoulded to approximate 100% Standard Maximum Dry Density and Optimum Moisture Content and soaked for 4 days.

LEVEL OF COMPACTION: 100.1 % SURCHARGE : 4.5 kg SWELL: 1 1%

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m3
At compaction		23.3	1.61
After soaking		24.9	1.60
After test	Top 30 mm	25.9	-
	Total sample	24.7	-
Field values		23.5	-
Standard compaction		23.0	1.61

RESULTS		
TYPE	PENETRATION	CBR
TOP	- 2.5 mm	5
	- 5.0 mm	5
BOTTOM	- 2.5 mm	-
	- 5.0 mm	-

TEST METHOD: AS1289 6.1.1. CBR Test.
AS1289.2.1.1 Oven Moisture Content

TESTED BY: SJ
CHECKED BY: DE

LABORATORY - Brisbane 1289 REPORT No: B03-445 SIGNED:

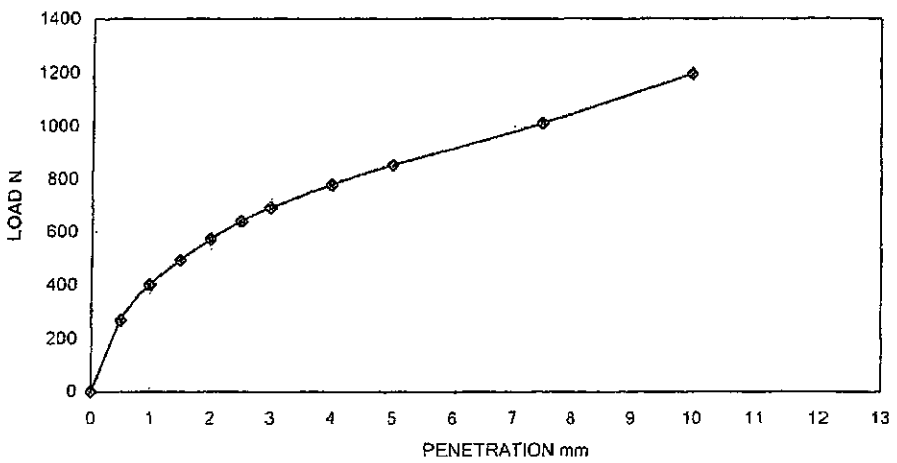
D.A.ELDER

Douglas Partners
Geotechnics · Environment · Groundwater

RESULT OF CALIFORNIA BEARING RATIO TEST

CLIENT :	LENSWORTH GROUP LTD	**DATE :**	21/7/03
PROJECT :	ASS & PRELIMINARY GEOTECHNICAL INVESTIGATION	**PROJECT No. :**	33454A
LOCATION :	2 - 32 & 34 NOLAN DRIVE, MORAYFIELD	**DATE OF TESTING:**	14/7/03
TEST LOCATION :	TP35	**DEPTH :**	0.5-0.8 m

CBR TEST



DESCRIPTION : SILTY CLAY

PREPARATION : Remoulded to approximate 100% Standard Maximum Dry Density and Optimum Moisture Content and soaked for 4 days.

LEVEL OF COMPACTION: 100.4 % **SURCHARGE :** 4.5 kg **SWELL:** 1.1%

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m3
At compaction		19.4	1.68
After soaking		21.9	1.66
After test	Top 30 mm	22.0	-
	Total sample	21.5	-
Field values		22.5	-
Standard compaction		20.0	1.67

RESULTS		
TYPE	PENETRATION	CBR
TOP	- 2.5 mm	5.0
	- 5.0 mm	4.5
BOTTOM	- 2.5 mm	-
	- 5.0 mm	-

TEST METHOD: AS1289 6.1.1. CBR Test.
AS1289.2.1.1 Oven Moisture Content

TESTED BY: SJ
CHECKED BY: DE

LABORATORY - Brisbane 1289 REPORT No: B03-446 SIGNED:

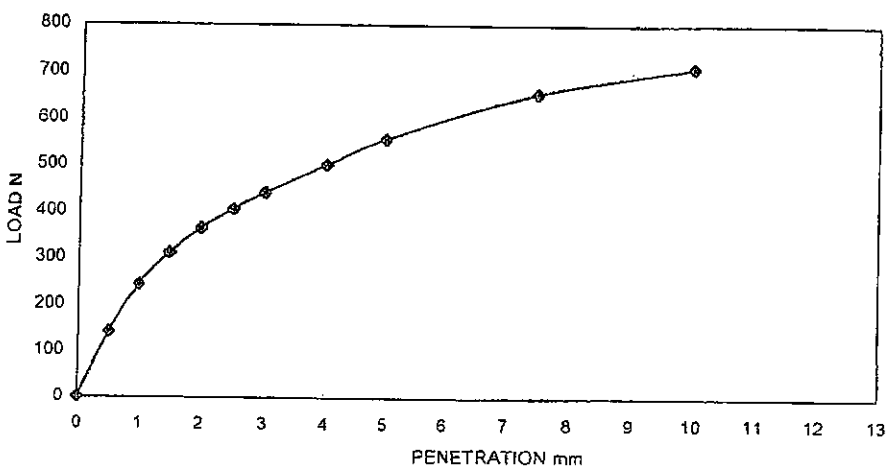
D.A.ELDER

RESULT OF CALIFORNIA BEARING RATIO TEST

CLIENT : LENSWORTH GROUP LTD
PROJECT : ASS & PRELIMINARY GEOTECHNICAL INVESTIGATION
LOCATION : 2 - 32 & 34 NOLAN DRIVE, MORAYFIELD
TEST LOCATION : TP37

DATE : 21/7/03
PROJECT No. : 33454A
DATE OF TESTING: 14/7/03
DEPTH : 0.5-0.9 m

CBR TEST



DESCRIPTION : SILTY CLAY

PREPARATION : Remoulded to approximate 100% Standard Maximum Dry Density and Optimum Moisture Content and soaked for 4 days.

LEVEL OF COMPACTION: 99.6 % SURCHARGE : 4.5 kg SWELL: 3.4%

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m3
At compaction		23.2	1.57
After soaking		28.2	1.52
After test	Top 30 mm	29.0	-
	Total sample	26.4	-
Field values		25.5	-
Standard compaction		24.5	1.58

RESULTS		
TYPE	PENETRATION	CBR
TOP	- 2.5 mm	3.0
	- 5.0 mm	3.0
BOTTOM	- 2.5 mm	-
	- 5.0 mm	-

TEST METHOD: AS1289 6.1.1. CBR Test.
AS1289.2.1.1 Oven Moisture Content

TESTED BY: SJ
CHECKED BY: DE

LABORATORY - Brisbane 1289

REPORT No: B03-447

SIGNED:

D.A.ELDER

Douglas Partners
Geotechnics · Environment · Groundwater

RESULTS OF COMPACTION TESTS

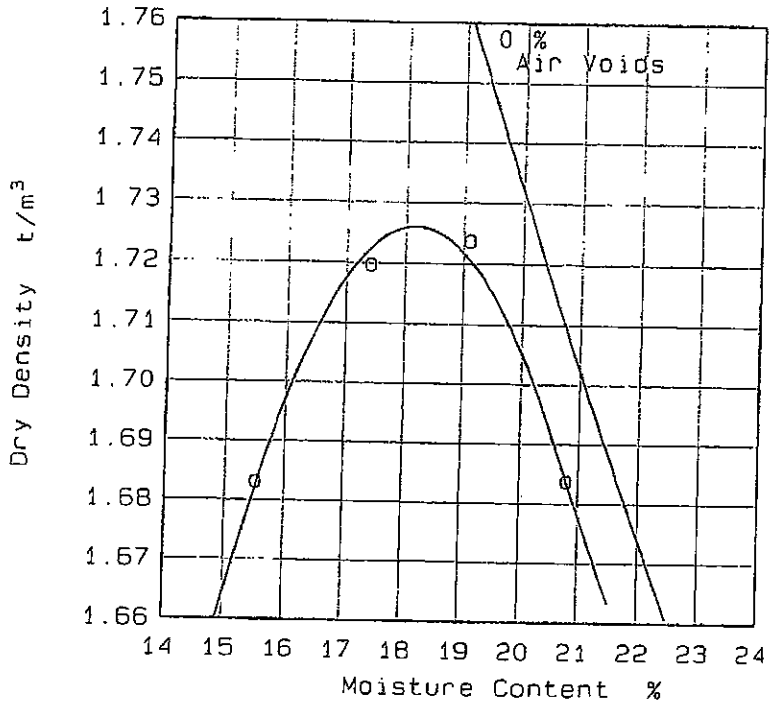
CLIENT LENSWORTH GROUP LTD

DATE 21/07/2003

PROJECT ASS & PRELIMINARY GEOTECHNICAL INVESTIGATION

PROJECT No. 33454A

LOCATION 2-32 & 34 NOLAN DRIVE, MORAYFIELD



TEST LOC. TP 26

DEPTH 0.5-0.8 m

DESCRIPTION SANDY SILTY CLAY

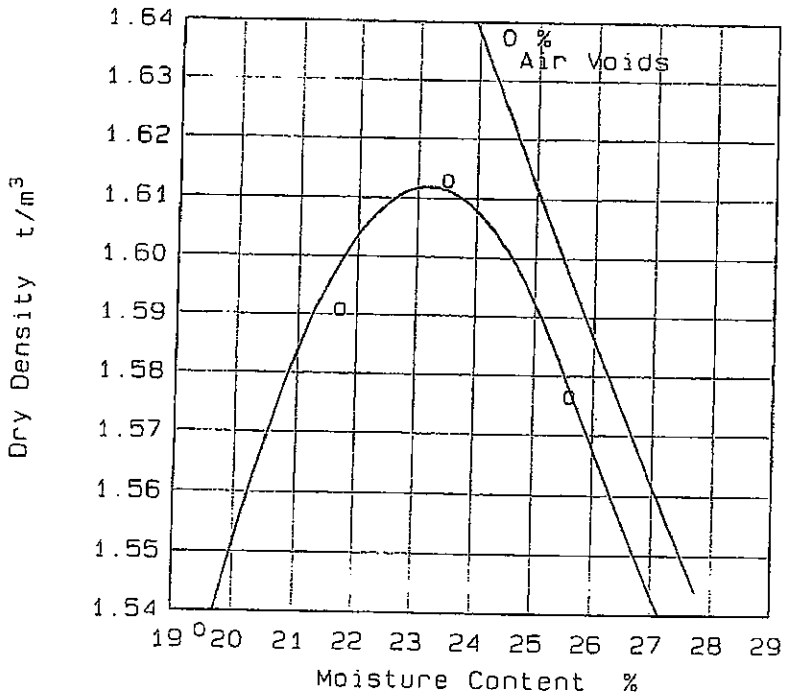
SPECIFIC GRAVITY (Assumed) 2.65

Particles >19mm -

FIELD MOISTURE CONTENT -

OPTIMUM MOISTURE CONTENT 18.0 %

MAXIMUM DRY DENSITY 1.73 t/m^3



TEST LOC. TP 28

DEPTH 0.4-0.8 m

DESCRIPTION SILTY CLAY

SPECIFIC GRAVITY (Assumed) 2.70

Particles >19mm -

FIELD MOISTURE CONTENT -

OPTIMUM MOISTURE CONTENT 23.0 %

MAXIMUM DRY DENSITY 1.61 t/m^3

TEST METHOD AS1289.5.1.1 (Standard)

TESTED SJ

CHECKED DE

LABORATORY Brisbane 1289 REPORT No B03-442

SIGNED

D. A. ELDER

Douglas Partners
Geotechnics · Environment · Groundwater

RESULTS OF COMPACTION TESTS

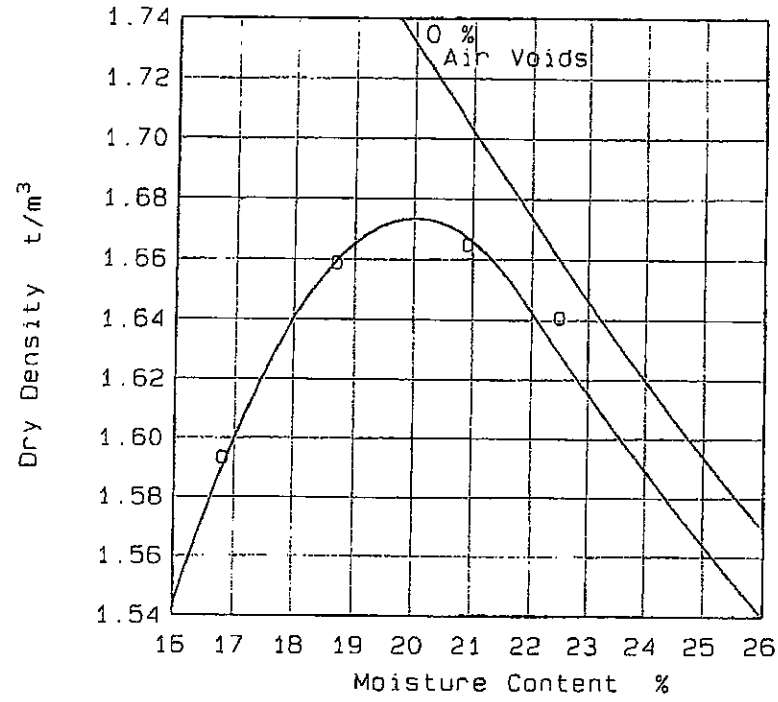
CLIENT LENSWORTH GROUP LTD

DATE 21/07/2003

PROJECT ASS & PRELIMINARY GEOTECHNICAL INVESTIGATION

PROJECT No. 33454A

LOCATION 2-32 & 34 NOLAN DRIVE, MORAYFIELD



TEST LOC. TP 35

DEPTH 0.5-0.8 m

DESCRIPTION SILTY CLAY

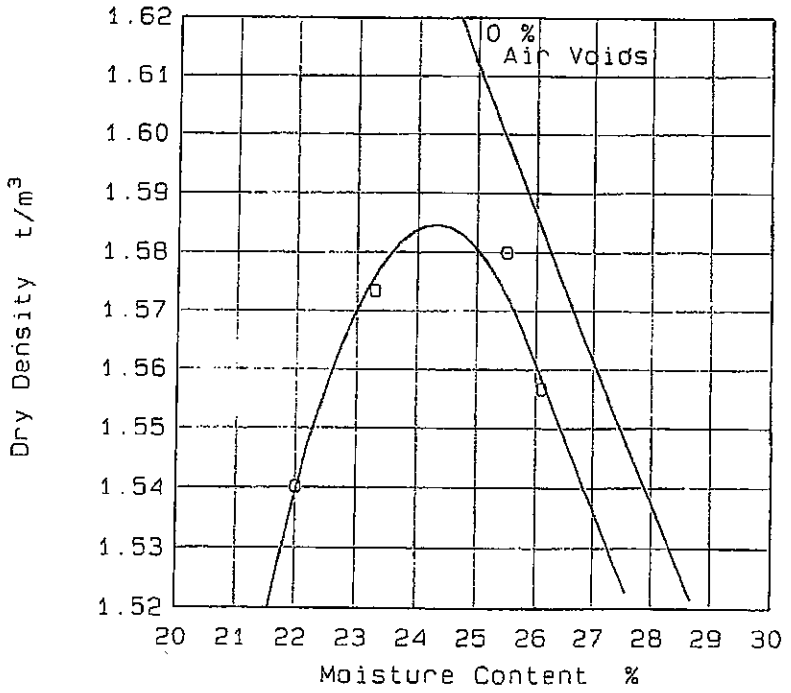
SPECIFIC GRAVITY (Assumed) 2.65

Particles >19mm -

FIELD MOISTURE CONTENT -

OPTIMUM MOISTURE CONTENT 20 0 %

MAXIMUM DRY DENSITY 1.67 t/m^3



TEST LOC. TP 37

DEPTH 0.5-0.9 m

DESCRIPTION SILTY CLAY

SPECIFIC GRAVITY (Assumed) 2 70

Particles >19mm -

FIELD MOISTURE CONTENT -

OPTIMUM MOISTURE CONTENT 24.5 %

MAXIMUM DRY DENSITY 1.58 t/m^3

TEST METHOD AS1289.5.1.1 (Standard)

TESTED SJ

CHECKED DE

LABORATORY Brisbane 1289 REPORT No 803-443

SIGNED

D. A. ELDER

Douglas Partners
Geotechnics · Environment · Groundwater

Bio-Track
Acid Sulphate Test Results

LBH Series (Coffey Geotechnics)

A.S.S. SOIL TEST SCREEN REPORT

Refer to attached notes for analytical methods.

Analysis By: Bio-Track Pty Ltd
ABN 91 056 237 275
Mt. Glorious Road
Highvale, Brisbane, Australia, 4520
Ph. 07 3289 7179 Fx. 07 3289 7155

DATE OF REPORT 20 NOVEMBER 2006
CLIENT NAME THEO GERRITSEN
CLIENT FIRM COFFEY GEOTECHNICSS PTY LTD YOUR PROJECT/JOB REFERENCE GN18367AB
CLIENT ADDRESS PO BOX 108 SALISBURY QLD 4107
PROJECT NAME GN18367AB SAMPLING DATE 27-31/10/06
NUMBER OF SAMPLES 48 SAMPLE TYPE SOIL SAMPLE FOR ACID SULFATE STUDY
PACKAGING SAMPLES LABELLED - INTACT - BAGGED - STORED ON ICE
SAMPLES DISPOSED ON 1/3/2007
LOG-IN DATE 13 NOVEMBER 2006 LAB REF. LR13116.431

TEST METHODOLOGY FOR pH_f AND pH_fox AS PER QASSIT 2004 Laboratory Methods. Indications based on pH data only.
RATE: 0=none 1=slight 2=moderate 3=high 4=very high (steam evolved) visual observation at 0-5 minutes.
TEMP: Surface temperature rise ('C) oxidised sample at 5 minutes.

SAMPLE ID	Upper	Lower (m)	pH_f	pH_fox	change	RATE	TEMP	INDICATION
BH 1	0.25		4.3	3.5	-0.8	2	1	low sulphide
BH 1	0.50		4.4	3.8	-0.6	2	2	low sulphide
BH 1	0.75		4.4	3.6	-0.8	2	2	low sulphide
LBH 1	1.00		4.5	3.4	-1.1	2	2	low TAA & moderate TPA
BH 1	1.25		4.5	3.5	-1.0	2	1	low TAA
BH 1	1.50		4.5	3.5	-1.0	2	1	low TAA
BH 1	1.75		4.7	4.3	-0.4	2	1	low TAA & low sulphide
LBH 1	2.00		4.7	3.6	-1.1	2	2	low TAA
LBH 1	2.25		4.8	3.7	-1.1	2	1	low TAA
BH 1	2.50		5.0	3.3	-1.7	2	1	low TAA & moderate TPA
BH 1	2.75		5.0	3.3	-1.7	2	1	low TAA & moderate TPA
BH 1	3.00		5.1	4.3	-0.8	0	1	low TAA & low sulphide
LBH 2	0.25		4.3	2.9	-1.4	0	2	moderate TPA
BH 2	0.50		4.4	3.0	-1.4	0	2	moderate TPA
BH 2	0.75		4.4	3.2	-1.2	0	1	moderate TPA
BH 2	1.00		4.5	3.5	-1.0	0	1	low TAA
LBH 2	1.25		4.5	3.5	-1.0	0	1	low TAA
LBH 2	1.50		4.5	3.6	-0.9	0	2	low TAA & low sulphide
BH 2	1.75		4.7	3.4	-1.3	0	1	low TAA & moderate TPA
BH 2	2.00		5.0	3.7	-1.3	1	2	low TAA
BH 2	2.25		4.9	3.4	-1.5	0	2	low TAA & moderate TPA
LBH 2	2.50		4.9	3.2	-1.7	0	2	low TAA & moderate TPA
LBH 2	2.75		5.0	3.3	-1.7	0	1	low TAA & moderate TPA
BH 2	3.00		4.5	3.2	-1.3	1	2	low TAA & moderate TPA
BH 3	0.25		5.2	3.5	-1.7	1	3	low TAA
LBH 3	0.50		5.1	3.5	-1.6	0	2	low TAA
LBH 3	0.75		5.1	3.8	-1.3	0	2	low TAA
BH 3	1.00		5.2	3.9	-1.3	0	2	low TAA
BH 3	1.25		5.2	3.9	-1.3	0	2	low TAA
BH 3	1.50		5.2	4.1	-1.1	0	2	low TAA
LBH 3	1.75		5.3	3.4	-1.9	1	3	low TAA & moderate TPA
BH 3	2.00		5.3	4.0	-1.3	2	1	low TAA
BH 3	2.25		5.3	3.8	-1.5	1	2	low TAA
BH 3	2.50		5.4	3.7	-1.7	0	2	low TAA
LBH 3	2.75		5.2	3.9	-1.3	2	2	low TAA
LBH 3	3.00		5.1	4.1	-1.0	2	0	low TAA
BH 4	0.25		3.7	3.2	-0.5	2	3	moderate TPA & low sulphide
BH 4	0.50		4.1	2.3	-1.8	1	3	high TPA
BH 4	0.75		3.8	2.4	-1.4	1	2	high TPA
LBH 4	1.00		3.7	2.4	-1.3	1	1	high TPA
BH 4	1.25		3.8	2.5	-1.3	0	3	moderate TPA
BH 4	1.50		4.2	2.7	-1.5	1	2	moderate TPA
BH 4	1.75		4.1	3.1	-1.0	1	2	moderate TPA
LBH 4	2.00		4.2	3.4	-0.8	1	2	moderate TPA & low sulphide
LBH 4	2.25		4.4	3.3	-1.1	1	2	moderate TPA
BH 4	2.50		4.4	3.5	-0.9	1	2	low sulphide
BH 4	2.75		3.6	2.9	-0.7	1	1	moderate TPA & low sulphide

Signatory P. Robertson For and behalf of Bio-Track Pty Ltd

A.S.S. SOIL TEST SCREEN REPORT

Refer to attached notes for analytical methods.

Analysis By: Bio-Track Pty Ltd

ABN 91 056 237 275
Mt. Glorious Road
Highvale, Brisbane, Australia, 4520
Ph. 07 3289 7179 Fx. 07 3289 7155

DATE OF REPORT 20 NOVEMBER 2006
CLIENT NAME THEO GERRITSEN
CLIENT FIRM COFFEY GEOTECHNICSS PTY LTD YOUR PROJECT/JOB REFERENCE GN18367AB
CLIENT ADDRESS PO BOX 108 SALISBURY QLD 4107
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SAMPLES DISPOSED ON 1/3/2007
LOG-IN DATE 13 NOVEMBER 2006 LAB REF. LR13116.431

TEST METHODOLOGY FOR pH_f AND pH_fox AS PER QASSIT 2004 Laboratory Methods. Indications based on pH data only.
RATE: 0=none 1=slight 2=moderate 3=high 4=very high (steam evolved) visual observation at 0-5 minutes.
TMP: Surface temperature rise ('C) oxidised sample at 5 minutes.

SAMPLE ID	Upper	Lower (m)	pH_f	pH_fox	change	RATE	TEMP	INDICATION
BH 4	3.00		3.9	2.8	-1.1	1	1	moderate TPA

Signatory P. Johnston For and behalf of Bio-Track Pty Ltd

A.S.S. SOIL TEST SCREEN REPORT

Refer to attached notes for analytical methods.

Analysis By: Bio-Track Pty Ltd

ABN 91 056 237 275
Mt. Glorious Road
Highvale, Brisbane, Australia, 4520
Ph. 07 3289 7179 Fx. 07 3289 7155

DATE OF REPORT 20 NOVEMBER 2006
CLIENT NAME THEO GERRITSEN
CLIENT FIRM COFFEY GEOTECHNICSS PTY LTD YOUR PROJECT/JOB REFERENCE GN18367AB
CLIENT ADDRESS PO BOX 108 SALISBURY QLD 4107
PROJECT NAME GN18367AB SAMPLING DATE 1/11/06
NUMBER OF SAMPLES 37 SAMPLE TYPE SOIL SAMPLE FOR ACID SULFATE STUDY
PACKAGING SAMPLES LABELLED - INTACT - BAGGED - STORED ON ICE
SAMPLES DISPOSED ON 1/3/2007
LOG-IN DATE 13 NOVEMBER 2006 LAB REF. LR13116.439

TEST METHODOLOGY FOR pH_f AND pH_fox AS PER QASSIT 2004 Laboratory Methods. Indications based on pH data only.
RATE: 0=none 1=slight 2=moderate 3=high 4=very high (steam evolved) visual observation at 0-5 minutes.
TEMP: Surface temperature rise ('C) oxidised sample at 5 minutes.

SAMPLE ID	Upper	Lower (m)	pH_f	pH_fox	change	RATE	TEMP	INDICATION
BH 5	0.25		6.1	2.2	-3.9	4	7	low TAA & high TPA & high sulphide/low buffer
BH 5	0.50		5.9	2.8	-3.1	4	1	low TAA & moderate TPA & high sulphide/low buffer
BH 5	0.75		6.1	1.9	-4.2	4	3	low TAA & high TPA & high sulphide/low buffer
LBH 5	1.0		6.2	1.9	-4.3	3	0	low TAA & high TPA & high sulphide/low buffer
LBH 5	1.25		5.6	2.8	-2.8	3	2	low TAA & moderate TPA & sulphide possible
BH 5	1.5		5.9	2.0	-3.9	3	1	low TAA & high TPA & high sulphide/low buffer
BH 5	1.75		5.9	2.2	-3.7	3	2	low TAA & high TPA & high sulphide/low buffer
BH 5	2.0		6.1	1.7	-4.4	4	3	low TAA & high TPA & high sulphide/low buffer
LBH 5	2.25		5.8	1.6	-4.2	2	8	low TAA & high TPA & high sulphide/low buffer
BH 5	2.5		5.6	2.0	-3.6	4	1	low TAA & high TPA & high sulphide/low buffer
BH 5	2.75		5.9	1.7	-4.2	2	4	low TAA & high TPA & high sulphide/low buffer
BH 5	3.0		5.9	2.3	-3.6	4	4	low TAA & high TPA & high sulphide/low buffer
LBH 5	3.45		6.1	1.8	-4.3	3	11	low TAA & high TPA & high sulphide/low buffer
LBH 6	0.25		4.8	2.3	-2.5	3	7	low TAA & high TPA & sulphide possible
BH 6	0.5		4.7	2.7	-2.0	3	1	low TAA & moderate TPA
BH 6	0.75		4.8	2.4	-2.4	3	3	low TAA & high TPA & sulphide possible
BH 6	1.0		5.1	2.8	-2.3	3	3	low TAA & moderate TPA & sulphide possible
LBH 6	1.25		5.3	3.1	-2.2	2	4	low TAA & moderate TPA & sulphide possible
BH 6	1.5		5.1	2.6	-2.5	3	1	low TAA & moderate TPA & sulphide possible
BH 6	1.75		4.5	1.8	-2.7	3	7	low TAA & high TPA & sulphide possible
H 6	2.0		4.6	2.0	-2.6	3	4	low TAA & high TPA & sulphide possible
H 6	2.25		4.9	2.2	-2.7	4	2	low TAA & high TPA & sulphide possible
LBH 6	2.5		5.2	2.8	-2.4	4	1	low TAA & moderate TPA & sulphide possible
BH 6	2.75		5.2	2.6	-2.6	4	1	low TAA & moderate TPA & sulphide possible
BH 6	3.0		5.1	2.4	-2.7	4	2	low TAA & high TPA & sulphide possible
BH 9	0.25		4.9	3.2	-1.7	1	2	low TAA & moderate TPA
LBH 9	0.5		4.9	3.8	-1.1	1	1	low TAA
BH 9	0.75		4.9	2.9	-2.0	1	2	low TAA & moderate TPA
BH 9	1.0		4.8	3.6	-1.2	1	1	low TAA
BH 9	1.25		4.9	4.1	-0.8	1	4	low TAA & low sulphide
LBH 9	1.5		4.9	4.1	-0.8	0	1	low TAA & low sulphide
LBH 9	1.75		4.9	4.1	-0.8	0	3	low TAA & low sulphide
BH 9	2.0		5.0	4.0	-1.0	1	4	low TAA
BH 9	2.25		5.1	4.1	-1.0	1	4	low TAA
BH 9	2.5		5.1	4.1	-1.0	1	3	low TAA
LBH 9	2.75		4.9	4.4	-0.5	1	2	low TAA & low sulphide
BH 9	3.0		4.9	4.1	-0.8	1	2	low TAA & low sulphide

Signatory P. Schirtow For and behalf of Bio-Track Pty Ltd

DETERMINATION OF ACID SULFATE SOIL PROPERTIES

CERTIFICATE OF ANALYSIS

Analysis By: Bio-Track Pty Ltd ABN 91 056 237 275

781 Mt. Glorious Road Highvale, Brisbane, Australia, 4520 Ph. 07 3289 7179 Fx. 07 3289 7155

LAB REFERENCE LR1126.623 DATE OF REPORT 11 DECEMBER 2006 @10:26:48
CLIENT NAME THEO GERRITSEN c/o COFFEY GEOTECHNICSS PTY LTD PO BOX 108 SALISBURY QLD 4107
PROJECT NAME NORTH EAST BUSINESS PARK YOUR PROJECT/JOB REFERENCE GN 18367 AC
SAMPLING DATE 2006 NUMBER OF SAMPLES 14 Samples supplied by client SAMPLE TYPE:SOIL SAMPLE FOR ACID SULFATE STUDY
DATE RECEIVED 01 DECEMBER 2006 PACKAGING 3 Ground Oven Dry Samples DISPOSED ON 1/9/2007

Sample ID as received. METHODOLOGY: As per (DNR QASSIT May 2004), oven dried (85'C), >1000 um shell removed, fine grind. All reported values gravimetric, dry mass.
LIME1 rates calculated to neutralise TPA (or TAA if >TPA)+ aS_RAS -ANC_E/1.5 LIME2 rates calculated to neutralise TAA + aS_POS or S_Cr + aS_RAS -ANC_E/1.5
NB. Lime rates assume 97% lime neutralisation but DO NOT include any safety factors. Suggested factor=1.5-2. Rates are kg/ton. Multiply by bulk density to convert to kg/m3.
Fineness Factor=1.5 CBN POS= moles carbonate alkalinity released by oxidation assuming (Ca POS - Ca KCl) + (Mg POS - Mg KCl) is due to carbonate solution.
Blanks represent unmeasured values, zeros & <0.x represent measured values. If pH KCl>4.5 then s-RAS (calculated from acid extract) may be zero for undisturbed soil. Ca/ar is the acid reactive calcium calculated as the difference between 1 M KCl and 4 M HCl soluble Ca.

ID.	DEPTH m	pH KCL	pH ox	TAA m/t	TPA m/t	TSA m/t	S KCl %	S P %	S POS %	S Cr %	s-RAS %	s EQ %	Ca KCl mg/kg	Ca P mg/kg	Mg KCl mg/kg	Mg P mg/kg	CBN POS m/t	LIME1 kg/t	LIME2 kg/t	sANC_E %	Ca/ar mg/kg
Analytical Method Codes		23A	23B	23F	23G	23H	23Ce	23De	23Ee	22B	s23Re	s	23Vh	23Wh	23Sm	23Tm	a23U&X			s19A2	
LBH 1	2.5-2.75	4.64	5.45	5	10	6	0.01	<0.01	<0.01		<0.01	0.016	116	132	533	523	1	0.8	0.5		54
LBH 1	2.75-3.0	4.35	7.76	6	0	0	<0.01	<0.01	<0.01		<0.01	-0.146	88	91	484	500	2	-3.0	-2.9	0.16	45
LBH 2	0.25-0.5	4.23	6.62	26	0	0	<0.01	<0.01	<0.01		<0.01	-0.056	22	24	22	24	0	-0.8	-0.6	0.11	11
LBH 2	2.5-2.75	4.13	5.55	38	9	0	<0.01	0.02	<0.01		<0.01	0.071	96	103	148	180	3	2.0	2.2		25
LBH 3	1.75-2.0	4.53	5.69	23	12	0	<0.01	0.02	0.01		<0.01	0.059	108	130	176	211	4	1.4	1.8		56
LBH 4	0.5-0.75	3.81	5.08	49	17	0	0.02	0.03	0.01		<0.01	0.093	181	192	233	264	3	2.6	2.9		47
LBH 4	1.0-1.25	3.82	5.11	48	15	0	0.03	0.04	0.01		<0.01	0.097	211	233	296	350	6	2.7	2.9		58
LBH 4	2.75-3.0	3.84	5.29	35	15	0	0.04	0.05	0.01		<0.01	0.075	327	352	536	604	7	2.0	2.2		83
LBH 5	1.0-1.25	4.33	2.25	15	425	410	0.08	0.68	0.60		0.07	0.694	318	350	712	804	9	24.0	22.0		62
LBH 5	2.0-2.25	8.25	2.71	0	173	173	0.05	0.41	0.36		0.03	0.387	231	248	520	548	3	9.8	12.3		31
LBH 5	3.5	5.74	4.92	17	14	0	0.02	0.15	0.13		<0.01	0.163	112	147	253	330	8	1.2	5.0		56
LBH 6	0.75-1.0	4.81	5.81	23	7	0	<0.01	0.02	0.01		<0.01	0.049	384	501	288	390	14	1.2	1.1		166
LBH 6	1.75-2.0	4.71	5.04	6	17	11	0.01	0.12	0.11		<0.01	0.123	190	194	231	235	0	1.1	3.9		43
LBH 9	0.75-1.0	4.04	5.61	22	5	0	<0.01	<0.01	<0.01		<0.01	0.047	15	19	129	155	2	1.4	1.4		<10

Signatory P. Colinton

For and on behalf of Bio-Track Pty Ltd

Bio-Track
Acid Sulphate Test Results

TPC Series (Coffey Geotechnics)

A.S.S. SOIL TEST SCREEN REPORT

Refer to attached notes for analytical methods.

Analysis By: Bio-Track Pty Ltd

ABN 91 056 237 275
Mt. Glorious Road
Highvale, Brisbane, Australia, 4520
Ph. 07 3289 7179 Fx. 07 3289 7155

DATE OF REPORT 18 DECEMBER 2006 Page 1 of 1 Report Pages.
CLIENT NAME MR KARL MUNIZ
CLIENT FIRM COFFEY GEOTECHNICSS PTY LTD YOUR PROJECT/JOB REFERENCE GEONATH 18367 AC
CLIENT ADDRESS PO BOX 108 SALISBURY QLD 4107
PROJECT NAME GEONATH 18367 AC SAMPLING DATE 11/12/6
NUMBER OF SAMPLES 11 SAMPLE TYPE SOIL SAMPLE FOR ACID SULFATE STUDY
PACKAGING SAMPLES LABELLED - INTACT - BAGGED - CHILLED IN INSULATED PACKAGING
SAMPLES DISPOSED ON 1/4/2007
LOG-IN DATE 13 DECEMBER 2006 LAB REF. LR13126.530

TEST METHODOLOGY FOR pH_f AND pH_fox AS PER QASSIT 2004 Laboratory Methods. Indications based on pH data only.
RATE: 0=none 1=slight 2=moderate 3=high 4=very high (steam evolved) visual observation at 0-5 minutes.
TEMP: Surface temperature rise ('C) oxidised sample at 5 minutes.

SAMPLE ID	Upper	Lower (m)	pH_f	pH_fox	change	RATE	TEMP	INDICATION
TP 101	1.2		6.6	5.7	-0.9	0	6	no TAA & low TPA & low sulphide
TP 102	1.3		4.8	3.9	-0.9	1	0	low TAA & low sulphide
TP 103	1.2		4.2	3.3	-0.9	1	2	moderate TPA & low sulphide
TP 104	1.0		4.0	2.6	-1.4	2	6	moderate TPA
TP 105	1.2		3.9	2.6	-1.3	2	3	moderate TPA
TP 106	1.2		5.8	2.8	-3.0	3	13	low TAA & moderate TPA & sulphide possible
TP 107	1.1		4.2	3.3	-0.9	4	31	moderate TPA & low sulphide
TP 108	1.0		4.3	3.1	-1.2	1	1	moderate TPA
TP 109	0.6		4.3	2.6	-1.7	1	3	moderate TPA
TP 110	0.9		4.6	3.4	-1.2	2	5	low TAA & moderate TPA
TP 111	0.9		4.6	3.4	-1.2	0	6	low TAA & moderate TPA

Signatory P. Edmonds For and behalf of Bio-Track Pty Ltd

97-3369 9722

DETERMINATION OF ACID SULFATE SOIL PROPERTIES

CERTIFICATE OF ANALYSIS

Analysis By: **Bio-Track Pty Ltd** ABN 91 056 237 275

781 Mt. Glorious Road Highvale, Brisbane, Australia, 4520 Ph. 07 3289 7179 Fx. 07 3289 7155

LAB REFERENCE LR19126.528 DATE OF REPORT 05 FEBRUARY 2007 @09:38:13
CLIENT NAME MR KARL MUNIZ c/o COFFEY GEOTECHNICSS PTY LTD PO BOX 108 SALISBURY QLD 4107
PROJECT NAME GEONATH 18367 AC YOUR PROJECT/JOB REFERENCE GEONATH 18367 AC
SAMPLING DATE 11/12/6 NUMBER OF SAMPLES 6 Samples supplied by client SAMPLE TYPE:SOIL SAMPLE FOR ACID SULFATE STUDY
DATE RECEIVED 19 DECEMBER 2006 PACKAGING SAMPLES LABELLED - INTACT - BAGGED - CHILLED IN INSULATED PACKAGING Ground Oven Dry Samples DISPOSED ON 1/9/2007

Sample ID as received. METHODOLOGY: As per (DNR QASSIT May 2004), oven dried (85°C), >1000 um shell removed, fine grind. All reported values gravimetric, dry mass.
LIME1 rates calculated to neutralise TPA (or TAA if >TPA)+ aS_RAS -ANC_E/1.5 LIME2 rates calculated to neutralise TAA + aS_POS or S_Cr + aS_RAS -ANC_E/1.5
NB. Lime rates assume 97% lime neutralisation but DO NOT include any safety factors. Suggested factor=1.5-2. Rates are kg/ton. Multiply by bulk density to convert to kg/m3.
Fineness Factor=1.5 CBN POS= moles carbonate alkalinity released by oxidation assuming (Ca POS - Ca KCl) + (Mg POS - Mg KCl) is due to carbonate solution.
Blanks represent unmeasured values, zeros & <0.x represent measured values. If pH KCl>4.5 then s-RAS (calculated from acid extract) may be zero for undisturbed soil. Ca/ar is the acid reactive calcium calculated as the difference between 1 M KCl and 4 M HCl soluble Ca.

ID.	DEPTH	pH	pH	TAA	TPA	TSA	S KCl	S P	S POS	S Cr	s-RAS	s EQ	Ca KCl	Ca P	Mg KCl	Mg P	CBN POS	LIME1	LIME2	sANC_E	Ca/ar
	m	KCL	ox	m/t	m/t	m/t	%	%	%	%	%	%	mg/kg	mg/kg	mg/kg	mg/kg	m/t	kg/t	kg/t	%	mg/kg
Analytical Method Codes		23A	23B	23F	23G	23H	23Ce	23De	23Ee	22B	s23Re	s	23Vh	23Wh	23Sm	23Tm	a23U&X			s19A2	
TP 104	1.0	3.69	4.45	132	64	0	0.02	0.04	0.01		<0.01	0.222	610	652	645	659	3	6.8	7.0		50
TP 105	1.2	3.77	4.91	91	32	0	0.01	0.02	<0.01		<0.01	0.155	321	337	406	401	1	4.8	4.9		46
TP 106	1.2	6.14	5.04	1	40	39	0.05	0.14	0.10		<0.01	0.105	602	672	1271	1290	5	2.3	3.2		145
TP 107	1.1	3.75	4.52	114	72	0	0.01	0.04	0.02		<0.01	0.212	244	287	247	235	2	6.0	6.7		52
TP 109	0.6	4.61	5.93	9	5	0	<0.01	<0.01	<0.01		<0.01	0.018	18	84	11	13	4	0.5	0.5		57
TP 110	0.9	3.80	5.11	96	45	0	0.02	0.05	0.03		<0.01	0.183	428	465	436	436	2	5.0	5.8		72

Signatory P. Robinson

For and on behalf of Bio-Track Pty Ltd

DETERMINATION OF ACID SULFATE SOIL PROPERTIES

CERTIFICATE OF ANALYSIS

Analysis By: **Bio-Track Pty Ltd** ABN 91 056 237 275

781 Mt. Glorious Road Highvale, Brisbane, Australia, 4520 Ph. 07 3289 7179 Fx. 07 3289 7155

LAB REFERENCE LR19126.528 DATE OF REPORT 05 FEBRUARY 2007 @09:38:13
CLIENT NAME MR KARL MUNIZ c/o COFFEY GEOTECHNICSS PTY LTD PO BOX 108 SALISBURY QLD 4107
PROJECT NAME GEONATH 18367 AC YOUR PROJECT/JOB REFERENCE GEONATH 18367 AC
SAMPLING DATE 11/12/6 NUMBER OF SAMPLES 6 Samples supplied by client SAMPLE TYPE:SOIL SAMPLE FOR ACID SULFATE STUDY
DATE RECEIVED 19 DECEMBER 2006 PACKAGING SAMPLES LABELLED - INTACT - BAGGED - CHILLED IN INSULATED PACKAGING Ground Oven Dry Samples DISPOSED ON 1/9/2007

Sample ID as received. METHODOLOGY: As per (DNR QASSIT May 2004), oven dried (85'C), >1000 um shell removed, fine grind. All reported values gravimetric, dry mass.
LIME1 rates calculated to neutralise TPA (or TAA if >TPA)+ aS_RAS -ANC_E/1.5 LIME2 rates calculated to neutralise TAA + aS_POS or S_Cr + aS_RAS -ANC_E/1.5
NB. Lime rates assume 97% lime neutralisation but DO NOT include any safety factors. Suggested factor=1.5-2. Rates are kg/ton. Multiply by bulk density to convert to kg/m3.
Fineness Factor=1.5 CBN POS= moles carbonate alkalinity released by oxidation assuming (Ca POS - Ca KCl) + (Mg POS - Mg KCl) is due to carbonate solution.
Blanks represent unmeasured values, zeros & <0.x represent measured values. If pH KCl>4.5 then s-RAS (calculated from acid extract) may be zero for undisturbed soil. Ca/ar is the acid reactive calcium calculated as the difference between 1 M KCl and 4 M HCl soluble Ca.

ID.	DEPTH	pH	pH	TAA	TPA	TSA	S KCl	S P	S POS	S Cr	s-RAS	s EQ	Ca KCl	Ca P	Mg KCl	Mg P	CBN POS	LIME1	LIME2	sANC_E	Ca/ar
	m	KCL	ox	m/t	m/t	m/t	%	%	%	%	%	%	mg/kg	mg/kg	mg/kg	mg/kg	m/t	kg/t	kg/t	%	mg/kg
Analytical Method Codes		23A	23B	23F	23G	23H	23Ce	23De	23Ee	22B	s23Re	s	23Vh	23Wh	23Sm	23Tm	a23U&X			s19A2	
TP 104	1.0	3.69	4.45	132	64	0	0.02	0.04	0.01		<0.01	0.222	610	652	645	659	3	6.8	7.0		50
TP 105	1.2	3.77	4.91	91	32	0	0.01	0.02	<0.01		<0.01	0.155	321	337	406	401	1	4.8	4.9		46
TP 106	1.2	6.14	5.04	1	40	39	0.05	0.14	0.10		<0.01	0.105	602	672	1271	1290	5	2.3	3.2		145
TP 107	1.1	3.75	4.52	114	72	0	0.01	0.04	0.02		<0.01	0.212	244	287	247	235	2	6.0	6.7		52
TP 109	0.6	4.61	5.93	9	5	0	<0.01	<0.01	<0.01		<0.01	0.018	18	84	11	13	4	0.5	0.5		57
TP 110	0.9	3.80	5.11	96	45	0	0.02	0.05	0.03		<0.01	0.183	428	465	436	436	2	5.0	5.8		72

Signatory P. Polkinghorne For and on behalf of Bio-Track Pty Ltd

A.S.S. SOIL TEST SCREEN REPORT

Refer to attached notes for analytical methods.

Analysis By: Bio-Track Pty Ltd

ABN 91 056 237 275
Mt. Glorious Road
Highvale, Brisbane, Australia, 4520
Ph. 07 3289 7179 Fx. 07 3289 7155

DATE OF REPORT 18 DECEMBER 2006
CLIENT NAME MR KARL MUNIZ
CLIENT FIRM COFFEY GEOTECHNICSS PTY LTD YOUR PROJECT/JOB REFERENCE GEONATH 18367 AC
CLIENT ADDRESS PO BOX 108 SALISBURY QLD 4107
PROJECT NAME GEONATH 18367 AC SAMPLING DATE 11/12/6
NUMBER OF SAMPLES 11 SAMPLE TYPE SOIL SAMPLE FOR ACID SULFATE STUDY
PACKAGING SAMPLES LABELLED - INTACT - BAGGED - CHILLED IN INSULATED PACKAGING
SAMPLES DISPOSED ON 1/4/2007
LOG-IN DATE 13 DECEMBER 2006 LAB REF. LR13126.530

TEST METHODOLOGY FOR pH_f AND pH_fox AS PER QASSIT 2004 Laboratory Methods. Indications based on pH data only.
RATE: 0=none 1=slight 2=moderate 3=high 4=very high (steam evolved) visual observation at 0-5 minutes.
TEMP: Surface temperature rise (°C) oxidised sample at 5 minutes.

SAMPLE ID	Upper	Lower (m)	pH_f	pH_fox	change	RATE	TEMP	INDICATION
TP 101	1.2		6.6	5.7	-0.9	0	6	no TAA & low TPA & low sulphide
TP 102	1.3		4.8	3.9	-0.9	1	0	low TAA & low sulphide
TP 103	1.2		4.2	3.3	-0.9	1	2	moderate TPA & low sulphide
TP 104	1.0		4.0	2.6	-1.4	2	6	moderate TPA
TP 105	1.2		3.9	2.6	-1.3	2	3	moderate TPA
TP 106	1.2		5.8	2.8	-3.0	3	13	low TAA & moderate TPA & sulphide possible
TP 107	1.1		4.2	3.3	-0.9	4	31	moderate TPA & low sulphide
TP 108	1.0		4.3	3.1	-1.2	1	1	moderate TPA
TP 109	0.6		4.3	2.6	-1.7	1	3	moderate TPA
TP 110	0.9		4.6	3.4	-1.2	2	5	low TAA & moderate TPA
TP 111	0.9		4.6	3.4	-1.2	0	6	low TAA & moderate TPA

Signatory P. Edwards For and behalf of Bio-Track Pty Ltd

A.S.S. SOIL TEST SCREEN REPORT

Refer to attached notes for analytical methods.

Analysis By: Bio-Track Pty Ltd

ABN 91 056 237 275
Mt. Glorious Road
Highvale, Brisbane, Australia, 4520
Ph. 07 3289 7179 Fx. 07 3289 7155

DATE OF REPORT 18 DECEMBER 2006 Page 1 of 1 Report Pages.
CLIENT NAME MR KARL MUNIZ
CLIENT FIRM COFFEY GEOTECHNICSS PTY LTD YOUR PROJECT/JOB REFERENCE GEOLNATH 20070 AA
CLIENT ADDRESS PO BOX 108 SALISBURY QLD 4107
PROJECT NAME GEOLNATH 20070 AA SAMPLING DATE 29-30/11/6
NUMBER OF SAMPLES 11 SAMPLE TYPE SOIL SAMPLE FOR ACID SULFATE STUDY
PACKAGING SAMPLES LABELLED - INTACT - BAGGED - CHILLED IN INSULATED PACKAGING
SAMPLES DISPOSED ON 1/4/2007
LOG-IN DATE 11 DECEMBER 2006 LAB REF. LR11126.561

TEST METHODOLOGY FOR pH_f AND pH_fox AS PER QASSIT 2004 Laboratory Methods. Indications based on pH data only.
RATE: 0=none 1=slight 2=moderate 3=high 4=very high (steam evolved) visual observation at 0-5 minutes.
TEMP: Surface temperature rise ('C) oxidised sample at 5 minutes.

SAMPLE ID	Upper	Lower (m)	pH_f	pH_fox	change	RATE	TEMP	INDICATION
EN TP1	0.3	0.5	4.6	2.8	-1.8	3	8	low TAA & moderate TPA
EN TP2	0.4	0.7	6.5	3.8	-2.7	4	6	low TAA & sulphide possible
EN TP 3	0.8	1.0	4.8	2.9	-1.9	1	1	low TAA & moderate TPA
EN TP 5	0.2	0.4	5.0	3.3	-1.7	0	1	low TAA & moderate TPA
EN TP6	0.4	0.6	4.4	3.7	-0.7	0	1	low sulphide
AM TP 1	0.3	0.5	4.8	2.8	-2.0	4	23	low TAA & moderate TPA
AM TP2	0.5	0.8	7.8	5.5	-2.3	4	9	no TAA & low TPA & sulphide possible
AM TP3	0.6	0.8	4.4	3.9	-0.5	0	1	low sulphide
AM TP4	0.6	0.8	4.7	4.1	-0.6	0	1	low TAA & low sulphide
AM TP5	1.3	1.5	4.0	3.4	-0.6	1	0	moderate TPA & low sulphide
AM TP 6	0.5	0.8	3.9	3.7	-0.2	0	0	low sulphide

Signatory P. Edmiston For and behalf of Bio-Track Pty Ltd

ALS Environmental
Acid Sulphate Test Results

TP Series (Douglas Partners)

ALS Environmental

CERTIFICATE OF ANALYSIS

CONTACT:	MR A LUPTON	**BATCH:**	AEB56753
CLIENT:	DOUGLAS PARTNERS PTY LTD	**SUB BATCH:**	0
ADDRESS:	439 MONTAGUE ROAD WEST END QLD 4101	**LABORATORY:**	BRISBANE
		DATE RECEIVED:	15/07/2003
		DATE COMPLETED:	23/07/2003
ORDER No.:	43162	**SAMPLE TYPE:**	SOIL
PROJECT:	33454A	**No. of SAMPLES:**	21

COMMENTS

Results apply to sample(s) as submitted. POCAS as per method of Ahern et al (1998). Results expressed as mole H+/tonne. Chromium Reducible Sulphur as per Method 22B ASSMAC Laboratory Methods Guidelines, August 1998. This batch supersedes EB56753.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: BRISBANE

Address
32 Shand Street
Stafford QLD 4053
Australia

Phone: 61-7-3243 7222
Fax: 61-7-3243 7218
Email: michael.heery@alsenviro.com

Signatory

Batch: 3567

Sub Batch: 0

Date of Issue: 23/07/2003

Client: DOUGLAS PARTNERS PTY LTD

Client Reference: 33454A

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	2	3	4	5	6	7	8	9	10
		Date Sampled											
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	TP18-1.5m	TP19-0.5m	TP19-1.5m	TP20-1.5m	TP21-0.5m	TP22-1.0m	TP23-0.5m	YP23-1.0m	TP24-1.0m	TP25-1.0m
EA-002	pH after Oxidation		0.1	4.7	---	3.1	3.0	3.6	3.4	---	3.0	2.9	2.9
EA-022	Ca (Acid Reacted)	%	0.02	<0.02	---	<0.02	<0.02	<0.02	<0.02	---	<0.02	<0.02	<0.02
EA-022	Ca (KCl)	%	0.02	<0.02	---	<0.02	<0.02	<0.02	<0.02	---	<0.02	0.02	0.02
EA-022	Ca (Peroxide)	%	0.02	<0.02	---	<0.02	<0.02	<0.02	<0.02	---	<0.02	<0.02	<0.02
EA-022	Mg (Acid Reacted)	%	0.02	<0.02	---	<0.02	<0.02	<0.02	<0.02	---	<0.02	<0.02	<0.02
EA-022	Mg (KCl)	%	0.02	<0.02	---	0.06	0.03	<0.02	<0.02	---	0.08	0.06	0.04
EA-022	Mg (Peroxide)	%	0.02	<0.02	---	0.04	0.03	<0.02	<0.02	---	0.05	0.04	0.03
EA-022	Na (Acid Reacted)	%	0.02	<0.02	---	<0.02	<0.02	<0.02	<0.02	---	<0.02	<0.02	<0.02
EA-022	Na (KCl)	%	0.02	<0.02	---	0.12	0.05	<0.02	<0.02	---	0.17	0.11	0.10
EA-022	Na (Peroxide)	%	0.02	<0.02	---	0.08	0.04	<0.02	<0.02	---	0.12	0.07	0.08
EA-022	S (KCl)	%	0.02	<0.02	---	0.06	0.02	<0.02	<0.02	---	0.05	0.04	0.03
EA-022	S (Peroxide)	%	0.02	<0.02	---	0.04	0.02	<0.02	<0.02	---	0.03	0.03	0.04
EA-022	S (Pos)	%	0.02	<0.02	---	<0.02	<0.02	<0.02	<0.02	---	<0.02	<0.02	<0.02
EA-022	TAA	mole/tonne	2	<2	---	21	74	13	4	---	44	80	103
EA-022	TPA	mole/tonne	2	<2	---	42	74	17	25	---	59	97	122
EA-022	TSA	mole/tonne	2	<2	---	21	<2	4	21	---	15	17	19
EA-022	pH (KCl)		0.1	5.2	---	3.7	3.6	4.5	4.8	---	3.6	3.5	3.5
EA-026	Chromium Reducible Sulphur	%	0.02	---	0.04	---	---	---	---	<0.02	---	---	---

Batch: B56
Sub Batch: 0
Date of Issue: 23/07/2003
Client: DOUGLAS PARTNERS PTY LTD
Client Reference: 33454A

CERTIFICATE OF ANALYSIS

METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	Laboratory I.D. / SAMPLE IDENTIFICATION									
	Date Sampled			11	12	13	14	15	16	17	18	19	20
				TP26-0.5m	TP27-0.5m	TP28-1.0m	TP29-0.5m	TP31-2.0m	TP32-1.0m	TP34-1.0m	TP35-1.0m	TP36-0.5m	TP37-0.5m
EA-002	pH after Oxidation		0.1	3.1	3.4	3.1	3.6	3.2	3.2	3.6	3.8	3.4	3.2
EA-022	Ca (Acid Reacted)	%	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
EA-022	Ca (KCl)	%	0.02	<0.02	0.10	0.02	0.12	<0.02	<0.02	0.09	0.14	0.09	0.07
EA-022	Ca (Peroxide)	%	0.02	<0.02	0.07	<0.02	0.10	<0.02	<0.02	0.08	0.13	0.06	0.06
EA-022	Mg (Acid Reacted)	%	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
EA-022	Mg (KCl)	%	0.02	0.06	0.07	0.04	0.12	0.07	0.03	0.11	0.13	0.07	0.08
EA-022	Mg (Peroxide)	%	0.02	0.05	0.05	0.03	0.09	0.06	0.02	0.10	0.12	0.05	0.06
EA-022	Na (Acid Reacted)	%	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
EA-022	Na (KCl)	%	0.02	0.09	<0.02	0.08	0.06	0.11	0.02	0.05	0.05	<0.02	0.03
EA-022	Na (Peroxide)	%	0.02	0.09	<0.02	0.06	0.04	0.10	<0.02	0.04	0.03	<0.02	<0.02
EA-022	S (KCl)	%	0.02	0.04	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
EA-022	S (Peroxide)	%	0.02	0.06	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
EA-022	S (Pos)	%	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
EA-022	TAA	mole/tonne	2	25	6	23	<2	42	13	<2	<2	4	11
EA-022	TPA	mole/tonne	2	51	42	40	30	44	21	17	10	32	50
EA-022	TSA	mole/tonne	2	26	36	17	30	2	8	17	10	28	39
EA-022	pH (KCl)		0.1	4.1	4.5	3.9	5.7	3.7	4.1	5.8	5.8	4.6	4.3
EA-026	Chromium Reducible Sulphur	%	0.02	---	---	---	---	---	---	---	---	---	---

Batch: B56

Sub Batch: 0

Date of Issue: 23/07/2003

Client: DOUGLAS PARTNERS PTY LTD

Client Reference: 33454A

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		21									
		Date Sampled											
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	TP30-1.5m									
EA-002	pH after Oxidation		0.1	3.4									
EA-022	Ca (Acid Reacted)	%	0.02	<0.02									
EA-022	Ca (KCl)	%	0.02	0.06									
EA-022	Ca (Peroxide)	%	0.02	0.05									
EA-022	Mg (Acid Reacted)	%	0.02	<0.02									
EA-022	Mg (KCl)	%	0.02	0.10									
EA-022	Mg (Peroxide)	%	0.02	0.08									
EA-022	Na (Acid Reacted)	%	0.02	<0.02									
EA-022	Na (KCl)	%	0.02	0.16									
EA-022	Na (Peroxide)	%	0.02	0.12									
EA-022	S (KCl)	%	0.02	0.03									
EA-022	S (Peroxide)	%	0.02	0.03									
EA-022	S (Pos)	%	0.02	<0.02									
EA-022	TAA	mole/tonne	2	8									
EA-022	TPA	mole/tonne	2	27									
EA-022	TSA	mole/tonne	2	19									
EA-022	pH (KCl)		0.1	4.4									
EA-026	Chromium Reducible Sulphur	%	0.02	----									

Batch: B50

Sub Batch: 0

Date of Issue: 23/07/2003

Client: DOUGLAS PARTNERS PTY LTD

Client Reference: 33454A

QUALITY CONTROL REPORT

METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	Laboratory I.D.	200	201	300	301						
				Date Sampled										
					Method Blank 1	Inorg 1 LCS % Rec	Method Blank 2	Inorg 2 LCS % Rec						
					SAMPLE IDENTIFICATION									
					CHECKS AND SPIKES									
EA-002	pH after Oxidation		0.1		----	----	----	----						
EA-022	Ca (Acid Reacted)	%	0.02		<0.02	----	<0.02	----						
EA-022	Ca (KCl)	%	0.02		<0.02	----	<0.02	----						
EA-022	Ca (Peroxide)	%	0.02		<0.02	----	<0.02	----						
EA-022	Mg (Acid Reacted)	%	0.02		<0.02	----	<0.02	----						
EA-022	Mg (KCl)	%	0.02		<0.02	----	<0.02	----						
EA-022	Mg (Peroxide)	%	0.02		<0.02	----	<0.02	----						
EA-022	Na (Acid Reacted)	%	0.02		<0.02	----	<0.02	----						
EA-022	Na (KCl)	%	0.02		<0.02	----	<0.02	----						
EA-022	Na (Peroxide)	%	0.02		<0.02	----	<0.02	----						
EA-022	S (KCl)	%	0.02		<0.02	----	<0.02	----						
EA-022	S (Peroxide)	%	0.02		<0.02	----	<0.02	----						
EA-022	S (Pos)	%	0.02		<0.02	----	<0.02	----						
EA-022	TAA	mole/tonne	2		<2	----	<2	----						
EA-022	TPA	mole/tonne	2		<2	----	<2	----						
EA-022	TSA	mole/tonne	2		<2	----	<2	----						
EA-022	pH (KCl)		0.1		----	----	----	----						
EA-026	Chromium Reducible Sulphur	%	0.02		<0.02	104	<0.02	104						

Test Results for Acid Sulphate Soils

TP Series (Douglas Partners)

FIELD SCREENING TEST RESULTS FOR ACID SULFATE SOILS
Ref: Qld ASS Sampling and Testing Guidelines, 1998

PROJECT: ASS & Preliminary Geotechnical Investigation	PROJECT NO: 33454A
CLIENT: LENSWORTH GROUP LTD	STORAGE: Frozen
SAMPLING METHOD:	DATE TESTED: 07-07-03
DATE SAMPLED: 03-07-03	TESTED BY: ACL

SAMPLE IDENTIFICATION		pH_F	pH_{FOX}	ΔpH	REACTION *
TP32	0.5 m	5.1	2.9	2.2	2
	1.0 m	5.6	3.1	2.5	2
	1.5 m	5.2	3.1	2.1	2
	2.0 m	4.5	3.5	1.0	2
TP33	0.5 m	5.2	3.2	2.0	2 – organic
	1.0 m	7.6	7.8	0.0	3
	1.5 m	8.2	8.0	0.2	3
	2.0 m	7.9	5.9	2.0	2
TP34	0.5 m	5.4	3.0	2.4	2 – organic
	1.0 m	6.6	3.9	2.7	2
	1.5 m	7.3	7.4	0.0	3
	2.0 m	8.1	7.9	0.2	4
TP35	0.5 m	5.7	2.7	3.0	2 – organic
	1.0 m	6.6	4.5	2.1	2
	1.5 m	6.6	4.6	2.0	2
	2.0 m	7.5	6.2	1.3	3
TP36	0.5 m	5.8	2.9	2.9	2
	1.0 m	6.5	4.2	2.3	2
	1.5 m	7.6	5.5	2.1	2
	2.0 m	7.9	7.8	0.1	2
TP37	0.5 m	5.4	2.4	3.0	2
	1.0 m	5.4	3.6	1.8	2
	1.5 m	6.0	4.3	1.7	2
	2.0 m	6.4	4.9	1.5	2

Notes:

*** Reaction Intensity:**

(1) No Reaction (2) Mild Reaction (3) Vigorous Reaction (4) Violent Reaction

pH_F: Field pH; pH_{FOX}: Field pH after hydrogen peroxide oxidation; ΔpH: pH_F - pH_{FOX}

CALIBRATION DETAILS			
Standard Buffer pH 4	☑	Use by Date: 12/03	pH Meter No: MC-81
Standard Buffer pH 6.88	☑	Use by Date: 12/03	pH of Hydrogen Peroxide: 4.9

CHECKED: 24-7-03	NAME: ADAM LUPTON	SIGNED: A. Lupton

Douglas Partners
Geotechnics · Environment · Groundwater

FIELD SCREENING TEST RESULTS FOR ACID SULFATE SOILS
Ref: Qld ASS Sampling and Testing Guidelines, 1998

PROJECT: ASS & Preliminary Geotechnical Investigation	PROJECT NO: 33454A
CLIENT: LENSWORTH GROUP LTD	STORAGE: Frozen
SAMPLING METHOD:	DATE TESTED: 07-07-03
DATE SAMPLED: 03-07-03	TESTED BY: ACL

SAMPLE IDENTIFICATION		pH_F	pH_{FOX}	ΔpH	REACTION *
TP18	0.5 m	5.3	1.6	3.7	2 – organic
	1.0 m	5.7	4.0	1.7	2
	1.5 m	5.9	4.0	1.9	2
	2.0 m	5.0	3.2	1.8	2
TP19	0.5 m	5.8	1.4	4.4	2 – organic
	1.0 m	4.1	2.1	2.0	2
	1.5 m	3.8	2.5	1.3	2
	2.0 m	4.0	2.8	1.2	2
TP20	0.5 m	5.1	2.0	3.1	2 – organic
	1.0 m	4.7	2.6	2.1	2
	1.5 m	5.1	2.7	2.4	2
	2.0 m	4.6	2.6	2.0	2
TP21	0.5 m	5.6	1.8	3.8	2
	1.0 m	4.7	4.4	0.3	2
	1.5 m	5.4	3.0	2.4	2
TP22	0.5 m	5.1	1.9	3.2	2 – organic
	1.0 m	5.2	2.4	2.8	2
	1.5 m	5.4	2.6	2.8	2 – organic
TP23	0.5 m	6.3	1.9	4.4	2 - organic
	1.0 m	4.2	2.5	1.7	2
	1.5 m	4.2	2.6	1.6	2
	2.0 m	4.3	2.9	1.4	2
TP24	0.5 m	5.3	1.6	3.7	2 – organic
	1.0 m	3.7	1.9	1.8	2
	1.5 m	3.4	1.6	1.8	2
	2.0 m	3.8	2.0	1.8	2

Notes:

*** Reaction Intensity:**

(1) No Reaction (2) Mild Reaction (3) Vigorous Reaction (4) Violent Reaction

pH_F: Field pH; pH_{FOX}: Field pH after hydrogen peroxide oxidation; ΔpH: pH_F - pH_{FOX}

CALIBRATION DETAILS			
Standard Buffer pH 4	☑	Use by Date: 12/03	pH Meter No: MC-81
Standard Buffer pH 6.88	☑	Use by Date: 12/03	pH of Hydrogen Peroxide: 4.9

CHECKED: 24-7-03	NAME: ADAM LUPTON	SIGNED: A. Lupton

Douglas Partners
Geotechnics · Environment · Groundwater

FIELD SCREENING TEST RESULTS FOR ACID SULFATE SOILS
Ref: Qld ASS Sampling and Testing Guidelines, 1998

PROJECT: ASS & Preliminary Geotechnical Investigation	PROJECT NO: 33454A
CLIENT: LENSWORTH GROUP LTD	STORAGE: Frozen
SAMPLING METHOD:	DATE TESTED: 07-07-03
DATE SAMPLED: 03-07-03	TESTED BY: ACL

SAMPLE IDENTIFICATION		pH_F	pH_{FOX}	ΔpH	REACTION *
TP25	0.5 m	4.2	2.9	1.3	4 – organic
	1.0 m	3.7	1.7	2.0	2
	1.5 m	3.6	1.7	1.9	2
	2.0 m	5.1	2.9	2.2	2
TP26	0.5 m	4.7	2.7	2.0	2
	1.0 m	4.8	3.0	1.8	2
	1.5 m	4.5	2.8	1.7	2
	2.0 m	5.4	2.4	3.0	2
TP27	0.5 m	5.8	3.2	2.6	2
	1.0 m	6.1	3.6	2.5	2
	1.5 m	4.3	2.3	2.0	2
	2.0 m	5.2	2.8	2.4	2
TP28	0.5 m	4.9	2.6	2.3	2
	1.0 m	4.3	2.7	1.6	2
	1.5 m	4.4	2.8	1.6	2
	2.0 m	6.4	3.2	3.2	2 – organic
TP29	0.5 m	6.7	3.9	2.8	2
	1.0 m	5.4	2.9	2.5	2
	1.5 m	5.3	3.2	2.1	2
	2.0 m	5.9	2.9	3.0	2 – organic
TP30	0.5 m	5.2	2.6	2.6	2
	1.0 m	4.9	2.6	2.3	2
	1.5 m	5.2	1.5	3.7	2
	2.0 m	5.6	2.6	3.0	2
TP31	0.5 m	5.3	2.8	2.5	2
	1.0 m	4.9	3.2	1.7	2
	1.5 m	5.7	3.7	2.0	2
	2.0 m	4.4	1.6	2.8	2 – organic

Notes:

*** Reaction Intensity:**

(1) No Reaction (2) Mild Reaction (3) Vigorous Reaction (4) Violent Reaction

pH_F: Field pH; pH_{FOX}: Field pH after hydrogen peroxide oxidation; ΔpH: $pH_F - pH_{FOX}$

CALIBRATION DETAILS			
Standard Buffer pH 4	☑	Use by Date: 12/03	pH Meter No: MC-81
Standard Buffer pH 6.88	☑	Use by Date: 12/03	pH of Hydrogen Peroxide: 4.9

CHECKED: 24-7-03	NAME: ADAM LUPTON	SIGNED: A. Lupton

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