

# 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



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	y 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.

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 5.1: Soil Classification

#### Table 5.2: Landform Classification

Cat	Landform Description		
В	Hill slopes	Ground sloping towards higher altitude areas.	
С	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	
Е	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.

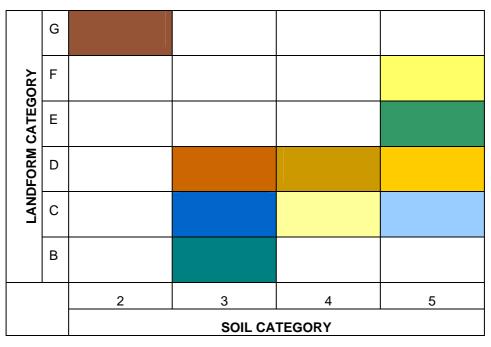


Table 5.3: Soil – Landform Category Matrix

# 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.

Test Location Identification			Samples tested SPOCAS	Samples tested SPOCAS positive	
LBH	96	85	14	2	
TPC	21	26	8	3	
ТРК	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.

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

Table 6.2: Summary of Laboratory Testing

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.

Landform	RL (m)	Soil	Thickness	Depth Below Ground level	
		Silty Sand (SM)	0.2m - 0.8m	0.0 - 0.8	
B3	5.5 - 17.5	Clayey Sand (SC)	0.6m - 3.2m	1.4 - 4.0	
		Clay (CL)	0.4m - 3.0m	3.6 - 6.2	
		Clay (CL)	2.5m - 5.0m	0.0 - 2.5	
C3	2 - 3	Clayey Sand (SC)	1.8m - 6.4m	0.0 - 6.4	
		Clay (CH)	approx 2.0m	5.0 - 8.5	
		Clay (CH)	0.8m - 5.0m	0.0 - 5.0	
C4	2 - 5	Clayey Sand (SC)	0.6m - 4.5m	1.0 - 4.5	
		Clay (CH)	0.8m - 7.0m	0.0 - 7.6	
		Silty Sand (SM)	0.4m - 0.6m	0.0 - 1.0	
C5	2 - 5	Clay (CH)	0.6m - 2.0m	0.4 - 3.0	
		Clayey Sand (SC)	0.4m - 1.6m	1.0 - 3.4	
		Clay (CL)	0.2m - 0.4m	0.0 - 0.4	
D3	2 - 5	Clay (CH)	1.2m - 10m	0.2 - 2.8	
		Clayey Sand (SC)	approx 4.0m	10 - 14.6	
		Clay (CL)	1.0m - 1.8m	0.0 - 1.6	
D5	1.5 - 2.5	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	
	1 0.5	Clay (CL)	1.0m - 2.6m	0.4 - 4.6	
		Clay (CH)	1.0m - 3.0m	0.0 - 3.0	
F5	2 - 3	Clayey Sand (SC)	0.6m - 2.8m	1.6 - 4.6	
		Clay (CL)	1.0m - 2.6m	0.6 - 7.4	
		Sand (SP)	0.2m - 2.2m	0.0 - 2.0	
G2	1.5 - 3.5	Coffee Rock	0.4m - 0.6m	1.2 - 2.8	
		Clay (CH)	0.6m - 4.4m	2.4 - 9.0	
D4	2 - 3.5				

Table 7.1: Summary of soil type per land form area

# 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.

Soil Type	Depth (m)	Plasticity	Effective Cohesion	Effective Friction Angle	mv	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 <sup>2</sup> – 8000kN/ <sup>2</sup>				

Table 7.2: Preliminary estimate of soil properties marina area

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.

Soil Type	Estimated Volume (m <sup>3</sup> )	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.

					LANDFO	RM 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%	

#### Table 8.1: Summary ASS testing

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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	Client:					SS PARK				Projec	tarted:	GEONATH18367AB 30.10.2006
	Principal:	NO	RTH EAS	TBU	SINE.	SS PARK					ompleter	
L	Project:	NO	RTH EAS	TBUS	S/NE	SS PARK				Logge	•	LH
	Borehole Locat	ion: AS	PER MAR	<b>&gt;</b>						Check	•	
12.06	drill model and mo	unting;	Edson 3000,	4WD Tru	ick Mou	rfledting:	slop	oe: -90°			_	Surface:
DATE: 13.12.06	hole diameter: drilling inform		100 mm	materi	ial sut	Northing	bea	ring:			datu	im:
	method 1 2 penetration Support water	notes samples, tests, etc	RL depth		symbol	······································	aterial particle charact	teristics, onents.	moisture condition	consistency/ density index	100 × pocket 200 × pocket 300 b penetro- 400 meter	structure and additional observations
EXISTING STUFF.GPJ. LIBRARY FILE: COFGEOTECHVER7REV1.GLB, TEMPLATE FILE: COFFEY.GDT FRAME TITLE		SPT 6,6,11 N*=17 SPT 30/30mm N*=R SPT 10,17,21 N*=38			CH GI gr siz 9 A GF hig 9 9 A GR and A CL ora	AVELLY CLAYEY SAND I red, fine gravel of 1-3m AY: high plasticity, grey NDY CLAY: high plastic nge, medium grained sar	plasticity, red ar quartzitic origin arse grained sa D: coarse grai ravel up to 6mm D: coarse grai m, high plasticit city, grey, red ar nd.	nd grey, ranging in nd. ned, red, n in size, ned, grey y clay.	M	VSt VD		EXTREMELY WEATHERED
[1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]     [1]	T cable tool A hand auger T diatube blank bit V bit TC bit sit shown by suffix	ving* ∦ g* ( € []	11 11 11 11 12 support M mud C casing penetration 2 3 4 no resid ranging vater 101/98 water 001/98 water water cutflow water cutflow	ito Frievel Vn		s, samples, tests undisturbed sample 50 undisturbed sample 50 undisturbed sample standard penetration te SPT - sample recovere SPT with solid cone vane shear (kPa) pressuremeter bulk sample environmental sample refusal	)mm diameter Imm diameter est (SPT)	classification soil descripti- based on unifi system D dry M moist Wp plastic li Wp plastic li W <sub>L</sub> liquid lin	on ied class		F S F S F F V L	firm St stiff /St very stiff h hard b friable /L very loose loose D medium dense dense

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	cipal	:							IESS P,						Date d				
Pro <sub>j</sub> Por		1						USIN	ESS P	ARK					Logge			LH	
			ation:												Check				
	diame		iounung.		20307) 00.mm		4WD	Fruck N	ourlifesting Northin			slope:	-90°			-	R.L. 8	Surface:	
dril	-	nforr	nation		;		mat	erial s	ubstance			bearing:				_	datun	n:	
'n	penetratior	ਦ ਦ	sam				; log	cation			material				dex dex	pocket nenetro-	1		<u> </u>
method	2 3	support	די ש ש ש ש		RL n	depth netres	graphic log	classification symbol	   soil f	type: plasticit	y or particle ch ry and minor c	aracteristics,		maisture condition	consistency/ density index	kP		structur additional ob	e and servations
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			AS	s				СН		LAY: high rained sand.		and black,			.			OPSOIL	
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	M		SPT				<i>A</i> -	ਸ਼ੀਰ	LAY: higi	nlasticity o	rey, some fine						1		
			2,3,6 N*≃9						and.	r piasticity, g	rey, some fine	grained	Ň				RES	IDUAL SOIL	
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			4,5,5 N*=10			17	i sc	CL	AYEY SAN sticity clay.	D: coarse	prained, grey, l artzitic grave!	ligh	-				Sand poorly	is of quartzitic orig graded.	in and 📩
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	auger rolier/	t drilling Tricone	g*	С са репе	asing stration		11)	U <sub>50</sub>	es, samples, undisi	urbed sample	50mm diameter	classifica soil descr	tion sy	mbols	and		CONS VS S	ilstency/density ind very soft	ex
	wash) cable	tool			34 	o resista	nce	U <sub>69</sub> D	undist disturt	urbed sample : Ded sample	33mm diameter	based on system	unified	classific	ation		F St	soft firm	
	hand a diatub	e		water	<u>over</u> ≉ re	anging to efusal		N N*	SPT-	ard penetration sample recove	test (SPT) red	moisture				_	VSt H	stiff very stiff bard	
	blank   V bit	bit		<b>V</b> 1		water le shown	eval	Nc V P	vале s	ith solid cone hear (kPa)		D dry M mois	st				Fb VL	hard friable very loose	
own by:				► w	/ater inf	fiow		Bs E	bułk sa			W wet	tic limit				L MD	loose medium da	
	ADT	_			ater ou	utflow	_	R	refusal	nmental sampli	•		d limit			1	D	dense	

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f					orehole				Sheet Projec		2 of 2 	
_	Client:				NESS PARK				Date s	tarted:	30.10.2006	-
	Principal:				NESS PARK				Date c	ompleted	30.10.2006	
	Project: Borehole Loca				NESS PARK			ļ	Logge	d by:	LH	
		_			MounEedting			_	Checke	ed by:		
¢	hole diameter:	1	00 mm		Northing		lope: -90° earing:				Surface	1
U H	hole diameter:				substance					datun	n:	
-		notes samples, tests, etc	depth RL metres	graphic log classification	soil type: plast	material icity or particle chara dary and minor corr	acteristics, iponents,	moisture condition	consistency/ density index	100 × pocket 200 × pocket 300 v penetro- 400 meter	structure and additional observations	
STUFF.GPJ. LIBRARY FILE: COFGEOTECHVER/REVI.GLB. TEMPLATE FILE: COFFEY.GDT FRAME TITLE: BORFHALE		SPT 5,11,14 N*=25 SPT ,29,30/145mm N*=R SPT 7,11,18 N*=29			H CLAY: high plasti sand, trace angular CLAY: high plastic some medium gra trace quartzitic gra	city, grey, some fine quartzitic gravel up ity, grey. ined sand vel.	grained		H		STREMELY WEATHERED	
Million         Million <t< th=""><th>method AS auger screv. AD auger drillin RR roller/tricon 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</th><th>wing* M g* C pen 1 2 wat</th><th>11 11 11 11 12 12 12 12 12 12</th><th>nii I L noe E N N</th><th>Jos         undisturbed sample           Josturbed sample         standard penetr           Istandard penetr         SPT - sample re           Ic         SPT with solid cr           Vane shear (kPa         pressuremeter           s         bulk sample           supple         environmertal sa</th><th>nple 50mm diameter nple 63mm diameter e ation test (SPT) covered one )</th><th>classification soil descriptio based on unifie system moisture D dry M moist W vet Wp plastic lin W<sub>L</sub> liquid lim</th><th>on ed classifi</th><th></th><th>Coi VS F St VSI H F b VL L VD D VD</th><th>soft firm stiff</th><th></th></t<>	method AS auger screv. AD auger drillin RR roller/tricon 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	wing* M g* C pen 1 2 wat	11 11 11 11 12 12 12 12 12 12	nii I L noe E N N	Jos         undisturbed sample           Josturbed sample         standard penetr           Istandard penetr         SPT - sample re           Ic         SPT with solid cr           Vane shear (kPa         pressuremeter           s         bulk sample           supple         environmertal sa	nple 50mm diameter nple 63mm diameter e ation test (SPT) covered one )	classification soil descriptio based on unifie system moisture D dry M moist W vet Wp plastic lin W <sub>L</sub> liquid lim	on ed classifi		Coi VS F St VSI H F b VL L VD D VD	soft firm stiff	

	]	С	of	ffe	V <sup>8</sup>	>	geo	⊃te	echnics		-	Boreh		0		
	]	En	gin	eerin	g Lo	og - l	Bore	ehc	ble			Sheet	t	υ.	LBH5 1 of 2	
	) ] ]	Clien Princ Proje	t: ipal: ct:		NORT NORT	Ή ΕΑ: Ή ΕΑ: Ή ΕΑ:	ST BL ST BL ST BL	ISIN ISIN	ESS PARK ESS PARK ESS PARK			Date s Date c Logge	-	eted:	GEONATH1836 30.10.2006 30.10.2006 LH	<u>7AB</u>
[			del and	mounting:		on 3000 mm	4WD T	ruck M		lope: -90°			ed by:	R.L. Su	IGC	
[]		driili	ng info	rmation			mate	rial s	Northing b ubstance	earing:			(	iatum:		
		Ĕ 1	c penetration support	not samp tests,	etc	depth L metres	graphic log	classification symbol	material soil type: plasticity or particle char colour, secondary and minor con	acteristics,	moisture condition	consistency/ density index	100 200 A pocket 300 a penetro-		structure and additional observation	s
	BOREHOLE GEONATH 18367 EXISTING STUFF.GPJ COFFEY.GDT 9.1.07	2		ASS ASS ASS ASS ASS ASS ASS ASS ASS ASS	etc   R	L depth metres 		CL SC SC L SC L SC SC SC SC SC SC SC SC SC SC SC SC SC	CLAY: high plasticity, black, r CLAY: high plasticity, black, r CLAYEY SAND: coarse grained, black angular gravel 5mm size of quartzitic or SRAVELLY CLAYEY SAND: coarse grained, black angular gravel 5mm size of quartzitic or black, quartizitic angular gravel up to 5m ligh plasticity black clay. ANDY CLAY: medium plasticity, grey, rained sand. LAY: low plasticity, grey and orange, tr barse sand, trace angular quartzitic grave c.	fine M ace el 6-7mm		D Consisten		€ ALL	additional observation	°
	ACO 9:3 Issue 3 Kev.2 A C B C C A C A C A C A C A C A C A C A	shown by	auger o roiler/tr washbo cable to hand a diatube blank b V bit TC bit	icone bre bol uger	water water 1 water water	nud asing tration 3 4 no re- rangir conserved	ier level own	Siz U U U N N N N N N N N N N N N N N N N	<ul> <li>botes, samples, tests</li> <li>undisturbed sample 50mm diameter</li> <li>undisturbed sample 63mm diameter</li> <li>disturbed sample</li> <li>standard penetration test (SPT)</li> <li>SPT - sample recovered</li> <li>SPT with solid cone</li> <li>vane shear (kPa)</li> <li>pressuremeter</li> </ul>	classification s soil description based on unified system moisture D dry M moist W wet Wp plastic lim W <sub>L</sub> liquid limit	t dass			cons VS F St Fb VSt H Fb VL MD D VD	Istency/density Index very soft soft firm stiff very stiff hard friable very loose loose medium dense dense very dense	

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				ring								Sheet Projec	t No:		2 of 2 GEONATH18367AI
Clie		·							ESS PARK			Date s			30.10.2006
Prir	ncipa	al:		NC	RTH	EAS	ST BL	JSINI	ESS PARK		i	Date c	omp	eted:	30.10.2006
Pro	ject:			NO	RTH	EAS	T BL	JSIN	ESS PARK		I	ogge	d by:		LH
_				on: <b>AS</b>	PER	MAI	P				(	Check	ed by	<i> </i> :	KI-
	mode diam			inting:	Edso: 100 n		4WD T	'ruck M	ourffedting: slope: Northing bearin					R.L. S datum	
	illing			tion	· · · · ·	1	mate	erial s	ubstance	<u></u>				uatum	· · · · · · · · · · · · · · · · · · ·
method	1 Denetration	_	1	notes samples tests, eta	;	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characte colour, secondary and minor compon	ristics,	moisture condition	consistency/ density index	100 pocket	a	structure and additional observations
T		M		SPT 6,9,10 N*=19		7		CL	CLAY: low plasticity, grey and orange to t some fine grained sand.	prown,	м	VSt St			
			NOT MEASURED	SPT 5,7,8 N*=15				СН	CLAY: high plasticity, grey, orange and br	rown.					
			Z	SPT 6,10,13 N*=23				CL SC	CLAY: low plasticity, grey and orange-brow CLAYEY SAND: medium to coarse graine and orange-brown, medium plasticity clay.		-	М			-
						10			Perchala I. D'10 familia 141 at 40m						
						- - 1 <u>1</u> - - - - -			Borehole LBH5 terminated at 10m						
netho S D R R V T IA D T oit sho	od own by	au roli wa cai hai dia bla V li	ger dri ler/tricc shbore ble too nd aug tube nk bit bit bit bit	one e	M n C c pen 1 2 ₩ Watt	port mud casing etration 3 4 no rar rar	water lev shown low	e /el	notes, samples, tests         U <sub>60</sub> undisturbed sample 50mm diameter         U <sub>82</sub> 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 soil descript based on unit system moisture D dry M moist W vet Wp plastic W <sub>L</sub> liquid If	ion Ted cla				consistency/density index       VS     very soft       S     soft       =     firm       St     stiff       VSt     very stiff       H     hard       Fb     friable       /L     very loose       -     loose       VD     medium dense       00     dense       VD     very dense

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														Sheet		•	<b>LBH6</b>	
Engineering Log - Borehole         Client:       NORTH EAST BUSINESS PARK         Bringingli       NORTH EAST SUBMISSION PARK												·	Project No		No:	1 of 2 		
Principal: NORTH EAST BUSINESS PARK																		2.11.2006
	Principal: NORTH EAST BUSINESS PARK Project: NORTH EAST BUSINESS PARK												Date o	completed:		2.11.2006		
	•		ocat	ion: AS				60	51141	ESS PARK				Logge	d by:		LH	
								/D Tr	uck M	ountesting		lope; -		Check	ed by:			
drill model and mounting: Edson 3000, 4WD Tri hole diameter: 100 mm drilling information mater										Northing		iope: iearing:	90°			t Sui atum:	rface;	
ari			orm	<u> </u>			<u>  "</u>	-		ubstance								
ъ	Denetration		:	notes sample	s, [	ł	4		classification symbol		material			ncy/ ndex	pocket penetro- meter	2	structure and	
method		15	water	tests, e		de	pth		lassifi ymbo	soil type: pla	sticity or particle char	acteristics,	moisture condition	consistency/ density index	요원 kPa		additional observation	ons
P P	12	3   °		455		L mei	ires.			colour, seco CLAY: high plas	indary and minor con	nponents.	Ĕ 8		<u>888</u>			
				ASS	4		-1						1 1/1	S-F		ALL	UVIAL SOIL	
				ASS	_				сн	SANDY CLAY:	igh plasticity, grey, m	edium to						
				ASS						coarse grained sa	na.					}		
				ASS			1											
				ASS					SC	CLAYEY SAND: high plasticity clay.	medium to coarse gr	ained, grey,		- <u>-</u>				
			V	ASS	1		Ľ							1	1111	Ì		
			-	ASS	1		<b>_</b> /⁄.:						-					
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-8	$\left  \right $			ASS		3	]/.											
-		м	Í	SPT 0,0,0		_	//	:		.some quartzitic gr	avel up to 5mm in siz	æ.						
				N*=0		- 1	1. 5											
						-	(÷.)											
						-	//											
						4	• \$][\$][	S	G	RAVELLY CLAYE	SAND: medium to		.					
						-			- gr	aneo, quanzitic or	avel up to 15mm, but n, high plasticity clay.	-		VSt				
			-			1												
				SPT 7,8,15	1	_		Cł	1 54 to	coarse grained sai	n plasticity, pale grey, nd.	medium	M			RESID	DUAL SOIL	
		1		N*=23		5		Cŀ		AY: high plastici	y, pale grey.							
								ĊL	. CL	AY: medium plas	sticity, pale grey, son gravel 2-3mm, in siz	le coarse						_
										,	graner z ennin, in siz	.c.						-
													Ì					
						1			р	ale grey and orang	e red.							-
hod					supp	6			+			<b>.</b>		_				-
		auger auger			M m C ca	ud	N	nil		tes, samples, tests		classifica	tion symbo	ols and		cons VS	istency/density Index very soft	
		roller/t washb	ricone			tration 3 4				<ul> <li>undisturbed s</li> </ul>	ample 50mm diameter ample 63mm diameter	soil descr				S F	soft	
		cable i hand a	uger	l	<u> </u>		resistan Iging to Iusal	ce	N N <sup>4</sup>	disturbed san standard pen SPT - sample	tration test (SPT)	system				St VSt	stiff very stiff	
		diatub blank t				0/1/98 v	water le	vel	Nc V		cone	moisture D dry				H Fb	hard friable	1
shown .	-	V bit FC bit			<u>≭</u> or	n date s	shown		P Bs	pressuremete bulk sample		M moi W wet				VL L MD	very loose loose	
- DWOL		AULX ADT		<u> </u>		ater infl ater out			ER	environmental refusal	sample		tic limít d fimit			MD D	medium dense dense	

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	<b>Coffey</b> geotechnics Engineering Log - Borehole														LBH6								
E	Eng	jir	)e	ering	g L	.og	-	Boi	rehole			Sheet Project No:			2 of 2								
	Client: NORTH EAST BUSINESS PARK												tarte										
Pi	rincipa	l:		NO	RTH	EAS	T B	JSIN	ESS PARK		I	Date c	omp	olete									
Pi	roject:			NOI	RTH	EAS	TB	JSIN	ESS PARK		I	Logged	d by		LH								
_	-			on: AS	PER	R MAI	D				(	Check	əd b	y:	KL								
	ill mode de diam		mou	•	Edsor		4WD	Fruck M	ourfiedting: slop					R.I	R.L. Surface;								
	Irilling		rma		100 11		mat	erial s	Northing bea	ring:				dat	tum:								
method	notes sample: tests, et 123 xate- tests, et 123					1							depth	graphic log	classification symbol	material soil type: plasticity or particle charac	teristics,	moisture condition	consist <del>enc</del> y/ density index	Ki	benetro- meter	structure and additional observation	 IS
- ⊢	123	M	5		RL	metres		CL	colour, secondary and minor comp CLAY: medium plasticity, pale grey, sor	ne coarse	ЕХ M	ଧ-ଞ VSt	₿ĝ I	8章									
				U <sub>50</sub>		-			sand, some quartzitic gravel 2-3mm, in si (continued)	ze.					160mm recovered								
			ŀ		1										↑PP>>500kPa								
ł																							
						7_			<b>5</b>														
					-			fine quartzitic gravel up to 3mm						EXTREMELY WEATHERED SANDSTONE									
	SPT 16, 30/80mm												11										
									trace coarse sand.			Н											
						_			trace gravel 40mm in size														
						CL GRAVELLY CLAY: low plasticity, grey, quartizitic gravel, well graded up to 5mm in size.										_							
		graver, well graded up to smm in size.						ļ															
	SPT 30/120mm №=R							CL	SANDY CLAY: low plasticity, grey and re	d cooreo													
						9		grained sand, trace quartzitic gravel 5mm in size.								_							
						10										-							
						4			Borehole LBH6 terminated at 10m							-							
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																_							
meth AS AD	od auger screwing* auger drilling*				supp М.т Сса	ыd	N		notes, samples, tests	classificati		ols and		Τ	consistency/density index VS very soft								
RR W			/Iricor			tration 34			U <sub>50</sub> undisturbed sample 50mm diameter U <sub>60</sub> undisturbed sample 63mm diameter D disturbed sample	soîl descrij based on u		ssification	n		S soft F firm St stiff								
CT HA		cable hand	tool auge	r I	# <b>5</b> _	rang soor∎refu	resistanc ging to Isal		N standard penetration test (SPT) N* SPT - sample recovered	system					St starr VSt verystiff H hard								
DT B		diatu blank			water <b>V</b> 1	0/1/98 w	/ater lev	el	Nc SPT with solid cone V vane shear (kPa)	moisture D dry M mois	t				Fb friable VL very loose								
V T *bitst	hown by :	V bit TC bi auffix	t			n date s /ater inflo			P pressuremeter Bs bulk sample	W wet	ic limit				L ioose MD medium dense								
e,g,	own by l	ADT		!		ater out			E environmental sample R refusal	W <sub>L</sub> liquid					D dense VD very dense								

Er	Client: NORTH EAST BUSINESS PARK										Sheel Projec		LBH7 1 of 3 GEONATH18367,
Princi Proje	ct:		NC NC	ORTH ORTH	I EAS I EAS	T BI	USIN	ESS PARK ESS PARK					27.10.2006 ed: 27.10.2006 LH
Borer drill mo			n: AS				- Truck M	louržed ting:			Logge Check	-	Kh
	ameter: ng info		tion	100 n				Northing	slope: -90 bearing:				Surface:
nethod	support	water	notes samples tests, etc		depth metres	graphic log	classification symbol	material soil type: plasticity or particle of colour, secondary and minor	haracteristics,	moisture condition	consistency/ density index	b d b b b b b b c c c c c c c c c c c c	structure and additional observations
AD					- - - 1_ -		CL       CLAY: medium plasticity, brown to black, trace coarse grained sand, trace quartzitic gravel 3mm in size.       M         CH       CLAY: high plasticity, red to brown, trace coarse grained sand.       M	F	100 200 200	TOPSOIL RESIDUAL SOIL			
		KVEU	SPT 4,5,4 N*=9					SANDY CLAY: high plasticity, red, sand of quartzitic origin, some quart in size. gravel content increasing with dept	ific gravel 2mm				~
L			SPT ,14,19 N*=33				d	SANDY CLAY: high plasticity, red a coarse grained quartzitic sand, some quartzitic gravel. .gravel content increasing with dept	2-3mm		St		
		13,	SPT .17,15 *=32				9  5a :H Gi 2-	LAYEY GRAVEL: medium grained rey, high plasticity clay. grading in parts into extremely weath andstone. RAVELLY CLAY: high plasticity, g 4mm quartzitic gravel, pockets of ve d sandstone.	rered		D St		
ethod S C R R K Shown by	auger s auger c roller/Iri washbo cable to hand au diatube blank bi V bit TC bit suffix ADT	frilling* icone bre bol uger		⊷ wate	t f ng ition	i to er level Miti	na U, D N N N P Bs E	<ul> <li>undisturbed sample 63mm diame disturbed sample standard penetration test (SPT) SPT - sample recovered</li> <li>SPT with solid cone vane shear (kPa) pressuremeter</li> </ul>	ter based on un system molsture D dry M moist Wp plastic Wp plastic	tion ified class			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

								echnics rehole				Sheet		<b>LBH7</b> 2 of 3			
~	Client				TH EAS		Projec Date s	t No: started:	GEONATH18367A 27.10.2006	B							
	Princip	oal:		NORI	TH EAS	TBU	SIN		ompleted:	27.10.2006							
	Projec	t:		NORI	TH EAS	TBU	SIN	ESS PARK				Logge		LH			
					ER MAI								ed by:	KL			
12.06	drill mod hole dia		mounting			4WD Tr	uck M	fourlifedting:	si	ope: -90		R.L. S		-7			
() DATE: 13.12.06			rmation		0 mm	mate	Northing bearing: material substance						datum:				
BOREHOLE	method 7 T Denetration	3 <sup>1]</sup> S	sam	tes pies, s, etc F	depth RL metres	graphic log	classification symbol	colour, seconda	material ty or particle chara any and minor com	ponents,	moisture condition	consistency/ density index	100 × pocket 200 v penetro- 400 meter	structure and additional observations			
		N	SP 6,10 N*=	F 10 20	RL metres		СН СН	Colour, seconda SANDY CLAY: high some fine quartzitic gr CLAY: high plasticity grained sand.	ny and minor com plasticity, white, c ravel up to 3mm in r, red and white, so	ponents, oarse sand, n size.	Ω M	VSt					
GEO 5,3 Issue 3 Rev.2 → < ∞ q ∓ o, ≶ ∞ ≥ ∞ ⇒ ⇒ =	D R / T T it shown by s	auger o roller/tr washbo cable to hand a diatube blank b V bit TC bit	icone pre pol uger	M C c pen 1 2 Wate	rangin refusa	er level wn	na U, U V P Bs E R	<ul> <li>undisturbed sample disturbed sample standard penetrati</li> <li>SPT - sample record SPT with solid con vane shear (kPa)</li> </ul>	overed	classificatio soil descrip based on ur system <b>moisture</b> D dry M moist W wet Wp plastic WL liquid	nified class		Cor VS F St VSt L MD D VL VD	sistency/density index very soft soft firm stilf very stiff hard friable very loose loose medium dense dense very dense	-		

									echnics			•	Boreh	ole N	No.	LBH7	
E	n	gi	ne	erin	g l	_O <u>ç</u>	<b>j -</b>	Bo	rehole				Sheet		_	3 of 3	
	ient:								ESS PARK				Projec Date s			GEONATH183 27.10.2006	867,
Pri	incip	bal:		NO	RTH	EAS	ST BI	USIN	ESS PARK				Date o				
Pro	ojeci	t:		NO	RTH	EAS	ST BL	USIN	ESS PARK				Logge			LH	
_	-			ion: AS	PER	R MA	P						Check	-		K~	
	mod e diar			unting:			4WD 7	Fruck M	ourfesting:	s	ope: -90	1°	-		R.L. S	Surface;	
				ation	100 m		mat	erial s	Northing ubstance	be	aring:	<u> </u>			datum		
method	N penetration	15	water	notes samples, tests, etc		depth metres	graphic log	classification symbol	soil type: plastic	material ity or particle chara	icteristics,	moisture condition	consistency/ density index	y pocket Ti nenatro	a	structure and additional observati	ons
F				SPT 7,14,16 N*=30				sc	CLAYEY SAND: co high plasticity clay, so size.	arse grained red	to brown	M	88 D	5 G	11E	XTREMELY WEATHERE	D
			OBSERVED														
			NOT OBSI			1 <u>3</u>											
				SPT		-											
				8,13,24 N*=37		ļ											
		T				-14			Borehole LBH7 termin	ated at 13.95m					+		
						-											
				i	ł												
						4											
						1 <u>5</u>											
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thod		auor	er screv	wina*	suppor M mu		N or		······································						co	nsistency/density index	
		auge	r drillin /(ricon:	g*	C casi penetra	ing ation	N nil	Ū,		ple 50mm diameter	classificatio soil descrip	otion			VS S	S very soft soft	
		wasi cable	bare tool			4 	sistance 19 to	U D N	disturbed sample		based on ur system		sification		F St	firm sliff	
		hand diatu blank			water	rangir S≪refusa		N' No	SPT - sample rec	overed	moisture D dry				VS H Fb	hard	
		V bit TC bi		-		1/98 wal date sho		P	vane shear (kPa) pressuremeter		M moist W wet					very loose loose	
show	n by s	suffix ADT		▶		ier inflow ier outflo		Bs E R	i bulk sample environmental sa	mple	Wp plastic W <sub>L</sub> liquid				MD D	) medium dense dense	

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	C	;(	)f	fey			ge	ote	echnics			-	Boreh			1 2/10
									rehole				Sheet			LBH9 1 of 3
#C):	Clie				_				ESS PARK		<u> </u>		Projec Date s			GEONATH18367AB 26.10.2006
	Prin	cipai	:						ESS PARK				Date c			
د)	Proj	ect:							ESS PARK					•	cieu	LH
	•		Loca	ation: A									Logge	•		
္ကုန	-			iounting:				Truck N	lourHedting:	sio	ope: -90'		Check	-		Surface:
13,12	_	diame			100 r	nm			Northing	be	aring:				datu	
DATE: 13.12.06	dri		inforr	nation			mat	· · · · ·	ubstance			7	••••			
HOLE	method	penetration	support	notes sample tests, e	s,	depth	graphic log	classification symbol	soil type: plastic	material	rtaristics	moisture condition	consistency/ density index	pecket		structure and additional observations
BORI		123	D,	Š	RL	metres	<u>16</u>		colour, second	lary and minor comp	ponents.		Loo den	9 <u>6</u> 9		
	AD		IN	ASS			· .	SM-	SILTY SAND: fine grey.	o medium grained,	brown to	D M	S		T	TOPSOIL
RAME				ASS			<u>i li</u>	sc	CLAYEY SAND: m	edium grained, area	modium					
				ASS		-	1		plasticity clay.	calani granica, grey	, mealam		F		11	
COFFEY.GDT		ļ		ASS		-		1								Clay content increases with depth
				ASS												
					{		/									_
PLATE		8		ASS	4		. / . 7777	CL	SANDY CLAY: med	lium plasticity, grov	Dense fine					_
TEM				ASS	_				grained sand.	sum plasticity, grey,	some line	D	VSt			-
GLB.				ASS		2							ļ			-
GEOTECHVER7REV1.GLB.				ASS				СН	SANDY CLAY: high to coarse grained san	plasticity, grey, som d.	ne medium					—
IVER7				ASS		-									s	and possibly quartzitic in origin.
TECH				ASS												
FGEC					-											]
 E: CO⊟	<u>н</u>			ASS	-	3						-				
۲ FIL			2	SPT 20,30/135	mm	-	$\langle \rangle \rangle$					ĺ	Η			
LIBRARY FILE:				N*=R	-	-										-
GPJ. 1								сн	CLAY: high plasticity	, red.						_
TUFF.			1													-
7 IS DN						Ť		СН	SANDY CLAY: high coarse grained sand.	plasticity, grey, med	lium to	м	St			_
-) IXISTI									oodioo grainea adita.				ĺ			-
) 9367 E					-			СН	SANDY CLAY: high	plasticity, grey, coar	se orained					f
DROJECT FILE: GEONATH 18367 EXISTING STUFF				SPT 5,7,9 N*=16					sand, some finely grad	ed quartzitic gravel.	3					-
EON			[	N -10	-	5										
ΠE											}				Sa	and content increasing with depth,
ECTF								1								]
DROJ				DS	1	-0		СН	SANDY CLAY: high pand.	lasticity, red, coarse	e grained	Í				]
						-1			oliu.							-
2.000	method				supp	6			<b></b>		<b></b>				-	Consistency/density is Joy
	AS AD	a	uger di		M m C ca	ud	Ni		notes, samples, tests U <sub>se</sub> undisturbed sa	mple 50mm diameter	classificat		ois and			Consistency/density index VS very soft S soft
Rev	RR W	v	oller/tric vashboi	e	12		esistance		U <sub>sa</sub> undisturbed sau D disturbed samp	mple 63mm diameter le	soil descri based on u	•	sification	1		S SOT. F firm St stiff
1 81	CT HA	h	able to and au			rang ‱a⊄refus	ing to	e		ration test (SPT)	system moisture					VSt very stiff H hard
5.5 E	77 3 7	b	liatube lank bit bit	i		0/1/98 wa		el 1	NC SPT with solid of V varie shear (kP	one	D dry M mois	t				Fo friable VL very loose
Щ, т		Т	C bit			n date sh ater inflo		- I i	pressuremeter 3s bulk sample		W wet	ic limit				L loose MD medium dense
	bit and wi 9.g.		DT.			ater outfi			E environmental s R refusal	ample	W <sub>L</sub> liquid			İ		D dense VD very dense

		neerir	ng Log	<u> - E</u>	Bor	chnics ehole				Sheet Projec	t No:	LBH9 2 of 3 GEONATH18367AB
	Principal: Project: Borehole Lo	NO NO	ORTH EAS	ST BU ST BU	SINE	SS PARK SS PARK					tarted: ompleted d by:	26.10.2006 1: 26.10.2006 LH
DATE: 13.12.06	drill model and hole diameter: drilling info	mounting:	Edson 3000, 100 mm	4WD Tri		urEedling: Northing bstance		ope: -90 earing:		Check		Ku Surface: m:
	method 6 penetration support	notes sample tests, et ख	s,	graphic log	classification symbol	soil type: plastic colour, second	material tity or particle chara	acteristics,	moisture condition	consistency/ density index	100 × pocket 200 × penetro- 400 meter	structure and additional observations
	nethod	SPT 9,17,21 N*=38 30/110mm N*=R 30/110mm N*=R			GP C 1 CL C of of of of of of of of of of	CLAY: high plastic CLAYEY GRAVEL: -3mm. grey, high pla CLAY: medium plas hedium grained sand LAYEY GRAVEL: f argillaceous materia ay. LAYEY SAND: fine own, high plasticity of gravel is speckled bi th red to brown soil of coarse grained, red t me subrounded gra gillaceous and quart	rounded quartzit asticity clay. sticity, red to brown i. rounded gravel of al, red to brown, hit to medium graine day. ack (coal), white gra lumps. to brown high plast vel of 1-2mm in siz zitic origin.	5-8mm size 5-8mm size gh plasticity d, red to rey quartz	M	H D-VD		ANDSTONE
GEO 5.3 Issue 3 Rev.2	AS augers AD augers RR roller/tr W washbo CT cable to A hand an DT diatube S blank b V bit TC bit TC bit	icone ore bol uger	M mud C casing penetration 1 2 3 4 no resi rangin vater 10/1/98 wate on date shor water outflow	g to er level Min	note U <sub>ss</sub> D N N <sup>≁</sup> Nc V P ës E R	es, samples, tests undisturbed sam disturbed sample standard penetra SPT - sample rec SPT with solid co vane shear (kPa) pressuremeter bulk sample environmental sa refusal	tlion test (SPT) xovered ne	classificatic soil descrip based on un system moisture D dry M moist W wet Wp plastic W <sub>L</sub> ilquid	tion ified class 		V S F S	firm t stiff St very stiff hard o friable L very loose loose D medium dense dense

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	C	)(	)ff	fey	/ <sup>6</sup>		geo	ote	echnics					<u> </u>			
									rehole				Sheet		).	<b>LBH10</b> 1 of 3	
	Clie								IESS PARK		<b>-</b>		Projec Date s	started		GEONATH18367 26.10.2006	AB
	Prir	icipal	:	N	ORTH	I EAS	TBL	JSIN	IESS PARK					comple		26.10.2006	
11	Pro	ject:		N	ORTH	IEAS	TBU	ISIN	ESS PARK				Logge	•		LH	
$\cap$	Bor	ehole	Locat	ion: AS	S PEF	R MAI	D							ed by:			
90	drill r	nodel	and mo	unting:	Edso	n 3000,	4WD Ti	ruck N	AounHedting:	sic	pe: -90		CHECK		R.L. Su		
ີ 13.12.06		diame	ter: nform	ation	100 r	nm	+	<del></del>	Northing	be	aring:				iatum:	11400,	
DATE				1			mate	_	substance				1	1 .			
	method	penetration	support water	notes sample tests, e	s,	depth	graphic log	classification symbol	soil type: plactic	material ity or particle charac	of	moisture condition	consistency/ density index	pocket pocket kPa		structure and additional observations	
E E		123	N N	<u> </u>	RL	metres	Bre	-85 ≩ CH		ary and minor comp	cteristics, ponents.	con	den den	주 있 없			
7 EXISTING STUFF.GPJ. LIBRARY FILE: COFGEOTECHVER7REV1.GLB. TEMPLATE FILE: COFFEY.GDT FRAME TITLE: BOREHOLE.	T  AD		NOT MEASURED	SPT 3,6,9 N*≃15 SPT 4,8,8 N*=16					red to brown, grey anred to brown, grey an	h, grey. nd black.		M	St			LUVIAL SOIL	
	method AS AD RR	a	Jger scree	ng*	suppo M mu C ca	ud Sing	N nil		red brown and black. . <u>red brown and grey.</u> 	iple 50mm diameter	classificatio soil descrip	on symbol	ols and		con VS S	sistency/density index very soft soft	
m GEO 5.3 Issue 3 Rev	RR W CT HA DT DT S V V K bit shown 2.g.	い にお し し て で	ashbore Ible tool and auge atube ank bit bit bit bit		🛨 or	14	ier level own		J <sub>ss</sub> undisturbed sample           O         disturbed sample           N         standard penetra           V         SPT - sample rec           NC         SPT with solid co           V         vane shear (kPa)           P         pressuremeter           Us         bulk sample           environmental sa         environmental sa	ple 63mm diameter ation test (SPT) covered ane )	boli descrip based on ur system D dry M moist W wet Wp plastic W <sub>L</sub> liquid	nified clas	sification		SFStVSt F5VLLDD DVD	son firm stiff very stiff hard hard friable very loose loose medium dense dense very dense	

	C	);	<b>)f</b>	fe	V	<u>S</u> >	ge	ote	echnics	5						
									rehole				Sheet	-	<b>LBH10</b> 2 of 3	
	Clie								IESS PARK			····	Projec Date o	ct No: started:	GEONATH18367AB 26.10.2006	_
	Prin	cipal	:	٨	IORT	H EAS	STBL	JSIN	IESS PARK					completer		
	Proj							ISIN	ESS PARK				Logge		LH	
						RMA							Check	-		
12.06	drill n hole d			ounting:			4WD T	ruck M	louifedting;	5	slope: -9	0°			Surface:	٦
DATE: 13.12.06			nform	ation	100	mm	mate	erial s	Northing ubstance	t	earing:			datu	lm;	
J	method	5 penetration	support water	note sampl tests,	es,	depth	graphic log	classification symbol	colour, secon	material icity or particle char dary and minor cor	nponents.	moistur <del>e</del> condition	consistency/ density index	00 × pocket 00 vd penetro- 00 meter	structure and additional observations	
G STUFF.GPU. LIBRARY FILE: COFGEOTECHVER7REV1.GLB. TEMPLATE FILE: COFFEY.GDT FRAME TITLE: BOREHOLE.			NOT MEASURED	SPT 4,5,7 N*=1. SPT 5,8,9 N*≕17	2			CH	SANDY CLAY: me grained sand.	city, brown to grey. dium plasticity, grey	(continued) , fine	M	Vst			
GEO 5.3 Issue 3 Rev.2     PROJECT FILE: GEONATH 18367 EXISTING       I < ∞ I ¥ 0 ≤ 37 ≥ 3 =	) T L t shown by	aug rolle was cab( hand diatu blan V bit TC b	er screw er drillin, r/tricone hbore s tool d auger ibe k bit	g* .	suppo M mu C cas penetr 1 2 3 water water 10 on wa	ud sing	to r level	рі: s qu:	tes, samples, tests undisturbed samp standard penetn SPT - sample	nple 50mm diameter nple 63mm diameter e ation test (SPT) covered one	relati	otion nified class 			soft firm stiff hard friable very loose loose D medium dense dense	

Ci Pr Pr Bo	lient: rincip roject	<b>gi</b> al: : le L	ne	erir No No No	I <b>g</b> DRTI DRTI DRTI S PEI	Log H EA H EA H EA R MA	<mark>д -</mark> sтв sтв	Bo USIN USIN USIN	echnics <b>rehole</b> Jess park Jess park	<u></u>			Boref Sheet Projec Date s Date c Logge Check	startec comple d by:	l: eted:	LBH10 <sup>3</sup> of 3 GEONATH1836 26.10.2006 26.10.2006 LH	<u>7</u> AI
	e dian			unting:	Edso 100 i		), 4WD	Truck N	Acuitesting:		lope: -90'	o			R.L. Su		
method p	penetration	uoport		notes sample: tests, et	s,   c	depth	aphic log	classification symbol	soil type: plasticity colour, secondar	material or particle chan y and minor con	iponents,	moisture condition	consistency/ density index	100 200 X pocket 300 X penetro-	1	structure and additional observation	s
			NOT MEASURED ES	SPT 15,10/20: N*=R				SC	CLAYEY SAND: coar plasticity clay, some fin and sub rounded grave origin up to 10x10x4mn gravel size increasing to clay present Borehole LBH10 termina	e to medium gra el of argillaceous n in size. <i>(contin</i> with depth	ined angular		VD		EX SAI	mmer bouncing TREMELY WEATHERED NDSTONE	too
method AS AD RR W CT HA DT JT S M bit show .g.	i i i t t τ T n by su	auger folfer/f washt cable hand a fiatub plank f bit TC bit	tool auger e	g* -	🚣 on 🛏 wa	id sing ation 4	ai iter level own v		disturbed sample standard penetration SPT - sample recov SPT with solid cone vane shear (kPa) pressuremeter	a 63mm diameter in test (SPT) vered	classificatio soil descript based on un system moisture D dry M moist W wet Wp plastic Wp plastic	tion ified classi			Cons VS S F St VSt H Fb VL L MD D	sistency/density index very soft soft firm stiff very stiff hard friable very loose loose medium dense dense	

## Test Pit Logs – TPK Series

		<b>7 y</b>	• •	ر ۲	<u>,</u>		echnics			Excav			TPK101	
Engi	neeri									Sheet Projec		1	of 1 GEOTNATH18	336
Client: Principal:							ESS PARK ESS PARK - LAING O'RO			Date s			11.12.2003	
Project:							ESS PARK - LAING O'RO	URKE		Date c	-	eted:	11.12.2006	
Test pit lo	cation:	TP1		. 02	0,2	0///	NOAL INVESTIGATION			Logge	-		ККМ	
equipment t		odel:					Pit Orientation:	Easting: 4	98748 m	Check		R.L. SI	uface: NOT MEASI	IRE
excavation of excavation		·	m lon	ġ mv		orial	substance	Northing: 7	002119 r	n		datum:		
								<del>.</del>	1	- ×				
method 5 penetration	t si	n <b>otes</b> amples, ests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle ch colour, secondary and minor c	aracteristics,	moisture condition	consistency/ density index	100 A pocket 200 A pocket 300 benetro-	ιļ.	structure and additional observati	ions
HB	N			0.5		CH	SANDY SILT: low plasticity, pale gr organic content.	ey brown, low	D	S/F	20	Т		
	NON OBSERVED	/PASS		1.0 1.5 1.5 2.0 2.5			blue grey.	own, motued	Μ	St/Vst			LUV!UM	
Sketch				3. <u>0</u> - - 3. <u>5</u> - - - - - - - - - - - - - - - - - - -		v	Test pit TPK101 terminated at 2.7m							
Sketch		}			<u> </u>		notes samplas tests							
natura existir H backh		n		ration 4	al	1	notes, samples, tests U <sub>so</sub> undisturbed sample 50mm diame U <sub>dat</sub> undisturbed sample 63mm diame D disturbed sample V vane shear (kPa) Bs bulk sample E environmental sample R refusal	er soil descr er based on system D dry M moi W wet Wp plas	unified clas			Cor VS F St VSt Fb VL L	sofi firm stiff	

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	y <sup>्रिः</sup> geot	CONTROS		Excava	tion No.	TPK102
Engineeri	g log - Excava	ition		Sheet Project		of 1 GEOTNATH183
Client:	NORTHEAST BUSI	ESS PARK		Date sta		11.12.2006
Principal:	NORTHEAST BUSIN			Date co	mpleted:	11.12.2006
Project:	MARINA GEOTECH	NICAL INVESTIGA	TION	Logged	by:	KKM
Test pit location: equipment type and m	TP102			Checke	d by:	
excavation dimensions	m long m wide	Pit Orientation:	Easting: Northing:	499527 m 7001588 m	R.L. Su datum:	Inface: NOT MEASUR
excavation inform		substance				
p ti ti sa	tes Di Lo ples, ples, cetc depth de service RL metres Di Di Lo RL metres Di	soil type: plasticity o	aterial r particle characteristics, and minor components.	nd ois	ady pocket benetro- meter	structure and additional observation
HE N				M S	<u>특</u> 휪ᇙᇴ         TO	PSOIL
	0.5					
		SANDY CLAY: high pla	sticity voltage trans			
	1. <u>0</u>	mottled blue grey, some f	ine grained sand.	M/W St		LUVIUM
Bs	455 1. <u>5</u>					
	Sw Sw	SAND: fine to medium g	rained, blue grey.	W VL		
	2. <u>0</u>					
	2.5					
		Collapse of alluvial sand p excavation. Test pit TPK102 terminate				
	3. <u>0</u>					
	3.5	-				
	4.0					
Sketch						
method	support	notes, samples, tests	classifi	cation symbols and		nsistency/density index
N natural exposure K existing excavatio 3H backhoe bucket	S shoring N nil	U <sub>so</sub> undisturbed sample U <sub>so</sub> undisturbed sample D disturbed sample	50mm diameter soil des 63mm diameter based o	n unified classification	VS S	very soft soft
bulldozer blade Ripper	penetration 1 2 3 4 no resistance ranging to	D disturbed sample V vane shear (kPa) Bs bulk sample	moistur	e	F St VSI	firm stiff
excavator	ranging to refusal water	E environmental samp R refusal	ie Dol M.m.	ry ooist	H Fb	very stiff hard friable
	water level on date shown			astic limit	VL L	very loose loose
	water inflow		W <sub>L</sub> lic	quid limit	MD D	medium dense

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	C	:0	ff	ev	S)	ge	ote	echnics		Freak	ation No			
. ) ,	Er	nai	nee	rina l	log - I	Exca	ava	tion		Sheet		7. <b>/ P/</b> 1 of 1	<103	
	Clie							ESS PARK		Projec	t No:	GEC	0 <u>TNATH183</u> 2.2006	<u>67</u> A
)	Prin	icipal:						ESS PARK - LAING O'ROURKE	E		complete		2.2006 2.2006	
	Proj					EOTE	ECHN	ICAL INVESTIGATION		Logge	d by:	KKN	Ţ	
7		t pit lo oment (		i: <b>TP1</b> d model:	103			Pit Orientation: Easting		Check				
]	exca	vation	dimens		m long n			Northin	-			., Sunface: um:	NOT MEASUR	ED
7					1			substance		~ *				
J		5 penetration	water	notes samples, tests, etc	dept RL metre	ы Ч graphic log	classification symbol	material soil type: plasticity or particle characterist colour, secondary and minor componen	nts. ∣Ĕ₿	consistency/ density index	100 pocket 200 y pocket 300 benetro		structure and onal observation	5
.]	BH		N		0.5		SM	SILTY SAND: fine grained, dark brown, high organic content.		L		TOPSOIL		
			<b>RVED</b>		1.0		СН	SILTY CLAY: high plasticity, grey mottled on brown.	ange M	F/St		ALLUVIUM,	strong H2S odou	г.
			NON OBSERVED	Bs/PASS	1.5		SC	CLAYEY SAND: fine grained, orange brown, moderate plasticity clay.	M	MD		RESIDUAL sandstone.	SOIL Landsborou	gh
					2. <u>0</u>									_
					2. <u>5</u>									_
					3. <u>0</u>			Test pit TPK103 terminated at 2.7m						
														-
					3. <u>5</u>									_
					4.0									
9.1.07	Sket	ich	<u> </u>									<u> </u>	<u> </u>	
COFFEY.GDT 9.1.07														
GEOTNATH18367AC.GPJ														
GEOTNATH1														
TESTPIT G														
Issue 3 Rev.2	method N X BH B R E	existir backh		ration et	support S shoring penetration 1 2 3 4 no rar rar ref	N n resistance ging to usal	18       	Jeo     undisturbed sample 50mm diameter     sr       Jeo     undisturbed sample 63mm diameter     br       O     disturbed sample     sr       Vane shear (kPa)     sr     sr       Bs     bulk sample     m       environmental sample     D				VS S F St VSt H	density index very soft soft firm stiff very stiff hard	
Form GEO 5.2				-	water lev on date s water infl water out	ihown ow		k Ferusal M W W W	/ wet /p plastic limit			Fb VL L MD D VD	friable very loose loose medium dense dense very dense	

	110)		č	,	~	echnics		Excav	ation No.	TPK104
Engin	eering	loc	<b>j - E</b> :	xca	vat	ion		Sheet		1 of 1
Client:					_	SS PARK		Projec Date s		GEOTNATH183
Principal:						SS PARK - LAING O'ROUR	PKF		ompleted:	
Project:						CAL INVESTIGATION				
Test pit loc		P104						Logge Check	-	ККМ
equipment ty	e and model:			·		Pit Orientation: Ea	isting: 499874			Surface: NOT MEASURE
excavation di	nensions: informatio	m lo.	ng miv			No	orthing: 700142	21 m	datum	
		<u></u>		mat		ubstance				
penetration	note sampl	-		graphic log	classification symbol	material	و	condition consistency/ density index	pocket penetro- meter	structure and
method 55 pene	tests, ior ≥		depth metres	graph	classi symbo	soil type: plasticity or particle charact colour, secondary and minor compo	teristics,	ondition	kPa	additional observations
H N			-	· · [ · · ]	SM	SILTY SAND: fine grained, dark brown.			₽8889 TTTT	
				·   ·		organic content,				
			0.5		СН	SANDY CLAY: high plasticity, pale blue	grey, trace M/	N S		
	KED					fine sand.	groy, nace w			
		s	1.0							
	IO NON									
	ž		1.5		SP	GRAVELLY CLAYEY SAND: fine to med	lium W			
						grained, blue grey, some moderate plastic gravel.	A 54	MD	RE	SIDUAL SOIL Landsboroug
			2.0			SANDY CLAY: moderate plasticity, orang race fine to medium sand.	ge brown,		Sa	indstone.
	ł									
			2.5			Test pit TPK104 terminated at 2.3m				
				ł						
			- 3.0		ĺ					
			<u>-</u>							
			3. <u>5</u>							
			3. <u>5</u> -							
			-				ł			
Sketch			4.0							
SKEIGH										
·		-								
	exposure	supp Ssh		N nil	L		classification sy soil description	mbols and	CO VS	onsistency/density index
existing H backhoe buildoze		pener 1 2	ration			disturbed sample	based on unified system	classification	S F	s very soπ soft firm
ripper excavati			a 4 no res tangin	istance g to í	B		moisture		St VS	stiff
ongavali	-	water		4	E R	environmental sample refusal	D dry M moist		H Fb	hard
		<b>.</b>	ator love			•	141			
		<u> </u>	ater level n date sho ater inflow				W wet Wp plastic limit W <sub>L</sub> liquid limit			very loose loose

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	Jy ∼	3.00	echnics		Excav	ation No.	TPK105
Engineer	ing log - E	Excava	tion		Sheet	•	
Client:	NORTHEA	ST BUSIN	ESS PARK		Projec	started:	GEOTNATH18367 11.12.2006
Principal:	NORTHEAS	ST BUSIN	ESS PARK - LAING O'R	OURKE	Date o	completed:	11.12.2006
Project:	MARINA G	EOTECHN	IICAL INVESTIGATION		Logge	d by:	KKM
Test pit location:	TP105				Check	ed by:	
equipment type and excavation dimension		ı wide	Pit Orientation:		036 m	R.L. SI	urface: NOT MEASURED
excavation infor			substance	Northing: 700 <sup>-</sup>	1404 m	datum:	
thod penetration port ter	notes	log tation	material		ncy/	pocket penetro- meter	· · · · · · · · · · · · · · · · · · ·
2   5 ē	samples, tests, etc but tests	6 3 graphic log classification symbol	soil type: plasticity or particle	haracteristics,	moisture condition consistency/ density index	kPa	structure and additional observations
<sup> </sup>	RL metre	S ອນ ອີດ SM	SILTY SAND: fine grained, dark		10 L		PSOL
			organic content.				
	0.5	SC	SANDY CLAY: high plasticity, blu orange brown, some fine to mediu	e grey mottled n grained sand.	M/W F/St	AL	
	1.0						
	Bs/PASS						
	1.5	GP	SANDY GRAVEL: medium to coa grey.	rse grained, blue	W VL		
		e ; p ;					
			Collapse of alluvial sand pre cludes excavation. Test pit TPK105 terminated at 2m	further			
	2. <u>5</u>						
				ľ			
	3. <u>0</u>						
	3. <u>5</u>						
Sketch	4.0		······				<u></u>
				-			
nethod V natural exposur		N nil	notes, samples, tests U <sub>so</sub> undisturbed sample 50mm diar	classification eter soil descripti	symbols and	c0	nsistency/density index
K existing excaval BH backhoe bucket bulkezer blade	penetration		U <sub>53</sub> undisturbed sample 63mm dian D disturbed sample		ied classification	VS S	; very soft soft firm
bulldozer blade ripper excavator	(2000 ra)	resistance	V vane shear (kPa) Bs bulk sample	moisture		St √s	stiff
- chuavaiui	water water lev		E environmental sample R refusal	D dry M moist		H Fb	hard friable
	on date :			W wet Wp plastic I		VL L	very loose loose
	water inf			W <sub>L</sub> liquid lir	រារក	MD	medium dense

 $\Box$ 

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Engine	ering log - E		Excavation No. <b>TPK106</b> Sheet 1 of 1
Client: Principal: Project:	NORTHEAS NORTHEAS	T BUSINESS PARK T BUSINESS PARK - LAING O'ROURKE	Project No: GEOTNATH18
Test pit locatio	n: <b>TP106</b>	Pit Orientation:	Logged by: KKM Checked by:
excavation dimension		Eddung,	K.L. Surrace: NOT MEASU
BH method C benetration C support water	notes samples, tests, stc RL metres	B     E     material       Image: Solid Structure     Solid Structure     Solid Structure       Image: Solid Structure     Solid Structure     Solid Structure	s, countries and structure and structure and structure and structure and structure and structure and so conditional observation additional observation structure and so conditional observation additional observation structure and so conditional observation additional observation structure and so conditional observation structure and str
	Bs/PASS 1. <u>5</u>	CH CLAY: high plasticity, orange brown. CH CLAY: high plasticity, blue grey, becoming san with depth.	
	2. <u>0</u> 2. <u>5</u> 3. <u>0</u>		
	3.5	Test pit TPK106 terminated at 3.2m	
Sketch			
method	support S shoring penetration 1 2 3 4	sol de	fication symbols and consistency/density index escription VS very soft on unified classification S soft F firm

		/	II (	Ξy	~~	5	200		echnics		E	xcava	tion No	TP	K107	
E	ngi	ne	e	ring l	og	- E	xca	val	tion			heet	N/~.	1 of 1	OTMATUGO	~~~
Cli	ent:			NO	RTH	IEAS	T BU	SIN	ESS PARK			roject ate sta		_	<u>OTNATH18</u> 12.2006	367,
Pri	ncipal	l:		NO	RTH	IEAS	T BU	ISINE	ESS PARK - LAING O'ROURI	KE	Da	ate co	mplete		2.2006	
Pro	ject:			MA	RIN.	A GE	оте	CHN	ICAL INVESTIGATION		Lo	gged	by:	ΚΚΙ	И	
	st pit I				07						Cł	necke	d by:			
	ipment avation			model:		· · · · · ·				-	170 m		R.L	Surface:	NOT MEASU	RED
		-		rmation		ng miv		erial s	substance	thing: 7000	1774 m		dati	ım;		
	penetration			notes			8	ation	material			₩ Å	ket etro-			
method	123	support	water	samples, tests, etc		depth metres	graphic log	classification symbol	soil type: plasticity or particle charact colour, secondary and minor compo	eristics, nents.	moisture condition		200 A pocket 300 b penetro- 400 meter	addi	structure and tional observatio	ns
ВН		N						SM	SILTY SAND: fine grained, dark brown, I organic content.	nigh	D			TOPSOIL		
						0.5										
								СН	SANDY CLAY: high plasticity, orange bro fine to medium grained sand.	wn, some	w	F		ALLUVIUN	1	-
						1.0										
				Bs/PASS				sw	SAND: fine to medium grained, blue grey			<u> </u>			•	
						1.5			of the three to medicin grained, plue gies	-						
							]		becomes dark brown.			-				
			▶			2. <u>0</u> -			becomes pale yellow brown.			7		weakly ce	emented	
		_				2.5			Test pit TPK107 terminated at 2.5m	····						
						-			rest pit in itror terminated at 2.5m							
						3. <u>0</u> -										
						-										
						3. <u>5</u>										
						-										
Ski	iii ∋tch					4.0		1								
UN0	26012															
ietho	d			r				<u> </u>			_					
61110	nat		xposi excav	ure ation	supp S sh	ioring	Nn	1	notes, samples, tests U <sub>50</sub> undisturbed sample 50mm diameter U <sub>83</sub> undisturbed sample 63mm diameter	classification soil description based on unifi	on			VS	y/density index very soft	
H	bac bull	khoe doze	buck r blad	et	pene	tration	esistance		D disturbed sample V vane shear (kPa)	based on unifi system	ieu Gassif	ication		S F St	soft firm stiff	
	ripp exc	ier avato	ſ			rang refus	ing to		Bs bulk sample E environmental sample	moisture D dry				VSt H	very stiff hard	
						r vater leve in date sh			R refusal	M moist W wet Wp plastic li	imit			Fb VL	friable very loose	
				Í.	-					Wp plastic i W <sub>L</sub> líquid lin			1	L MD	loose	

	coffey	్రీ geote	echnics	Ēx	cavation No	TPK108
	Engineering I	og - Excava	tion		eet Dject No:	1 of 1
	Principal: <b>NO</b>		ESS PARK ESS PARK - LAING O'ROUI IICAL INVESTIGATION	Da R <b>KE</b> Da	te started: te completed	······································
U N	Test pit location: <b>TP1</b> equipment type and model;			Ch	gged by: ecked by:	ККМ
J		m long m wide material :	_	asting: 499132 m orthing: 7000952 m	R.L.	. Surface: NOT MEASURED
	b b b b b b b c c c c c c c c c c c c c	depth		teristics, onents.	density index 100 전 pocket 300 전 penetro- 400 meter	structure and additional observations
	BH	0. <u>5</u> Sw	SANDY CLAY: low plasticity, pale brow moderate organic content. SAND: fine to medium grained, yellow i	n. D	F	TOPSOIL
	Bs/PASS	1. <u>0</u> 	CLAYEY SAND: fine to medium grained brown mottled blue grey, moderate plasti	I, orange E bity clay.		RESIDUAL SOIL Landsborough sandstone - 
		2.0 : / 2. <u>5</u> 3.0 <sup>-</sup> 3.5	Pit terminated on the rock exposure. Test pit TPK108 terminated at 2m			
		4.0	·			
	N natural exposure existing excavation BH backhoe bucket bulidozer blade ripper excavator	S shoring N nil I penetration I 1 2 3 4 Tag ranging to E	notas, samples, tests U <sub>so</sub> undisturbed sample 50mm diameter U <sub>so</sub> undisturbed sample 63mm diameter D disturbed sample V vane shear (kPa) Bs bulk sampte E environmental sample R refusal	classification symbols and soil description based on unified classifice system moisture D dry M moist W wet Wp plastic limit W_ liquid limit	tion f	4D medium dense

C	01	T(	ey	C.	(	geo	ote	ect	nnics					Exc	aval	tion N	lo.	TPI	<109	
En	gin	eei	ring	og	- E	xca	vat	ior	Ì					She Proj		No:	1	of 1 GEC	DTNATH18	367A
Clien	t:								PARK				÷			arted:			2.2006	
Princi	•								PARK - L		ROUR	KE		Date	e co	mplet	ted:	11.1	2.2006	
Proje		<b>4</b> <sup>1</sup>			A GE	OTE	CHN	ICAI	L INVESTI	GATION				Log	_			KKN	1	
_	oit loca ient typ		TP: model:	09			<u> </u>	P	it Orientation;		Fa	sting:	498963	-	cke	d by:	I.L. Su		NOT MEAN	
	tion din			m lon	g mv							rthing:	700104				atum:	nace.	NOT MEAS	JKEU
_		info	rmation			mate		subst	ance			<del>.</del>			<u>_</u> 1					
e i	support	water	notes samples, tests, etc		depth metres		classification symbol		soil type; plast colour, secon	material city or particle dary and min	charact	eristics, onen <b>ts</b> .	moisture	consistency/	density index	100 A pocket 200 A pocket 300 B penetro		addit	structure and ional observati	ons
5	N	OBSERVED			0.5		sw	SAN	D: fine to me	dium grained	pale bro	wn grey.	D					OLIANT	DUNE SAND	
		NON OBS	Bs/PASS	1																
		N			1. <u>0</u>		SC	CLA	YEY SAND: fi n, moderate pla	ne to medium	grained,	orange			-				SOIL Landsbo	rough
					1.5				n, moderate pr	stationly clay of	(11.0) IL.						san	dstone		-
					-			Term	ination of test p	it on HW roc	ι								<u> </u>	
					2. <u>0</u>			lest	pit TPK109 terr	ninated at 1.5	m									-
							:													-
					2. <u>5</u>															-
					-															-
					3. <u>0</u> -															
																				-
					3. <u>5</u>															-
					- 4.0															-
Sketo	:h							·								<u></u>	<u></u>			
ethod				supp	ort		— <del></del> _	notas	complet tests			-11								
	natural existing	excav	ation	S sh	ioring	Nл	"	U <sub>50</sub> U <sub>63</sub>	undisturbed a	ample 50mm d ample 63mm d		soil de	ication sy scription on unified				vs VS	nsistenc	//density index very soft soft	
1	backho bulidoze ripper			pene 1 2	3 4	esislance		D V Bs	disturbed san vane shear (k buik sampte	iple		system					F St		tirm stiff	
	excava	tor		wate	r	ging to Isat		E R	environmenta refusal	l sample		Мл	ire fry noist				VS H Fb	t	very stiff hard friable	
					vater leve on date si							W v Wp p	vet plastic limil iquid limit	:			VL L		very loose loose	
				-	vater inflo vater outi							vvL 1	idena nillit				MD D VD		medium dense dense very dense	

Sector       Sector       Excavator         Description       Sector       Sector         Clent:       NORTHEAST BUSINESS PARK       Date state         Clent:       NORTHEAST BUSINESS PARK       LAING OCTORNATION       Date state         Textporter       MARIAGEOTECHNICAL INVESTIGATION       Logged by:         Textporter       Textporter       Control       Textporter         Textporter       Textporter       Textporter       Control       Textporter         Textporter       Textporter       Textporter       Textporter       Textporter       Textporter         Textporter       Textporter       Textporter       Textporter       Textporter       Textporter       Textporter       Textporter         Textporter       Textporter       Textporter       Textporter       Textporter       Textporter       Textporter       Textporter       Textporter       Textporter       Textporter       Textporter       Textporter       Textportinformation       Textporter	No. <b>TPK110</b>
Client:     NORTHEAST BUSINESS PARK     Date starte       Principal:     NORTHEAST BUSINESS PARK - LAING O'ROURKE     Date comp       Project:     MARINA GEOTECHNICAL INVESTIGATION     Logged by:       Test pit location:     TP110     Checked by       equipment type and model:     material     Soft Bast       excavation dimensions:     m long_m wide     Northing:     7000222 m       excavation information     material substance     Northing:     7000222 m       excavation information     CL     SM     SiLTY SAND: fine grained, dark brown, high     D       is an iterst at frown, some fine to medium grained sand and gravel.     Nu     F       is an iterst at frown, some fine to medium grained sand and gravel.     Nu     F       is an iterst at pit TPK110 terminated at 2m     Is an iterst at pit TPK110 terminated at 2m     Nu	
Project:       MARINA GEOTECHNICAL INVESTIGATION       Logged by         Test pit location:       Total       Checked by         equipment type and model:       Pit Orientation:       Easting:       501183 m         excavation dimension:       mong       model       Northing:       7000222 m         excavation information       material substance       Northing:       7000222 m         variable       samples, etc.       depth       gravelite       soil type: plasticity or particle characteristics.       gravelite         tests, etc.       RL metres       SM       SILTY SAND: fine grained, dark brown, high       D       L         tests, etc.       RL metres       SW       SILTY SAND: fine grained, dark brown, high       D       L         tests, etc.       RL metres       SW       SAND: fine grained, dark brown, high       D       L         tests, etc.       RL       SW       SAND: fine to medium grained sand and gravel.       VL       VL         tests       1.0       SW       SAND: fine to medium grained, blue grey.       VL       VL         tests pit TPK110 terminated at 2m       1.0       SW       SAND: fine to medium grained, blue grey.       VL         test       1.0       1.0       1.0       1.0       1	
Test pit location:       TP10       Checked by         equipment type and model:       Pit Orientation:       Easting:       501183 m.         excavation dimension:       mining m vide       Northing:       7000222 m.         excavation information       material substance       material substance       graph type:       grap type:       graph type:	leted: <b>11.12.0206</b>
Oriented D         Oriented D         Pil Orientation:       Easting: 501183 m         excavation dimensions:       miong m wide       Northing: 7000222 m         excavation information       material substance         vigge       notes       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g       g	ККМ
excavation dimensions:     m long     m wide     Northing:     7000222 m       excavation information     material substance     g g g g g g g g g g g g g g g g g g g	y:
Notifing: 700222 m         Totaling: 700222 m         Totaling: 700222 m         Total substance         Total subs	R.L. Surface: NOT MEASURED
Bes/PASS       RL metres       Bes/PASS       SW       SAND: fine to medium grained, dark brown, high       D       L         Bes/PASS       1.0       SW       SAND: fine to medium grained, dark brown, high       D       L         Bes/PASS       1.0       SW       SAND: fine to medium grained, dark brown, high       D       L         Bes/PASS       1.0       SW       SAND: fine to medium grained sand and gravel.       VL         Bes/PASS       1.0       SW       SAND: fine to medium grained sand and gravel.       VL         Bes/PASS       1.0       SW       SAND: fine to medium grained sand and gravel.       VL         Automation       SW       SAND: fine to medium grained at 2m       VL       VL         Automation       SW       SAND: fine to medium grained at 2m       VL       VL         Automation       Automation       Automation       Automation       VL       VL         Automation       Automation       Automation       Automation       Automation       Automation         Automation       Automation       Automation       Automation       Automation       Automation         Automation       Automation       Automation       Automation       Automation       Automation <t< td=""><td>datum:</td></t<>	datum:
a       123       a       N       AL metres       b       b       sol type: plasticity or particle characteristics, b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b       b	2 7
BarPASS       SM       SILTY SAND: fine grained, dark brown, high organic content.       D       L         BarPASS       0.5       CL       GRAVELLY SANDY CLAY: moderate plasticity, dark brown, some fine to medium grained sand and gravel.       W       F         BarPASS       1.0       SW       SAND: fine to medium grained, blue grey.       VL         1.5       SW       SAND: fine to medium grained, blue grey.       VL         1.5       SW       SAND: fine to medium grained, blue grey.       VL         1.5       SW       SAND: fine to medium grained, at 2m       VL         1.5       SW       SAND: fine to medium grained at 2m       VL         1.5       SW       SAND: fine to medium grained, at 2m       VL	
Bs/PASS     1.0     SW     SAND: fine to medium grained, blue grey.     VL       1.5     SW     SAND: fine to medium grained, blue grey.     VL	400
Bs/PASS 1.0 Bs/PASS 2.0 Bs/PASS 2.0 Bs/PASS 2.0 Bs/PASS 2.0 Bs/PASS 2.0 Bs/PASS 2.0 Bs/PASS 2.0 Bs/PASS 2.0 SAND: fine to medium grained, blue grey. VL VL VL VL VL VL	
Bs/PASS         1.0         SW         SAND: fine to medium grained, blue grey.         VL           1.5	ALLUVIUM
SW     SAND: fine to medium grained, blue grey.     VL       1.5     -       2.0     -       2.0     -       2.0     -       3.0     -       3.5     -       4.0     -	
2.0 <sup>-</sup> 2.0 <sup>-</sup> 2.5 <sup>-</sup> 3.0 <sup>-</sup> 3.5 <sup>-</sup> 3.5 <sup>-</sup> 4.0 <sup>-</sup>	
2.0         Test pit TPK110 terminated at 2m           2.5         -           3.0 <sup>-</sup> -           3.5         -           4.0 <sup>-</sup> -	Strong H2S odour.
2.5	
2.5	
3.5	
4.0	
4.0	
Sketch	
support     notes, samples, tests     classification symbols and soil description       N     natural exposure     S shoring     N nil       X     existing excavation     soil description       BH     backhoe bucket     penetration       B     bulldozer blade     ro resistance refusal       R     ripper       E     excavator       Water     R       V     valer level       on date shown     R	consistency/density index VS very soft S soft F firm St stiff

C	J,O		чy			100		501	nics			Excav	ation N	o. <b>TPI</b>	K111	
Eı	ngin	iee	ring	log	- E	хса	vat	lion				Sheet		1 of 1		
Clie	-								PARK			Projec	t No: tarted:		DTNATH183 2.2006	867
Prir	icipal:								PARK - LAING O'R	DURKE			omplete		2.2006	
Pro	ject:								INVESTIGATION			Logge	•	KKN		
Tes	t pit lo	cation	: TF	2111								Check	-			
	·		d mođel:					Pi	Orientation:	Easting:	501111 m			L. Surface:	NOT MEASUF	RED
	vation o		_		ng miv	_				Northing:	7000710	m	da	tum:	<b>.</b>	
ext			rmation	1		mat		substa	nce					<u></u>		
玻	penetration	FI.	notes sample			ic log	classification symbol		material		2.6	consistency/ density index	pocket penetro meter		structure and	
method	8. 123	support water	tests, e		depth metres		classi symbo		oil type: plasticity or particle o	haracteristics,	moisture condition	consis	kPa		ional observation	ns
H	123	N			- 1	· · · ·	SM	SLIT	SAND: fine grained, dark b				5885	TOPSOIL	····	
					-		ML		ic content. EY SILT: moderate plasticit	oranne brown						
					0.5				<b>F</b> /	, erenge bronn:		[ '				
			Bs/PAS	s	1.0		sw	SAND	: fine to medium grained, ye	low brown.	w					
									• • • •							
					1. <u>5</u>											
			<u> </u>		2. <u>0</u>			Test p	it TPK111 terminated at 1.9m	···						
					2. <u>5</u>								*			
						[						ļ				
					- 3.0											
					-		ĺ									
					- 3. <u>5</u>											
				Ì	-											
					- 4.0											
Ske	etch				4.0							<u></u>				
netho			-	sup	port			notes, :	amples, tests	classif	ication sym	bols and	<u> </u>	consistenc	y/density index	
	exis	ral expo ing exca	vation		horing	Nr	nil	U <sub>50</sub> U <sub>63</sub>	undisturbed sample 50mm dia undisturbed sample 63mm dia	neter soil de neter based (	scription on unified cl		I	VS S	very soft	
Н	bullo	hoe buo ozer bla		pen 1_2 ∭∎	etration 3 4	resistance		D V	disturbed sample vane shear (kPa)	system				F St	tirm stiff	
	rippe exca	vator			Stora refu	ging to		Bs E R	bulk sample environmental sample		iry			VSt H	very stiff hard	
				wat	er water lev on date s	el hown		к	refusal	w v	noisi vet Nastic limit			Fb VL	friable very loose	
					water infl						plastic limit Iquid limit			L MD D	loose medium dense	
					water out	£	1			1			- 1	VD	dense	

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## Test Pit Logs – TPC Series

## Borehole Logs – MBH Series

				ey						nic	S					Boreho	ole N	۱o.	MBH		
Ε	ng	ine	ee	ring L	_og	- E	Sore	eho	le							Sheet Project	: No:	:	1 of GEO	3 TNATH183	67AC
Cli	ent:			NO	RTH	EAS	T BU	SINE	SS P	ARK	-				1	Date si	arte	ed:	22.11	.2006	
Pri	ncipa	d:		NO	RTH	EAS	T BU	SINE	ESS P.	ARK	- LAING	GO'ROU	RKE		I	Date c	omp	lete	d: <b>22.11</b>	.2006	
Pro	oject:			MA	RIN/	A GE	OTE	CHN	ICAL I	INVE	STIGAT	ION			I	Logged	i by:		КМ		
Bo	rehol	e Lo	catio	on: AS	PER	MA	•								(	Checke	ed b	y:	Kn		
	mode		mou	-		O 200	TRAC	K RIG	Eastir	-	500149		ope:	-90°					. Surface:		
	e diam illing		rma		100 m	Im	mate	erial s	North: ubstan		7000600	be	earing:					datı	um:		
method	penetration	support	water	notes samples, tests, etc	RL	deptin	graphic log	classification symbol	so	oil type:	plasticity or	terial particle chan nd minor con	acterísti	cs,	moisture condition	consistency/ density index	k	o penetro- o meter		tructure and anal observation	ns
AD		3					3	SW				rained, pale l	•		W	VL VL	35	300	AEOLIAN D Becoming le	UNE SAND ss clayey with d	epth _ - - -
TB		С		SPT 30 N*=R		- 2		SP	GRAVE	ELLY S/ weakly	AND: fine cemented.	to medium gr	ained, d	Jark .		D-VD	×		RESIDUAL S Coffee Rock PP=100kPa		
				SPT 2,2,4 N*=6		- - - 4 - - - - - - - - - - - - - - - -		CL	SANDY	CLAY	medium ;	olasticity, gree	en grey.			S-F		* .	PP≍300kPa		- - - - - - -
				U <sub>50</sub>				CL	CLAY:	mediu	ım plasticity,	pale blue gro	<b>≩y</b> .			L-MD			PP≕400kPa PP=500kPa Sand/Clay 50	/50	
meth AS AD RR W CT HA DT B V T *bit sl e.g.	hown b	aug rolli was cab har dial blau V b TC	ger dri er/trice shbore ble too nd aug tube nk bit it bit x	one e	Min Coopen 12 Hit wate	ina Nacial re	o resistano nging to fusal water le shown flow	ce	notes, s U <sub>so</sub> D N N N N P Bs E R	undisi undisi disturi standa SPT - SPT v vane a pressi bulk s	turbed sample turbed sample bed sample ard penetratio sample recov- with solid cone shear (kPa) uremeter ample somental sample	rered	er P		tiption unified d				Consistency VS F St VSt H Fb VL L L MD D VD	y/density index very soft soft firm stiff very stiff hard friable very loose loose medium dense dense very dense	

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	coff	ey eotechnics	Borehole No.	
		ering Log - Borehole	Sheet Project No:	2 of 3 GEOTNATH18367AC
<u>ا</u> ر	Client:	NORTHEAST BUSINESS PARK	Date started:	22.11.2006
<u> </u>	Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Date completed:	22.11.2006
	Project:	MARINA GEOTECHNICAL INVESTIGATION	Logged by:	KM

КM

Logged by:

Project:

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MARINA GEOTECHNICAL INVESTIGATION Borehole Location: AS PER MAP

	Во	rehol	e Lo	cati	on: AS	PER	MAI							(	Check	ed by	<i>r</i> :	K
	drill	mode	í and	mol	inting:	JACR	O 200	TRAC	K RIG	Easting:	500149	slope	: -9	0°			R.L	Surface:
		e diam				100 m	im			Northing	7000600	beari	ng;				dat	um:
	dr	illing	into	erma	tion		1	mat		ubstance	·							······································
	method	5 penetration	_	water	notes sampies tests, etc		depth metres	graphic log	classification symbol	colour,	mater e: plasticity or par , secondary and	rticle characte minor compo	nents.	moisture condition	consistency/ density index	100 × pocket 200 × pocket	а	structure and additional observations
	TB		C		SPT 2,3,5 N*=8 SPT 6,11,20 N*=31		- - 7 - - 8		CL	(continued)	dium plasticity, p				L-MD	X		PP=260kPa PP=500kPa PP=400kPa
					SPT 16 N*=R	-	- - 9 -			grained sand GRAVELLY ( white; coarse	CLAY: medium grained with son	plasticity, pal ne fine graine	e grey -		VL VL			
Issue 3 Rev.2	metho AS AD AR AD AR AD AR	bd	aug rolle was cab han diat	er dril r/tricc hbore e tool d aug	ne	pene 1 2	nud asing tration 3 4 rar rar ref		ce i	U <sub>so</sub> undix D distu N stand N* SPT Nc SPT V vane	s, tests sturbed sample 50a sturbed sample dard penetration tet - sample recovered with solid cone e shear (kPa) suremeter	mm diameter st (SPT)	soil des based o system moistur D di M m	ry noist				consistency/density index VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable
Form GEO 5.	/ _	own by	V bi TC I	: Dit			10/1/98 v on date : water infl water out	shown ow		Bs bulk:	sample ronmental sample		Wp pi	et lastic limit quid limit				VL very loose L loose MD medium dense D dense VD very dense

U		J		e	y	Seotech	nnoc	2						Bo	orehole No.	MBł	
E	ng			rin	g L	og - Cored Bor	ehole								eet oject No:	3 of GEO	3 TNATH18367
	ent:					THEAST BUSINESS								Da	ite started:	22.11	.2006
	ncip					THEAST BUSINESS				IRKE				Da	te completed:		.2006
	ject					INA GEOTECHNICAL	. INVEST	IGAT	ION						gged by:	KM	
						ER MAP	Easti	na:	500149	-			00		ecked by:	12-	
hole				-		Drilling fluid:	North	-	7000600		ope: earing:		-90	-	R.L. Si datum		
dri	llin	g in	nform	ation		erial substance				1		-	k m	ass	defects		
method	core-lift	water	RL	depth	graphic log core recovery	material rock type; grain characteristi structure, minor compo		weathering alteration	estimate strength	D-d e	iam- kraj C	2	defe spac mr	ілд	type, inclir	efect des ation, plar coating, thi	narity, roughness, ickness
					┝──								5 <del>-</del> 7	==	particular		gen
				-	1	Continued from non-cored	borehole										
		T				SANDSTONE: fine to medium yellow and grey, massive.	grained,	HW									·····
				_													
				10	· · · · ·	SANDSTONE: fine grained, grained, graining, massive.	ey with iron	1					Ţ				
				-	:			]							PT, 0°, PL, S		
			ļ	-		SANDSTONE: fine grained, da massive. SANDSTONE: fine to medium	<b>C I</b>	MW							→ PT, 0°, PL, S → PT, 0°, PL, S	D, CN	
						grey, massive.	granico,								PT, 0°, PL, S PT, 0°, PL, S PT, 0°, PL, S	D, CN	
				11_	· · · · · · · · · · · · · · · · · · ·										PT, 0°, PL, So PT, 0°, PL, So	D, CN D, CN	
				_		SANDSTONE: fine to medium grey, massive, with siltstone gra 4-40mm inclusions.									PT, 0°, PL, SO PT, 0°, PL, SO	), CN	
+	+	┥			::::	MBH1 terminated at 11.4m					_				PT, 0°, PL, S PT, 0°, PL, S VPT, 0°, PL, S	, CN	
				-											PT, 0°, PL, SC PT, 0°, PL, SC	, CN	
				_ _12_											PT, 0°, PL, SC PT, 0°, PL, SC PT, 0°, PL, SC	, CN	
															PT, 0°, UN, S PT, 0°, UN, S	D, CN D, CN	
				_											PT, 0°, UN, S PT, 0°, UN, S PT, 0°, UN, S	D, CN	
				_											\\PT, 0°, UN, S( \PT, 0°, UN, S(	), CN ), CN	
		ł		-											\PT, 0°, UN, S	J, CN	
				1 <u>3</u>													
				-													
				]	[												
				4													
				14							8						
				-													
				1													
	<u> </u>			- 15													
ietho T S	od		diatub augeo	e screwing		core-lift casing used		1/98 wate: date show		weath FR SW	ering fresh slightly		ather	'ne	defect type JT joint PT parting		roughness VR very rough
D R			auger roller/ti	drilling		barrel withdrawn	- on c			MW HW XW	mode: highly	ratel) weat	/ wea there	there d	d SM seam SZ shear	d zone	RO rough SO smooth SL stickensided
B MLC			claw o NMLC	r blade b core	oit y	graphic log/core recovery		ial drill flui nplete drill		DW	extrem distinc (cover	tly w	eathe	ered	) CS crushe	d surface d seam	
Q, H	IQ, P	Q	wirelin	e core		- core recovered				streng VL	ith very lo low	w			planarity PL planar CU curved		coating CN clean SN stained
						indicate material no core recovered	gul) S	eons) for		M H	mediu high				UN undula ST steppe IR irregul	d _	VN veneer CO coating
							inter	val show	۱	VH	very hi extrem		niah		in integu		

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00	<b>.</b> ff	~ *	Ş	5. 20. <b>-</b>		<u>st</u>	echnics					
CC		ЗY	50	٢	Jer	JIC	50111105		Bore	ehole	e No.	MBH2
Eng	ineer	ing l	Log	<u>  - E</u>	Sor	ehc	le		Shee Proje		No:	1 of 2 GEOTNATH18367AC
Client:		NO	RTH	EAS	твU	SIN	ESS PARK		Date	e sta	rted:	23.11.2006
Principa	ł:	NO	RTH	EAS	T BU	SIN	ESS PARK - LAING O'ROURKE		Date	e cor	nplet	ed: 23.11.2006
Project:		МА	RIN/	GE	OTE	CHN	ICAL INVESTIGATION		Logg	jed l	by:	LH
Borehol	e Locatio	on: AS	PER	MAF	>				Cheo	ckec	ł by:	K
	and mour	nting:		O 200	TRACI	< RIG	Easting: 500097 slope:	-90°				L. Surface: NOT MEASURED
hole diam drilling	informat	tion	100 m	Im	mat	erial s	Northing 7000469 bearing: ubstance	<u>_</u>			da	atum;
method t penetration	support water	notes samples, tests, etc		depth metres	graphic log	classification symbol	material		condition consistency/		A pocket b d penetro-	
- 123 LQV	C C	-	I KL	metres	3	SW	colour, secondary and minor componen SAND: fine to coarse grained, grey white.	πs. Ε Ν				MARINE SOIL
A												(quartzitic material) ~~
		N*=18				SC	CLAYEY SAND: coarse grained, dark grey.			-!!		RESIDUAL SOIL
				<u>-</u>		СН	CLAY: high plasticity, yellow, some fine grain sand.	ied	St-Vi	st		coffee rock -
	M	SPT 6,7,7		3		SC .	CLAYEY SAND: medium to coarse grained, brown.		/ MD			
		N*=14				сн	CLAY: high plasticity, grey and yellow, trace or grained sand, some quartzitic sub angular grav to 4mm in length SANDY CLAY: high plasticity, yellow and gree	vel up	F			
		SPT		4		SC	CLAYEY SAND: fine to medium grained, yello and grey, some argillaceous rounded and suba gravel up to 12mm in length.		D-VC			-
		8,16,26 N*=42		5		CH	CLAY: high plasticity, grey, some sand.		VSt			small decaying rootiets
				9) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1)		СН	SANDY CLAY: high plasticity, grey and yellow grained sand.	v, fine				
method AS AD RR M CT HA DT A J J T bit shown by 호명	auger scre auger drilli roller/tricor washbore cable tool hand auge diatube blank bit V bit TC bit suffix ADT	ing* ne	vate	nud asing tration 3 4 no ran	water lev shown ow	æ	Use     undisturbed sample 50mm diameter       Use     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	classification s soil descriptio based on unifie system moisture D dry M moist W wet Wp plastic lin W <sub>L</sub> liquid lim	n d classifica			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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		С	C	off	e	¢ ک	geote	chnic	3				Bo	orehole	No.	MBH	2	
i n							og - Cored E							neet oject N	lo:	∮ of GEO1	2 NATH18367	AC
الاست		Clie	nt:				THEAST BUSINE						Da	ate sta	rted:	23.11	2006	
		Prir	cipal	:			THEAST BUSINE				IRKE		Da	ate con	npleted:	23.11.	2006	
			ect:				NNA GEOTECHNI	CAL INVES	TIGAT	ION			Lo	gged b	by:	LH		
<i>(</i> ' ' ' '							PER MAP						Cł	necked	by:	JC	•	
į		1	nodel diame		_		200 TRACK RIG		•	500097 7000469	slope:		-90°		R.L. Su	inface:	NOT MEASURED	
					nation	-	terial substance	NO	hing:	000489	bearin	-	ck mass	defec	datum: ts			
		method	core-litt water		depth	graphic log core recovery	materii rock type; grain chara structure, minor c	cteristics, colour,	weathering alteration	estimate strength		% Q	defect spacing mm		type, inclina	efect desc ation, plana coating, thic	arity, roughness,	
$\cap$		β	ō s	RL	metres	gra	Continued from non-	cored borehole	alte	ליצי≩		RQD	3000 300 30	partici	ular		gen	eral
	GEOTINATH18367AC.GPJ COFFEY.GDT 9.1.07						SANDSTONE: fine grain grey, massive. SANDY CLAY: high play yellow, fine grained sand. SAND: coarse grained sand. brown, material is quartzit in origin. SANDSTONE: fine grain massive. SAND: coarse grained, white, trace high plasticity SANDSTONE: coarse grained, white, trace high plasticity SANDSTONE: coarse grained, brown and yellow, massive SANDSTONE: fine grain grey. MBH2 terminated at 11.5n	sticity, grey and red-white and c and argillaceous ed, yellow grey, prown red and clay. ained, grey s, ed, pale red and							0°, PL, SC 0°, PC 0°, PL, SC 0°, PL, SC 0°, PL, SC			
	CORED BOREHOLE				- 1 <u>2</u> -	ļ								¦\PT,	0°, UN, SC 0°, UN, SO 0°, PL, SO	CN CN		-
	ľ				-													
	GEO 5.5 Issue 3 Rev. 3	metho DT AS AD RR CB NMLC NQ, H		auger roller/ claw c NMLC	screwing drilling tricone or blade b	9    it	core-lift casing used barrel withdrawn graphic log/core recovery core recovered - graphic symbols indicate material	→ on → wz → pa → co	-	n d loss fluid ïoss e test result	MW mo HW hig XW ext DW dist (co strength VL ver L low M me	sh ghtly w derate hly we iremely tinctly vers h	eathered ely weathered athered y weathered weathered dW and HW	əd ! /)	CS crushe planarity PL planar CU curveđ UN undulat	d zone d surface d seam ting	roughness VR very rough RO rough SO smooth SL slickensided coating CN clean SN stained VN veneer	
	Form GEO 5.5 I						- graphic symbols	u) 52	ter pressur geons) for a erval showr	depth	VL ver L low M me H higi VH ver	i dium			PL planar CU curved	ting d	CN di SN st	ean ained eneer

	C	of	f	ey	S	ે <b>ડ્</b>	je	ote	ech	nics			•	Boreh	ole i	No.	MBH	13	
A	Eng	gin	eel	ring l	_00	1 - E	Sor	ehc	le					Sheet Projec		ŀ.	1 of GEO	3 FNATH183	6740
!	Client								ESS P	ARK				Date s			23.11		
$\square$	Princi										IG O'ROURI	KE		Date o	omp	pleted:		.2006	
( )	Projec			MA: on: AS				CHN	ICAL	INVESTIGA	ATION			Logge	-		LH		
	drill mo					0 200		K RIG	Easti	ing: 500127	slope	e: -90'		Check	ed b				ED
i_}	hole dia				100 m	ារព			North							datur			
Π	drillir		orma	notes		1			ubstan	ce		<u> </u>	1	~ ×	1.	6		<u> </u>	
	method 1	support	water	samples, tests, etc		depth metres	graphic log	classification symbol	so	oil type: plasticity	material or particle character and minor compo	eristics, nents.	moisture condition	consistency/ density index	k	300 b penetro-		ructure and nal observatio	15
	ADT	C		SPT 9,7,3 №*=10				sw	of high 3mm, t	plasticity clay, tra trace of argillaced	n grained, grey bro ace of quartzitic gr pous gravel up to 5n se grained, dark br	avel up to nm in size.	M	D		s		organic odour, plant matter (pi	- - - - - ossíbly_ -
( ( ())) ( ()) ( ()) (	1	M		SPT 2,3,4 N*=7				СН	CLAY: grained		yellaw grey, some i	fine	W	St	* * * *	P	P≕100kPa P=120kPa P=150kPa P=180kPa	DIL	
GEOTNATH18387AC.GPJ_COFFEY.GDT				U <sub>50</sub>						ontent increasing					×	P	P=145kPa		
2 BOREHOLE	method AS AD RR	aug rolli	jer dril er/trico	ne	репе	nud asing etration	z	CH	notes, s ປ <sub>ອ</sub> ປຸ <sub>ຄ</sub>	undisturbed sample	ple 50mm diameter ple 63mm diameter	classifica soli desc based on system	ription				VS S F	rdensity index very soft soft firm	-
Form GEO 5.3 Issue 3 Rev	W CT HA DT B V T *bit shown e.g.	cab har diat blar V b TC	bit ×		wate	an rar Soos ≠ ref	shown low		N NC V PBS ER	standard penetra SPT - sample rec SPT with solid con vane shear (kPa) pressuremeter bulk sample environmental sa refusal	overed ne		ist				St VSt H Fb VL L MD D VD	stiff very stiff hard friable very loose loose medium dense dense very dense	

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	CC	off	ev	S	ິ (	je	ote	echni	cs			-	Boreh	ole No		MBH:	2	
			ring l										Sheet			2 of 3	•	0674.0
	Client:							SS PAR	к				Projec Date s			23.11.2	NATH18: 2006	867 <u>AC</u>
	Principa	l:	NO	RTH	EAS	твι	JSINE	ESS PAR	K - LAING O	ROURK	E		Date c			23.11.2		
	Project:		МА	RIN	4 GE	ΟΤΕ	CHN	ICAL INV	ESTIGATIO	N			Logge	•		LH		
f	Borehole	e Locati	ion: AS	PER	R MAI	Р							Check	-	,	<		
	drill model	and mo	unting:	JACR	O 200	TRAC	K RIG	Easting:	500127	slope:	-90°			F	L. Sur		NOT MEASU	RED
	hole diam		ation	100 n	1171	Imai	erial e	Northing ubstance	7000289	bearin	ig:			d	atum:			
Π			notes					ubstance		·				± د				
U	thod penetration	티니	samples, tests, etc			graphic log	ification of the second s		materia	ıl		tion	stency ty ind	pocket penetro			ucture and al observatio	ns
	beither method 123	support water		RL	depth metres	grapi	classification symbol		e: plasticity or parti , secondary and m			moisture condition	consistency/ density index	kPa 章ରୁଚ୍ଚ				
	H I	м	SPT	1			GC		NDY GRAVEL: f		white	М	MD		grav	vel ranging	in size from : itic and argilla	2mm to
-			4,5,12 N*=17				GP CH	GRAVEL:	fine grained, brow y, some fine graine	n, some high	·		VSt-H		origi	in all well ro SIDUAL SC	ounded.	
					_			argillaceous	h plasticity, grey ye gravel up to 5mm,	some coars	e grained							-
					-			sand. Seco depth.	ndary elements inc	rease in size	e with							
					Z													
					-													
$\cap$				1	-													_
			SPT 20,30/35mm	h	-		SP	SAND: COR	arse grained, brow	n red, some o	quartzitic							
* f			N*=R		8		GP CH		grained, white.									-
									n plasticity, grey.									
U				1	_													1
$\cap$					_								н					]
					-		СН	CLAY: high	plasticity, yellow a	and arev			VSt					_
			SPT		<u>9</u>		0.1	vent. ng	r plaatoky, yekow z	ina gray.			VOL					
			30/70mm N*=R				-	Borehole MB	H3 continued as c	ored hole				┥┥┦				
$\Box$					ľ													_
$\cap$	9,1.07				-													-
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<i>[</i> ]	BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT																	
	Ö				4													
	0 0 0				4													4
	8367A				4													_
J	VATH1				11													
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<u> </u>	OREH				1													-[
	£				12													-
$\cup$	method AS	auger so		Mi		N	nit		isturbed sample 50m		classificati soil descri	iption			co VS		ensity index very soft	
	AD RR	auger dr roller/tric	one	pen	asing etration		Ī	U <sub>es</sub> und D dista	isturbed sample 63m urbed sample	m diameter	based on u system		assificatio	n	S F		soft firm	
L I	₩ ₩ CT 9. HA	washbor cable too hand au	ы			resistan Iging to Iusal	CÊ.	N* SPT	idard penetration test - sample recovered	(SPT)	moisture				St VS	t	stiff very stiff	ĺ
$\Box$	S DT	diatube blank bit		wate			avel	V van	with solid cone ∋ shear (kPa) suremeter		D dry M mois W wat	st			H Fb VL		hard friable	
- i / •	ы V T	V bit TC bit		<u> </u>	on date .	shown	vei	Bs bulk E envi	sample ronmental sample	ĺ	Wp plasi	tic limit d limit					very loose loose medium dense	
	e.g.	suffix ADT			water inf water ou			R refu									dense verv dense	

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					geotec					Shee	hole No. et ect No:	MBH 3 of GEOT	
P	lient: rincipal roject:	:	^	IOR	THEAST BUSINESS THEAST BUSINESS INA GEOTECHNICA	PARK - LA		URKE		Date	started: completed: ed by:	23.11	.2006
dr	ili model	& mou	ting: JA	CRO 2	ON TRACK RIG	Easting		slope	: -90		ked by: R.L. Su	Irface;	NOT MEASURED
	le diame Irilling i			_	Drilling fluid: erial substance	Northin	g: 7000289	beari	ig: rock m	ass de	datum: efects		
method	core-lift water	RL	depth metres	graphic log core recovery	material rock type; grain characteris structure, minor comp Continued from non-comp	tics, colour, onents	estima streng affectation affectation affectation affectation	ted Is <sub>(50)</sub> th MPa D-diam- etrai 포표 A-axial	defi spac % mi O Ø g g g g g g	ring 71	type, inclin c	efect desc ation, plan coating, thi	arity, roughness, ckness
			110     11 		Continued from non-corec CORE LOSS SANDSTONE: fine to medium grey-brown and red, massive. grey SANDSTONE: fine to medium grey, massive. undulating layers of 1-4mm o SANDSTONE: fine grained, g massive.	n grained, n grained, Hi of coal			₩ 100 100 100 100 100 100 100 10		-PT, 0°, PL, SC -PT, 0°, PL, SC -PT, 0°, PL, SC -PT, 0°, PL, SC PT, 0°, UN, SC	0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0	gener
DT AS AD RR CB Sme 3 Kev. 3 CB NM	Lthod	auger roller/i claw c NMLC	screwing drilling ricone r blade bi		ADDESS OF CORE MBH3 terminated at 13.1m MBH3 terminated at 13.1m terminated at 13.1m casing used barrel withdrawn graphic log/core recovery core recovered - graphic symbols indicate material no core recovered	vater i vater i vater i vater i vater f	B water level inflow drill fluid loss ete drill fluid loss pressure test resu ns) for depth i shown	MW mc HW hig XW exis DW dis (cc strength VL vei L low H hig VH vei	g sh hily weather remely weath tinctly weather tinctly weather vers MW and y low 7 dium	ed thered d bered reed	defect type JT joint PT parting SX sheare	d zone d surface d surface d seam	roughness VR very rough RO rough SO smooth SL slickensided coating CN clean SN stained VN veneer CO coating

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									-	ole No.	MBH4
Eng	ine	ering	Log	- B	sore	eho	le		Sheet Projec		1 of 3 GEOTNATH18367A
Client:		NC	RTH	EAST	T BU	SIN	SS PARK		Date s	tarted:	27.11.2006
Principa	l:						SS PARK - LAING O'ROURKE		Date c	omplete	ed: 27.11.2006
Project:						CHN	CAL INVESTIGATION		Logge	d by:	LH
	_	ation: AS				(			Check		KL
drifl mode hole diam		ounting:	100 m	O 200	TRACI	K RIG	Easting: 500255 slope: - Northing 7000235 bearing:	90°			L. Surface: NOT MEASURED tum:
drilling	infor	nation			mate	erial s	ubstance			·	
method 55 penetration	support	notes samples tests, et		depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture	consistency/ density index	100 X pocket 200 X pocket 300 & penetro- 400 meter	
ADT	N			- - 1 1		SP	SAND: medium to coarse grained, grey brown, some quartzitic gravel up to 3mm in size.	W	D		MARINE SOIL small tree rootlets up to 5mm in diameter rotten egg odour
		SPT 12,9,6 N*=15		- - 2 - -		SP CH SP	SAND: medium plasticity, black, some black clay. CLAY: high plasticity, green and grey, some coarse grained sand. SAND: grey.	M	MD F D		possible tree roots
		SPT 2,6,16 N*≓22		3		СН	SANDY CLAY: high plasticity, grey, medium to coarse grained sand, trace of quartzitic gravel up to 3mm.	M	St	*	RESIDUAL SOIL PP=200kPa
	w	SPT 00,13,21 N*=34		4		СН	some dark red angular arenitic gravel of up to 5mr in size. angular arenitic gravel up to 10mm; subrounded quartzific gravel up to 4mm. SANDY CLAY: high plasticity, grey and red, fine to medium grained sand.	n	VSt-H		PP=500kPa Residual soil
nethod S.D.B.R	auger roller/	screwing* drilling* tricone	pen	nud æsing etration	N	nil	notes, samples, tests U <sub>so</sub> undisturbed sample 50mm diameter D disturbed sample 63mm diameter D disturbed sample	escription	ymbols an classificat		consistency/density index VS very soft S soft F firm
V ST (A )T I , bit shown by .g,	washi cable hand diatub blank V bit TC bit y suffix ADT	tool auger e bit	1 2 wate	3 4 ro rar ref	water ie shown low		N     standard penetration test (SPT)       N*     SPT - sample recovered     moist       Nc     SPT with solid cone     D       V     vane shear (kPa)     M       P     pressuremeter     W       Bs     bulk sample     Wp       E     environmental sample     WL       R     refusal	ure dry moist wet plastic lim liquid limit			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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					ng l																Shee Proje		lai			of		14020	780
	ent:										ESS F	PAR	к								Date			l:			TNATH .2006	1030	740
Pri	ncipa	al:			NO	RTİ	HE	AS	T BU	SIN	ESS P	PAR	K-L	AING	3 O'f	ROUF	RKE				Date	cor	npl	etec	d: 2	7.11	.2006		
Pro	oject:	:			MA	RIN	IA	GE	OTE	CHN	ICAL	INV	'ESTI	IGA1	TON					l	Logg	ed	by:		L	Н			
					AS																Cheo	kec	l by	:	K				
	mode e diam			untin	g:	JAC 100			TRAC	( RIG	Eas <sup>.</sup> Nort	•	500:	255 0235			pe: aring:		90°						. Surfac	:e:	NOT ME	ASURE	D
dri	illing	inf	orm	atio	n				mat	erial s	ubsta		,				aring.				_	_		datu					·
method	Denetration		water	sa	notes imples, sts, etc			depth netres	graphic log	classification symbol	5	soil typ	e: plast	tícitv or	terial particle	e chara	cterist	tics, its.		moisture condition	consistency/		200 × pocket	a j	a		tructure a nal obser		l
ADT				14,30	SPT ,14,30 *=44 SPT //105m //105m			- - - - - - - - - - - - - - - - - - -		СН	SANE medi	YY CLJ	NY: hi ined sa	igh plas	sticity, ç	rey and 力				M	VSt-				materi Grey n	al. nateria	rk red and il softer th iterial diffe	an red.	
the	od	au rol cal ha dia bla V t TC	Ыt	illing* xone re xi ger		M C pei	1 ppoor mu cas netrn 2 3 1 tter 10 on	ing ation 4 no ran case refi	vater lev hown	e	notes, Uss DN*C PSs ER	und dista star SPT SPT van pres bulk	s, tests isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed ist	sample sample metration le recove lid cone (kPa) ter	63mm ( n test (S ered	liameter		Мл Wv Wpp	script on uni	lion fied cla					consi VS S F St VL L MD D	stency;	fdensity ind very soft firm soft siff very stiff hard friable very loos loose medium dense	e	

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	С	<b>:С</b>	)ff	e	V	Seotechr	nics	\$				Bo	prehole No.	MBH4	
[]						og - Cored Borel							neet oiect No:	3 of 3	ATH18367AC
<u> </u>	Clie					THEAST BUSINESS PA	_			<u> </u>		_	te started:	27.11.20	
$\cap$	Prir	ncipa	l:	i	NOR	THEAST BUSINESS PA	RK - L	.AING	O'ROU	RKE		Da	ite completed:	27.11.20	006
<u>[_</u> ]	Pro	ject:		l	MAR	NNA GEOTECHNICAL IN	IVEST	<b>IGAT</b>	ION			Lo	gged by:	LH	
·}	Bor	ehole	e Loca	tion: 🖌	4S F	PER MAP						Cł	ecked by:	K-	
				-		200 TRACK RIG	Eastir	•	500255	slope:		-90°	R.L. SL	rface; NC	DT MEASURED
$\sim$		diame Illing		nation		Drilling fluid: terial substance	North	ing:	7000235	bearin	ř –	k mass	datum: defects		
					og Very	material	-	Ē.	estimated	!s <sub>(50)</sub>		defect	d	efect descrip	tion
·_/	method	core-lift water		depth	graphic log core recovery	rock type; grain characteristics, o structure, minor component		weathering alteration	strength	MPá D-diam- etral	8	mm	type, inclin	ation, planarity cating, thickn	y, roughness, ess
$\bigcap$	e.	va Va	RL	metres	er o O		hole		ສ⊔≊≖ <u>≯</u>	A	a B B B B B B B B B B B B B B B B B B B	<u>5858</u>	particular		geлeral
<u>(_)</u>				_		SANDSTONE: fine grained, grey, massive. SANDSTONE: fine to medium gra		HW HW							-
Â				-		brown, massive, clay layer from 9.4	6-9.52.								-
[]						SANDSTONE: fine grained, grey a yellow, massive.	and								_
$\cap$				10	:::: ::::	SANDSTONE: coarse grained, da	rk	-							-
$\Box$						brown, massive.									_
$\circ$				-	:::: :::::	CONGLOMERATE SANDSTONE &							11xPT, 0°, UN 11xPT, 0°, UN		_
			ļ	-		SILTSTONE GRAVEL: brown, gre red, massive.	•						11xPT, 0°, UN	, RO, CN PT, 0°, UN, RI	0, CN -
				- 11	<u></u>	SANDSTONE: fine grained, dark g massive. SANDSTONE: fine to medium gra	/						PT, 0°, PL, SC		-
$\left[ \right]$				'-		brown and grey, massive. Coal layer of 20mm	nea,								-
()													PT, 0°, PL, SC PT, 0°, PL, SC PT, 0°, PL, SC	). CN	-
$\cap$				_									11,0,12,00	, 014	_
					::::	MBH4 terminated at 11.8m	· · ·							, CN	
$\cap$				12											
U B				-											-
) ( 7 9.1.07															-
EY.GDT				_											
COFFEY				1 <u>3</u>											_
C GPJ				-											-
B367AC				-			ĺ								ŀ
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GEOTA				14				Í							
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BOREHOL				-											-
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CORI				15											-
$\smile$	metho DT	bd	diatut	e	,	core-lift	water	/98 water	level	weathering FR fres	h		đefect type JT joint		roughness VR very rough
Rev. 3	AS AD		auger	screwing drilling		barrel withdrawn		ate show		SW sligt MW mod	ntly wea	weathere	PT parting		RO rough SO smooth
~~ e	RR CB NMLC	:		ricone F blade b Core	it	graphic log/core recovery	- partia	er inflow al driil fluid plete driil f		XW extr DW disti	emely wa	veathered eathered V and HW	SS sheare CS crushed	d surface	SL slickensided
5.5 Issue	NQ, H			iê core		core recovered	- cout	piete ûnit i	(ulu (USS	(cov strength VL very		v ai 10, MVV,	planarity PL planar	1	coating CN clean
						indicate material	- 6	r pressure cons) for d	e test result lepth	L low M med H high	lium		CU curved UN undulat ST stepped	ing y	SN stained VN veneer CO cpating
E E								val shown		VH very	high emely h	igh	IR irregula	r	
U															

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			ring I										Sheet Projec			1 of GEO	3 0TNATH1830	674(
Clien	t:		NO	RTH	EAS	Τ Βί	JSIN	ESS PA	RK	·			Date s			-	1.2006	07740
Princ	ipal:		NO	RTH	EAS	твι	JSINI	ESS PA	RK - LAING	O'ROURI	<b>KE</b>		Date o	omp	leted:	27.1	1.2006	
Proje	ct;		MA	RIN/	4 GE	ΟΤΕ	CHN	IICAL II	VESTIGATI	ION			Logge	•		LH		
Borel	iole L	ocatio	on: AS	PER	R MAI	Þ							Check	-		12-		
drill me	odel an	đ mou	nting:	JACR	0 200	TRAC	K RIG	Easting	: 500406	slope	: -90°	-			·	Surface:		
hole di	_			100 n	າກາ			Northin	ř – – – – – – – – – – – – – – – – – – –	beari	ng:				datun	1:		
	ng ini S	orma			1	mat	1	substance	<u>}</u>		· · · · · ·							
<b>.</b>	penetration		notes samples,			s log	classification symbol		mat	erial		θE	consistency/ density index	pocket	leter		structure and onal observation	_
e i	15	water	tests, etc		depth	graphic log	lassifi	soit	type: plasticity or p			moisture condition	onsist ensity	kF	'a		onal observation:	5
E 1 Q	23			RL	metres	  }11	SC	1	our, secondary and L: CLAY: high pla	•	nents.	EX	С F	88	_	OPSOIL		
A				[	-		sc		CLAY: medium to		d, brown.		'			ARINE SC		
																		-
					1													-
							SP	clay, son	coarse grained, gr te subrounded qua	rey, some high j artzitic gravel up	plasticity to 3mm in		MD					_
					-			size.										-
			SPT 2,2,5		-	• • •						Ŵ			s	ample has	organic odour	-
			N*=7	4	2	111	СН	CLAY:	high plasticity, brow	wn and yellow.			F	111				•
					-													-
						÷.,/	SC	medium p	SAND: medium: plasticity clay.	to coarse graine	ed, grey,		F/MD		0	rganic odo	lur	-
					_			high pla	sticity.									_
<u>p</u>	м	-	SPT		3	·//					ĺ							_
			3,3,4 N*=7			1///	СН	CLAY: Coarse gr	high plasticity, brow ained sand.	wn and yellow, t	race of					LLUVIAL S	SOIL	
					-			grey, y	ellow and brown, size, argillaceous gr	ome quartzitic ç	gravel of							-
					4			coarse sa										-
					ļ			grey an	d yellow.		-	ŀ	St-VSt		XX			
		╿┝			-										<u>ا</u> ا			-
			U <sub>50</sub>								[	-	н			o hard to j	push U50 to depti-	- י _
					5		CL	<pre>&gt;&gt;500</pre>	grey clay material		_{ ل	м				>>500kPa		
	ana							dark red, i	LAY: low to med coarse grained sar form of well grade	nd, some dark n	ed arenitic				Ь	tremely wa	eathered	_
					ł		i	from 2 to	4mm.	sa gravei langin	ig ni size					NDSBOR	OUGH SANDSTC	- NE -
					6													-
		2.10	SPT 5,30/120m	m	Ţ		ĊL	CLAY:	medium plasticity,	grey and yellow						OFFEE RC	юск	
		-	N*=R		-								[					_
					ľ													-
		ĺ			7													1
					-										110	n staining		-
		-	SPT		ľ		СН	CLAY: h	igh plasticity, grey	and red, some	medium							1
			11,12,13 N*=25					to coarse (	grained sand,									_
nethod	<u>a – 1</u>		u de ut	sup		<u>/////</u>			ples, tests		classificat		bols and	 			y/density index	
AS AD RR	au	ger sore ger drill ler/trico:	ng*		asing	N	nii	Uea	undisturbed sample 5 undisturbed sample 6		soil descri based on u		assificatio	on	1	VS S	very soft soft	
N N CT	wa	shbore shbore ple tool	~	pene 1 2	- no	resistan	ce	N s	disturbed sample standard penetration t SPT - sample recover		system					F St	រើវាញ stiff	
HA DT	ha	nd auge tube	er i	wate	éòcas ⊄ refi	iging to usal		No :	SPT - sample recover SPT with solid cone vane shear (kPa)	eu .	moisture D dry M mois	r4				VSt H ⊆⊨	very stiff hard frighte	
B		nk bit		•	10/1/98 v on date s		vel	P F	oressuremeter bulk sample		W wet	si tic limit				Fb VL L	friable very loose loose	
T T	TC by suff	bit x		<b>&gt;</b>	water infl	ow		E e	environmental sample refusal	÷		d limit				L MD D	loose medium dense dense	ļ
		т		-4	water out	tflow	- 1									VD	very dense	- 1

	coff	ey by geotechnics	Borehole No.	MBH5
Î	Enginee	ering Log - Borehole	Sheet Project No:	2 of 3 GEOTNATH18367AC
11	Client:	NORTHEAST BUSINESS PARK	Date started:	27.11.2006
7	Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Date completed:	27.11.2006
3	Project:	MARINA GEOTECHNICAL INVESTIGATION	Logged by:	LH

Logged by:

LH

Project:

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Borehole Location: AS		Produce PAAda	Checked by:
-	JACRO 200 TRACK RIG	Easting: 500406 slope: -90°	R.L. Surface:
tole diameter: drilling information	100 mm material s	Northing 700015 bearing:	datum:
notes samples, tests, etc 1 2 3 18	b log cation	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition the structure and additional observations additional observations sss sss sss sss sss sss sss sss sss
C 123 0 5 C 123 0 5 C 123 0 5 SPT 6,11,15 N*=26 SPT 30/100mm N*=R		<ul> <li>CLAY: high plasticity, grey and red, some medium to coarse grained sand. (continued)</li> <li>Red material has some medium grained sand.</li> <li>Grey material high plasticity clay.</li> </ul> SANDY CLAY: high plasticity, grey and red, some medium grained sand; trace dark red arenitic angular gravel up to 3mm. SANDY CLAY: medium to high plasticity, yellow, fine grained sand.	M H X PP=400kPa PP=460kPa PP=460kPa PP=460kPa PP=400kPa PP=400kPa PP=500kPa ×PP=500kPa Kock fabric visible
ethod S auger screwing* D auger drilling* R rollen/tricone r washbore T cable tool A hand auger	I I I I I I I I I I I I I I I I I I I	U <sub>so</sub> undisturbed sample 50mm diameter soil descr	ton symbols and iption unified classification S soft F firm St stiff H hard

ļ	C			[e]	y	Seotech	mes	5					-	Bo	rehole No.	MBH	5	
						og - Cored Bor								-	eet oject No:	3 of GEO1	3 "NATH18:	R674(
	Clie					THEAST BUSINESS F						_			te started;	27.11		<u>, , , , , , , , , , , , , , , , , , , </u>
F	Prin	cipa	ł:		NOR	THEAST BUSINESS P	PARK - L	.AING	O'ROU	RKE				Da	te completed:	27.11.	2006	
F	Proje	ect:			MAR	NNA GEOTECHNICAL	INVEST	<b>IGAT</b>	ION				1	Log	gged by:	LH		
E	Bore	hole	e Loc	ation:	AS F	PERMAP								Ch	ecked by:	احب	-	
				-		200 TRACK RIG	East	•	500406	slop	<b>;</b>	-	90°		R.L. S	urface:		
	ole d drill			nation		Drilling fluid: terial substance	Norti	oing:	700015	bear		ock	ma	55	datum defects			<u> </u>
					D Zev	material		5	estimated	Is(50)	T		lefec			lefect desc	ription	
	method	i ja		donth	graphic log core recoverv	rock type; grain characteristic structure, minor compor		weathering alteration	strength	MPá D-diam	.   %	1	pacin mm		type, incli	nation, plana coating, thic	arity, roughnes kness	s,
	ê l	water	RL	depth metres					우기호파웃	etral E A- axial	RQD	8	100 100 100	3000	particular			general
				-	1	SANDSTONE: fine to medium brown to red and grey, massive.	grained,	HW			Г				PT, 0°, PL, S			_
				-											━ PT, 0°, PL, 8 ■ PT, 0°, PL, 8			-
				13		SANDSTONE: fine to medium	grained,	sw							PT, 0°, PL, S	O, CN, 1mr	n	-
				· -		grey, massive.									PT, 0°, PL, S	O, CN, 1mr	n	
		ĺ		-											<sup>1</sup> PT, 0°, PL, S	U, UN, 1mr	n	-
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				1 <u>5</u>														-
						MBH5 terminated at 15.2m								┼┼				
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-				20														-
)	ethoo T	1	diate			core-lift	water • 10/	1/98 water	level		esh		<u></u>	,	defect type JT joint		roughness VR very rou	uah
l	S D R		aug	er screwin er drilling t/tricone	g	casing used	- <del>L</del> on	date show er inflow		MW m	ightly odera ghly w	tely v	veath		PT partin SM seam		RO rough SO smooth SL slickens	-
2	K B MLC		claw	or blade i C core	bit .	graphic log/core recovery	par	tial drill fiui 1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.		XW ex DW đi	dreme stinctl overs	ely we y wea	athere	≩d	SS shear CS crush	ed surface ed seam		
	Q, HC	I, PQ		ine core				gere te tanif		strength VL ve	ry low			,	pianarity PL plana		coating CN clean	
						indicate material		er pressur eons) for (	e test result lepth	L lo M m					CU curve UN undul ST stepp	ating ed	SN stained VN veneer CO coating	
								rval showr		VH ve	ry hig	h ly hig			IR irregu		73	

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$\left( \right)$					ring l										Sheet			1 of	3	
	-	Client								ESS PAR	2K				Projec Date s				<u>TNATH183</u> .2006	67AC
$\sim$		Princi	oal:								 K - LAING	O'ROURH	Œ		Date c					
5		Projec	:t:		МА	RINA	۹ GE	OTE	СНМ	ICAL IN	/ESTIGATI	ON			Logge	•		LH		
<u>ر</u> ے	_	Boreh	ole L	.ocati	on: AS	PER	R MA	Ρ						1	Check	ed b	y:		<b>12</b>	
	- 1	drill mo			unting:		ON 300	0		Easting:	500625	slope					Ř.L. (	Surface:		
$\sim$	ŀ	hole dia <b>drillir</b>			ation	100 m	m	mate	erial s	Northing substance	7000050	bearin	ng:				datur	n:		
		e l	handiation	water	notes samples, tests, etc		depth	graphic log	classification symbol	soil ty	mate	article characte		moisture condition	consistency/ density index	kī	b penetro- meter		tructure and inal observation	15
J	ŀ	LDA		N S			metres		CL	TOPSOIL:	ir, secondary and SANDY CLAY:	•		E 8 M	ខី <del>ទី</del> F	₽ŝ	9 9 9	TOPSOIL		
		A					- - - 1		СН	grained sai	gh plasticity, grey							ALLUVIAL S	OIL	
	ŀ	8		-			-			grov rod	and orange.			w	St		3	30mm reco	very	
6.2					U <sub>50</sub>		-			grey, rec	and orange.				31					_
							2			red							F	'P=140kPa		
$\int$							- - 3_									-		50mm recov		-
					U <sub>so</sub>		-								VSt			Johim leco	/ery	-
	T 9.1.07												-			>	< P	<b>P=</b> 295kPa		-
Π	COFFEY.GDT						4			grey				ļ						_
	GP									grey, yello	w and red									-
	118367/				U <sub>50</sub>		5						[				×			-
	LE GEOTNATH18367AC						-		СН	CLAY: hig Ch=VSt-H R	h plasticity, grey a ed CH=VStj	and red. [grey				į	G	P>>500kPa rey materiał ed material i	is very stiff to ha s very stiff.	ard
$\left[ \right]$	BOREHOLE									Red ciay d	ecreases with de	≄pth						ESIDUAL S	DIL	
	3 Rev.2 O ≤ 2 > > = =	D R	au ro wa	uger so uger dri iller/trice ashbore able too	one e	pene	nud asing atration 3 4 no	N i		U <sub>sa</sub> un D dis N sta	es, tests disturbed sample 5 disturbed sample 6 turbed sample ndard penetration t T - sample recover	3mm diameter test (SPT)	classificat soll descr based on system moisture	iption				?>>500kPa	/density index very soft soft firm stiff	
$\left[ \right]$	m GEO 5.3 Issue ルムヘヨロド	A T it shown	ha dia bla V T( by suf	and aug atube ank bit bit C bit fix			10/1/98 on date water inf	low	/el	NC SP V var P pre Bs bul	T with solid cone ne shear (kPa) issuremeter k sample vironmenta) sample usal		D dry M moi W wet Wp plas					VSI H Fb VL L MD D	very stiff hard friable very loose loose medium dense dense	
	Ē e.	g.	AI	דנ		<u> </u>	water ou	tflow			<u> </u>	<u> </u>							very dense	]

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coff	⊂y∖	~ č	<i>.</i>			00				Boreho	ole N	lo.	MBH6
Engineer										Sheet Projec			2 of 3 GEOTNATH18367AC
Client:	NORT	HEAS	T BU	SINE	SS PARI	ĸ				Date s	tarte	d:	20.11.2006
Principal:	NORT	HEAS	T BU	SINE	SS PARI	K - LAING	O'ROURKE		l	Date c	ompl	leted	: <b>20.11.2006</b>
Project:	MARI	VA GE	OTE	CHNI	CAL INV	ESTIGATI	ON			Logged	d by:		LH
Borehole Locatio	on: AS PE	R MAI	P						í	Check	ed by	y:	1<~
drill model and mou	nting: ED	SON 300	D		Easting:	500625	slope:	-90"	<u> </u>			R.L.	Surface:
hole diameter: drilling informa		) mm	T		Northing	7000050	bearing:					datu	m:
method method support support water	notes samples, tests, etc	depth	raphic log	classification symbol			erial narlicle characteristic d minor components		moisture condition	consistency/ density index	100 pocket	'a	structure and additional observations
BE N	U <sub>50</sub>	-		CL		dium plasticity, e of medium gra	grey to brown and re ined sand.	∍d to	W	Н			230mm Recovery U50 pushed approximately 200mm_ as material too hard.

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BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

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AD RR W

CT HA DT

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e.g.

ADT

water inflow

water outflow

GEO 5.3 Issue 3 Rev.2

Form

В

...some coarse grained sand SPT PP>>500kPa 30/130mm N\*=R 8 SANDY CLAY: medium plasticity, grey, fine and coarse grained sand; some flat angular gravel of up to CL 9 4mm in length. SPT 30/100mm N\*=R PP>>500kPa CLAYEY SAND: coarse grained, grey, medium plasticity clay. Sand content increases with depth. SC Extremely weathered SANDSTONE 1<u>0</u> SC CLAYEY SAND: coarse grained, grey. Borehole MBH6 continued as cored hole 11 method support notes, samples, tests classification symbols and consistency/density index auger screwing\* M mud undisturbed sample 50mm diameter undisturbed sample 63mm diameter N nil Uso soil description vs auger dritting\* roller/tricone C casing Ues based on unified classification S F penetration D disturbed sample system penetration 1 2 3 4 ranging to ranging to washbore standard penetration test (SPT) SPT - sample recovered SPT with solid cone Ν St cable tool N\* moisture D dry VSt hand auger Nc dry н diatube V P water vane shear (kPa) M W moist Fb biank bit 10/1/98 water level on date shown pressuremeter wet ٧L ¥ V V bit T TC bit \*bit shown by suffix Bs bulk sample plastic limit Wp L E R environmental sample w liquid limit MD

refusal

...grey

very soft

very süff

very loose

very dense

medium dense

hard friable

loose

dense

D

VD

soft

firm

stiff

			C	y .	Seotech geotech	mea	I							В	oreho	ole No.	MBI	H6	
					og - Cored Bore										heet roject	: No:	3 of GEO	5 3 9 TNATH18	367A0
Clie					THEAST BUSINESS P											arted:		1.2006	
Prin	cipal	:	J	NOR	THEAST BUSINESS P	ARK - L	AING	<i>•</i> 0	'RO	UR	RE			D	ate co	ompleted	: <b>20.1</b>	1.2006	
Proj	ect:		I	MAR	INA GEOTECHNICAL	INVEST	IGAT	101	V					Lo	oggeo	i by:	LH		
Bore	hole	Loca	tion: 🖌	AS P	ER MAP									C	hecke	ed by:	K~	مسرب	
drill n	nodel	& mou:	nting: ED	SON	3000	Eastin	ıg:	5008	625		slope:	:	-9	0°		R.L.	Surface:	· · · · ·	
hole (		eter: inform			Drilling fluid: erial substance	Northi	ng:	7000	0050		bearin	_			s defe	datu	m:		
					material	<u> </u>			stimat	ed	le	Ť		efect		013	defect des	scription	
method	water		depth		rock type; grain characteristics structure, minor compone	s, colour, ents	weathering alteration	S	streng		Is <sub>(50)</sub> MPa D-diam- etral	RQD %	spa n	acing nm		type, inc	lination, pla coating, th	narity, roughne nickness	SS,
5 2	5 ≥	RL	metres	ත ජ		· · · ·	5 ta	5_	ΣI	호표	A- axial	Ř	86		part	icular			genera
			_																
					Continued from non-cored bo	orehole													
			_				XW					$\square$		$\prod$					-
			- 11_																-
			· :					×**											
					SANDSTONE: fine grained, yell massive.	ow,													-
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			12_																_
			_																-
			_		Clay seam														-
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					MBH6 terminated at 13.61m							$\square$							
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netho	d		16		core-lift	water				l	veathering	3				defect typ		Foughnees	
DT AS			screwing		casing used	▲ 10/1 on d	/98 wate ate show	rieve vn	l	4	FR fres SW slig	jhtly w	/eath	ered		JT joint PT part	ing	roughness VR very ro RO rough	bugh
AD RR		roller/	drilling ricone		barrel withdrawn	wate					HW higi	hly we	athe	eathen red alhered			m ared zone ared surfaca	SO smoot SL slicker	h .
IMLC		NMLC		sit ;	graphic log/core recovery	parti comj					DW dist (co	tinctly	weat	hered Ind HV		CS crus	hed seam		
VQ, HC	2, PQ	wrelin	e core		core recovered - graphic symbols							y low				planarity PL plan CU curv		coating CN clean SN stained	
					no core recovered		r pressu ions) for				-i hígi	dium h					ulating ped	VN venee CO coating	r i
												y high							

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$\sim$			сy	<u> </u>	2	500	510	chni					Boreh	ole No.	MBH7
Eng	ine	e	ring L	_ <b>o</b> g	j - E	Bor	eho	le					Sheet Projec		1 of 3 GEOTNATH18367AC
Client:			NO	RTH	EAS	ΤBU	SINE	SS PAR	к —				Date s	tarted:	20.11.2006
Principa	d:		NO	RTH	EAS	TBU	SINE	SS PAR	K - LAING (	D'ROURKE		l	Date c	ompleted	: <b>20.11.2006</b>
Project:			MAI	RINA	4 GE	OTE	CHNI	CAL INV	ESTIGATIC	N		I	Logge	d by:	LH
Borehol	e Lo	catio	on: AS	PER	R MAI	D						(	Check	ed by:	1c-
drill mode	l and	mou	nting:	EDSC	ON 3000	)		Easting:	500672	slope;	-90°			R.L.	Surface:
hole diam	eter:			100 m	m			Northing	7000224	bearing:				datu	m:
drilling	info	rma	tion			mat	erial su	ubstance							
thod senetration	support	ater	notes samples, tests, etc			Do of trop     E trop     material       0 of trop     0 trop     0 trop     0 trop     0 trop       1 trop     0 trop     0 trop     0 trop       1 trop     0 trop     0 trop     0 trop       1 trop     0 trop       1 trop     0 trop       1 trop     0 trop       1 trop     0 trop       1 trop					ture Ition	consistency/ density index	pocket penetro- meter	structure and additional observations	

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25	<b>–</b>	ning		1 110		·		man	endi S	ubstance	·				
	method	penetration	support	water	notes samples, tests, etc		depth	graphic log	classification symbol	materia) soil type: plasticity or particle charac	steristics, condition conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents, conents,	consistency/ density index	- pocket	a benetro- meter	structure and additional observations
$\gamma$	Ĕ	123	Su	W		RL	metres	5 G	syı	colour, secondary and minor comp	onents.	<u> </u>	₽	888	
	AD		N						СН	CLAY: high plasticity, grey to brown, ye	llow. M	F			ALLUVIAL SOIL
7							_								_
									СН	CLAY: high plasticity, grey.		<u>.</u>			-
$\Box$							1								_
															-
	Ш					-									-
L.					U <sub>50</sub>				SC	CLAYEY SAND: medium grained, crang	te high	MD			
Π							2	/	00	plasticity clay.	ae' mâu				PP=100KPa
								///							-
n							-	/.							-
Ļ							3		СН	SANDY CLAY: high plasticity, red and g coarse grained sand; some gravel of up to	rey, Anamin	St-VSt			-
				Ī	U50					size,					
				-			Ŧ							*	PP=300kPa _
<u>.1.07</u>															-
CDT 9							4		сн	CLAY: high plasticity, red and grey, som	e medium				
COFFE										grained sand. dark red and grey, some coarse grained					-
Cep 1 6				+					СН	fine gravel up to 6mm in size. CLAY: high plasticity, grey and red, some		VSt-H		×	-
					U <sub>50</sub>		-			grained sand.					G=400kPa R>>500kPa
				F			5		СН	CLAY: high plasticity, grey and dark red. material is hard high plasticity clay. Grey m	Dark red M				-
E GEOI			ľ		i					stiff-very stiff high plasticity clay.			.		-
									CL	CLAY: medium plasticity, grey and red, s	ome				
							6			medium to coarse grained sand; trace of a gravel up to 4mm in size.	ngular				-
	metho AS AD	đ			ewing*	supp M n	nuɗ	NI	nil	notes, samples, tests U <sub>so</sub> undisturbed sample 50mm diameter				Ť	consistency/density index VS very soft
Zev.2	RR W		rolie was	er drii er/trica hbore	one		asing stration 3 4	resistanc		Ues         undisturbed sample 63mm diameter           D         disturbed sample           N         standard penetration test (SPT)	based on unified o system	assificati	оп		S soft F firm St stiff
ssue	CT HA DT			le too d aug ube		wate	ran Concertation	ging to		N*         SPT - sample recovered           Nc         SPT with solid cone           V         vane shear (kPa)	moisture D dry M moist				VSt very stiff H hard Fb friable
	B V T			nk bit t		<b>V</b> '	10/1/98 v on date s	vater lev hown	rel	P pressuremeter Bs bulk sample	W wet Wp plastic limit				VL very loose L loose
Ē		wn by		(			water inflo vater out			E environmental sample R refusal	W <sub>L</sub> liquid limit				MD medium dense D dense VD very dense
لينا															

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]	coffey Seotechnics	Borehole No.
].	Engineering Log - Borehole	Sheet Project No:
5	Client: NORTHEAST BUSINESS PARK	Date started:

NORTHEAST BUSINESS PARK - LAING O'ROURKE

Sheet Project No:	2 of 3 GEOTNATH18367AC
Date started:	20.11.2006
Date completed:	20.11.2006
Logged by:	LH

MBH7

MARINA GEOTECHNICAL INVESTIGATION Project:

Principal:

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				ion: AS			-					. <u> </u>		Check	ed b	y:	16-
drili	mode	l and	l mo	unting:	EDSC	ON 300	0		Easting:	500672	slope	e: -6	90"			R.	L. Surface:
	e diam				100 m	nm	<b>r</b> .		Northing	7000224	beari	ng:				da	tum:
dr		Inte	orm	ation	-		mat		ubstance					1			
method	<ul> <li>benetration</li> </ul>	support	water	notes samples tests, etc	:	depth metres	graphic log	classification symbol	coloui	mate be: plasticity or pa r, secondary and	article characte 1 minor compo	nents.	moisture condition	consistency/ density index	k	300 m penetro- 400 meter	
τв				U <sub>50</sub>	-	-		CL	gravel up to	edium plasticity, g coarse grained s o 4mm in size. <i>(co</i> ifferent strength.	and; trace of a ontinued)	iome ngular	M.	VSt-H			PP=260kPa grey clay PP=500kPa red clay
						- 7_ -		SC	CLAYEY SA red, mediun	AND: fine to coan plasticity clay.	arse grained, g	yrey and					RESIDUAL SOIL
				U <sub>so</sub>		- 8_ -										*	PP=400kPa
				SPT ,16,30/100		- - 9		SC	high plasticit	AY: coarse grai ly clay. me gravel up to 3		yellow,		D/VSt			Extremely weathered SANDSTONE
				N*=R		- - 1 <u>0</u> - -			Borehole M2	3H7 continued as	s cored hole						
						- 1 <u>1</u> - - - - 12											-
metho AS AD RR W CT HA DT B V T *bit sh e.g.	own by	aug roli wa: cat har diat bla bla V b TC	jer dr er/tric shbor de too nd au nd br>au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au nd au au n au n	e ol ger	vate	nud asing stration 3 4 no rar rar	shown Iow	e	U <sub>ss</sub> und D dist N star N* SPT Nc SPT V van P pres Bs bulk	disturbed sample 50 disturbed sample 63 turbed sample ndard penetration (it T - sample recovere T with solid cone te shear (kPa) ssuremeter k sample vironmental sample	3mm diameter est (SPT) ed	soil de based system moistu D M W W					consistency/density Index       VS     very soft       S     soft       F     firm       St     stiff       VSt     very stiff       H     hard       Fb     friable       VL     very losse       L     loose       MD     medium dense       D     dense       VD     very dense

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									g - Cored Bo								neet roject	No:	3 of GEO	3 7 <b>NATH18</b> :	367A(
	Clie	ent					NO	RTI	HEAST BUSINESS	PARK							ate sta			.2006	
ŀ	<sup>&gt;</sup> riı	ncij	bal			i	NOI	RTI	HEAST BUSINESS	PARK	- LAING	G O'ROI	IRKE			Da	ate co	mpleted:	20.11	.2006	
ł	⊃ro	jec	t:			i	MAI	RIN	IA GEOTECHNICA	. INVE	STIGA	TION				Lo	gged	by:	LH		
	Bor	eh	ole	Loc	atio	in: 1	AS	PE	RMAP							Cł	necke	d by:	て		
					untir	-	OSON			1	asting:	500672	slo	pe:	-9	90°		R.L. S	uface;	<u> </u>	
	dri			_	mat	10 tion	-	_	illing fluid: ial substance	1	lorthing:	7000224	bea	aring:	ock	mass	defe	datum: c <b>ts</b>			
								λ I	material			estimate	d ls <sub>isc</sub>			efect			lefect des	cription	
	method	Ħ	'n				graphic log		rock type; grain characteris structure, minor compo		', weathering alteration	strengti	D- dia		l r	acing nm			ation, plar coating, th	arity, roughnes	s,
	l net	core-lift	water	RL		lepth letres	grap	3	Continued from non-cored		weat	옥ㄱᇗ포 동	etra 五 A-axi		9 9 9	300	partic		Joanny, ut	ICKIIESS	general
						-		: S. : gi	ANDSTONE: fine to mediur rey-yellow, massive.					╈		TΠ					-
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						10_											рР	T, 0°, PL, S	D, CN .		-
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						_			ONGLOMERATE SANDSTO												-
						1 <u>1</u>	· · · ·	:   SI	L'ISTONE GRAVEL & COBE coarse grained, grey and bro	LES: fi	ne						<b></b> P'	Г, 0°, PL, S(	D, CN		-
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						12	· · · ·	54	NDSTONE: fine grained, g	ov and	xw										_
						_		ye	llow, massive.	су апа				:			P1	", 0°, PL, SC ", 0°, PL, SC	), CN ), CN		_
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5	)			aug	er dri		'	Ц	casing used barre! withdrawn		on date show	'n	MW	slightly modera highly v	itely wa	eathere	d	PT parting SM seam	d zone	RO rough SO smooth	-
E	7 3 VII (1			claw	r/trica / or bi _C ca	lade b	it	l f grap	phic log/core recovery		water inflow partial drill flu		XW DW	extreme distinctl	ely wea ly weat	ithered hered	- 1	SS sheare	d zone d surface d seam	SL slickens	iloe¢
	MLC Q, H		Q		line c			Ē	core recovered		complete dri	i tiluid loss	strengti			nd HW		planarity PL planar		coating CN clean	
								E	- graphic symbols indicate material	T	-	re test result	L I M I	/ery lov ow nedium				CU curved UN undula	ling	SN stained VN veneer	
							- I		no core recovered	2	(lugeons) for	depth		nigh				ST steppe	5	CO coating	

coffey	<b>ර</b> ි⊃ geot	echnics	Borehole No.	MBH8
Engineering	Log Porch		Sheet	1 of 3
· · · · · · · · · · · · · · · · · · ·	DRTHEAST BUSIN		Project No:	GEOTNATH18367AC
		ESS PARK ESS PARK - LAING O'ROURKE	Date started:	21.11.2006
		ESS PARK - LAING O ROURKE VICAL INVESTIGATION		
Borehole Location: AS		NOAL INVESTIGATION	Logged by:	LH
drill mode! and mounting:	EDSON 3000	Easting: 500697 slope:	-90° R	.L. Surface:
hole diameter:	100 mm	Northing 7000358 bearing:		atum:
drilling information		substance		
Poup a distance of the sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sam	s, olog	material soil type: plasticity or particle characteris colour, secondary and minor componer	strate to the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the stat	
		CLAY:       high plasticity, grey to brown.        grey and yellow, some fine grained sand.         SANDY CLAY:       medium plasticity, grey, fine grained sand.         SANDY CLAY:       medium plasticity, grey, fine grained sand.         SANDY CLAY:       high plasticity, yellow, fine grained sand.         CLAY:       high plasticity, grey, some fine graine sand.         CLAY:       high plasticity, grey, some fine graine sand.         CLAY:       high plasticity, grey, some fine graine sand.        grey and red, trace of gravel up to 3-4mm in	d rd	ALLUVIAL SOIL  PP≈180kPa pushed 170mm PP>>500kPa 
8PT 21,30/140n №##R		dark grey and dark red. CLAY: low plasticity, dark grey, some fine gra	ined	Possibly a RESIDUAL SOIL extremely weathered SANDSTONE.
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 T C bit *bit shown by suffix e.g. ADT	support M mud N nil C casing penetration 1 2 3 4 maging to ranging to refusal water ↓ 10/1/98 water level on date shown water inflow water outflow	Bs bulk sample	classification symbols and soil description based on unlified classification system moisture D dry M moist W wet Wp plastic limit W <sub>L</sub> liquid limit	consistency/density index       VS     very soft       S     soft       F     firm       St     stiff       VSt     very stiff       H     hard       Fb     friable       VL     very losse       L     losse       MD     medium dense       D     dense       VD     very dense

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<b>coffey</b> <sup>୍ରିତ</sup> geotechnics	Borehole No.
Engineering Log - Borehole	Sheet Project No:

MBH8

21.11.2006

21.11.2006

LH

Date started:

Logged by:

Date completed:

2 of 3 GEOTNATH18367AC

Client:	
Principal:	

## NORTHEAST BUSINESS PARK NORTHEAST BUSINESS PARK - LAING O'ROURKE

Project:

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MARINA GEOTECHNICAL INVESTIGATION

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-	_	diam				100 n	nm			Northing	7000358	bear	ing:				daf	um:	
Ļ	dri	iling	info	rma	tion			mat	erial s	ubstance									· · · · · · · · · · · · · · · · · · ·
	8 method	2 penetration		water	notes samples tests, etc		depth	graphic log	classification symbol	colour	e: plasticity or j , secondary ar	terial particle charact nd minor compo	onents.	moisture condition	consistency/ density index	k	300 m penetro-	str addition	ructure and nal observations
	18				SPT 12,22,28 N*=50		- - - 7		CL	CLAY: low sand. <i>(contir</i>		k grey, some fir	le grained	M	H or Fb				
					SP⊺ 9,30/130m N*=R	μ Π	- 8 -		CL	CLAY: Iow medium graii from 2mm to	ned sand; som	grey, some fin le gravel rangin	e to g in size					above	nard than material usal approximately _
1.07					SPT 10,13,18 N*=31		- 9 - -		CL	CLAY: med pale grey ma material low p	terial high plas plasticity clay, s	w and red, pale grey to da ticity clay, dark some fine and r up to 6mm in si	grey nedium			>	~ × × ×	PP=260kPa PP=300kPa PP=340kPa PP=400kPa PP=500kPa	-
TH18367AC.GPJ COFFEY.GDT 9.1.07				2	SPT 7,30/70mn N*≂R		- 1 <u>0</u> - - - 11			and orange.		ow, pale grey, d	ark grey		VSLH				-
AILA										Borehole MBH	H8 continued a	as cored hole				$\prod$			
BOREHOLE GEOTNATH18367AC							- - - 12	-											-
GEO 5.3 Issue 3 Rev.2 A C H H C H H C H H C H H C H H C H H C H H C H H C H H C H H C H H H H H H H H H H H H H H H H H H H H	tsho	d own by	aug rolle was cabi han diati blan V bi TC I	er drif r/tricc hbore e tool d aug ube k bit it	une	wate	nud asing atration 3 4 no rai	shown łow	ж	U <sub>es</sub> undi D distu N stan N* SPT Nc SPT V vane P pres Bs bulk	sturbed sample t sturbed sample dard penetration - sample recove with solid come a shear (kPa) suremeter sample ronmentat sample	63mm diameter i test (SPT) ered	soil des based or system D dr M m W we Wp pla	n unified cli e y oist				consistency/o VS F St VSt Fb VL L MD D VD	tensity index very soft soft firm siff very stiff hard friable very loose loose medium dense dense very dense

C			C	y	≫ geotec	11103					B	orehole No.	MBH	18
					og - Cored Bo		_					heet roject No:	3 of GEO	3 TNATH18367A
Clie	ent:			NOF	RTHEAST BUSINESS	PARK					D	ate started:	21.11	.2006
Prir	icipa	l:	1	NOF	RTHEAST BUSINESS	PARK - LAI	NG	O'ROUI	RKE		D	ate completed:	21.11	.2006
Pro	ect:			MAF	RINA GEOTECHNICA	L INVESTIG	ATI	ON			Lo	ogged by:	LH	
Bor	ehole	e Loca	tion:	AS	PER MAP						C	hecked by:		-
			nting: El	DSON	3000	Easting:	5	00697	slope:		-90°	R.L. S	urface:	<u> </u>
	diam Iling		10 nation	1	Drilling fluid: terial substance	Northing:	7	000358	bearin	_	k mace	datum s defects	:	
								estimated	ls		defect		defect des	cription
method	core-lift water		depth	graphic log one renoverv	rock type; grain characteris structure, minor comp	tics, colour, juint onents g	alteration	strength	Is <sub>(50)</sub> MPa D- diam- etral	8	spacing mm		nation, plan coating, thi	arity, roughness, ckness
έ	8 š	RL	metres	555	Continued from non-cored SANDSTONE: medium to co		Ť	≓_≊∓≩¦	A- axial	ъ К	\$ <u>5</u> 85 <u>5</u> 8			genera
			-		grained, red, massive.		IVU .					PT, 0°, PL, S		
Í			-				ĺ					PT, 0°, PL, S		
			-									PT, 0°, PL, S		
					SANDSTONE: medium to co		Í					PT, 0°, PL, S	O, CN	-
			12_		grained, grey brown and white	massive.						PT, 0°, PL, S	O, CN	-
			-									PT, 0°, PL, S	O, CN	
			_									PT, 5°, PL, S PT, 0°, UN, S	O, CN	
			13_									P1, 0 , 0N, 8	U, UN	-
			_											—
			_									PT, 0°, PL, S	D, CN	-
			-											-
			-										-	_
			14		SANDSTONE: fine to mediun grey, massive.	1 grained, Mi	$\sim$					PT, 0°, PL, S PT, 0°, PL, S PT, 0°, PL, S	D, CN D, CN	
				••••	MBH8 terminated at 14.2m							'P1, 0', PL, 5	J, CN	
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netho	l d		17		core-lift	water			weathering			defect type		
AS			screwing	9	casing used	10/1/98 v on date s	vater showr	level		ntiy wea	athered	JT joint PT partin	)	roughness VR very rough RO rough
ND RR		roller/	drilling tricone		barrel withdrawn	water infi			HW high XW extr	ly wea emely v	/ weathere thered weatherec	SZ shear	ed zone ed surface	SO smooth SL slickensided
СВ IMLC	ገ ¤≏	NMLC		ont	graphic log/core recovery			loss Iuid loss	DW disti (cov	nctiy w	eathered V and HW	CS crush	ed seam	
vu, H	<u>,</u> PQ	wreit	ie core		core recovered     graphic symbols	_			strength VL very L low	low		planarity PL plana: CU curver		coating CN clean SN stained
					no core recovered	없. (lugeons)	for d	eptin	M med H high			UN undula ST steppe	ating ad	VN veneer CO coating
					L1	interval si	hown			high Ismely i	-1-1-	IR irregu	di	

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	ient:								ESS PA	RK					Date s				11.2006	0017
Pri	incipa	al:		NO	RTH	EAS	твU	SINE	ESS PA	RK	- LAING	O'ROUR	KE		Date o	omp	olete	ed: <b>22.</b>	11.2006	
210	oject:			МА	RINA	4 GE	OTE	CHN	ICAL IN	VVE:	STIGATI	ON			Logge	d by	<i>r</i> :	LH		
Во	rehol	le Lo	catio	on: <b>AS</b>	PER	R MA	Р								Check	ed b	oy:	KL		
dril	l mode	el and	l mou	inting:	EDSC	ON 300	0		Easting	<b>j</b> :	500702	slop	be: -9					L. Surface:	NOT MEASU	JRED
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d	penetration	Ţ		samples tests, etc			graphic log	classification symbol			mate	rial		on te	consistency/ density index	ocke	penetro- meter	add	structure and itional observati	ons
method	12:	support	water			depth metres	graph	classi symbo	soil	type: p	plasticity or p	article charac minor comp	teristics,	maisture condition	onsis iensit	k	Pa			
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						-	//													
						-		СН	CLAY: I a low plas	high pl	asticity, red a	nd grey. Red	material is					Red mate with depth	rial increasing in (	quanti
						-				Soony c	nery.							with depth	•	
						3		СН				ty, grey, coai		M	D					
			ľ	SPT	1	- <u>-</u>			size.	ne Ara		ic ongin up to	o o nan na		-					
				30/700mm N*=R																
			-			-	<u>,,,,</u>	SC	CLAYEY	SAND	coarse gra	uined, grey, h	igh	-	VD					
						-	/		size.	clay; so	ome quartzitio	gravel up to	3mm in							
						-	.,,,,		red,											
						4		CL/ML	CLAY: d	iark gr	ey, pieces of	red indurated	d sand of	-	н					
			Ì			-			up to 5mm	n in sìz	e.									
1000						-														
				SPT		-														
			17	7,30/145mi N*=R	†	-														
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D R		aug	jer drij er/tricc	iling*	Сс	asing etration			U <sub>53</sub> 1	undistu	rbed sample 6 d sample		based o	n unified cl	assificati	on		S	very soft soft	
/ T		was	hbore le tool	•	1 2	3 4 10	resistanc	æ	N s	standar	d penetration t		system				_	F St	firm stiff	
A T			d aug			rai	nging to lusal		No S	SPT wit	ample recover h solid cone	-u	D di	у				VSt H	very stiff hard	
3			ak bit			10/1/98		vel	P F	pressur			W w					Fb VL	friable very loose	
V T		TC	bit			on date :			E e		nple mental sample			astic limit juid limit				L MD	loose medium dens	e
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			ff		, Ş	>	ner	nte	echnics			-			,			
				сy	$\sim$		<i>,</i> ,		Serrinoo				Boreho	le N	0.	MBH	19	
E	En	gir	iee	ering	Log	3 - E	Bor	eho	ble				Sheet Project	No:		2 of GEO	3 TNATH183	674C
	lient								ESS PARK			-	Date st		i:		.2006	
Ρ	rinci	pal:		NC	RTH	EAS	ТBU	ISIN	ESS PARK - LAIN	G O'ROURI	KE	I	Date co	ompl	eted:	22.11	.2006	
P	rojeo	st:		MA	RIN	A GE	OTE	CHN	IICAL INVESTIGA	TION		l	oggeo	l by:		LH		
-	_	_		tion: AS	PEF	R MAI	Þ					(	Checke	ed by	:	10		
	ill mo ple dia			ounting:		ON 3000	ן		Easting: 500702	slop						urface;	NOT MEASUR	ED
			_	ation	100 n	nm	mat	erial s	Northing 7000454 substance	bear	ing:				datum:			
ſ	;	ation		notes			ő	tion		aterial			cy/ dex	pocket penetro-	ы Б		tructure and	
method		penetration	support water	samples tests, et			graphic log	classification symbol			- 4-41	moisture condition	consistency/ density index	Dod E			inal observation	s
	1	23	_		RL	depth metres	gra			and minor compo	nents.		den	5 8 8 5 8 8				
Ē			N	SPT 18,30/148	nm	-		CL	CLAY: low plasticity, da pale grey and red.	ark grey. (continue	ed)	M	Н					
				N*≂R														_
Γ	T					-			Borehole MBH9 continue	d as cored hole						<u> </u>		
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	hođ	<u> </u>				12 port		-1	notes, samples, tests		classifica		ools and				/density index	
AS AD RR		a		crewing* irilling* cone	C	mud Casing otration	N	ณม	U <sub>so</sub> undisturbed sampl U <sub>so</sub> undisturbed sampl D disturbed sample		soil desci based on	-	issificatio	n	1 8	/S	very soft soft	
W		٧	ashbo able to	re	pen 12	etration 3 4 no	resistan	ce	D disturbed sample N standard penetrati N* SPT - sample reco		system moisture				- 1	: St /St	firm sliff verv stiff	
HA DT		ł	and au iatube	ıger	wat	Sooce t ref	iging to usal		Nc SPT with solid con V vane shear (kPa)		D dry M moi				- I +		very stiff hard friable	
B V T		١	lank bi bit	t		10/1/98 on date :		vel	P pressuremeter Bs bulk sample		W wet Wp plas	t Stic limit			L L	/L	very loose loose	
T *bit: e.g.	shown	by su	C bit ffix DT			water inf water ou			E environmental sam R refusal	ipie	W <sub>L</sub> liqu	id limit					medium dense dense	
	_														<u> </u>	/D	very dense	

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Form GEO 5.3 Issue 3 Rev.2

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amples, tests	classification symbols and	consistenc	y/density index
undisturbed sample 50mm diameter	soll description	vs	very soft
undisturbed sample 63mm diameter	based on unified classification	s	soft
disturbed sample	system	F	firm
standard penetration test (SPT)		St	stiff
SPT - sample recovered	moisture	VSt	very stiff
SPT with solid cone	D dry	н	hard
vane shear (kPa)	M moist	Fb	friable
pressuremeter	W wet	VL	very loose
bulk sample	Wp plastic limit	L	loose
environmental sample	W <sub>L</sub> liquid limit	MD	medium dense
refusal		D	dense
		VD	very dense
refusal		-	

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	C	of	fe	$\mathbf{V}^{c}$	➢ geotech	nics					E	orehole No.	 MB	H9
					og - Cored Bore							heet roject No:	3 0	
	Client			NOR	THEAST BUSINESS P	ARK					C	ate started:		1.2006
	Princip	oal:	1	NOR	THEAST BUSINESS P	ARK - LA	ING	O'ROU	IRKE		D	ate completed:	22.1	1.2006
	Projec	t:	i i	ИAR	INA GEOTECHNICAL	INVESTIC	<b>GATI</b>	ION			L	ogged by:	LH	
	Boreh	ole Loc	ation: 🖌	4 <i>S P</i>	ERMAP					_	С	hecked by:	1C-	
[-]			unting: El			Easting	.: 5	500702	slope:	:	-90°	R.L. S	Surface;	NOT MEASURED
€ J	hole dia drillin	meter: Ig infor			Drilling fluid: erial substance	Northing	<u>g: 7</u>	7000454	bearin	÷		datum s defects	n:	
. []				ery ery	material		_	estimated	I IS/500		defect		defect de	scription
ļ	method core-lift	Nater RL	depth	graphic log core recovery	rock type; grain characteristic: structure, minor compone	s, colour, ents	weathering alteration	strength	D-diam- etral	RQD %	spacing mm		nation, pla coating, t	anarity, roughness, hickness
		∛ RL	metres	50	Continued from non-cored b SANDSTONE: fine to coarse gr		≷ ऌ XW	צֿד≌רא		₩		particular		general
			7  8  9	· · · · ·	SANDSTONE: fine to coarse grapale grey, massive.							PT, 1°, UN, PT, 1°, UN, PT, 1°, UN, PT, 1°, UN, PT, 0°, UN, I PT, 0°, UN, I PT, 0°, UN, F PT, 0°, UN, F PT, 0°, UN, F PT, 0°, UN, F	RO, CN RO, CN RO, CN RO, CN RO, CN RO, CN RO, CN RO, CN RO, CN	
			-		MBH9 terminated at 9.6m				-			PT, 0°, UN, F	10, CN 20, CN	-
9.1.07		ľ	10	ĺ										-
														-
COFFEY.GDT			]											-
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C. CPJ														1
367AC			11_											
J ATH18			_											L L
EOTN			-											_
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			- 1 <u>2</u>											-
COREE			-											-
5.5 issue 3 Rev. 3	method DT AS AD RR CB NMLC NQ, HQ, F	auge roller claw NML	be er screwing er drilling /tricone or blade b C core ne core		ore-lift  casing used  barrel withdrawn  raphic log/core recovery  core recovered  - core recovered		drilí fluid	í loss	MW mod HW higt XW extr DW dist (cov strength	sh htiy w derate hiy we remely inctiy	veathered ely weather sathered y weathered weathered MW and HV	S2 shear SS shear CS crush V) <b>planarity</b> PL plana	g red zone red surface ed seam	roughness VR very rough RO rough SO smooth SL slickensided coating CN clean
Form GEO 5					- graphic symbols indicate material no core recovered		ns) for de		L low M mea H high VH very	dium 1 y high	y <u>high</u>	CU curve UN undut ST stepp iR irregu	d ating ed	SN stained VN veneer CO coating

	1	C	O	ff	ev	Ś	ે ડ્	ge	ote	echni	CS		-	Boreh	nie N	0	MBH10	
'} 	ļ	En	ain		•			) <b>.</b>	- h -					Sheet		0.	1 of 6	
	}			ee	ring									Projec	t No:		GEONATH18367	AB
<u>i</u> 13		Clien								ESS PAR	-		1	Date s	tarteo	d:	2.11.2006	
$\mid \cap$		Princi	•							ESS PAR			ļ	Date c	ompl	eted		
		Proje								ESS PAR			1	Logge	d by:		LH	\$
		-							*		ELEVATED DUNE	)	(	Check	ed by	<i>r</i> :	K	
		drill mo			inting:		n 3000,	4WD <sup>-</sup>	Fruck N	lourHesting:		ope: -90°					Surface:	
1,3			ng inf		ition	mm		mat	erial s	Northing ubstance	DE	earing:			<del></del>	datu	n:	
N			penetration.		notes samples			log	ation		material			ncy/ ndex	pocket	ter	structure and	
L ()		1 8 1		water	tests, etc		depth	graphic log	classification symbol	soil type	e: plasticity or particle chara secondary and minor com		moisture condition	consistency/ density index	k P	a	additional observations	
1		₽ Q ∭	23	_	ASS		inieu ea		SP	T T	ium to coarse grained, wh	•		MD	288   288		AEOLIAN DUNE SAND	
	•					-	-											-
$\cap$					ASS	4												-
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(/					ASS		1											-
$\square$					ASS	1												-
[_]					ASS	1							ĺ					-
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						-												
·/					ASS		2											]
					ASS				СН	CLAY: high	plasticity, grey.		ŀ	F				
					ASS	]		//										1
<u></u>				Ð	ASS	1	_		SP	SAND: med some high pla	ium to coarse grained, whi sticity clay.	te and grey,	w	MD				
				EASURED	ASS	-	-											4
<u> </u>		<u> </u>	M	ーラト		{	3		ĈĹ	CLAY: low p	asticity, pale grey, some o	Darse	-	F			ESIDUAL SOIL	
$\square$	9.1.07			NOT	SPT 3,3,6 N*=9		-	//	İ	grained sand.				-				-
U	GDT			╞		-				trace quartz	itic gravel up to 4mm in siz	e.						-
1 <sup></sup>	FFEY.																	-
	1 CO						⊿											-
Ļ	FF.GP																	-
$\cap$	9 STU						Ī						-	s				-
	STING													Ĭ				1
$\Box$	GEONATH 18367 EXISTING STUFF.GPJ COFFEY.GDT 9.1.07				SPT 2,2,4		I											1
	H 183				N*=6		5			<b></b>								1
Ļ	TANC								CL	CLAY: medi quartzitic sand	um plasticity, pale grey, soi	ne coarse	ļ					]
$\square$																		]
$\Box$	OREHOLE						-											
,,	BORE						-											_
	ŀ	method				sup	6			notes, samples	fests	classificat		nie and			consistent damaker to dama	
		AS AD		iger scr ger dril	ewing* ling*	Min		N	nil	U <sub>se</sub> undis	turbed sample 50mm diamete. turbed sample 63mm diamete	r soit descri	iption				consistency/density index VS very soft S soft	
n	3 Rev.2	RR W	roli	ier/tricc ishbore	ine	pen	etration 3 4			D distu	bed sample ard penetration test (SPT)	system					S son F firm St stiff	
$\Box$	sue 3 F	CT HA	ha	ble tool nd aug			ran Sectar refi	resistanc Iging to Usal	*	N* SPT NC SPT	sample recovered with solid cone	moisture D dry					VSt very stiff H hard	
$\cap$	വ	DT B	bla	itube ink bit		wate	10/1/98 v	vater lev	/eì	P press	shear (kPa) uremeter	M mois W wet					Fb friable VL very loose	
	СШ СШ	V T	V t TC	bit			on date s water infl			E envire	ample primental sample		tic limit d limit				L loose MD medium dense	
	Fom	*bit shown e.g.	by suff AD				water nn water out			R refus	a)						D dense VD very dense	

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	cof	ffev	S. (	geo	ote	chnics		Boreh	ole No.	 MBH10
		eering L						Sheet		2 of 6
	Client:					SS PARK		Projec		GEONATH18367AB
}	Principal:					ESS PARK			started:	2.11.2006
$\overline{\left[ \right]}$	Project:					ESS PARK			ompleted	
	-					TRACK, ELEVATED DUNE)		Logge		LH
5	drill model and		Edson 3000,	÷			0°	Check	· · · · · · · · · · · · · · · · · · ·	Surface:
	hole diameter:		mm		-	Northing bearing:	-		datu	
~	drilling info			mat		Ibstance	1			
	method 5 5 penetration support	notes sampies, 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	00 × pocket 00 v penetro- 00 meter	structure and additional observations
5.3 Issue 3 Rev.2	method AS aug AD aug CT cabl	SPT 3,5,7 N*=12 SPT 3,6,8 N*=14 SPT 30/100mm N*=R SPT 30/100mm N*=R SPT 30/100mm N=R SPT 30/100mm N=R		N r esistance plag to part fevo	CL CL	CLAY: medium plasticity, pale grey, some coarse quartzitic sand. (continued)         SANDY CLAY: medium plasticity, grey and brown, coarse grained sand.         GRAVELLY CLAY: medium plasticity, grey, fine grained angular quarzitic gravel up to 4mm in size.        grey & red to brown        grey.        grey.         otss, samples, tests        grey & red to brown        grey.        grey.	ation sym ription unified cl	S VSt	E	Sand content increasing with depth.

UU	icy	, <sup>(</sup> )) <sup>,</sup> geote				B	orehole No.	MBH10
		Log - Cored I					roject No:	3 of 6 <u>GEONATH18367AE</u>
Client:		ORTH EAST BUSIN				Da	ate started:	2.11.2006
Principal:		RTH EAST BUSIN				Da	ate completed:	2.11.2006
Project:		RTH EAST BUSIN				Lo	gged by:	LH
		RINA (NORTH OF			-		necked by:	K
hole diameter:	-	3000, 4WD Truck Mounted Drilling fluid:	Easting: Northing		slope: bearin	-90°	R.L. Si datum:	
drilling info	ormation m	naterial substance		,	Joarn	rock mass		
method core-lift water	depth depth L metres 6	rock type; grain chara		estimated strength strengt	MPa D- diam- etral	defect spacing % mm O D 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	type, inclin	lefect description ation, planarity, roughness, coating, thickness
T T NOT MEASURED		GRAVELLY CLAY: med         grey, fine grained angula         to 4mm in size. (continued         CLAY: medium plastici         some fine to medium gra         GRAVELLY CLAY: me         brown, fine grained angu         argillaceous origin of 2-4;         CLAY: medium plasticil         some fine to medium gra	dium plasticity, r quarzitic gravel up c/) ty, pale grey, ined sand. dium plasticity, lar gravel of mm in size. y, pale grey,			R 300 300 300 300 300 300 300 300 300 30	particular	gene
6 au 0 au 7 rol	16 16 17 17 17 17 18 18 18 18 18 18 18 18 18 18	SANDY CLAY: medium grey, fine to medium grain black angular gravel of arg up to 3mm in size.	ed sand, some jillaceous origin water 10/1/98 on date		MW mod HW high XW extra	h ily weathered erately weathered by weathered mely weathered mely weathered	SZ sheare SS sheare	SO smooth

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}	CC	ff	ey	S	Ģ	geo	ote	chni	CS		-	Boreho	ole No.		MBH10
,			ring l									Sheet Project	No		4 of 6 GEONATH18367AB
	Client:							ESS PAR	(			Project Date si			2.11.2006
ſ	Principal		NO	RTH	EAS	TBL	JSIN.	ESS PARF	۲.			Date c	omplei	ed:	2.11.2006
	Project:		NO	RTH	EAS	TBL	JSIN	ESS PARF	r			Logged	•		LH
	-	Locati	on: <b>MA</b> I	RIN/	A (NC	ORTH	I OF	TRACK. E	LEVATED DUNE)			Checke	-		
	drill model					-		iountedting;	slop	e: -90°		Oneon		.L. Su	IC
	hole diame			mm				Northing	bea	ring:			d	atum:	
	drilling i	nforma		<b></b>	Ť	mate	- ·	ubstance				T	1		
	method 5 T penetration	support water	notes samples, tests, etc		depth metres	graphic log	classification symbol	soil type: colour, s	material plasticity or particle charact secondary and minor compo	erístics, onents.	moisture condition	consistency/ density index	100 × pocket 200 × pocket 300 v penetro-		structure and additional observations
LE GEONATH 18367 EXISTING STUFF.GPJ COFFEY.GDT 9.1.07		NOT MEASURED					CL CL CL	to medium gra of argillaceous black sand,	AY: medium plasticity, pa lar gravel of argillaceous or m plasticity, pale grey, som sand, trace black argillaceo	le fine to	W			Har Blau fing	rer of harder material der material sk material easily broken with ers. Possible carbonaceous, ease in argillaceous material depth. Sand quartzitic in origin
m GEO 5.3 Issue 3 Rev.2	AD RR W CT HA DT B V V T *bit shown by s	auger sc auger dri roller/trico washbore cable too hand aug diatube blank bit V bit TC bit uffix ADT	lling* one one	vate	nud asing tration 3 4 no ran ran	nown ow	e	Uss     undist       D     disturb       N     standa       N*     SPT -       Nc     SPT w       V     vane s       P     pressu       Bs     bulk sa	urbed sample 50mm diameter urbed sample 63mm diameter wed sample ind penetration test (SPT) sample recovered ith solid cone thear (kPa) iremeter ample omental sample		iption unified da		n	сс У S F St У f b V L M U D	soft firm stiff St very stiff hard o friable very loose loose

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C	C	)TT	'e'	Y	⋛ <sup>∋</sup> geotech	nics	6				Bo	orehole No.	MBH10	
Ε	ngi	nee	ering	g L	og - Cored Bore	ehole						eet oject No:	5 of 6 GEONA	H18367A
	ent:				TH EAST BUSINESS I							ite started:	2.11.200	
Pri	ncipal	:	1	NOR	TH EAST BUSINESS I	PARK					Da	te completed:	2.11.200	6
Pro	oject:		I	vor	TH EAST BUSINESS I	PARK					Lo	gged by:	LH	
Boi	rehole	Loca	tion: I	MAR	INA (NORTH OF TRAC	CK, ELE	VATED	DUNE	9		Ch	ecked by:	K	
drill	model	& mou	nting: Ed	son 30	00, 4WD Truck Mounted	Easti	ng;		slope:		-90°	R.L. :	Surface:	
	e diame illina i	_	m ation		Drilling fluid: erial substance	North	ning:		bearin		mase	datur defects	n:	
		Τ			material			estimated	15		defect		defect descripti	on
method	core-lift water	RL	depth metres	graphic log core recovery	rock type; grain characteristic structure, minor compon-		eathering teration	strength 	Is <sub>(50)</sub> MPa D- diam- etral A- axial	s % []	pacing mm		lination, planarity, coating, thicknes	3S
⊢					CLAY: medium plasticity, pale some fine to coarse grained sand	grey, I. trace		- JSISI	u		- 8 - 8		<del>.</del>	gene
					black argillaceous material up to size. (continued)									
			_		CLAY: high plasticity, pale grey fine grained sand.	, some	-							
	ĺ		_		The Stelling Still.									
			25	HA	SANDY GRAVELLY CLAY: hig		$\left  \right $							
			-		plasticity, pale grey, medium to co grained sand, trace quartzitic gra- black argillaceous material up to	/el. trace								
				M	biaok arginaceode materiar ap to	1-2000								
1									i					
			26											
			-	M										
1														
	JRED		-	ID										
	MEASURED		27											
	NOT N													
			-											
									ĺ					
			28											
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			29											
			-											
			30	<u>///}</u>										
metho DT AS	ođ	diatub			ore-lift Casing used		/98 water lev	vel	weathering FR frest			defect type JT joint	VF	ughness Very rough
AD RR		auger auger roller/ti			barrel withdrawn	Ι.	ate shown er inflow		MW mod HW high	ly weath	veathered ered		ng RG N <sub>.</sub> SC	o rough
CB NMLC		claw o NMLC	blade bi core	'   9	raphic log/core recovery	- parti	al drill fluid lo plete drill flui	255	DW distin	nctly wea	athered athered and HW)	SS shear CS crush	red surface led seam	
NQ, H	Q, PQ	wireline	e core	Ē	core recovered				strength VL very		,	planarity Pf. plana	រ ្ក	ating I clean
				<b>I</b> F	indicate material no core recovered		r pressure te eons) for dep	th .	L Iow M med H high			UN undu ST stepp	ating VN ed CC	veneer
					1	inten	val shown			high		IR irregu	iar	

(	C	C	)T	[e]	<b>y</b> <sup>°</sup>	<sup>≳&gt;</sup> geotech	nics	1			Ē	orehole No.	MBH10
	Er	ıgi	ine	ering	g L	og - Cored Bore	ehole					Sheet Project No:	6 of 6 GEONATH18367A
	Clie					TH EAST BUSINESS I					_	ate started:	2.11.2006
F	Prin	cipa	ŀ:	1	NOR	TH EAST BUSINESS F	PARK					ate completed:	2.11.2006
		ect:				TH EAST BUSINESS F					L	ogged by:	LH
_						INA (NORTH OF TRAC	K, ELE	ATE	D DUNE	9	c	hecked by:	IC
[		nodel diam				100, 4WD Truck Mounted Drilling fluid:	Eastir	-		slope:			urface:
	_	_	_	nation		erial substance	Northi	rig;		bearir	rock mas	datum s defects	: <u> </u>
					og overy	material		<u>6</u> _	estimated strength	is <sub>(50)</sub> MPa	defect spacing		defect description
hodian	method	water	RL	depth metres	graphic log core recovery	rock type; grain characteristic: structure, minor compone		weathering alteration	z no r≩ Z no r ¥	D- diam- etral	Spacing CO S S S S S S S S S S S S S S S S S S	type, inclin	nation, planarity, roughness, coating, thickness geni
		NOT MEASURED				SANDY GRAVELLY CLAY: hig plasticity, pale grey, medium to c grained sand, trace quartitic gra black argillaceous material up to (continued) CLAY: medium plasticity, pale g some fine grained sand.	oarse vel, trace 1-2mm.						
								ł					
me	ethoo	1		36		ore-lift	water			weathering			
DT AS AD RR	Г 3 0 3		auger	e screwing drilling ricone		casing used barrel withdrawn	10/1/	98 water ite showr inflow	level	FR fres SW slig MW mod HW high	h htiy weathered derately weather hly weathered	SZ sheare	SO smooth ed zone SL slickensided
CB NN	3 ALC	I, PQ	claw c NMLC	r blade bi		raphic log/core recovery core recovered - graphic symbols indicate material no core recovered	water % (luger	lete drill 1	luid loss test result epth	DW disti (cov strength VL very L low M med H high VH very		CS crushe	ed surface ed seam CN clean I SN stained ting VN veneer ed CO coating

## Borehole Logs – MBH Series

				ey						nic	S					Boreho	ole N	۱o.	MBH		
Ε	ng	ine	ee	ring L	_og	- E	Sore	eho	le							Sheet Project	: No:	:	1 of GEO	3 TNATH183	67AC
Cli	ent:			NO	RTH	EAS	T BU	SINE	SS P	ARK	-				1	Date si	arte	ed:	22.11	.2006	
Pri	ncipa	d:		NO	RTH	EAS	T BU	SINE	ESS P.	ARK	- LAING	GO'ROU	RKE		I	Date c	omp	lete	d: <b>22.11</b>	.2006	
Pro	oject:			MA	RIN/	A GE	OTE	CHN	ICAL I	INVE	STIGAT	ION			I	Logged	i by:		КМ		
Bo	rehol	e Lo	catio	on: AS	PER	MA	•								(	Checke	ed b	y:	Kn		
	mode		mou	-		O 200	TRAC	K RIG	Eastir	-	500149		ope:	-90°					. Surface:		
	e diam illing		rma		100 m	Im	mate	erial s	North: ubstan		7000600	be	earing:					datı	um:		
method	penetration	support	water	notes samples, tests, etc	RL	deptin	graphic log	classification symbol	so	oil type:	plasticity or	terial particle chan nd minor con	acterísti	cs,	moisture condition	consistency/ density index	k	o penetro- o meter		tructure and anal observation	ns
AD		3					3	SW				rained, pale l	•		W	VL VL	3	300	AEOLIAN D Becoming le	UNE SAND ss clayey with d	epth _ - - -
TB		С		SPT 30 N*=R		- 2		SP	GRAVE	ELLY S/ weakly	AND: fine cemented.	to medium gr	ained, d	Jark .		D-VD	×		RESIDUAL S Coffee Rock PP=100kPa		
				SPT 2,2,4 N*=6		- - - 4 - - - -		CL	SANDY	CLAY	medium ;	olasticity, gree	en grey.			S-F		* .	PP≍300kPa		- - - - - - -
				U <sub>50</sub>				CL	CLAY:	mediu	ım plasticity,	pale blue gro	<b>≩y</b> .			L-MD			PP≕400kPa PP=500kPa Sand/Clay 50	/50	
meth AS AD RR W CT HA DT B V T *bit sl e.g.	hown b	aug rolli was cab har dial blau V b TC	ger dri er/trice shbore ble too nd aug tube nk bit it bit x	one e	Min Coopen 12 Hit wate	ina Nacial re	o resistano nging to fusal water le shown flow	ce	notes, s U <sub>so</sub> D N N N N P Bs E R	undisi undisi disturi standa SPT - SPT v vane a pressi bulk s	turbed sample turbed sample bed sample ard penetratio sample recov- with solid cone shear (kPa) uremeter ample somental sample	rered	er P		tiption unified d				Consistency VS F St VSt H Fb VL L L MD D VD	y/density index very soft soft firm stiff very stiff hard friable very loose loose medium dense dense very dense	

	coff	ey eotechnics	Borehole No.	
		ering Log - Borehole	Sheet Project No:	2 of 3 GEOTNATH18367AC
l	Client:	NORTHEAST BUSINESS PARK	Date started:	22.11.2006
<u> </u>	Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Date completed:	22.11.2006
	Project:	MARINA GEOTECHNICAL INVESTIGATION	Logged by:	KM

КM

Logged by:

Project:

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MARINA GEOTECHNICAL INVESTIGATION Borehole Location: AS PER MAP

	Во	rehol	e Lo	cati	on: AS	PER	MAI							(	Check	ed by	<i>r</i> :	K
	drill	mode	í and	mol	inting:	JACR	O 200	TRAC	K RIG	Easting:	500149	slope	: -9	0°			R.L	Surface:
		e diam				100 m	im			Northing	7000600	beari	ng;				dat	um:
	dr	illing	into	erma	tion		1	mat		ubstance	·							······································
	method	5 penetration	_	water	notes sampies tests, etc		depth metres	graphic log	classification symbol	colour,	mater e: plasticity or par , secondary and	rticle characte minor compo	nents.	moisture condition	consistency/ density index	100 × pocket 200 × pocket	а	structure and additional observations
	TB		C		SPT 2,3,5 N*=8 SPT 6,11,20 N*=31		- - 7 - - 8		CL	(continued)	dium plasticity, p				L-MD	X		PP=260kPa PP=500kPa PP=400kPa
					SPT 16 N*=R	-	- - 9 -			grained sand GRAVELLY ( white; coarse	CLAY: medium grained with son	plasticity, pal ne fine graine	e grey -		VL VL			
Issue 3 Rev.2	metho AS AD AR AD AR AD AR	bd	aug rolle was cab han diat	er dril r/tricc hbore e tool d aug	ne	pene 1 2	nud asing tration 3 4 rar rar ref		ce i	U <sub>so</sub> undix D distu N stand N* SPT Nc SPT V vane	s, tests sturbed sample 50a sturbed sample dard penetration tet - sample recovered with solid cone e shear (kPa) suremeter	mm diameter st (SPT)	soil des based o system moistur D di M m	ry noist				consistency/density index VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable
Form GEO 5.	/ _	own by	V bi TC I	: Dit			10/1/98 v on date : water infl water out	shown ow		Bs bulk:	sample ronmental sample		Wp pi	et lastic limit quid limit				VL very loose L loose MD medium dense D dense VD very dense

U		J		e	y	Seotech	nnoc	2						Bo	orehole No.	MBł	
E	ng			rin	g L	og - Cored Bor	ehole								eet oject No:	3 of GEO	3 TNATH18367
	ent:					THEAST BUSINESS								Da	ite started:	22.11	.2006
	ncip					THEAST BUSINESS				IRKE				Da	te completed:		.2006
	ject					INA GEOTECHNICAL	. INVEST	IGAT	ION						gged by:	KM	
						ER MAP	Easti	na:	500149	-			00		ecked by:	12-	
hole				-		Drilling fluid:	North	-	7000600		ope: earing:		-90	-	R.L. Si datum		
dri	llin	g in	nform	ation		erial substance				1		-	k m	ass	defects		
method	core-lift	water	RL	depth	graphic log core recovery	material rock type; grain characteristi structure, minor compo		weathering alteration	estimate strength	D-d e	iam- kraj C	2	defe spac mr	ілд	type, inclir	efect des ation, plar coating, thi	narity, roughness, ickness
					┝──								5 <del>-</del> 7	= =	particular		gen
				-	1	Continued from non-cored	borehole										
		T				SANDSTONE: fine to medium yellow and grey, massive.	grained,	HW									·····
				_													
				10	· · · · ·	SANDSTONE: fine grained, grained, graining, massive.	ey with iron	1					Ţ				
				-	:			]							PT, 0°, PL, S		
			ļ	-		SANDSTONE: fine grained, da massive. SANDSTONE: fine to medium	<b>C I</b>	MW							→ PT, 0°, PL, S → PT, 0°, PL, S	D, CN	
						grey, massive.	granico,								PT, 0°, PL, S PT, 0°, PL, S PT, 0°, PL, S	D, CN	
				11_	· · · · · · · · · · · · · · · · · · ·										PT, 0°, PL, So PT, 0°, PL, So	D, CN D, CN	
				_		SANDSTONE: fine to medium grey, massive, with siltstone gra 4-40mm inclusions.									PT, 0°, PL, SO PT, 0°, PL, SO	), CN	
+	+	┥			::::	MBH1 terminated at 11.4m	-				_				PT, 0°, PL, S PT, 0°, PL, S VPT, 0°, PL, S	, CN	
				-											PT, 0°, PL, SC PT, 0°, PL, SC	, CN	
				_ _12_											PT, 0°, PL, SC PT, 0°, PL, SC PT, 0°, PL, SC	, CN	
															PT, 0°, UN, S PT, 0°, UN, S	D, CN D, CN	
				_											PT, 0°, UN, S PT, 0°, UN, S PT, 0°, UN, S	D, CN	
				_											\\PT, 0°, UN, S( \PT, 0°, UN, S(	), CN ), CN	
		ł		-											\PT, 0°, UN, S	J, CN	
				1 <u>3</u>													
				-													
				]	[												
				4													
				14							8						
				-													
				1													
	<u> </u>			- 15													
ietho T S	od		diatub augeo	e screwing		core-lift casing used		1/98 wate: date show		weath FR SW	ering fresh slightly		ather	'ne	defect type JT joint PT parting		roughness VR very rough
D R			auger roller/ti	drilling		barrel withdrawn	- on c			MW HW XW	mode: highly	ratel) weat	/ wea there	there d	d SM seam SZ shear	d zone	RO rough SO smooth SL stickensided
B MLC			claw o NMLC	r blade b core	oit y	graphic log/core recovery		ial drill flui nplete drill		DW	extrem distinc (cover	tly w	eathe	ered	) CS crushe	d surface d seam	
Q, H	IQ, P	Q	wirelin	e core		- core recovered				streng VL	ith very lo low	w			planarity PL planar CU curved		coating CN clean SN stained
						indicate material no core recovered	100) S	eons) for		M H	mediu high				UN undula ST steppe IR irregul	d _	VN veneer CO coating
							inter	val show	۱	VH	very hi extrem		niah		in integu		

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00	<b>.</b> ff	~ *	Ş	5. 20. <b>-</b>		<u>st</u>	echnics					
CC		ЗY	50	٢	Jer	JIC	50111105		Bore	ehole	e No.	MBH2
Eng	ineer	ing l	Log	<u>  - E</u>	Sor	ehc	le		Shee Proje		No:	1 of 2 GEOTNATH18367AC
Client:		NO	RTH	EAS	твU	SIN	ESS PARK		Date	e sta	rted:	23.11.2006
Principa	ł:	NO	RTH	EAS	T BU	SIN	ESS PARK - LAING O'ROURKE		Date	e cor	nplet	ed: 23.11.2006
Project:		МА	RIN/	GE	OTE	CHN	ICAL INVESTIGATION		Logg	jed l	by:	LH
Borehol	e Locatio	on: AS	PER	MAF	>				Cheo	ckec	ł by:	K
	and mour	nting:		O 200	TRACI	< RIG	Easting: 500097 slope:	-90°				L. Surface: NOT MEASURED
hole diam drilling	informat	tion	100 m	Im	mat	erial s	Northing 7000469 bearing: ubstance	<u>_</u>			da	atum;
method t penetration	support water	notes samples, tests, etc		depth metres	graphic log	classification symbol	material		condition consistency/		A pocket b d penetro-	
- 123 LQV	C C	-	I KL	metres	3	SW	colour, secondary and minor componen SAND: fine to coarse grained, grey white.	πs. Ε Ν				MARINE SOIL
A												(quartzitic material) ~~
		N*=18				SC	CLAYEY SAND: coarse grained, dark grey.			-!!		RESIDUAL SOIL
				<u>-</u>		СН	CLAY: high plasticity, yellow, some fine grain sand.	ied	St-Vi	st		coffee rock -
	M	SPT 6,7,7		3		SC .	CLAYEY SAND: medium to coarse grained, brown.		/ MD			
		N*=14				сн	CLAY: high plasticity, grey and yellow, trace or grained sand, some quartzitic sub angular grav to 4mm in length SANDY CLAY: high plasticity, yellow and gree	vel up	F			
		SPT		4		SC	CLAYEY SAND: fine to medium grained, yello and grey, some argillaceous rounded and suba gravel up to 12mm in length.		D-VC			-
		8,16,26 N*=42		5		CH	CLAY: high plasticity, grey, some sand.		VSt			small decaying rootiets
				9) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1)		СН	SANDY CLAY: high plasticity, grey and yellow grained sand.	v, fine				
method AS AD RR M CT HA DT A J J T bit shown by 호.g.	auger scre auger drilli roller/tricor washbore cable tool hand auge diatube blank bit V bit TC bit suffix ADT	ing* ne	vate	nud asing tration 3 4 no ran	water lev shown ow	æ	Use     undisturbed sample 50mm diameter       Use     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	classification s soil descriptio based on unifie system moisture D dry M moist W wet Wp plastic lin W <sub>L</sub> liquid lim	n d classifica			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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		С	C	off	e	¢ ک	geote	chnic	3				Bo	orehole	No.	MBH	2	
i n							og - Cored E							neet oject N	lo:	∮ of GEO1	2 NATH18367	AC
الاست		Clie	nt:				THEAST BUSINE						Da	ate sta	rted:	23.11	2006	
		Prir	cipal	:			THEAST BUSINE				IRKE		Da	ate con	npleted:	23.11.	2006	
			ect:				NNA GEOTECHNI	CAL INVES	TIGAT	ION			Lo	gged b	by:	LH		
<i>(</i> ' ' ' '							PER MAP						Cł	necked	by:	JC	•	
į		1	nodel diame		_		200 TRACK RIG		•	500097 7000469	slope:		-90°		R.L. Su	inface:	NOT MEASURED	
					nation	-	terial substance	NO	hing:	000489	bearin		ck mass	defec	datum: ts			
$\left[ \right]$		method	core-litt water		depth	graphic log core recovery	materii rock type; grain chara structure, minor c	cteristics, colour,	weathering alteration	estimate strength		% Q	defect spacing mm		type, inclina	efect desc ation, plana coating, thic	arity, roughness,	
$\cap$		β	ō s	RL	metres	gra	Continued from non-	cored borehole	alte	ליצי≩		RQD	3000 300 30	partici	ular		gen	eral
	GEOTINATH18367AC.GPJ COFFEY.GDT 9.1.07						SANDSTONE: fine grain grey, massive. SANDY CLAY: high play yellow, fine grained sand. SAND: coarse grained sand. brown, material is quartzit in origin. SANDSTONE: fine grain massive. SAND: coarse grained, white, trace high plasticity SANDSTONE: coarse grained, white, trace high plasticity SANDSTONE: coarse grained, brown and yellow, massive SANDSTONE: fine grain grey. MBH2 terminated at 11.5n	sticity, grey and red-white and c and argillaceous ed, yellow grey, prown red and clay. ained, grey s, ed, pale red and							0°, PL, SC 0°, PC 0°, PL, SC 0°, PL, SC 0°, PL, SC 0°, PL, SC 0°, PL, SC			
	CORED BOREHOLE				- 1 <u>2</u> -	ļ								¦\PT,	0°, UN, SC 0°, UN, SO 0°, PL, SO	CN CN		-
	ľ				-													
	GEO 5.5 Issue 3 Rev. 3	metho DT AS AD RR CB NMLC NQ, H		auger roller/ claw c NMLC	screwing drilling tricone or blade b	9    it	core-lift casing used barrel withdrawn graphic log/core recovery core recovered - graphic symbols indicate material	→ on → wz → pa → co → wa	-	n d loss fluid ïoss e test result	MW mo HW hig XW ext DW dist (co strength VL ver L low M me	sh ghtly w derate hly we iremely tinctly vers h	eathered ely weathered athered y weathered weathered dW and HW	əd ! /)	CS crushe planarity PL planar CU curveđ UN undulat	d zone d surface d seam ting	roughness VR very rough RO rough SO smooth SL slickensided coating CN clean SN stained VN veneer	
	Form GEO 5.5 I						- graphic symbols	u) 52	ter pressur geons) for a erval showr	depth	VL ver L low M me H higi VH ver	i dium			PL planar CU curved	ting d	CN di SN st	ean ained eneer

	C	of	f	ey	S	ે <b>ડ્</b>	je	ote	ech	nics			•	Boreh	ole i	No.	MBH	13	
$\bigcap$	Eng	gin	eel	ring l	_00	1 - E	Sor	ehc	le					Sheet Projec		ŀ.	1 of GEO	3 FNATH183	6740
!	Client								ESS P	ARK				Date s	-		23.11		
$\square$	Princi										IG O'ROURI	KE		Date o	omp	pleted:		.2006	
( )	Projec			MA: on: AS				CHN	ICAL	INVESTIGA	ATION			Logge	-		LH		
	drill mo					0 200		K RIG	Easti	ing: 500127	slope	e: -90'		Check	ed b				ED
i_}	hole dia				100 m	កា			North							datur			
Π	drillir		orma	notes		1			ubstan	ce		<u> </u>	1	~ ×	1.	6		<u> </u>	
	method 1	support	water	samples, tests, etc		depth metres	graphic log	classification symbol	so	oil type: plasticity	material or particle character and minor compo	eristics, nents.	moisture condition	consistency/ density index	k	300 b penetro-		ructure and nal observatio	15
	ADT	C		SPT 9,7,3 №*=10				sw	of high 3mm, t	plasticity clay, tra trace of argillaced	n grained, grey bro ace of quartzitic gr pous gravel up to 5n se grained, dark br	avel up to nm in size.	M	D		s		organic odour, plant matter (pi	- - - - - ossíbly_ -
( ( ())) ( ()) ( ()) (	1	M		SPT 2,3,4 N*=7				СН	CLAY: grained		yellaw grey, some i	fine	W	St	* * * *	P	P≕100kPa P=120kPa P=150kPa P=180kPa	DIL	
GEOTNATH18387AC.GPJ_COFFEY.GDT				U <sub>50</sub>						ontent increasing					×	P	P=145kPa		
2 BOREHOLE	method AS AD RR	aug rolli	jer dril er/trico	ne	репе	nud asing etration	z	CH	notes, s ປ <sub>ອ</sub> ປຸ <sub>ຄ</sub>	undisturbed sample	ple 50mm diameter ple 63mm diameter	classifica soli desc based on system	ription				VS S F	rdensity index very soft soft firm	-
Form GEO 5.3 Issue 3 Rev	W CT HA DT B V T *bit shown e.g.	cab har diat blar V b TC	bit ×		wate	an rar Soosi≤ ref	shown low		N NC V PBS ER	standard penetra SPT - sample rec SPT with solid con vane shear (kPa) pressuremeter bulk sample environmental sa refusal	overed ne		ist				St VSt H Fb VL L MD D VD	stiff very stiff hard friable very loose loose medium dense dense very dense	

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	CC	off	ev	S	ິ (	je	ote	echni	cs			-	Boreh	ole No		MBH:	2	
			ring l										Sheet			2 of 3	•	0674.0
	Client:							SS PAR	к				Projec Date s			23.11.2	NATH18: 2006	867 <u>AC</u>
	Principa	l:	NO	RTH	EAS	твι	JSINE	ESS PAR	K - LAING O	ROURK	E		Date c			23.11.2		
	Project:		МА	RIN	4 GE	ΟΤΕ	CHN	ICAL INV	ESTIGATIO	N			Logge	•		LH		
f	Borehole	e Locati	ion: AS	PER	R MAI	Р							Check	-	,	<		
	drill model	and mo	unting:	JACR	O 200	TRAC	K RIG	Easting:	500127	slope:	-90°			F	L. Sur		NOT MEASU	RED
	hole diam		ation	100 n	1171	Imai	erial e	Northing ubstance	7000289	bearin	ig:			d	atum:			
Π			notes					ubstance		·				± ط				
U	thod penetration	티니	samples, tests, etc			graphic log	ification of the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second s		materia	ıl		tion	stency ty ind	pocket penetro			ucture and al observatio	ns
	beither method 123	support water		RL	depth metres	grapi	classification symbol		e: plasticity or parti , secondary and m			moisture condition	consistency/ density index	kPa 章ରୁଚ୍ଚ				
	H I	м	SPT	1			GC		NDY GRAVEL: f		white	М	MD		grav	vel ranging	in size from : itic and argilla	2mm to
-			4,5,12 N*=17			27777	GP CH	GRAVEL:	fine grained, brow y, some fine graine	n, some high	·		VSt-H		origi	in all well ro SIDUAL SC	ounded.	
					_			argillaceous	h plasticity, grey ye gravel up to 5mm,	some coars	e grained							-
					-			sand. Seco depth.	ndary elements inc	rease in size	e with							
I N					Z													
					-													
$\cap$				1	-													_
			SPT 20,30/35mm	h	-		SP	SAND: COR	arse grained, brow	n red, some o	quartzitic							
* f			N*=R		8		GP CH		grained, white.									-
									n plasticity, grey.									
U					_													1
$\cap$					_								н					]
					-		СН	CLAY: high	plasticity, yellow a	and arev			VSt					_
			SPT		<u>9</u>		0.1	vent. ng	r plaatoky, yekow z	ina gray.			VOL					
			30/70mm N*=R				-	Borehole MB	H3 continued as c	ored hole				┥┥┦				
$\Box$					ľ													_
$\cap$	9,1.07				-													-
$\bigcup$	6				10													_
<i>[</i> ]	BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT																	
	Ö				4													
	0 0 0				4													4
	8367A				4													_
U	VATH1				11													
$\cap$	96015				-						ĺ							
$\bigcup$					-													-
<u> </u>	OREH				1													-[
	£				12													-
$\cup$	method AS	auger so		Mi		N	nit		isturbed sample 50m		classificati soil descri	iption			co VS		ensity index very soft	
	AD RR	auger dr roller/tric	one	pen	asing etration		Ī	U <sub>es</sub> und D dista	isturbed sample 63m urbed sample	m diameter	based on u system		assificatio	n	S F		soft firm	
L I	₩ ₩ CT 9. HA	washbor cable too hand au	ы			resistan Iging to Iusal	CÊ.	N* SPT	idard penetration test - sample recovered	(SPT)	moisture				St VS	t	stiff very stiff	ĺ
$\Box$	S DT	diatube blank bit		wate			avel	V van	with solid cone ∋ shear (kPa) suremeter		D dry M mois W wat	st			H Fb VL		hard friable	
- i / •	ы V T	V bit TC bit		<u> </u>	on date .	shown	vei	Bs bulk E envi	sample ronmental sample	ĺ	Wp plasi	tic limit d limit					very loose loose medium dense	
	e.g.	suffix ADT			water inf water ou			R refu									dense verv dense	

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					geotec					Shee	hole No. et ect No:	MBH 3 of GEOT	
P	lient: rincipal roject:	:	^	IOR	THEAST BUSINESS THEAST BUSINESS INA GEOTECHNICA	PARK - LA		URKE		Date	started: completed: ed by:	23.11	.2006
dr	ili model	& mou	ting: JA	CRO 2	ON TRACK RIG	Easting		slope	: -90		ked by: R.L. Su	Irface;	NOT MEASURED
	le diame Irilling i			_	Drilling fluid: erial substance	Northin	g: 7000289	beari	ig: rock m	ass de	datum: efects		
method	core-lift water	RL	depth metres	graphic log core recovery	material rock type; grain characteris structure, minor comp Continued from non-comp	tics, colour, onents	estima streng affectation affectation affectation affectation	ted Is <sub>(50)</sub> th MPa D-diam- etrai 포표 A-axial	defi spac % mi O Ø g g g g g g	ring 71	type, inclin c	efect desc ation, plan coating, thi	arity, roughness, ckness
			110 		Continued from non-corec CORE LOSS SANDSTONE: fine to medium grey-brown and red, massive. grey SANDSTONE: fine to medium grey, massive. undulating layers of 1-4mm o SANDSTONE: fine grained, g massive.	n grained, n grained, Hi of coal			₩ 100 100 100 100 100 100 100 10		-PT, 0°, PL, SC -PT, 0°, PL, SC -PT, 0°, PL, SC -PT, 0°, PL, SC PT, 0°, UN, SC PT, 0°, UN, SC PT, 0°, UN, SC PT, 0°, UN, SC PT, 0°, UN, SC PT, 0°, UN, SC PT, 0°, UN, SC PT, 0°, UN, SC PT, 0°, UN, SC PT, 0°, UN, SC PT, 0°, UN, SC PT, 0°, UN, SC PT, 0°, UN, SC PT, 0°, UN, SC	0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0	gener
DT AS AD RR CB Sme 3 Kev. 3 CB NM	Lthod	auger roller/i claw c NMLC	screwing drilling ricone r blade bi		ADDESS OF CORE MBH3 terminated at 13.1m MBH3 terminated at 13.1m terminated at 13.1m casing used barrel withdrawn graphic log/core recovery core recovered - graphic symbols indicate material no core recovered	vater i vater i vater i vater i vater f	B water level inflow drill fluid loss ete drill fluid loss pressure test resu ns) for depth i shown	MW mc HW hig XW exis DW dis (cc strength VL vei L low H hig VH vei	g sh hily weather remely weath tinctly weather tinctly weather wers MW and y low 7 diurn	ed thered d bered reed	defect type JT joint PT parting SX sheare	d zone d surface d surface d seam	roughness VR very rough RO rough SO smooth SL slickensided coating CN clean SN stained VN veneer CO coating

$\mathbf{c}\mathbf{c}$	١f	fev	,S	) د	lec	ote	chnics		Barah	ala Ma	
									-	ole No.	MBH4
Eng	ine	ering	Log	- B	sore	eho	le		Sheet Projec		1 of 3 GEOTNATH18367A
Client:		NC	RTH	EAST	T BU	SIN	SS PARK		Date s	tarted:	27.11.2006
Principa	1:						SS PARK - LAING O'ROURKE		Date c	omplete	ed: 27.11.2006
Project:						CHN	CAL INVESTIGATION		Logge	d by:	LH
	_	ation: AS				(			Check		KL
drifl mode hole diam		ounting:	100 m	O 200	TRACI	K RIG	Easting: 500255 slope: - Northing 7000235 bearing:	90°			L. Surface: NOT MEASURED tum:
drilling	infor	nation			mate	erial s	ubstance			·	
method 55 penetration	support	notes samples tests, et		depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture	consistency/ density index	100 X pocket 200 X pocket 300 & penetro- 400 meter	
ADT	N			- - 1 1		SP	SAND: medium to coarse grained, grey brown, some quartzitic gravel up to 3mm in size.	W	D		MARINE SOIL small tree rootlets up to 5mm in diameter rotten egg odour
		SPT 12,9,6 N*=15		- - 2 - -		SP CH SP	SAND: medium plasticity, black, some black clay. CLAY: high plasticity, green and grey, some coarse grained sand. SAND: grey.	M	MD F D		possible tree roots
		SPT 2,6,16 N*≓22		3		СН	SANDY CLAY: high plasticity, grey, medium to coarse grained sand, trace of quartzitic gravel up to 3mm.	M	St	*	RESIDUAL SOIL PP=200kPa
	w	SPT 00,13,21 N*=34		4		СН	some dark red angular arenitic gravel of up to 5mr in size. angular arenitic gravel up to 10mm; subrounded quartzific gravel up to 4mm. SANDY CLAY: high plasticity, grey and red, fine to medium grained sand.	n	VSt-H		PP=500kPa Residual soil
nethod S.D.B.R	auger roller/	screwing* drilling* tricone	pen	nud æsing etration	N	nil	notes, samples, tests U <sub>so</sub> undisturbed sample 50mm diameter D disturbed sample 63mm diameter D disturbed sample	escription	ymbols an classificat		consistency/density index VS very soft S soft F firm
V ST (A )T I , bit shown by .g,	washi cable hand diatub blank V bit TC bit y suffix ADT	tool auger e bit	1 2 wate	3 4 ro rar ref	water ie shown low		N     standard penetration test (SPT)       N*     SPT - sample recovered     moist       Nc     SPT with solid cone     D       V     vane shear (kPa)     M       P     pressuremeter     W       Bs     bulk sample     Wp       E     environmental sample     WL       R     refusal	ure dry moist wet plastic lim liquid limit			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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	ent:										ESS F	PAR	к								Date			l:			TNATH .2006	1030	740
Pri	ncipa	al:			NO	RTİ	HE	AS	T BU	SIN	ESS P	PAR	K-L	AING	3 O'f	ROUF	RKE				Date	cor	npl	etec	d: 2	7.11	.2006		
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					AS																Cheo	kec	l by	:	K				
	mode e diam			untin	g:	JAC 100			TRAC	( RIG	Eas <sup>.</sup> Nort	•	500:	255 0235			pe: aring:		90°						. Surfac	:e:	NOT ME	ASURE	D
dri	illing	inf	orm	atio	n				mat	erial s	ubsta		,				aring.				_	_		datu					·
method	benetration		water	sa	notes imples, sts, etc			depth netres	graphic log	classification symbol	5	soil typ	e: plast	tícitv or	terial particle	e chara	cterist	tics, its.		moisture condition	consistency/		200 × pocket	a j	a		tructure a nal obser		I
ADT				14,30	SPT 1,14,30 1*=44 SPT //105m //105m			- - - - - - - - - - - - - - - - - - -		СН	SANE medi	YY CLJ	NY: hi ined sa	igh plas	sticity, ç	rey and 力				M	VSt-				materi Grey n	al. nateria	rk red and il softer th iterial diffe	an red.	
the	od	au rol cal ha dia bla V t TC	Ыt	illing* xone re xi ger		M C pei	1 ppoor mu cas netrn 2 3 1 tter 10 on	ing ation 4 no ran case refi	vater lev hown	e	notes, Uss DN*C PSs ER	und dista star SPT SPT van pres bulk	s, tests isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed isturbed ist	sample sample metration le recove lid cone (kPa) ter	63mm ( n test (S ered	liameter		Мл Wv Wpp	script on uni	lion fied cla					consi VS S F St VL L MD D	stency;	fdensity ind very soft firm soft siff very stiff hard friable very loos loose medium dense	e	

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[]						og - Cored Borel							neet oiect No:	3 of 3	ATH18367AC
<u> </u>	Clie					THEAST BUSINESS PA	_			<u> </u>		_	te started:	27.11.20	
$\cap$	Prir	ncipa	l:	i	NOR	THEAST BUSINESS PA	RK - L	.AING	O'ROU	RKE		Da	ite completed:	27.11.20	006
<u>[_</u> ]	Pro	ject:		l	MAR	NNA GEOTECHNICAL IN	IVEST	<b>IGAT</b>	ION			Lo	gged by:	LH	
·}	Bor	ehole	e Loca	tion: 🖌	4S F	PER MAP						Cł	ecked by:	K-	
				-		200 TRACK RIG	Eastir	•	500255	slope:		-90°	R.L. SL	rface; NC	DT MEASURED
$\sim$		diame Illing		nation		Drilling fluid: terial substance	North	ing:	7000235	bearin	ř –	k mass	datum: defects		
					og Very	material	-	Ē.	estimated	!s <sub>(50)</sub>		defect	d	efect descrip	tion
·_/	method	core-lift water		depth	graphic log core recovery	rock type; grain characteristics, o structure, minor component		weathering alteration	strength	MPá D-diam- etral	8	mm	type, inclin	ation, planarity cating, thickn	y, roughness, ess
$\bigcap$	e.	va Va	RL	metres	er o O		hole		ສ⊔≊≖ <u>≯</u>	A	a B B B B B B B B B B B B B B B B B B B	<u>5858</u>	particular		geлeral
<u>(_)</u>				_		SANDSTONE: fine grained, grey, massive. SANDSTONE: fine to medium gra		HW HW							-
Â				-		brown, massive, clay layer from 9.4	6-9.52.								-
[]						SANDSTONE: fine grained, grey a yellow, massive.	and								_
$\cap$				10	:::: ::::	SANDSTONE: coarse grained, da	rk	-							-
$\Box$						brown, massive.									_
$\circ$				-	:::: :::::	CONGLOMERATE SANDSTONE &							11xPT, 0°, UN 11xPT, 0°, UN		_
				-		SILTSTONE GRAVEL: brown, gre red, massive.	•						11xPT, 0°, UN	, RO, CN PT, 0°, UN, RI	0, CN -
				- 11	<u></u>	SANDSTONE: fine grained, dark g massive. SANDSTONE: fine to medium gra	/						PT, 0°, PL, SC		-
$\left[ \right]$				'-		brown and grey, massive. Coal layer of 20mm	nea,								-
()													PT, 0°, PL, SC PT, 0°, PL, SC PT, 0°, PL, SC	). CN	-
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ш				4											_
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CORI				15											-
$\smile$	metho DT	bd	diatut	e	_ I,	core-lift	water	/98 water	level	weathering FR fres	h		đefect type JT joint		roughness VR very rough
Rev. 3	AS AD		auger	screwing drilling		barrel withdrawn		ate show		SW sligt MW mod	ntly wea	weathere	PT parting		RO rough SO smooth
~~ e	RR CB NMLC	:		ricone F blade b Core	it	graphic log/core recovery	- partia	er inflow al driil fluid plete driil f		XW extr DW disti	emely wa	veathered eathered V and HW	SS sheare CS crushed	d surface	SL slickensided
5.5 Issue	NQ, H			iê core		core recovered		piete ûnit i	(ulu (USS	(cov strength VL very		v ai 10, MVV,	planarity PL planar	1	coating CN clean
						indicate material	- 6	r pressure cons) for d	e test result lepth	L low M med H high	lium		CU curved UN undulat ST stepped	ing y	SN stained VN veneer CO coating
E E								val shown		VH very	high emely h	igh	IR irregula	r	
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			ring I										Sheet Projec			1 of GEO	3 0TNATH1830	674(
Clien	t:		NO	RTH	EAS	Τ Βί	JSIN	ESS PA	RK	·			Date s			-	1.2006	07740
Princ	ipal:		NO	RTH	EAS	твι	JSINI	ESS PA	RK - LAING	O'ROURI	<b>KE</b>		Date o	omp	leted:	27.1	1.2006	
Proje	ct;		MA	RIN/	4 GE	ΟΤΕ	CHN	IICAL II	VESTIGATI	ION			Logge	•		LH		
Borel	iole L	ocatio	on: AS	PER	R MAI	Þ							Check	-		12-		
drill me	odel an	đ mou	nting:	JACR	0 200	TRAC	K RIG	Easting	: 500406	slope	: -90°	-			·	Surface:		
hole di	_			100 n	າກາ			Northin	ř – – – – – – – – – – – – – – – – – – –	beari	ng:				datun	1:		
	ng ini S	orma			1	mat	1	substance	<u>}</u>		· · · · · ·							
<b>.</b>	penetration		notes samples,			s log	classification symbol		mat	erial		θE	consistency/ density index	pocket	leter		structure and onal observation	_
e i	15	water	tests, etc		depth	graphic log	lassifi	soit	type: plasticity or p			moisture condition	onsist ensity	kF	'a		onal observation:	5
E 1 Q	23			RL	metres	  }11	SC	1	our, secondary and L: CLAY: high pla	•	nents.	EX	С F	88	_	OPSOIL		
A				[	-		sc		CLAY: medium to		d, brown.		'			ARINE SC		
																		-
					1													-
							SP	clay, son	coarse grained, gr te subrounded qua	rey, some high j artzitic gravel up	plasticity to 3mm in		MD					_
					-			size.										-
			SPT 2,2,5		-	• • •						Ŵ			s	ample has	organic odour	-
			N*=7	4	2	111	СН	CLAY:	high plasticity, brow	wn and yellow.			F	111				•
					-													-
						÷.,/	SC	medium p	SAND: medium: plasticity clay.	to coarse graine	ed, grey,		F/MD		0	rganic odo	lur	-
					_			high pla	sticity.									_
<u>p</u>	м	-	SPT		3	·//					ĺ							_
			3,3,4 N*=7			11/1	СН	CLAY: Coarse gr	high plasticity, brow ained sand.	wn and yellow, t	race of					LLUVIAL S	SOIL	
					-			grey, y	ellow and brown, size, argillaceous gr	ome quartzitic ç	gravel of							-
					4			coarse sa										-
					ļ			grey an	d yellow.		-	ŀ	St-VSt		XX			
		╿┝			-										<u>ا</u> ا			-
			U <sub>50</sub>								[	-	н			o hard to j	push U50 to depti-	- י _
					5		CL	<pre>&gt;&gt;500</pre>	grey clay material		_{ ل	м				>>500kPa		
	ana							dark red, i	LAY: low to med coarse grained sar form of well grade	nd, some dark n	ed arenitic				Ь	tremely wa	eathered	
					ł		i	from 2 to	4mm.	sa gravei langin	ig ni size					NDSBOR	OUGH SANDSTC	- NE -
					6													-
		2.10	SPT 5,30/120m	m	Ţ		ĊL	CLAY:	medium plasticity,	grey and yellow						OFFEE RC	юск	
		-	N*=R		-								[					_
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		ĺ			7													1
					-										110	n staining		-
		-	SPT		ľ		СН	CLAY: h	igh plasticity, grey	and red, some	medium							1
			11,12,13 N*=25					to coarse (	grained sand,									_
nethod	<u>a – 1</u>		u de ut	sup		<u>/////</u>			ples, tests		classificat		bols and	<u> </u>			y/density index	
AS AD RR	au	ger sore ger drill ler/trico:	ng*		asing	N	nii	Uea	undisturbed sample 5 undisturbed sample 6		soil descri based on u		assificatio	on	1	VS S	very soft soft	
N N CT	wa	shbore shbore ple tool	~	pene 1 2	- no	resistan	ce	N s	disturbed sample standard penetration t SPT - sample recover		system					F St	រើវាញ stiff	
HA DT	ha	nd auge tube	er i	wate	éòcasi⊄ refi	iging to usal		No :	SPT - sample recover SPT with solid cone vane shear (kPa)	eu .	moisture D dry M mois	r4				VSt H ⊆⊨	very stiff hard frighte	
B		nk bit		•	10/1/98 v on date s		vel	P F	oressuremeter bulk sample		W wet	si tic limit				Fb VL L	friable very loose loose	
T T	TC by suff	bit x		<b>&gt;</b>	water infl	ow		E e	environmental sample refusal	÷		d limit				L MD D	loose medium dense dense	ļ
		т		-4	water out	tflow	- 1									VD	very dense	- 1

	coff	ey by geotechnics	Borehole No.	MBH5
Î	Enginee	ering Log - Borehole	Sheet Project No:	2 of 3 GEOTNATH18367AC
11	Client:	NORTHEAST BUSINESS PARK	Date started:	27.11.2006
7	Principal:	NORTHEAST BUSINESS PARK - LAING O'ROURKE	Date completed:	27.11.2006
3	Project:	MARINA GEOTECHNICAL INVESTIGATION	Logged by:	LH

Logged by:

LH

Project:

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Borehole Location: AS		Neutron Canada	Checked by:
drill model and mounting:	JACRO 200 TRACK RIG	Easting: 500406 slope: -90°	
tole diameter: drilling information	100 mm material s	Northing 700015 bearing:	datum:
notes samples, tests, etc tate tests, etc 1 2 3 1 1 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	o log cation		A condition a condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition condition conditi
- 123 M - 123 M - SPT 6,11,15 N*=26 - N - SPT 30/100mm N*=R		CLOUT, secondary and minor components. 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. SANDY CLAY: high plasticity, grey and red, some medium grained sand; trace dark red arenitic angular gravel up to 3mm. SANDY CLAY: medium to high plasticity, yellow, fine grained sand.	M H X PP=400kPa × PP=400kPa PP=460kPa PP=460kPa PP=460kPa × PP=500kPa × PP=500kPa × PP=500kPa Kock fabric visible
lethod S auger screwing* D auger drilling* R roller/tricone T cable tcol A hand auger T diatube blank bit	I 13 	U <sub>50</sub> undisturbed sample 50mm diameter soil descr	unified classification S soft F firm St stiff VSt very stiff H hard

ļ	C			[e]	y	Seotech	mes	5					-	Bo	rehole No.	MBH	5	
						og - Cored Bor								-	eet oject No:	3 of GEO1	3 "NATH18:	R674(
	Clie					THEAST BUSINESS F						_			te started;	27.11		<u>, , , , , , , , , , , , , , , , , , , </u>
F	Prin	cipa	ł:		NOR	THEAST BUSINESS P	PARK - L	.AING	O'ROU	RKE				Da	te completed:	27.11.	2006	
F	Proje	ect:			MAR	NNA GEOTECHNICAL	INVEST	<b>IGAT</b>	ION				1	Log	gged by:	LH		
E	Bore	hole	e Loc	ation:	AS F	PERMAP								Ch	ecked by:	احب	-	
				-		200 TRACK RIG	East	•	500406	slop	<b>;</b>	-	90°		R.L. S	urface:		
	ole d drill			nation		Drilling fluid: terial substance	Norti	oing:	700015	bear	- i -	ock	ma	55	datum defects			<u> </u>
					D Zev	material		5	estimated	Is(50)	T		lefec			lefect desc	ription	
	method	j ja		donth	graphic log core recoverv	rock type; grain characteristic structure, minor compor		weathering alteration	strength	MPá D-diam	.  %	1	pacin mm		type, incli	nation, plana coating, thic	arity, roughnes kness	s,
	ê l	water	RL	depth metres					우기호파웃	etral E A- axial	RQD	8	100 100 100	3000	particular			general
				-	1	SANDSTONE: fine to medium brown to red and grey, massive.	grained,	HW			Γ				PT, 0°, PL, S			_
				-											━ PT, 0°, PL, 8 ■ PT, 0°, PL, 8			-
				13		SANDSTONE: fine to medium	grained,	sw							PT, 0°, PL, S	O, CN, 1mr	n	-
				- <sup>-</sup>		grey, massive.									PT, 0°, PL, S	O, CN, 1mr	n	_
		ĺ		-											<sup>1</sup> PT, 0°, PL, S	U, UN, 1mr	n	-
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l	S D R		aug	er screwin er drilling t/tricone	g	casing used	- <del>L</del> on	date show er inflow		MW m	ghtly odera ghly v	tely v	veath		PT partin SM seam		RO rough SO smooth SL slickens	-
2	K B MLC		claw	or blade i C core	bit .	graphic log/core recovery	par	tial drill fiui 1		XW ex DW đi	trem stincti overs	ely we y wea	athere	≩d	SS shear CS crush	ed surface ed seam		140U
	Q, HC	I, PQ		ine core				gere te tanif		strength VL ve	ry lov			,	pianarity PL plana		coating CN clean	
						indicate material		er pressur eons) for (	e test result lepth	L lo M m					CU curve UN undul ST stepp	ating ed	SN stained VN veneer CO coating	
								rval showr		VH ve	ry hig	h ly hig			IR irregu		73	

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$\sim$		Pri	ncipa	ıl:								K - LAING	O'ROURH	Œ		Date c					
J	L	Pro	oject:			МА	RIN	۹ GE	OTE	СНЛ	IICAL INV	/ESTIGATI	ON			Logge	•		LH		
<u></u>	۱.	Bo	rehol	e Lo	catio	on: AS	PER	R MA	Ρ							Check	ed b	y:	1cc	•	
					mou	inting:		ON 300	0		Easting:	500625	slope	: -90°				Ř.L.	Surface:		
~		_	e diam illing		orma	ition	100 m	m	mate	erials	Northing substance	7000050	beari	ig:				datu	n:		
			penetration	Τ		notes samples			[og	ation		mate	erial			ncy/ ndex	cket	penetro- meter		ructure and	
<u>ر</u> م		method	pene	support	water	tests, etc		depth	graphic log	classification symbol	soil typ	pe: plasticity or p			moisture condition	consistency/ density index	ki	Pa	additio	nal observation	5
		ADT n	123	N N	M.		RL	metres	: ज	ວິດ CL		r, secondary and SANDY CLAY:	•		Е8 М	8 <del>ម</del> F	₽ã	8 8 9	TOPSOIL		
		AL						-		СН	brown.	gh plasticity, grey						ίL	ALLUVIAL S	OIL	
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<i>د</i> )								_		СН	grained san	gh plasticity, grey id.	, some fine to r	nedium							]
		Ħ						_			grey, red a	and orange.			w	St			330mm reco	very	_
-,-						U <sub>50</sub>		-				-					×				-
								<u> </u>			red								P=140kPa		
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<i>د</i> ۔		000000000000000000000000000000000000000			-													<b>*    </b> P	P=295kPa		
	9.1.07							-							ĺ						
	Y.GDT							4			grey										_
$\left[ \right]$	COFFEY							-							1						-
	GPJ	2000			-						grey, yellov	w and red									-
$\left[ \right]$	367AC.					U <sub>so</sub>															
U	GEOTNATH18367AC				_			5		СН	CLAY: high	n plasticity, grey	and red Farey					×P	P>>500kPa	5	
7	EOTN							-		<b>U</b> II	Ch=VSt-H R	ed CH=VStj	and red. [grey					R	ed material i	is very stiff to ha s very stiff.	ra _
$\bigcup$								-													-
<u>ر</u> ے	BOREHOLE							Ŧ			Red clay d	ecreases with de	nth								-
								6											ESIDUAL SO P>>500kPa	DIL	
	1	netho AS	bd			ewing*	sup M r	nud	N	nit		disturbed sample 5		classificat soll descr	iption			T	consistency. VS	density index very soft	
	21	AD RR N		rolle	er dril :r/tricc hbore	one	pene	asing stration 3 4			D disl	disturbed sample 6 turbed sample ndard penetration t		based on a system	unified cla	assificatio	ก		S F St	soft firm stiff	
5	tie 3	TC HA		cab han	le tool d aug			no ra	resistano nging to iusal	e	N* SP	T - sample recover T with solid cone		moisture D dry					St VSt H	stiff very stiff hard	
$\left[ \right]$	60 E				ik bit			10/1/98	water lev	/el	V var P pre	te shear (kPa) ssuremeter		M moi W wet					Fb VL	friable very loose	
(_)	U U U U	Г	own by	V bi TC I suffix	bit			on date water inf				k sample /ironmental sample usal			tic limit d limit				L MD D	loose medium dense dense	
[```)		e.g.		ADI			· ·	water ou				<b></b>				-			VD	dense very dense	

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Engineer										Sheet Projec			2 of 3 GEOTNATH18367AC
Client:	NORT	HEAS	T BU	SINE	SS PARI	ĸ				Date s	tarte	d:	20.11.2006
Principal:	NORT	HEAS	T BU	SINE	SS PARI	K - LAING	O'ROURKE			Date c	ompl	leted	: <b>20.11.2006</b>
Project:	MARII	VA GE	OTE	CHNI	CAL INV	ESTIGATI	ON			Logged	d by:		LH
Borehole Locatio	on: AS PE	R MAI	P						I	Check	ed by	y:	1<~
drill model and mou	nting: ED	SON 300	D		Easting:	500625	slope:	-90"				R.L.	Surface:
hole diameter: drilling informa		) mm	T		Northing	7000050	bearing:			_		datu	m:
method 7 2 penetration 8 upport 8 upport	notes samples, tests, etc	depth	raphic log	classification symbol			erial article characteristic d minor components		moisture condition	consistency/ density index	100 pocket	'a	structure and additional observations
B	U <sub>50</sub>	-		CL		dium plasticity, e of medium gra	grey to brown and re ined sand.	∍d to	W	Н			230mm Recovery U50 pushed approximately 200mm_ as material too hard.

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BOREHOLE GEOTNATH18367AC.GPJ COFFEY.GDT 9.1.07

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AS

AD RR W

CT HA DT

в

e.g.

ADT

water inflow

water outflow

GEO 5.3 Issue 3 Rev.2

Form

В

...some coarse grained sand SPT PP>>500kPa 30/130mm N\*=R 8 SANDY CLAY: medium plasticity, grey, fine and coarse grained sand; some flat angular gravel of up to CL 9 4mm in length. SPT 30/100mm N\*=R PP>>500kPa CLAYEY SAND: coarse grained, grey, medium plasticity clay. Sand content increases with depth. SC Extremely weathered SANDSTONE 1<u>0</u> SC CLAYEY SAND: coarse grained, grey. Borehole MBH6 continued as cored hole 11 method support notes, samples, tests classification symbols and consistency/density index auger screwing\* M mud undisturbed sample 50mm diameter undisturbed sample 63mm diameter N nil Uso soil description vs auger dritting\* roller/tricone C casing Ues based on unified classification S F penetration D disturbed sample system penetration 1 2 3 4 ranging to ranging to washbore standard penetration test (SPT) SPT - sample recovered SPT with solid cone Ν St cable tool N\* moisture D dry VSt hand auger Nc dry н diatube V P water vane shear (kPa) M W moist Fb biank bit 10/1/98 water level on date shown pressuremeter wet ٧L ¥ V V bit T TC bit \*bit shown by suffix Bs bulk sample plastic limit Wp L E R environmental sample w liquid limit MD

refusal

...grey

very soft

very süff

very loose

very dense

medium dense

hard friable

loose

dense

D

VD

soft

firm

stiff

1	J	C		e	<b>y</b>	Seotech geotech	mes	5							B	orehole No.	MBI	46	
						og - Cored Bore										neet roject No:	3 of GEO	3 TNATH183	67A(
	lien					THEAST BUSINESS P								•		ate started:		1.2006	
Pr	rinc	ipal	:	i	NOR	THEAST BUSINESS P	ARK - L	AING	<i>•</i> 0	'RO	UR	KE			Da	ate completed	i: <b>20.1</b> ;	1.2006	
Pr	oje	ct:		l	MAR	INA GEOTECHNICAL	INVEST	'IGAT	101	N					Lo	gged by:	LH		
Bo	ore	nole	Loca	tion:	AS F	ER MAP									C	necked by:	よ~		
dri	ll m	odei	& mou	nting: El	DSON	3000	Easti	ng:	500	625		slope:		-9	0°	R.L	Surface:	····	
		iame na i		10 nation		Drilling fluid:	North	ing:	700	0050		bearin	÷	ok i	200	date defects	im:		
-										stimat	ed	le			fect		defect des	scription	
method	core-lift	water		depth		rock type; grain characteristic: structure, minor compone	s, colour, ents	weathering alteration	5	streng		ls <sub>(50)</sub> MPa D-diam- etral	RQD %	spa n	acing nm		clination, pla coating, th	narity, roughness nickness	i.
5	8	Š	RL	metres	: 5.8		······	j≊ <del>t</del> a	₹.	ΣI	호표	A- axial	Ř	85	3000	particular		<u> </u> {	genera
				_															
				-		Continued from non-cored b	orehole												
			ļ	-				XW											-
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						SANDSTONE: fine grained, yell massive.	ow,												
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		ĺ		_		Clay seam													-
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						MBH6 terminated at 13.61m					1			ÌΪ					
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net DT	hod		diatul		Ţ	core-lift	water	, /98 wate		af I		veathering FR fres	-	1 1		defect fy JT join	pe	roughness	- 1-
4S 4D			auge	r screwing r drilling	9	casing used	- <u>-</u> on d	late show	ทา		1	SW slig VW mo	htly w derate	ely we	eathere	ed SM sea	ting Im	VR very roug RO rough SO smooth	
RR CB			daw	tricone or blade b	pit	barrel withdrawn graphic log/core recovery		ial drili flu				KW extr DW dist	inctly	y wea weati	ilhered hered	SS shu CS cru	eared zone eared surface shed seam	SL slickensid	dedi
NML VQ		PQ		C core ne core		core recovered	<b>-</b> com	plete dri(	l fluid	loss		co») trength	versit	/W a	nd HV	/) planarity		coating	
						- graphic symbols indicate material		r pressu			. [[	_ low	y low dium			UN une	ved Iulating	CN clean SN stained VN veneer	
						no core recovered		eons) for val show		h	ľ	−i híg≵ /H veny	n y high				oped gular	CO coating	
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			сy	<u> </u>	2	500	510	chni					Boreh	ole No.	MBH7
Eng	gin	ee	ring L	_ <b>o</b> g	j - E	Bor	eho	le					Sheet Projec		1 of 3 GEOTNATH18367AC
Client:			NO	RTH	EAS	TBU	SINE	SS PAR	к —				Date s	tarted:	20.11.2006
Princip	al:		NO	RTH	EAS	ТBU	SINE	SS PAR	K - LAING (	O'ROURKE		l	Date c	ompleted	: <b>20.11.2006</b>
Project	t:		MA	RINA	4 GE	OTE	CHNI	CAL INV	ESTIGATIC	ON .		I	Logge	d by:	LH
Boreho	ole Lo	ocatio	on: AS	PER	R MAI	D						(	Check	ed by:	1c-
drill mod	lel and	i mou	nting:	EDSC	ON 3000	)		Easting:	500672	slope;	-90°			R.L.	Surface:
hole diar	meter	:		100 m	m			Northing	7000224	bearing:				datu	m:
drilling	g inf	orma	tion	• .		mat	erial su	ubstance							
thod benetration	support	ater	notes samples, tests, etc			graphic log	classification symbol		mater	ial		moisture condition	consistency/ density index	pocket penetro- meter	structure and additional observations

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25	L ui	ning	n ne	31 HIC				man	eriai s	substance					
	method	penetration	support	water	notes samples, tests, etc		depth	graphic log	classification symbol	materia) soil type: plasticity or particle charac	teristics, Eoropa	consistency/ density index	k	enetro- meter	structure and additional observations
$\gamma$		123		3		RL	metres	5,					<u>5</u>	888	
	AD		N						СН	CLAY: high plasticity, grey to brown, ye	liow. M	F			ALLUVIAL SOIL
									СН	CLAY: high plasticity, grey.	  -w-				
							- 1							:	-
	TB					-									-
U	н				U <sub>50</sub>		2		sc	CLAYEY SAND: medium grained, orang plasticity clay.	ge, high	MD	- *		 PP≕100kPa ~~
							_	/							
П							-								-
$\Box$				-			3		СН	SANDY CLAY: high plasticity, red and g coarse grained sand; some gravel of up to size.	rey, o 4mm in	St-VSt			-
				1	U <sub>50</sub>									¥	- PP=300kPa -
DT 9.1.07							4								-
COFFEY.G									СН	CLAY: high plasticity, red and grey, som grained sand. dark red and grey, some coarse grained					-
GP.				F	<u> </u>				CH	fine gravel up to 6mm in size. CLAY: high plasticity, grey and red, some		VSt-H		*	
		~			U <sub>so</sub>		5			grained sand.					G=400kPa - R>>500kPa -
GEOT										CLAY: high plasticity, grey and dark red. material is hard high plasticity clay. Grey m stiff-very stiff high plasticity clay.	Dark red M naterial is				
BOREHOLE							6			CLAY: medium plasticity, grey and red, s medium to coarse grained sand; trace of a gravel up to 4mm in size.	some Ingular				-
3 Rev.2	metho AS AD RR W CT	đ	aug rolie was	er sci er dri er/tricc hbore le too	one 9		nud asing stration 3 4	N r		notes, samples, tests           U <sub>so</sub> undisturbed sample 50mm diameter           U <sub>es</sub> undisturbed sample 63mm diameter           D         disturbed sample           N         standard penetration test (SPT)           N         SPT_00mm percentation test (SPT)	based on unified c system				consistency/density index VS very soft S soft F firm St stiff
0.5.3 Issue	HA DT B V T		han diat	d aug ube ık bit t		<u> </u>	ran refu 10/1/98 v on date s	ging to Isal vater lev ihown	el	N*     SPT - sample recovered       Nc     SPT with solid cone       V     vane shear (kPa)       P     pressuremeter       Bs     bulk sample       E     environmental sample	moisture D dry M moist W wet Wp plastic limit W <sub>L</sub> liquid limit				VSt very stiff H hard Fb friable VL very loose L loose MD medium dense
Ē	*bit sh e.g.	own by	Suffix ADT				vater infli vater out			R refusal					D dense VD very dense
السابية															

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].	Engineering Log - Borehole	Sheet Project No:
5	Client: NORTHEAST BUSINESS PARK	Date started:

NORTHEAST BUSINESS PARK - LAING O'ROURKE

Sheet Project No:	2 of 3 GEOTNATH18367AC
Date started:	20.11.2006
Date completed:	20.11.2006
Logged by:	LH

MBH7

MARINA GEOTECHNICAL INVESTIGATION Project:

Principal:

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drill	mode	land	mou	unting:	EDSC	ON 300	)		Easting:	500672	slope	e: -9	90"			R.	L. Surface:
	e diam				100 m	nm	<b>-</b>		Northing	7000224	beari	ng:				da	tum:
dr	illing	Info	orma	ition	1		mate		ubstance					1			
method	L benetration	support	water	notes samples, tests, etc	:	depth metres	graphic log	classification symbol	coloui	mate be: plasticity or pa r, secondary and	article characte d minor compoi	nents.	moisture condition	consistency/ density index	k	300 m penetro- 400 meter	
ΤB		N		U <sub>50</sub>	-	-		CL	gravel up to	edium plasticity, g coarse grained s o 4mm in size. <i>(co</i> ifferent strength.	sand; trace of a continued)	iome ngular	M!	VSt-H			PP=260kPa grey clay PP=500kPa red clay
						- 7_ -		SC	CLAYEY SA red, mediun	AND: fine to coan plasticity clay.	arse grained, g	yrey and					RESIDUAL SOIL
				U <sub>50</sub>		- 8_ -										*	PP=400kPa
				SPT 16,30/100r		- - 9		SC	high plasticit	AY: coarse grai ly clay. me gravel up to 3		yellow,		D/VSt			Extremely weathered SANDSTONE
				N*=R		- - 1 <u>0</u> - -			Borehole M2	3H7 continued as	s cored hole						
						- 1 <u>1</u> - - - - 12											
metho AS AD RR W CT HA DT B V T *bit shi e.g.		aug rolid was cab han diat blar V bi TC	er dri ar/trice hbore le too d aug ube ik bit t bit	one e	vate	nud asing stration 3 4 no rar	shown Iow	e	U <sub>ss</sub> und D dist N star N* SPT Nc SPT V van P pres Bs bulk	disturbed sample 50 disturbed sample 63 turbed sample ndard penetration (it T - sample recovere T with solid cone te shear (kPa) ssuremeter k sample vironmental sample	3mm diameter lest (SPT) ed	soil de based system moistu D o M a W v Wp p					consistency/density index       VS     very soft       S     soft       F     firm       St     stiff       VSt     very stiff       H     hard       Fb     friable       VL     very losse       L     loose       MD     medium dense       D     dense       VD     very dense

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									g - Cored Bo								neet roject	No:	3 of GEO	3 7 <b>NATH18</b> :	367A(
	Clie	ent					NO	RTI	HEAST BUSINESS	PARK							ate sta			.2006	
ŀ	<sup>&gt;</sup> riı	ncij	bal			i	NOI	RTI	HEAST BUSINESS	PARK	- LAING	G O'ROI	IRKE			Da	ate co	mpleted:	20.11	.2006	
ł	⊃ro	jec	t:			i	MAI	RIN	IA GEOTECHNICA	. INVE	STIGA	TION				Lo	gged	by:	LH		
	Bor	eh	ole	Loc	atio	in: 1	AS	PE	RMAP							Cł	necke	d by:	て		
					untir	-	OSON			1	asting:	500672	slo	pe:	-9	90°		R.L. S	uface;	<u> </u>	
	dri			_	mat	10 tion	-	_	illing fluid: ial substance	1	lorthing:	7000224	bea	aring:	ock	mass	defe	datum: c <b>ts</b>			
								λ I	material			estimate	d ls <sub>isc</sub>			efect			lefect des	cription	
	method	Ĕ	'n				graphic log		rock type; grain characteris structure, minor compo		', weathering alteration	strengti	D- dia		l r	acing nm			ation, plar coating, th	arity, roughnes	s,
	l net	core-lift	water	RL		lepth letres	grap	3	Continued from non-cored		weat	옥ㄱᇗ포 동	etra 五 A-axi		9 9 9	300	partic		Joanny, ut	ICKIIESS	general
						-		: S. : gi	ANDSTONE: fine to mediur rey-yellow, massive.					╈		TT					-
					1	-															-
						10_											рР	T, 0°, PL, S	D, CN .		-
						_											\P	T, 0°, PL, S T, 0°, PL, S	D, CN		-
								S/	ANDSTONE: fine to coarse flow and grey, massive.	grained,	HW						1	T, 0°, PL, S T, 0°, PL, S			-
						_			ONGLOMERATE SANDSTO												-
						1 <u>1</u>	· · · ·	:   SI	L'ISTONE GRAVEL & COBE coarse grained, grey and bro	LES: fi	ne						<b></b> P'	Г, 0°, PL, S(	D, CN		-
																	 	T, O°, PL, R(	D. CN		
																		T, 0°, PL, R	-		-
							· · · ·											r, 0°, PL, R(			-
						_	· · · · ·											.54-11.74-F	PT, 5°, PL,	RO, CN	-
						12	· · · ·	54	NDSTONE: fine grained, g	ov and	xw										_
						_		ye	llow, massive.	су апа				:			P1	", 0°, PL, SC ", 0°, PL, SC	), CN ), CN		_
						-															-
						-															_
						13															_
	┢	T	1		-	13	<u>.</u>	ME	3H7 terminated at 13m	-					$\left  \right $		<del>_</del> PT	<u>, 0°, PL, SC</u>	0CN		
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T		d		diate				cori	e-lift	wate	10/1/98 wate			fresh				defect type JT joint		roughness VR very rou	un
S C E	)			aug	er dri		'	Ц	casing used barre! withdrawn		on date show	'n	MW	slightly modera highly v	itely wa	eathere	d	PT parting SM seam	d zone	RO rough SO smooth	-
E	7 3 VII (1			claw	r/trica / or bi _C ca	lade b	it	l f grap	phic log/core recovery		water inflow partial drill flu		XW DW	extreme distinctl	ely wea ly weat	ithered hered	- 1	SS sheare	d zone d surface d seam	SL slickens	iloeđ
	MLC Q, H		Q		line c			Ē	core recovered		complete dri	i tiluid loss	strengti			nd HW		planarity PL planar		coating CN clean	
								E	- graphic symbols indicate material	T	-	re test result	L I M I	/ery lov ow nedium				CU curved UN undula	ling	SN stained VN veneer	
							- I		no core recovered	2	(lugeons) for	depth		nigh				ST steppe	5	CO coating	

coffey	<b>ර</b> ි⊃ geot	echnics	Borehole No.	MBH8
Engineering	Log Porch		Sheet	1 of 3
· · · · · · · · · · · · · · · · · · ·	DRTHEAST BUSIN		Project No:	GEOTNATH18367AC
		ESS PARK ESS PARK - LAING O'ROURKE	Date started:	21.11.2006
		ESS PARK - LAING O ROURKE VICAL INVESTIGATION		
Borehole Location: AS		NOAL INVESTIGATION	Logged by:	LH
drill mode! and mounting:	EDSON 3000	Easting: 500697 slope:	-90° R	.L. Surface:
hole diameter:	100 mm	Northing 7000358 bearing:		atum:
drilling information		substance		
Poup a distance of the sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sample sam	s, olog	material soil type: plasticity or particle characteris colour, secondary and minor componer	strate to the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the stat	
		CLAY:       high plasticity, grey to brown.        grey and yellow, some fine grained sand.         SANDY CLAY:       medium plasticity, grey, fine grained sand.         SANDY CLAY:       medium plasticity, grey, fine grained sand.         SANDY CLAY:       high plasticity, yellow, fine grained sand.         CLAY:       high plasticity, grey, some fine graine sand.         CLAY:       high plasticity, grey, some fine graine sand.         CLAY:       high plasticity, grey, some fine graine sand.        grey and red, trace of gravel up to 3-4mm in	d rd	ALLUVIAL SOIL  PP≈180kPa pushed 170mm PP>>500kPa 
8PT 21,30/140n №##R		dark grey and dark red. CLAY: low plasticity, dark grey, some fine gra	ined	Possibly a RESIDUAL SOIL extremely weathered SANDSTONE.
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 T C bit *bit shown by suffix e.g. ADT	support M mud N nil C casing penetration 1 2 3 4 maging to ranging to refusal water ↓ 10/1/98 water level on date shown water inflow water outflow	Bs bulk sample	classification symbols and soil description based on unlified classification system moisture D dry M moist W wet Wp plastic limit W <sub>L</sub> liquid limit	consistency/density index       VS     very soft       S     soft       F     firm       St     stiff       VSt     very stiff       H     hard       Fb     friable       VL     very losse       L     losse       MD     medium dense       D     dense       VD     very dense

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<b>coffey</b> <sup>୍ରିତ</sup> geotechnics	Borehole No.
Engineering Log - Borehole	Sheet Project No:

MBH8

21.11.2006

21.11.2006

LH

Date started:

Logged by:

Date completed:

2 of 3 GEOTNATH18367AC

Client:	
Principal:	

### NORTHEAST BUSINESS PARK NORTHEAST BUSINESS PARK - LAING O'ROURKE

Project:

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MARINA GEOTECHNICAL INVESTIGATION

	Boi	rehole	e Lo	cati	on: AS	PER	R MA	Р							Check	ed b	y:	12-	
- [	drill	mode	land	mou	inting:	EDSC	ON 300	0		Easting:	500697	slop	e: -9(	0°		_	R,I	., Surface:	
	_	diam				100 n	nm			Northing	7000358	bear	ing:				daf	um:	
Ļ	dri	iling	info	rma	tion			mat	erial s	ubstance									· · · · · · · · · · · · · · · · · · ·
	8 method	2 penetration		water	notes samples tests, etc		depth	graphic log	classification symbol	colour	e: plasticity or j , secondary ar	terial particle charact nd minor compo	onents.	moisture condition	consistency/ density index	k	300 m penetro-	str addition	ructure and nal observations
	18				SPT 12,22,28 N*=50		- - - 7		CL	CLAY: low sand. <i>(contir</i>		k grey, some fir	le grained	M	H or Fb				
					SP⊺ 9,30/130m N*=R	μ Π	- 8 -		CL	CLAY: Iow medium graii from 2mm to	ned sand; som	grey, some fin ne gravel rangin	e to g in size					above	nard than material usal approximately _
1.07					SPT 10,13,18 N*=31		- 9 - -		CL	CLAY: med pale grey ma material low p	terial high plas plasticity clay, s	w and red, pale grey to da ticity clay, dark some fine and r up to 6mm in si	grey nedium			>	~ × × ×	PP=260kPa PP=300kPa PP=340kPa PP=400kPa PP=500kPa	-
TH18367AC.GPJ COFFEY.GDT 9.1.07				2	SPT 7,30/70mn N*≂R		- 1 <u>0</u> - - - 11			and orange.		ow, pale grey, d	ark grey		VSLH				-
AILA										Borehole MBH	H8 continued a	as cored hole				$\prod$			
BOREHOLE GEOTNATH18367AC							- - - 12	-											-
GEO 5.3 Issue 3 Rev.2 A C H H C H H C H H C H H C H H C H H C H H C H H C H H C H H C H H H H H H H H H H H H H H H H H H H H	tsho	d own by	aug rolle was cabi han diati blan V bi TC I	er drif r/tricc hbore e tool d aug ube k bit it	une	wate	nud asing atration 3 4 no rai	shown łow	ж	U <sub>es</sub> undi D distu N stan N* SPT Nc SPT V vane P pres Bs bulk	sturbed sample t sturbed sample dard penetration - sample recove with solid come a shear (kPa) suremeter sample ronmentat sample	63mm diameter i test (SPT) ered	soil des based or system D dr M m W we Wp pla	n unified cli e y oist				consistency/o VS F St VSt Fb VL L MD D VD	tensity index very soft soft firm siff very stiff hard friable very loose loose medium dense dense very dense

C			C	y	≫ geotec	11103					B	orehole No.	MBH	18
					og - Cored Bo		_					heet roject No:	3 of GEO	3 TNATH18367A
Clie	ent:			NOF	RTHEAST BUSINESS	PARK					D	ate started:	21.11	.2006
Prir	icipa	l:	1	NOF	RTHEAST BUSINESS	PARK - LAI	NG	O'ROUI	RKE		D	ate completed:	21.11	.2006
Pro	ect:			MAF	RINA GEOTECHNICA	L INVESTIG	ATI	ON			Lo	ogged by:	LH	
Bor	ehole	e Loca	tion:	AS	PER MAP						C	hecked by:		-
			nting: El	DSON	3000	Easting:	5	00697	slope:		-90°	R.L. S	urface:	<u> </u>
	diam Iling		10 nation	1	Drilling fluid: terial substance	Northing:	7	000358	bearin	_	k mace	datum s defects	:	
				-				estimated	ls		defect		defect des	cription
method	core-lift water		depth	graphic log one renoverv	rock type; grain characteris structure, minor comp	tics, colour, juint onents g	alteration	strength	Is <sub>(50)</sub> MPa D- diam- etral	8	spacing mm		nation, plan coating, thi	arity, roughness, ckness
Ē	8 š	RL	metres	555	Continued from non-cored SANDSTONE: medium to co		Ť	≓_≊∓≩¦	A- axial	ъ К	\$ <u>5</u> 85888			genera
			-		grained, red, massive.		IVU .					PT, 0°, PL, S		
Í			-				ĺ					PT, 0°, PL, S		
			-									PT, 0°, PL, S		
					SANDSTONE: medium to co		Í					PT, 0°, PL, S	O, CN	-
			12_		grained, grey brown and white	massive.						PT, 0°, PL, S	O, CN	-
			-									PT, 0°, PL, S	O, CN	
			_									PT, 5°, PL, S PT, 0°, UN, S	O, CN	
			13_									P1, 0 , 0N, 8	U, UN	-
			_											—
			_									PT, 0°, PL, S	D, CN	-
			-											-
			-										-	_
			14		SANDSTONE: fine to mediun grey, massive.	1 grained, Mi	$\sim$					PT, 0°, PL, S PT, 0°, PL, S PT, 0°, PL, S	D, CN D, CN	
				••••	MBH8 terminated at 14.2m							'P1, 0', PL, 5	J, CN	
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netho	l d		17		core-lift	water			weathering			defect type		
AS			screwing	9	casing used	10/1/98 v on date s	vater shown	level		ntiy wea	athered	JT joint PT partin	)	roughness VR very rough RO rough
ND RR		roller/	drilling tricone		barrel withdrawn	water infi			HW high XW extr	ly wea emely v	/ weathere thered weatherec	SZ shear	ed zone ed surface	SO smooth SL slickensided
СВ IMLC	ገ ¤≏	NMLC		ont	graphic log/core recovery			loss Iuid loss	DW disti (cov	nctiy w	eathered V and HV	CS crush	ed seam	
vu, H	<u>,</u> PQ	wreit	ie core		core recovered     graphic symbols	_			strength VL very L low	low		planarity PL plana: CU curver		coating CN clean SN stained
					no core recovered	없. (lugeons)	for d	eptin	M med H high			UN undula ST steppe	ating ad	VN veneer CO coating
					L1	interval si	hown			high Ismely i	-1-1-	IR irregu	di	

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				ring											Sheet Projec		):		of 3 OTNATH18	3674
	ient:								ESS PA	RK					Date s				11.2006	0017
Pri	incipa	al:		NO	RTH	EAS	твU	SINE	ESS PA	RK	- LAING	O'ROUR	KE		Date o	omp	olete	ed: <b>22.</b>	11.2006	
210	oject:			МА	RINA	4 GE	OTE	CHN	ICAL IN	VVE:	STIGATI	ON			Logge	d by	<i>r</i> :	LH		
Во	rehol	le Lo	catio	on: <b>AS</b>	PER	R MA	Р								Check	ed b	oy:	KL		
dril	l mode	el and	l mou	inting:	EDSC	ON 300	0		Easting	<b>j</b> :	500702	slop	be: -9					L. Surface:	NOT MEASU	JRED
_	e diam rilling			tion	100 m	າກ	Imat		Northin ubstance	ž.	7000454	bea	ring:				da	tum:		
u	_			notes	-	Ï.	Î	T.	unstance	8		-			- ×		ģ	T		· · · ·
d	penetration	Ţ		samples tests, etc			graphic log	classification symbol			mate	rial		on te	consistency/ density index	ocke	penetro- meter	add	structure and itional observati	ons
method	12:	support	water	icsis, etc		depth metres	graph	classi symbo	soil	type: p	plasticity or p	article charac minor comp	teristics,	maisture condition	onsis iensit	k	Pa			
Ą					+	lineace		СН	SANDY	CLAY:		ity, dark grey		M	0 0	98	388 888	ALLUVIA		
						-			grained s	sand.					1					
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				U <sub>so</sub>																
					-	2			grey an	d red					F-St	×		PP= 80kF	a	
						-	//													
						-		СН	CLAY: I a low plas	high pl	asticity, red a	nd grey. Red	material is					Red mate with depth	rial increasing in (	quanti
						-				Soony c	nery.							with depth	•	
						3		СН				ty, grey, coai		M	D					
			ļ	SPT	1	- <u>-</u>			size.	ne Ara		ic ongin up to	o o nan na		-					
				30/700mm N*=R																
			-			-	<u>,,,,</u>	SC	CLAYEY	SAND	coarse gra	uined, grey, h	igh	-	VD					
						-	/		size.	clay; so	ome quartzitio	gravel up to	3mm in							
						-	.,,,,,		red,											
						4		CL/ML	CLAY: d	iark gr	ey, pieces of	red indurated	d sand of	-	н					
			Ì			-			up to 5mm	n in sìz	e.									
1000						-														
				SPT		-														
			17	7,30/145mi N*=R	†	-														
			ŀ			5		CL	CLAY: Ic		sticity, dark g									
						-				ow pia:	siicity, uark g	ey.								
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ieth S	od	auo	jer scr	rewing*	supp Mir		N	nil	notes, sam U <sub>so</sub> t		ests rbed sample 50	mm diameter	classific soll des	ation sym	ibols and	di di di di di di di di di di di di di d		consiste VS	ncy/density index	
D R		aug	jer drij er/tricc	iling*	Сс	asing etration			U <sub>53</sub> 1	undistu	rbed sample 6 d sample		based o	n unified cl	assificati	on		S	very soft soft	
/ T		was	hbore le tool	•	1 2	3 4 10	resistanc	æ	N s	standar	d penetration t		system				_	F St	firm stiff	
A T			d aug			rai	nging to lusal		No 8	SPT wit	ample recover h solid cone	-u	D di	у				VSt H	very stiff hard	
3			ak bit			10/1/98		vel	P F	pressur			W w					Fb VL	friable very loose	
V T		TC	bit			on date :			E e		nple mental sample			astic limit juid limit				L MD	loose medium dens	e
UIT ST	iown by	/ Suffic AD1				water inf water ou			R r	efusal			1				- 1	D	dense	

			ff		, Ş	>	ner	nte	echnics			-			,			
				сy	$\sim$		<i>,</i> ,		Serrinoo				Boreho	le N	0.	MBH	19	
E	Eng	gir	iee	ering	Log	3 - E	Bor	eho	ble				Sheet Project	No:		2 of GEO	3 TNATH183	674C
	lient								ESS PARK			-	Date st		i:		.2006	
Ρ	rinci	pal:		NC	RTH	EAS	ТBU	ISIN	ESS PARK - LAIN	G O'ROURI	KE	I	Date co	ompl	eted:	22.11	.2006	
P	rojeo	st:		MA	RIN	A GE	OTE	CHN	IICAL INVESTIGA	TION		l	oggeo	l by:		LH		
-	_	_		tion: AS	PEF	R MAI	Þ					(	Checke	ed by	:	10		
	ill mo ple dia			ounting:		ON 3000	ן		Easting: 500702	slop						urface;	NOT MEASUR	ED
			_	ation	100 n	nm	mat	erial s	Northing 7000454 substance	bear	ing:				datum:			
ſ	;	ation		notes			ő	tion		aterial			cy/ dex	pocket penetro-	ы Б		tructure and	
method		penetration	support water	samples tests, et			graphic log	classification symbol			- 4-41	moisture condition	consistency/ density index	Dod E			inal observation	s
	1	23	_		RL	depth metres	gra			and minor compo	nents.		den	5 8 8 5 8 8				
Ē			N	SPT 18,30/148	nm	-		CL	CLAY: low plasticity, da pale grey and red.	ark grey. (continue	ed)	M	Н					
				N*≂R														_
Γ	T					-			Borehole MBH9 continue	d as cored hole						<u> </u>		
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	hođ	<u> </u>				12		-1	notes, samples, tests		classifica		ools and				/density index	
AS AD RR		a		crewing* irilling* cone	C	mud Casing otration	N	ณม	U <sub>so</sub> undisturbed sampl U <sub>so</sub> undisturbed sampl D disturbed sample		soil desci based on	-	issificatio	n	1 8	/S	very soft soft	
W		٧	ashbo able to	re	pen 12	etration 3 4 no	resistan	ce	D disturbed sample N standard penetrati N* SPT - sample reco		system moisture				- 1	: St /St	firm sliff verv stiff	
HA DT		ł	and au iatube	ıger	wat	Sooce t ref	iging to usal		Nc SPT with solid con V vane shear (kPa)		D dry M moi				- I +		very stiff hard friable	
B V T		١	lank bi bit	t		10/1/98 on date :		vel	P pressuremeter Bs bulk sample		W wet Wp plas	t Stic limit			L L	/L	very loose loose	
T *bit: e.g.	shown	by su	C bit ffix DT			water inf water ou			E environmental sam R refusal	pie	W <sub>L</sub> liqu	id limit					medium dense dense	
	_														<u> </u>	/D	very dense	

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Form GEO 5.3 Issue 3 Rev.2

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amples, tests	classification symbols and	consistenc	y/density index
undisturbed sample 50mm diameter	soll description	vs	very soft
undisturbed sample 63mm diameter	based on unified classification	s	soft
disturbed sample	system	F	firm
standard penetration test (SPT)		St	stiff
SPT - sample recovered	moisture	VSt	very stiff
SPT with solid cone	D dry	н	hard
vane shear (kPa)	M moist	Fb	friable
pressuremeter	W wet	VL	very loose
bulk sample	Wp plastic limit	L	loose
environmental sample	W <sub>L</sub> liquid limit	MD	medium dense
refusal		D	dense
		VD	very dense
refusal		-	

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	C	of	fe	$\mathbf{V}^{c}$	➢ geotech	nics					E	orehole No.	 MB	H9
					og - Cored Bore							heet roject No:	3 0	
	Client			NOR	THEAST BUSINESS P	ARK					C	ate started:		1.2006
	Princip	oal:	1	NOR	THEAST BUSINESS P	ARK - LA	ING	O'ROU	IRKE		D	ate completed:	22.1	1.2006
	Projec	t:	i i	ИAR	INA GEOTECHNICAL	INVESTIC	<b>GATI</b>	ION			L	ogged by:	LH	
	Boreh	ole Loc	ation: 🖌	4 <i>S P</i>	ERMAP					_	С	hecked by:	1C-	
[-]			unting: El			Easting	.: 5	500702	slope:	:	-90°	R.L. S	Surface;	NOT MEASURED
€ J	hole dia drillin	meter: Ig infor			Drilling fluid: erial substance	Northing	<u>g: 7</u>	7000454	bearin	÷		datum s defects	n:	
. []				ery ery	material		_	estimated	I IS/500		defect		defect de	scription
ļ	method core-lift	Nater RL	depth	graphic log core recovery	rock type; grain characteristic: structure, minor compone	s, colour, ents	weathering alteration	strength	D-diam- etral	RQD %	spacing mm		nation, pla coating, t	anarity, roughness, hickness
		∛ RL	metres	50	Continued from non-cored b SANDSTONE: fine to coarse gr		≷ ऌ XW	צֿד≌רא		₩		particular		general
			7                                                                               	· · · · ·	SANDSTONE: fine to coarse grapale grey, massive.							PT, 1°, UN, PT, 1°, UN, PT, 1°, UN, PT, 1°, UN, PT, 0°, UN, I PT, 0°, UN, I PT, 0°, UN, F PT, 0°, UN, F PT, 0°, UN, F PT, 0°, UN, F	RO, CN RO, CN RO, CN RO, CN RO, CN RO, CN RO, CN RO, CN RO, CN	
			-		MBH9 terminated at 9.6m				-			PT, 0°, UN, F	10, CN 20, CN	-
9.1.07		ľ	10	ĺ										-
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COFFEY.GDT			]											-
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367AC			11_											_
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EOTN			-											_
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			- 1 <u>2</u>											-
COREE			-											-
5.5 issue 3 Rev. 3	method DT AS AD RR CB NMLC NQ, HQ, F	auge roller claw NML	be er screwing er drilling /tricone or blade b C core ne core		ore-lift  casing used  barrel withdrawn  raphic log/core recovery  core recovered  - core recovered		drilí fluid	í loss	MW mod HW higt XW extr DW dist (cov strength	sh htiy w derate hiy we remely inctiy	veathered ely weather sathered y weathered weathered MW and HV	S2 shear SS shear CS crush V) <b>planarity</b> PL plana	g red zone red surface ed seam	roughness VR very rough RO rough SO smooth SL slickensided coating CN clean
Form GEO 5					- graphic symbols indicate material no core recovered		ns) for de		L low M mea H high VH very	dium 1 y high	y <u>high</u>	CU curve UN undut ST stepp iR irregu	d ating ed	SN stained VN veneer CO coating

	1	C	O	ff	ev	Ś	ે ડ્	ge	ote	echni	CS		-	Boreh	nie N	0	MBH10	
'} 	ļ	En	ain		•			) <b>.</b>	- h -					Sheet		0.	1 of 6	
	}			ee	ring									Projec	t No:		GEONATH18367	AB
<u>i</u> 13		Clien								ESS PAR	-		1	Date s	tarteo	d:	2.11.2006	
$\mid \cap$		Princi	•							ESS PAR			ļ	Date c	ompl	eted		
		Proje								ESS PAR			1	Logge	d by:		LH	\$
		-							*		ELEVATED DUNE	)	(	Check	ed by	<i>r</i> :	K	
		drill mo			inting:		n 3000,	4WD <sup>-</sup>	Fruck N	lourHesting:		ope: -90°					Surface:	
1,5			ng inf		ition	mm		mat	erial s	Northing ubstance	DE	earing:			<del></del>	datu	n:	
N			penetration.		notes samples			log	ation		material			ncy/ ndex	pocket	ter	structure and	
L ()		1 8 1		water	tests, etc		depth	graphic log	classification symbol	soil type	e: plasticity or particle chara secondary and minor com		moisture condition	consistency/ density index	k P	a	additional observations	
1		₽ Q ∭	23	_	ASS		inieu ea		SP	T T	ium to coarse grained, wh	•		MD	288   288		AEOLIAN DUNE SAND	
	•					-	-											-
$\cap$					ASS	4												-
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·/					ASS		2											]
					ASS				СН	CLAY: high	plasticity, grey.		ŀ	F				
					ASS	]		//										1
<u></u>				Ð	ASS	1	_		SP	SAND: med some high pla	ium to coarse grained, whi sticity clay.	te and grey,	w	MD				
				EASURED	ASS	-	-											4
<u> </u>		<u> </u>	M	ーラト		{	3		ĈĹ	CLAY: low p	asticity, pale grey, some o	Darse	-	F			ESIDUAL SOIL	
$\square$	9.1.07			NOT	SPT 3,3,6 N*=9		-	//	İ	grained sand.				-				-
U	GDT			╞		-				trace quartz	itic gravel up to 4mm in siz	e.						-
1 <sup></sup>	FFEY.																	-
	1 CO						⊿											-
Ļ	FF.GP																	-
$\cap$	9 STU						Ī						-	s				-
	STING													Ĭ				1
$\Box$	GEONATH 18367 EXISTING STUFF.GPJ COFFEY.GDT 9.1.07				SPT 2,2,4		I											1
	H 183				N*=6		5			<b></b>								1
Ļ	TANC								CL	CLAY: medi quartzitic sand	um plasticity, pale grey, soi	ne coarse	ļ					]
$\square$																		]
$\Box$	OREHOLE						-											
,,	BORE						-											_
	ŀ	method				sup	6			notes, samples	fests	classificat		nie and			consistent damaker to dama	
		AS AD		iger scr ger dril	ewing* ling*	Min		N	nil	U <sub>se</sub> undis	turbed sample 50mm diamete, turbed sample 63mm diamete	r soit descri	iption				consistency/density index VS very soft S soft	
n	3 Rev.2	RR W	roli	ier/tricc ishbore	ine	pen	etration 3 4			D distu	bed sample ard penetration test (SPT)	system					S son F firm St stiff	
$\Box$	sue 3 F	CT HA	ha	ble tool nd aug			ran Sectar refi	resistanc Iging to Usal	*	N* SPT NC SPT	sample recovered with solid cone	moisture D dry					VSt very stiff H hard	
$\cap$	വ	DT B	bla	itube ink bit		wate	10/1/98 v	vater lev	/eì	P press	shear (kPa) uremeter	M mois W wet					Fb friable VL very loose	
	СШ СШ	V T	V t TC	bit			on date s water infl			E enviro	ample primental sample		tic limit d limit				L loose MD medium dense	
	Fom	*bit shown e.g.	by suff AD				water nn water out			R refus	a)						D dense VD very dense	

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	cof	ffev	S. (	geo	ote	chnics		Boreh	ole No.	 MBH10
		eering L						Sheet		2 of 6
	Client:					SS PARK		Projec		GEONATH18367AB
}	Principal:					ESS PARK			started:	2.11.2006
$\overline{\left[ \right]}$	Project:					ESS PARK			ompleted	
	-					TRACK, ELEVATED DUNE)		Logge		LH
5	drill model and		Edson 3000,	÷			0°	Check	· · · · · · · · · · · · · · · · · · ·	Surface:
	hole diameter:		mm		-	Northing bearing:	-		datu	
~	drilling info			mat		Ibstance	1			
	method 5 5 penetration support	notes sampies, 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	00 × pocket 00 v penetro- 00 meter	structure and additional observations
5.3 Issue 3 Rev.2	method AS aug AD aug CT cabl	SPT 3,5,7 N*=12 SPT 3,6,8 N*=14 SPT 30/100mm N*=R SPT 30/100mm N*=R SPT 30/100mm N=R SPT 30/100mm N=R		N r esistance plag to sal	CL CL	CLAY: medium plasticity, pale grey, some coarse quartzitic sand. (continued)         SANDY CLAY: medium plasticity, grey and brown, coarse grained sand.         GRAVELLY CLAY: medium plasticity, grey, fine grained angular quarzitic gravel up to 4mm in size.        grey & red to brown        grey.        grey.         otss, samples, tests        grey & red to brown        grey.        grey.	ation sym cription unified cl	S VSt	E	Sand content increasing with depth.

UU	icy	, १२२२ geote				B	orehole No.	MBH10
		Log - Cored I					roject No:	3 of 6 <u>GEONATH18367AE</u>
Client:		ORTH EAST BUSIN				Da	ate started:	2.11.2006
Principal:		RTH EAST BUSIN				Da	ate completed:	2.11.2006
Project:		RTH EAST BUSIN				Lo	gged by:	LH
		RINA (NORTH OF			-		necked by:	K
hole diameter:	-	3000, 4WD Truck Mounted Drilling fluid:	Easting: Northing		slope: bearin	-90°	R.L. Si datum:	
drilling info	ormation m	naterial substance		,	Joarn	rock mass		
method core-lift water	depth depth L metres 6	rock type; grain chara		estimated strength strengt	MPa D- diam- etral	defect spacing % mm O D 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	type, inclin	lefect description ation, planarity, roughness, coating, thickness
T T NOT MEASURED		GRAVELLY CLAY: med         grey, fine grained angula         to 4mm in size. (continued         CLAY: medium plastici         some fine to medium gra         GRAVELLY CLAY: me         brown, fine grained angu         argillaceous origin of 2-4;         CLAY: medium plasticil         some fine to medium gra	dium plasticity, r quarzitic gravel up cl) ty, pale grey, ined sand. dium plasticity, lar gravel of mm in size. y, pale grey,			R 300 300 300 300 300 300 300 300 300 30	particular	gene
6 au 0 au 7 rol	16 16 17 17 17 17 18 18 18 18 18 18 18 18 18 18	SANDY CLAY: medium grey, fine to medium grain black angular gravel of arg up to 3mm in size.	ed sand, some jillaceous origin water 10/1/98 on date		MW mod HW high XW extra	h ily weathered erately weathered by weathered mely weathered mely weathered	SZ sheare SS sheare	SO smooth

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	method 5 T penetration	support water	notes samples, tests, etc		depth metres	graphic log	classification symbol	soil type: colour, s	material plasticity or particle charact secondary and minor compo	erístics, onents.	moisture condition	consistency/ density index	100 × pocket 200 × pocket 300 v penetro-		structure and additional observations
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m GEO 5.3 Issue 3 Rev.2	AD RR W CT HA DT B V V T *bit shown by s	auger sc auger dri roller/trico washbore cable too hand aug diatube blank bit V bit TC bit uffix ADT	lling* one one	vate	nud asing tration 3 4 no ran ran	nown ow	e	Uss     undist       D     disturb       N     standa       N*     SPT -       Nc     SPT w       V     vane s       P     pressu       Bs     bulk sa	urbed sample 50mm diameter urbed sample 63mm diameter wed sample ind penetration test (SPT) sample recovered ith solid cone thear (kPa) iremeter ample omental sample		iption unified da		n	сс У S F St У S t F b U U U D	soft firm stiff St very stiff hard o friable very loose loose

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					black argillaceous material up to size. (continued)									
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			25	HA	SANDY GRAVELLY CLAY: hig		$\left  \right $							
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					og overy	material		<u>6</u> _	estimated strength	is <sub>(50)</sub> MPa	defect spacing		defect description
hodian	method	water	RL	depth metres	graphic log core recovery	rock type; grain characteristic: structure, minor compone		weathering alteration	z no r≩ Z no r ¥	D- diam- etral	Spacing CO S S S S S S S S S S S S S S S S S S	type, inclin	nation, planarity, roughness, coating, thickness geni
		NOT MEASURED				SANDY GRAVELLY CLAY: hig plasticity, pale grey, medium to c grained sand, trace quartitic gra black argillaceous material up to (continued) CLAY: medium plasticity, pale g some fine grained sand.	oarse vel, trace 1-2mm.						
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me	ethoo	1		36		ore-lift	water			weathering			
DT AS AD RR	Г 3 0 3		auger	e screwing drilling ricone		casing used barrel withdrawn	10/1/	98 water ite showr inflow	level	FR fres SW slig MW mod HW high	h htiy weathered derately weather hly weathered	SZ sheare	SO smooth ed zone SL slickensided
CB NN	3 ALC	I, PQ	claw c NMLC	r blade bi		raphic log/core recovery core recovered - graphic symbols indicate material no core recovered	water % (luge	lete drill 1	luid loss test result epth	DW disti (cov strength VL very L low M med H high VH very		CS crushe	ed surface ed seam CN clean SN stained ting VN veneer ed CO coating

# Appendix B

Important Information about your Coffey Report

# Appendix B

Important Information about your Coffey Report



### 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

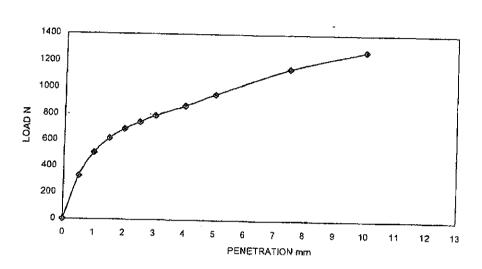
TP Series (Douglas Partners)

CLIENT : PROJECT : LOCATION : TEST LOCATION :

LENSWORTH GROUP LTD ASS & PRELIMINARY GEOTECHNICAL INVESTIGATION 2 - 32 & 34 NOLAN DRIVE, MORAYFIELD D TP26

CBR TEST

DATE : 21/7/03 N PROJECT No. : 33454A DATE OF TESTING: 14/7/03 DEPTH : 0.5-0.8 m



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%

CBR

6

5

RESULTS

PENETRATION

- 2.5 mm

- 5.0 mm

- 2.5 mm - 5.0 mm

CONDI	TON	MOISTURE	DRY DENSITY
<u></u>		CONTENT %	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

TEST METHOD: AS1289 6.1.1. CBR Test. AS1289.2.1.1 Oven Moisture Content

TESTED BY: SJ CHECKED BY: DE

TYPE

TOP

BOTTOM

LABORATORY - Brisbane 1289

REPORT No: B03-444

SIGNED:

DOU

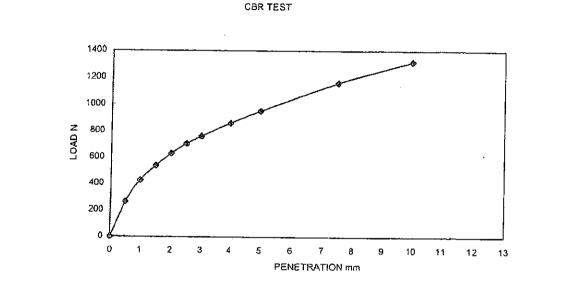
D.A.ELDER





CLIENT : PROJECT : LOCATION : TEST LOCATION : LENSWORTH GROUP LTD ASS & PRELIMINARY GEOTECHNICAL INVESTIGATION 2 - 32 & 34 NOLAN DRIVE, MORAYFIELD D TP28

DATE : 21/7/03 N PROJECT No. : 33454A DATE OF TESTING: 14/7/03 DEPTH : 0.4-0.8 m



DESCRIPTION : SILTY CLAY

**PREPARATION:** 

SILTI ULAT

 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%

CBR

5

5

...

RESULTS

PENETRATION

- 2.5 mm

- 5.0 mm

- 2.5 mm

- 5.0 mm

CONDIT	ION	MOISTURE	DRY DENSITY
		CONTENT %	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

TEST METHOD: AS1289 6.1.1. CBR Test. AS1289.2.1.1 Oven Moisture Content

TESTED BY: SJ CHECKED BY: DE

TYPE

TOP

BOTTOM

LABORATORY - Brisbane 1289

REPORT No: B03-445

SIGNED:

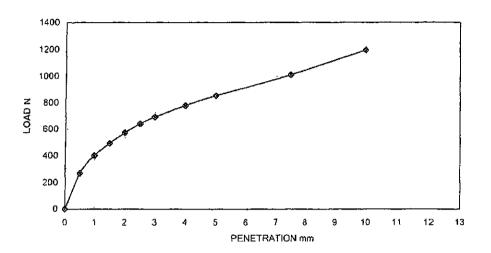
D.A.ELDER





CLIENT : PROJECT : LOCATION : TEST LOCATION : LENSWORTH GROUP LTD DATE : 21/7/03 ASS & PRELIMINARY GEOTECHNICAL INVESTIGATION PROJECT No. : 33454A 2 - 32 & 34 NOLAN DRIVE, MORAYFIELD DATE OF TESTING: 14/7/03 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

TYPE

TOP

BOTTOM

TESTED BY: SJ

CHECKED BY: DE

SWELL: 1 1%

CBR

5.0

4.5

-

RESULTS

PENETRATION

- 2.5 mm

- 5.0 mm

- 2.5 mm

- 5.0 mm

CON	DITION	MOISTURE	DRY DENSITY
}		CONTENT %	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 compactic	n	20.0	1.67

TEST METHOD: AS1289 6.1.1. CBR Test. AS1289.2.1.1 Oven Moisture Content

REPORT No: B03-446 SIGNED:

Old

D.A.ELDER



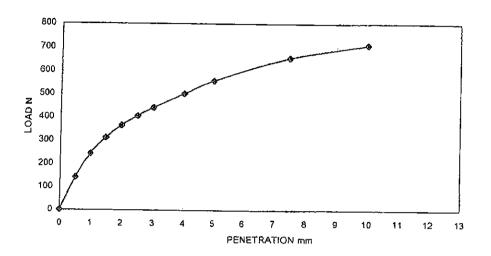
LABORATORY - Brisbane 1289



CLIENT : **PROJECT** : LOCATION : TEST LOCATION :

LENSWORTH GROUP LTD ASS & PRELIMINARY GEOTECHNICAL INVESTIGATION PROJECT No. : 33454A 2 - 32 & 34 NOLAN DRIVE, MORAYFIELD DATE OF TESTING: 14/7/03 **TP37** 





#### **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%

CBR

3.0

3.0

-

RESULTS

PENETRATION

- 2.5 mm

- 5.0 mm

- 2.5 mm

- 5.0 mm

DATE: 21/7/03

DEPTH: 0.5-0.9 m

COND	TION	MOISTURE	DRY DENSITY
		CONTENT %	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

TEST METHOD: AS1289 6.1.1. CBR Test. AS1289.2.1.1 Oven Moisture Content

TESTED BY: SJ CHECKED BY: DE

TYPE

TOP

BOTTOM

LABORATORY - Brisbane 1289

REPORT No: B03-447

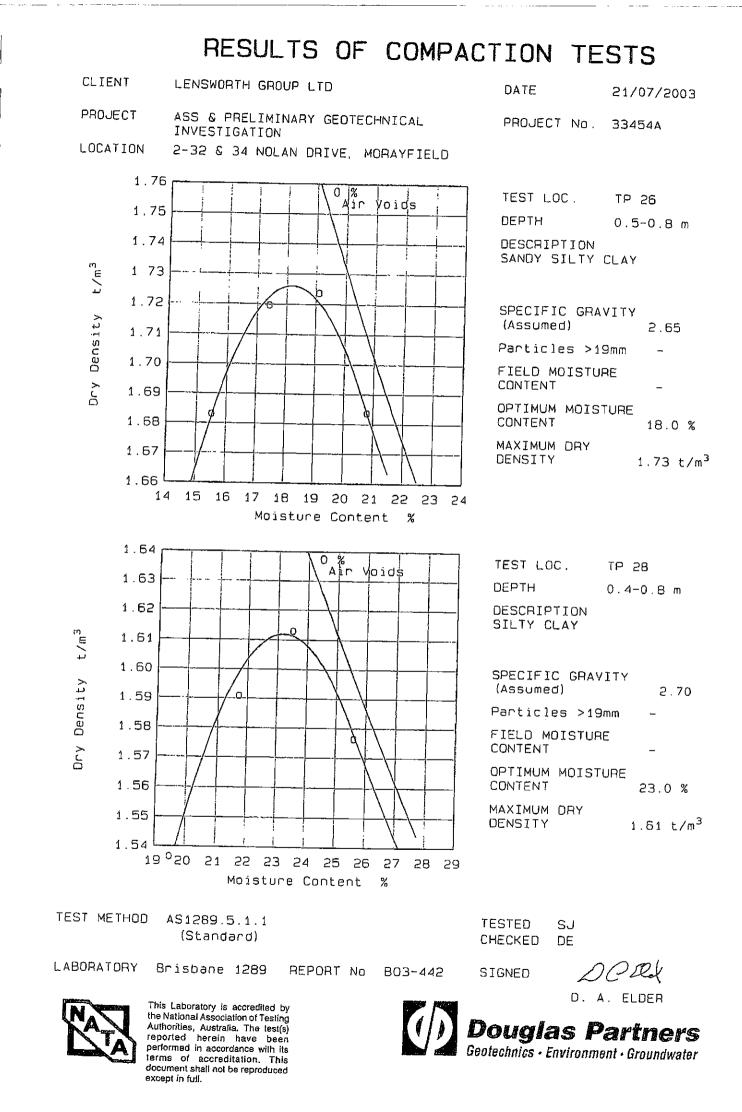
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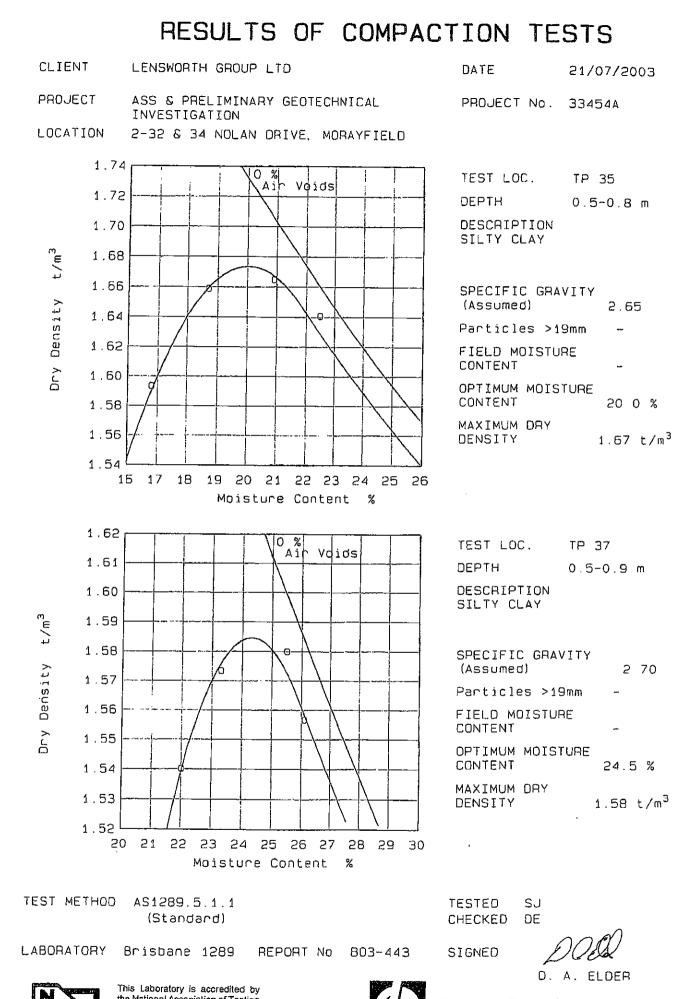
**D.A.ELDER** 







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This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its terms of accreditation. This document shall not be reproduced except in full.

**Dou** Geotect

**Douglas Partners** Geotechnics · Environment · Groundwater

# Bio-Track Acid Sulphate Test Results

LBH Series (Coffey Geotechnics)

-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

VATE OF REPORT 20 NOVEMBER 2006 Page 1 of 2 Report Pages. LIENT NAME THEO GERRITSEN COFFEY GEOTECHNICSS PTY LTD PO BOX 108 SALISBURY QLD 4107 YOUR PROJECT/JOB REFERENCE GN18367AB CLIENT ADDRESS -ROJECT NAME GN18367AB SAMPLING DATE 27-31/10/06 SAMPLE TYPE SOIL SAMPLE FOR ACID SULFATE STUDY UMBER OF SAMPLES 48 SAMPLES LABELLED - INTACT - BAGGED - STORED ON ICE 1/3/2007 ACKAGING SAMPLES DISPOSED ON LOG-IN DATE 13 NOVEMBER 2006 LAB REF. LR13116.431

EST METHODOLOGY FOR pH\_f AND pH\_fox AS PER QASSIT 2004 Laboratory Methods. Indications based on pH data only. PATE: 0=none 1=slight 2=moderate 3=high 4=very high (steam evolved) visual observation at 0-5 minutes. MP: Surface temperature rise ('C) oxidised sample at 5 minutes.

	<b>N</b>						
SAMPLE I	D Upper	Lower (m)	pH_f pH_fc	x change	RATE	TEMP	INDICATION
[]ВН 1	0.25		4.3 3.5	-0.8	2	1	low sulphide
BH 1	0.50		4.4 3.8	-0.6	ž	2	low sulphide
L_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
Свн 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
∏βн 1	2.50		5.0 3.3	-1.7	2	1	low TAA & moderate TPA
[ вн 1	2.75		5.0 3.3	-1.7	2	1	low TAA & moderate TPA
(_asn 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
<sub>բ</sub> ւթի 2	0.50		4.4 3.0	-1.4	0	2	moderate TPA
βH 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
Евн 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
3H 2	1.75		4.7 3.4	-1.3	Û	1	low TAA & moderate TPA
BH 2	2.00		5.0 3.7	-1.3	1	2	low TAA
<u>۲</u> ۲۲ H	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
ե_2814 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
⊢ЧВН З ВН З	2.00		5.3 4.0	-1.3	2	1	low TAA
3 1	2.50		5.3 3.8	-1.5	1	2	LOW TAA
」BH 3 LBH 3	2.75		5.4 3.7 5.2 <b>3.</b> 9	-1.7 -1.3	0	2 2	LOW TAA
LBH 3	3.00		5.1 4.1	-1.0	2 2	0	Low TAA
BH 4	0.25		3.7 3.2	-0.5	2	3	Low TAA
8H 4	0.50		4.1 2.3	-1.8	1	3	moderate TPA & low sulphide
- -≓3H 4	0.75		3.8 2.4	-1.4	1	2	high TPA
	1.00		3.7 2.4	-1.3	1	1	high TPA high TPA
	1.25		3.8 2.5	-1.3	ò	3	moderate TPA
3H 4	1.50		4.2 2.7	-1.5	1	2	moderate TPA
) SH 4	1.75		4.1 3.1	-1.0	1	2	moderate TPA
LBH 4	2.00		4.2 3.4	-0.8	í	2	moderate TPA & low sulphide
LBH 4	2.25		4.4 3.3	-1.1	1	ž	moderate TPA
<b>∫</b> 3H 4	2.50		4.4 3.5	-0.9	1	ž	low sulphide
ВН 4	2.75		3.6 2.9	-0.7	1	1	moderate TPA & low sulphide
$ \sqcup $	-				•	-	
Signatory	10.			For	and be	half of I	Bio-Track Pty Ltd
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 $\neg$  Pefer 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

LIEN LIEN CLIEN PROJE UMBE ACKA SAMPL LOG-I EST RATE:	ES DISPO N DATE METHODOL	SS IPLES DSED ON .OGY FOR 9 1=slig	THEO COFFI PO BG GN183 48 SAMPI 1/3/2 13 NG PH_f / ht 2=m	DX 108 367AB SAN ES LA 2007 DVEMBE ND pH nodera	ITSEN DTECHI 3 SAL SAI 1PLE ABELLI R 200 I_fox ite 3	NICSS P ISBURY MPLING TYPE S ED - IN D6 LA AS PER S=high	QLD 410 DATE 2 OIL SAM TACT - B REF. QASSIT 4=ver	7 7-31/1 PLE FO BAGGED LR13 2004 y high	0/06 R ACID - STOF 116.431 Laborat (steam	tory Methods. Indications based on pH data only. M evolved) visual observation at 0-5 minutes
SAMPLI	E ID	Upper	Lower	(m)	pH_f	pH_fox	change	RATE	TEMP	INDICATION
88 4		3.00			3.9	2.8	-1.1	1	1	moderate TPA
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Signator	у Л.	Pohn	$\overline{\omega}$				For	and bel	half of B	io-Track Pty Ltd

Refer to attached notes for analytical methods.

P. Entertono

Signatory



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

NATE OF REPORT 20 NOVEMBER 2006 Page 1 of 1 Report Pages. LIENT NAME THEO GERRITSEN LIENT FIRM COFFEY GEOTECHNICSS PTY LTD YOUR PROJECT/JOB REFERENCE GN18367AB CLIENT ADDRESS PO BOX 108 SALISBURY QLD 4107 SAMPLING DATE 1/11/06 PROJECT NAME GN18367AB SAMPLE TYPE SOIL SAMPLE FOR ACID SULFATE STUDY UMBER OF SAMPLES 37 SAMPLES LABELLED - INTACT - BAGGED - STORED ON ICE 1/3/2007 ACKAGING JAMPLES DISPOSED ON LOG-IN DATE 13 NOVEMBER 2006 LAB REF. LR13116.439

EST METHODOLOGY FOR pH\_f AND pH\_fox AS PER QASSIT 2004 Laboratory Methods. Indications based on pH data only. EATE: 0=none 1=slight 2=moderate 3=high 4=very high (steam evolved) visual observation at 0-5 minutes. MP: Surface temperature rise ('C) oxidised sample at 5 minutes.

AMPLE ID	Upper Lower (m)	pH_f pH_fox change RATE	TEMP INDICATION
-', ВН 5 ВН 5 ВН 5 LBH 5 LBH 5 LBH 5 БН 5	0.25 0.50 0.75 1.0 1.25 1.5	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	<ul> <li>low TAA &amp; high TPA &amp; high sulphide/low buffer</li> <li>low TAA &amp; moderate TPA &amp; high sulphide/low buffer</li> <li>low TAA &amp; high TPA &amp; high sulphide/low buffer</li> <li>low TAA &amp; high TPA &amp; high sulphide/low buffer</li> <li>low TAA &amp; moderate TPA &amp; sulphide possible</li> <li>low TAA &amp; high TPA &amp; high sulphide/low buffer</li> </ul>
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
- ВН 5	2.5	5.6 2.0 -3.6 4	1 low TAA & high TPA & high sulphide/low buffer
ВН 5	2.75	5.9 1.7 -4.2 2	4 low TAA & high TPA & high sulphide/low buffer
і́вн 5 LBH 5 LBH 6	3.0 3.45 0.25	5.9 2.3 -3.6 4 6.1 1.8 -4.3 3 4.8 2.3 -2.5 3	4 low TAA & high TPA & high sulphide/low buffer 11 low TAA & high TPA & high sulphide/low buffer
ВН 6	0.5	4.7 2.7 -2.0 3	1 low TAA & moderate TPA
ВН 6	0.75	4.8 2.4 -2.4 3	3 low TAA & high TPA & sulphide possible
<sup>⊾</sup> ≝ВН 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
_⊔_ВН 6	1.5	5.1 2.6 -2.5 3	1 low TAA & moderate TPA & sulphide possible
ВН 6	1.75	4.5 1.8 -2.7 3	<ol> <li>low TAA &amp; moderate TPA &amp; sulphide possible</li> <li>low TAA &amp; high TPA &amp; sulphide possible</li> <li>low TAA &amp; high TPA &amp; sulphide possible</li> </ol>
146	2.0	4.6 2.0 -2.6 3	
∃H 6 LBH 6 ∏3H 6	2.25 2.5 2.75	4.9 2.2 -2.7 4 5.2 2.8 -2.4 4 5.2 2.6 -2.6 4	2 low TAA & high TPA & sulphide possible 1 low TAA & moderate TPA & sulphide possible
ୁ ୫୫ ୫	3.0	5.1 2.4 -2.7 4	<ol> <li>low TAA &amp; moderate TPA &amp; sulphide possible</li> <li>low TAA &amp; high TPA &amp; sulphide possible</li> <li>low TAA &amp; moderate TPA</li> </ol>
ଜଣ୍ମ ୫	0.25	4.9 3.2 -1.7 1	
LBH 9 - BH 9 BH 9	0.5 0.75 1.0	4.9 3.8 -1.1 1 4.9 2.9 -2.0 1	1 low TAA 2 low TAA & moderate TPA
BH 9 LBH 9	1.0 1.25 1.5	4.8 3.6 -1.2 1 4.9 4.1 -0.8 1 4.9 4.1 -0.8 0	1 low TAA 4 low TAA & low sulphide 1 low TAA & low sulphide
LBH 9	1.75	4.9 4.1 -0.8 0	3 low TAA & low sulphide
3H 9	2.0	5.0 4.0 -1.0 1	4 low TAA
}н 9	2.25	5.1 4.1 -1.0 1	4 low TAA
8н 9	2.5	5.1 4.1 -1.0 1	3 low TAA
LBН 9	2.75	4.9 4.4 -0.5 1	2 low TAA & low sulphide
3H 9	3.0	4.9 4.1 -0.8 1	2 low TAA & low sulphide 2 low TAA & low sulphide

DETERMINATION OF ACID SULFATE SOIL PROPERTIES	CERTIFICATE OF ANALYSIS	<ul> <li>VII 10. Glorious Road Highvale, Brisbane, Australia, 4520 Pl. 07 32897179 Fx. 07 32897155</li> <li>LK1126.623 DATE OF REPORT 11 DECEMBER 2006 a10:26:48</li> <li>LR10 GERRITSEN c/o COFFEY GEOTECHNICSS PTY LTD PO BOX 108 SALISBURY QLD 4107</li> <li>NORTH EAST BUSINESS PARK YOUR PROJECT/JOB REFERENCE GN 18367 AC</li> <li>2006 NUMBER OF SAMPLES 14 Samples supplied by client SAMPLE TYPE:SOIL SAMPLE FOR ACID SULFATE STUDY</li> <li>DECEMBER 2006 PACKAGING 3 Ground Oven Dry Samples DISPOSED ON 1/9/2007</li> </ul>	<pre>Sample ID as received. METHODOLGGY: As per (DNR QASSIT May 2004), oven dried (85'C), &gt;1000 um shell removed, fine grind. All reported values gravimetric, dry mass. LIME1 rates calculated to neutralise TPA (or TAA if &gt;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 D0 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 &amp; &lt;0.x represent measured values. If PH KCl&gt;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.</pre>	pH pH TAA TPA TSA SKCL SP SPOS SCr s-RAS SEQCAKCL CaP MGKCL MG PCBN POS LIME1 LIME2 SANC_E Ca/ar KCL ox m/t m/t m/t % % % % % mg/kg mg/kg mg/kg mg/kg mg/kg m/t kg/t kg/t ~ % mg/kg s 23A 23B 23F 23G 23H 23Ce 23De 23Ee 22B s23Re s 23Vh 23Wh 23Sm 23Tm a23U&X s19A2	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	For and on behalf of Bio-Track Pty Ltd
	V ľáď arn 91 nse	1126.623 DATE EO GERRITSEN C. RTH EAST BUSINES 06 NUMBER OF DECEMBER 2006	ETHODOLOGY: As F o neutralise TPA % lime neutralis POS= moles carbo red values, zero ted as the diffe			
	Analysis By: Bio-Track Pty I.4d ARN 91 056237275	LAB REFERENCE LAB REFERENCE CLIENT NAME PROJECT NAME PROJECT NAME SAMPLING DATE DATE RECEIVED 01	Sample ID as received. M LIME1 rates calculated t NB. Lime rates assume 97 Fineness Factor=1.5 CBN Blanks represent unmeasu reactive calcium calcula	ID. DEPTH m Analytical Method Codes	LBH 1 $2.5-2.75$ LBH 1 $2.75-3.0$ LBH 2 $0.25-0.5$ LBH 2 $0.25-0.5$ LBH 3 $1.75-2.0$ LBH 4 $1.0-1.25$ LBH 4 $1.0-1.25$ LBH 5 $1.0-1.25$ LBH 5 $1.0-1.25$ LBH 5 $1.0-1.25$ LBH 5 $1.0-1.25$ LBH 6 $0.75-1.0$ LBH 6 $0.75-1.0$ LBH 9 $0.75-1.0$	Signatory P. Coluzion

## Bio-Track Acid Sulphate Test Results

TPC Series (Coffey Geotechnics)

Refer to attached notes for analytical methods.

P. Edutord

Signatory

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Bio-Track

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 CLIENT FIRM MR KARL MUNIZ COFFEY GEOTECHNICSS PTY LTD YOUR PROJECT/JOB REFERENCE GEONATH 18367 AC CLIENT ADDRESS PO BOX 108 SALISBURY OLD 4107 GEONATH 18367 AC SAMPLING DATE 11/12/6 11 SAMPLE TYPE SOIL SAMPLE FOR ACID SULFATE STUDY PROJECT NAME NUMBER OF SAMPLES SAMPLES LABELLED - INTACT - BAGGED - CHILLED IN INSULATED PACKAGING 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: O=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 L	ower (m)	pH_f	pH_fox	change	RATE	TEMP	INDICATION
TP 101 TP 102 TP 103 TP 104 TP 105 TP 106 TP 107 TP 108 TP 109 TP 109 TP 110 TP 111	1.2 1.3 1.2 1.2 1.2 1.2 1.1 1.0 0.6 0.9 0.9		4.8 4.2 4.0 3.9 5.8 4.2 4.3	3.3 3,1 2.6 3.4	-0.9 -0.9 -1.4 -1.3 -3.0 -1.2 -1.7 -1.2 -1.2	0 1 2 2 3 4 1 2 0	6 0 2 6 3 13 1 3 1 3 5 6	no TAA & low TPA & low sulphide low TAA & low sulphide moderate TPA & low sulphide moderate TPA low TAA & moderate TPA & sulphide possible moderate TPA & low sulphide moderate TPA Low TAA & moderate TPA low TAA & moderate TPA

For and behalf of Bio-Track Pty Ltd

	Bio-Track		is the acid		
	H H		kg/m3. Ca/ar is	Ca/ar mg/kg	24288
	and a second second	/9/2005	Y mass. onvert to bed soil.		
	listralia 453	SED ON	tric, dr E/1.5 Tty to o ution. undisturi	LIME1 LIME2 SANC E kg/t kg/t s19A	ϘϘ N ト.n.œ ト.vt m v O u
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ß	781 Mt. Glorious Road Higkwalle, Brisbine, Aistralia, 4520	1 Report Y Dry Sample	d values Cr + as   ply by b to carbo may be z	Mg P CBN POS mg/kg m/t 231m a23U&X	<b>6</b> 5,62,73,62,62,62,62,62,62,62,62,62,62,62,62,62,
	Norious Roa	1 of It Study d Oven D	reporte OS or S n. Multī is due Xtract)		575 575 575 575 575 575 575 575 575 575
SULFATE SOIL PROPERTIES	781 Mr. C	108 SAL1SBURY GLD 4107 108 SAL1SBURY GLD 4107 13367 AC ent SAMPLE TYPE:SDIL SAMPLE FOR ACID SULFATE STUDY EAGGED - CHILLED IN INSULATED PACKAGING Ground Oven Dry Sample's DISPOSED ON 1/9/2007	find. All M + as P ire kg/to Mg kcl) m acid e	ca P Mg KCl mg/kg mg/kg 23Wh 23Sm	\$ \$ \$ 3 3 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5
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	CATE OF ANALYSIS	9:38:13 PO 60X 108 SALISBURY ALD 4107 0NATH 18367 AC By client SAMPLE TYPE:SOIL TACT - BAGGED - CHILLED IN INS	um shell lculated ted fact oos - Ca ten s-RAS	K s RAS % s23Re	\$\$\$\$\$\$ \$\$\$\$\$\$ \$\$
OF ACID	E O E	SAL158U AC AC ED - CH	<ul> <li>&gt;1000</li> <li>rates ca</li> <li>Sugges</li> <li>Sugges</li> <li>fing (Ca</li> <li>for</li> <li>for</li> <li>for</li> </ul>	о N N	92 40.01 14 0.01 10 0.10 10 0.10 10 0.02 10
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		05 FEBR OTECHNIC JECT/JOB 6 Sam SAMPLES	SIT May >TPA)+ O NOT in nity rel present en 1 M K	TPA mVt 236	4835n3
Δ	8	REPORT OFFEY GE YOUR PRO SAMPLES KAGING	(DNR QAS ir TAA if on but D e alkali <0.x rei ce betwe	TAA m/t 23F	<u>8</u> 572°8
	91 056 237 :	<pre>3 DATE OF REPORT O5 FEBRUARY 2007 = 009-38:1 VI2 c/o COFFEY GEOTECHNICSS PTY LTD P0 60 567 AC YOUR PROJECT/JOB REFERENCE GEOMATH UNIMBER OF SAMPLES 6 Samples supplied by cl 2006 PACKAGING SAMPLES LABELLED - INTACT -</pre>	As per te TPA (c ralisati carbonat carbonat carbonat differen	Z38 x H	о (- 4 10 - 2 4 - 4 10 - 4 2 - 2 - 10 - 2 2 - 2 - 10 - 2 2 - 2 - 10 - 2 2 - 2 - 10 - 2 2 - 2 - 10 - 2 2 - 2 - 10 - 2 2 - 2 - 2 2 - 2 - 2 2 - 2 - 2 2 - 2 -
	Ltd ABN	LR19126-528 DATE OF REPORT O5 FEBRUARY 2007 B09-38 MR KARL MUNIZ C/O COFFEY GEOTECHNICSS PT7 LTD PO E GEONATH 13667 AC YOUR PROJECT/JOB REFERENCE GEONAT 11/12/6 NUMBER OF SAMPLES 6 Samples supplied by C 19 DECEMBER 2006 PACKAGING SAMPLES LABELLED - INTACT	Hopology heutrali lime neur S= moles I values I as the	в Б б б б б б	80.72123 7.202
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	Amalysis By: Blo-Track Pty Ltd ABN 91 056 237 275	LAB REFERENCE CLIENT NAME PROJECT NAME SAMPLING DATE DATE RECEIVED	Sample ID as received. METHOPOLOGY: As per (DNR QASSIT May 2004), over dried (85°C), >1000 um shell removed, fine grind. All reported values gravimetric, dry mass. LIME1 rates.calculated to neutralise FPA (or TAA if >1PA)+ as RAS -ANC E/1.5 LIME2 rates calculated to neutralise TAA + as POS or 5 Cr + as RAS -ANC E/1.5 MB. 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/mJ. Finehess 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 reactive calcium calculated as the difference between 1 M KCl and 4 M HCl soluble Ca.	ID. DEPTH m Ànalyticál Méthod Codes	44444444444444444444444444444444444444
	,	1 30205	<u>രചജലങ്</u>	ΞŘ	· <b>프로, 프로토토</b> , 이상 가지 않는 것이 있는 것이 있는 것이 있는 것이 있다. 1949년 - 이상 가지 아파가 가지 않는 것이 가지 않는 것이 있는 것이 있는 것이 있는 것이 있는 것이 있다.

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RENCE       LR197126.528       DATE OF REPORT US FERUARY 2007       a09:33:13         WME       WARE       WARL MUNIZ       CO. COFFEY GENCENICOS PTY LID       PO B03       Sault         WME       CEONATH 1337/AC       YOUR PROJECT/JOB REFERICE EEQUATH 13567 AC       Samples supplied by client	Analysis By: Bio-Tre	ack Pty Ltd ABN 91	056 237 27:	5						· _			781	l Mt. Gloric	us Road Hi	ghvale, Brist	barre, Austi		07 3289 7179	Fx. 07 3289 715
<pre>ID as received. METHODOLOGY: As per (DNR dASSIT May 2004), oven dried (85'C), &gt;1000 at es calculated to neutralise TPA (or TAA if &gt;TPA)+ as TAS -ANC_E/1.5 LTMET rates constants of the rates assume 97% lime neutralise TPA (or TAA if &gt;TPA)+ as TAS -ANC_E/1.5 LTMET rates .usual s factors: JOB POS= moles carbonate alkalinity released by oxidation assuming (is represent unmeasured values. JETOS 40.5 represent measured values. If pM KICN-5 e calculated as the difference between 1 M KCI and 4 M HCL soluble Ga. EFTH pH PM PR TAA TPA TSA S KCI S p S POS S Call method codes ZCL ox m/t m/t r W X X X x x x x x x x x x x x x x x x x</pre>	LAB REFERENCE CLIENT NAME PROJECT NAME SAMPLING DATE DATE RECEIVED	LR19726.528 D MR KARL MUNIZ GEONATH 18367 A 11/12/6 NUMB 19 DECEMBER 200		REPORT I FEY GEO' JUR PROJI IMPLES ( IGING S/	05 FEBRI TECHNIC: ECT/JOB 5 Sam MPLES 1	JARY 201 SS PTY 1 REFERE1 Mes sur	07 209: LTD P (CE GEON colied b ) - INTA	38:13 0 BOX ATH 18: Y clier CT - B/	B AS	SBURY QLI MPLE TYPI CHILLED	D 4107 E:SOIL (	SAMPLE FC .ATED PA(	JR ACID {	Page 1 SULFATE Ground O	of 1 stUDY ven Dry	Report P Samples	ages. D I SPOSE	00 1/9/200	20	
$\int_{1}^{1} \int_{1}^{1} mple ID as receiv LIMET rates calculu NB. Lime rates assu Fineness Factor=1. Blanks represent un reactive calcium ca	ved. METHODOLOGY: A ated to neutralise ume 97% (ime neutra 5 CBN POS= moles ca remeasured values, z afculated as the di	s per (l TPA (or Lisation rbonate eros & ≺ fferenc€	NR QASS TAA if : 1 but DO alkalin 0.x repr betweer	IT May ( >TPA)+ ( NOT inc ity rele resent m	2004), as RAS lude an sased by reasured	oven dri -ANC_E/1 ny safet / oxidat / values	ed (85 -5 LIM Y factur ion ass ion ass soluble	C), >10 52 rates ors. Sug numing ( KC(>4.1	00 um sh calcula gested f Ca POS - 5 then s	ell rem ted to 1 actor=1 Ca KCL -RAS (cc	oved, fii neutrali: .5-2. Rai ) + (Mg F ilculated	ne grind se TAA + tes are ] toS - Mg from ac	. All re as POS kg/ton. KCl ) is cid extr	ported v or S_Cr Multiply due to act) may	alues gr + aS RAS by bulk carbonat be zero	avimetr -ANC_E densit e solut for un	ic, dry mas: /1.5 / to conver ion. disturbed su	s. t to kg/m3 oil. Ca/ar	is the acid	
1.0     3.56     4.45     132     64     0.01     -0.01     0.222     610     652     653     5.3     7.0       1.1     3.14     4.19     10     0.02     0.04     0.01     0.015     622     610     52     653     3     6.3     3     6.3     3     6.3     3     6.3     3     6.3     3     6.3     3     6.3     3     6.3     3     6.3     3     6.3     3     6.3     3     6.3     3     6.3     3     6.3     3     6.3     3     6.3     3     6.3     3     4     0.0     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     <	ID. DEPTH m Analytical Method (		pH ox 23B	TAA m/t 23F	ТРА m/t 23G					_5 <u>% 8</u> _		- 578 09 Ш				BN POS m/t a23U&X	LIME1 L kg/t	IME2 SANC_E kg/t _ 7 s19a;	80	
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Refer to attached notes for analytical methods.



Analysis By: Bio-Track Pty Ltd

ABN 91 056 237 275 Mt. Glorious Road Highwale, 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 CLIENT FIRM MR KARL MUNIZ COFFEY GEOTECHNICSS PTY LTD PO BOX 108 SALISBURY QLD 4107 YOUR PROJECT/JOB REFERENCE GEONATH 18367 AC CLIENT ADDRESS GEONATH 18367 AC SAMPLING DATE 11/12/6 11 SAMPLE TYPE SOIL SAMPLE FOR ACID SULFATE STUDY PROJECT NAME NUMBER OF SAMPLES 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: O=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 RAT	E 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		LOW TAA & moderate TPA
TP 111	· 0,9	4.6 3.4 -1.2 0	6	low TAA & moderate TPA

Signatory

Page 1

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 CLIENT NAME 18 DECEMBER 2006 Page 1 of 1 Report Pages. MR KARL MUNIZ CLIENT FIRM CLIENT ADDRESS COFFEY GEOTECHNICSS PTY LTD PO BOX 108 SALISBURY QLD 4107 YOUR PROJECT/JOB REFERENCE GEOLNATH 20070 AA GEOLNATH 20070 AA SAMPLING DATE 29-30/11/6 11 SAMPLE TYPE SOIL SAMPLE FOR ACID SULFATE STUDY SAMPLES LABELLED - INTACT - BAGGED - CHILLED IN INSULATED PACKAGING PROJECT NAME NUMBER OF SAMPLES 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: O=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_fo	x 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	Ó	1	low TAA & moderate TPA
EN TP6	0.4	0.6	4.4	3.7	-0.7	Ó	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	ò	1	low sulphide
AM TP4	0.6	0.8	4.7	4.1	-0.6	Ō	i	low TAA & low sulphide
AM TP5	1.3	1.5	4.0	3.4	-0.6		_0	moderate TPA & low sulphide
AM TP <b>6</b>	0.5	0.8	3.9	3.7	-0.2	Q	0	low sulphide

Page 1

# 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: LABORATORY: BRISBANE DATE RECEIVED: 439 MONTAGUE ROAD 15/07/2003 WEST END QLD 4101 DATE COMPLETED: 23/07/2003 SAMPLE TYPE: SOIL ORDER No.: 43162 No. of SAMPLES: 21 PROJECT: 33454A 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 Phone: 61-7-3243 7222 32 Shand Street Fax: 61-7-3243 7218 Stafford QLD 4053 Australia Email: michael.heery@alsenviro.com Signatory NATA LABORATORIES AUSTRALASIA NATA Accredited Laboratory Number 825 AMERICAS Brisbane Hong Kong Vancouver Santiago Site: BRISBANE Melbourne Sydney Newcastle Singapore Kuala Lumpur This Laboratory is accredited by its National Association of Testing Authorities, Australia. The testis, reported harbin have been performed in accordance with its hems of accreditation. This decoment shell not be reproduced except in fail. Antofagasta Bogor Mumbai Lima Auckland stralian Laboratory Services Pty Ltd (ABN 84 009 936 029)

	CENTIFICATE OF ANALYSIS
0	23/07/2003

DOUGLAS PARTNERS PTY LTD

33454A Client Reference:

Date of Issue:

Client:~

Batch: Sub Batch:

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ALS Environmental

Australian Laboratory Services Pty Ltd (ABN 84 009 936 029)

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	20	TP37_0 5m	<ul> <li>3.2</li> <li>3.2</li> <li>3.2</li> <li>0.07</li> <li>0.06</li> <li>0.08</li> <li>0.08</li> <li>0.08</li> <li>0.08</li> <li>0.03</li> <li>0.03</li> <li>0.03</li> <li>0.03</li> <li>0.03</li> <li>0.03</li> <li>0.03</li> <li>0.03</li> <li>0.03</li> <li>0.03</li> <li>0.03</li> <li>0.03</li> <li>0.03</li> <li>0.04</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li> <li>0.05</li></ul>
	19	TP36-0.5m TI	
	18	TP35-1.0m	3.8 0.14 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.12 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.18 0.18 0.18 0.18 0.18 0.18 0.18 0.18 0.18 0.18 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0.100 0.100 0.100 0.100 0.100 0.100 0.100 0.1000 0.1000 0.1000 0.10000 0.10000000000
( )	17	TP34-1.0m	3.5 3.6 0.02 0.03 0.03 0.03 0.02 0.05 0.02 0.02 0.02 0.02 0.02 0.02
SAMPLE IDENTIFICATION	16	TP32-1.0m	3.2 60.02 60.02 60.02 60.02 60.02 60.02 60.02 13 13 13 13 13 13 13 13 13 13
SAMPLE ID	2	TP31-2.0m	3.2 60.02 60.02 60.02 60.02 60.02 60.02 60.02 60.02 60.02 60.02 60.02 81.1 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82.2 82
14		TP29-0.5m	3.6 0.12 0.12 0.12 0.12 0.05 0.02 0.06 0.02 0.05 0.02 0.05 0.02 0.05 0.02 0.05 0.02 0.05 0.02 1.7
13		TP28-1.0m	3.1 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5.0.02 5
12		TP27-0.5m	3.4 0.02 0.10 0.07 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02
11		TP26-0.5m	3.1 <ul> <li>3.1</li> <li>40.02</li> <li>40.02</li> <li>40.02</li> <li>40.03</li> <li>40.03</li> <li>40.09</li> <li>40.09</li> <li>0.06</li> <li>0.09</li> <li>0.09</li> <li>0.09</li> <li>0.09</li> <li>1.1</li> <li>2.5</li> <li>2.5</li> <li>2.5</li> <li>2.6</li> <li>3.1</li> <li>4.1</li> <li>4.1</li> </ul>
Laboratory I.D.	Uate Sampled	LOR	0.1 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0
Labora	Date	UNIT	mole/torne % % % % % % % % % % % % % % % % % % %
		ANALYSIS DESCRIPTION pH after Oxidation	Ca (Acid Reacted) Ca (Acid Reacted) Mg (Acid Reacted) Mg (Foroxide) Mg (Peroxide) Na (Acid Reacted) Na (Acid Reacted) Na (KCI) Na (KCI) S (Foroxide) S (Foroxide) S (Pos) TAA TPA TPA TPA TPA TPA TPA TPA TPA TPA
		METHOD EA-002	EA-022 EA-022 EA-022 EA-022 EA-022 EA-022 EA-022 EA-022 EA-022 EA-022 EA-022 EA-022 EA-022 EA-022 EA-022 EA-022

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Ratcht:         0         B56i         0           Sub Batch:         0         23/07/2003           Date of Issue:         23/07/2003           Client:         23/07/2003           Client:         23/07/2003           Client:         DOUGLAS PARTNERS PTY LTD           Date of Issue:         23/07/2003           Client:         DOUGLAS PARTNERS PTY LTD           Date of Issue:         23/07/2003           Client:         DOUGLAS PARTNERS PTY LTD           Date of Issue:         33454A           AD22         Client Reference:           AD22         Ph Atro Oxidation           AD22         Ca (Acid Reacted)           AD22         Mg (Acid Reacted)           AD22         Mg (Acid Reacted)           AD22         Mg (Acid Reacted)           AD22         Mg (Acid Reacted)           AD22         Mg (Acid Reacted)           AD22         Mg (Acid Reacted)           AD22         Mg (Acid Reacted)           AD22         Mg (Acid Reacted)		SAMPLE IDENTIFICATION		
In:     0       Ssue:     23/07/2003       Ssue:     23/07/2003       DOUGLAS PARTNERS PTY LTD       DOUGLAS PARTNERS PTY LTD       Terence:     33454A       ANALYSIS DESCRIPTION     UNIT       PH after Oxidation     0.1       Ca (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %       Mg (Acid Reacted)     %		2	TP30-1.5m	3.4 3.4 0.05 0.05 0.05 0.05 0.10 0.10 0.16 0.12 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.05 0.10 0.05 0.10 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.10 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.16 0.05 0.05 0.05 0.05 0.05 0.05 0.16 0.05 0.16 0.05 0.16 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.
th: ssue: ssue: by ANALYSIS DEc phaference: phaference: phaference: phaference: ca (Acid Reacted) mg (Acid Reacted) mg (Acid Reacted) mg (Acid Reacted) mg (Acid Reacted) mg (Acid Reacted) mg (KCI) mg (KCI) mg (KCI) mg (KCI) mg (Feroxide) S (Pos) TAA TPA TPA TPA TPA TPA TPA TPA TPA TPA	<u> </u>	Laboratory I.D. Date Sampled		
	:h: ssue: ference:			Oxidation S Reacted) vide) Heacted) bxide) ride) ide) m Reducible Sulphur

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	SAMPLE IDENTIFICATION		CHECKS AND SPIKES																		
	301 SAM	Inorg 2 LCS % Rec				l.				1						-					104
	300	Method Blank 2			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<b>40.02</b>	<0.02	<0.02	<0.02	<0.02	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	2	8	1	<0.02
∃ g	201	Inorg 1 LCS % Rec			<b>,</b>	ŀ	 	j'	<u>+</u>			]		1		1		I		* *	104
	200	Method Blank 1			<0.02	<0:02	<0.02	0.02 6.62	20.02	<0.02 5 5 5 5 6 7 6 7 6 7 6 7 7 7 7 7 7 7 7 7	<0.02	20.02		<0.02	<0.02	<0.02	Ŷ	Ø	\$	1	<0.02
	ny I.D.	LOR		0.1	0.02	0.02	0.02	0.02	20.0		20.0	20.0	200	20.0	0.02	0.02	2	~	~	0.1	0.02
	Laboratory I.D. Date Sampled	UNIT			%	* >	s 3	* *		* *	* *	8	~ ~	۶ ک	, s	× :	mole/tonne	mole/tonne	mole/tonne		\$
e: 23/07/2003 DOUGLAS PARTNERS PTY LTD ence: 33454A		ANALYSIS DESCRIPTION			Lca (Acid Reacted) Ca (KCI)	Ca (Peroxide)	Mg (Acid Reacted)	Mg (KCI)	Mg (Peroxide)	Na (Acid Reacted)	Na (KCI)	Na (Peroxide)	S (KCI)	S (Peroxide)	S (Pos)				pH (KCI)	Chromium Reducible Stilabur	
Batch: Sub Batch: Date of Issue: Client: Client Reference:		METHOD	EA-002		-				_						EA-022 S (F	EA-022 TAA	_	EA-022 TSA	EA-022 DH /		

ALS Environmental

Australian Laboratory Services Pty Ltd (ABN 84 009 936 029)

Page 5 of 5

# 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			al Investigation		NO: 33454A
	LENSWORTH GROUP L	.TD		STORAGE	: Frozen
	G METHOD:			DATE TES	TED: 07-07-03
DATE SAI	MPLED: 03-07-03		<u> </u>	TESTED B	Y: ACL
SAMPL	E IDENTIFICATION	рН <sub>ғ</sub>	pH <sub>FOX</sub>	∆рН	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	2 = organic 3
	1.5 m	8.2	8.0	0.2	3
	2.0 m	7.9	5.9	2.0	3
TP34	0.5 m	5.4	3.0	2.4	2 – organic
	1.0 m	6.6	3.9	2.7	2 - Organic 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
<u> </u>	1.5 m	6.6	4.6	2.0	2
	2.0 m	7.5	6.2	1.3	3
FP36	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
P37	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
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······································					
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Notes:

\* Reaction Intensity:

(1) No Reaction (2) Mild Reaction (3) Vigorous Reaction (4) Violent Reaction pH<sub>F</sub>: Field pH; pH<sub>Fox</sub>: Field pH after hydrogen peroxide oxidation;  $\Delta pH$ : pH<sub>F</sub> - pH<sub>Fox</sub>

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:



### FIELD SCREENING TEST RESULTS FOR ACID SULFATE SOILS Ref: Qld ASS Sampling and Testing Guidelines, 1998

NO: 33454A		CT: ASS & Preliminary Geotechnical Investigation				
· · · · · · · · · · · · · · · · · · ·	STORAGE	CLIENT: LENSWORTH GROUP LTD				
STED: 07-07-03	DATE TES	SAMPLING METHOD:				
BY: ACL	TESTED B			PLED: 03-07-03	DATE SAN	
REACTION *	ΔpH	рН <sub>FOX</sub>	pH <sub>F</sub>	IDENTIFICATION	SAMPLI	
2 - organic	3.7	1.6	5.3	0.5 m	TP18	
2	1.7	4.0	5.7	1.0 m		
2	1.9	4.0	5.9	1.5 m		
2	1.8	3.2	5.0	2.0 m		
2 – organic	4.4	1.4	5.8	0.5 m	TP19	
2	2.0	2.1	4.1	1.0 m		
2	1.3	2.5	3.8	1.5 m	<u></u>	
2	1.2	2,8	4.0 .	2.0 m		
2 – organic	3.1	2.0	5.1	0.5 m	<u>TP20</u>	
2	2.1	2.6	4.7	1.0 m		
2	2.4	2.7	5.1	1.5 m		
2	2.0	2.6	4.6	2.0 m		
2	3.8	1.8	5.6	0.5 m	TP21	
2	0.3	4.4	4.7	1.0 m	······	
2	2.4	3.0	5.4	1.5 m		
2 – organic	3.2	1.9	5.1	0.5 m	TP22	
2	2.8	2.4	5.2	1.0 m		
2 – organic	2.8	2.6	5.4	1.5 m		
2 - organic	4.4	1.9	6.3	0.5 m	TP23	
2	1.7	2.5	4.2	<u>1.0 m</u>		
2	1.6	2.6	4.2	<u>1.5 m</u>		
2	1.4	2.9	4.3	2.0 m		
2 – organic	3.7	1.6	5.3	0.5 m	TP24	
2	1.8	1.9	3.7	<u>1.0 m</u>		
2	1.8	1.6	3.4			
2	1.8	2.0	3.8	2.0 m		
					<u>.</u>	
					~	
	1.8	1.6	3.4	1.5 m 2.0 m		

Notes:

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\* 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;  $\Delta pH$ :  $pH_F - pH_{FOX}$ 

Standard Dufferent La ag	CALIBRATION DETAILS	_			
Standard Buffer pH 6 88	Standard Buffer pH 4	Ø	Use by Date:	12/03	pH Meter No: MC-81
Use by Date, 12/05 prior Hydrogen Peroxide: 4.9	Standard Buffer pH 6.88	2	Use by Date:	12/03	pH of Hydrogen Peroxide: 4.9

CHECKED: 24 . 7.03	NAME: ADAM LUPTON	SIGNED:
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### 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

	E IDENTIFICATION	pHF	pH <sub>FOX</sub>		REACTION *
TP25	0.5 m	4.2	2.9	1.3	4 - organic
	<u>1.0 m</u>	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
<u>.</u>	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
FP29	0.5 m	6.7	3.9	2.8	2
	1.0 m	5.4	2.9	2,5	2
<u> </u>	1.5 m	5.3	3.2	2.1	2
	2.0 m	5,9	2.9	3.0	2 - organic
P30	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
P31	0.5 m	5.3	2.8	2.5	2
<u>.                                    </u>	1.0 m	4.9	3.2	1.7	2
	1.5 m	5.7	3.7	2.0	2
<u> </u>	2.0 m	4.4	1.6	2.8	2 organic

Notes:

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\* Reaction Intensity:

(1) No Reaction (2) Mild Reaction (3) Vigorous Reaction (4) Violent Reaction  $pH_{F}$ : Field  $pH_{i}$   $pH_{Fox}$ : Field  $pH_{i}$  after hydrogen peroxide oxidation;  $\Delta pH_{i}$   $pH_{F} - pH_{Fox}$ 

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:

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	6/5	Douglas Partners Geotechnics · Environment · Graundwater
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