APPENDIX N

Acid Sulfate Soil Management Plan

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ACID SULPHATE SOIL ASSESSMENT AND MANAGEMENT PLAN

Submission to Ballina Shire Council

PROPOSED SAND EXTRACTION INDUSTRY
at
Lot 32 DP 1151612
Newrybar Swamp Road, Lennox Head

for:
Ballina Sands

January 2013

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Document Control Sheet

Filename:	6542 Acid Sulphate Assessment and Management 2013_01_15
Job No.:	6542w
Job Captain:	Evan Elford
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Client:	Ballina Sands
File/Pathname:	S:\01 Jobs\6500-6599\6542w Watson Sand Pit 2010\01 Administration\02 Reports\01 Current\ASSMP\6542 Acid Sulphate Assessment and Management 2013_01_15.doc

Revision No:	Date:	Checked By		Issued By	
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1 Table of Contents

2 Executive Summary

Ardill Payne (AP) has been commissioned by Ballina Sands Pty Ltd to carry out an Acid Sulphate Soil (ASS) Assessment and prepare a Management Plan for the sand extraction operation proposed for Lot 32 DP 1151612, Newrybar Swamp Road, Lennox Head.

The ASS assessment is based on two geotechnical investigations: the first conducted in 2008 and consisting of 5 boreholes sunk to a maximum depth of 15.5 mbgl; the second conducted in 2011 and consisting of 13 boreholes drilled to a maximum depth of 8 mbgl. The assessment has found that both Potential Acid Sulphate Soils (PASS) and Actual Acid Sulphate Soils (AASS) are present on site. The extent and depth of PASS varies across the site but is generally present between 3 and 7 mbgl. The highest oxidisable sulphur concentration (PASS) encountered was 0.41 $\%S_{CR}$.

Site soils and water will require management to prevent deleterious effects on the surrounding environment. The management approach consists of liming and validation tests; capturing and treating leachate; and ongoing monitoring.

This assessment and management plan has been prepared in accordance with the Acid Sulphate Soils Manual (ASSMAC, 1998).

3 Introduction

3.1 The Site

The real property description of the site is Lot 32 DP1151612 and is located on Newrybar Swamp Road, Lennox Head. A site locality plan is presented in **Figure 1**.

An existing sand extraction quarry has been operating on the adjacent site for the last 10 years. Upon conclusion of extraction of sand at this site, it is proposed to move extraction activities onto the adjacent site which is the subject of this report.

3.2 Acid Sulphate Soils

Acid Sulphate Soil (ASS) is the common name given to soils containing iron sulphides. When exposed to air, these soils can potentially oxidise to produce sulphuric acid. This acid can drain into waterways and cause severe short and long term socio-economic and environmental impacts. (AssMac, 1998)

ASS typically occur in low-lying coastal areas. Runoff from exposed ASS areas may find its way to stormwater, groundwater and eventually into natural aquatic environments. The acidic runoff may lower the pH of receiving waters, increase the concentration of metals and reduce the natural buffering capacity of the receiving waters.

There are two basic types of ASS: Actual Acid Sulphate Soils (AASS) and Potential Acid Sulphate Soils (PASS). AASS are soils that have already been oxidized. Hence AASS environments may be acidic, but have low potential for further acid generation. PASS are soils that have not yet been oxidized (i.e. they contain oxidisable sulphur). AASS and PASS can coexist. In anaerobic conditions, PASS do not pose an environmental threat, however if conditions change, the sulphides will oxidise and form sulphuric acid. Developments involving excavation or dewatering must establish the presence and extent of ASS down the soil profile, as works may intercept ASS horizons and pose risks to both human and ecological health.

Figure 1 Site Locality Plan *(Google 2012)*

3.3 Objective and Requirements

The Ballina Shire Council Acid Sulphate Soils Planning Map **(Figure 2)** indicate the site is classified as Class 3 where an Acid Sulphate Investigation is required if works extend one metre below the natural ground surface, or where the water table may be lowered by greater than one metre.

Further, the OEH (formerly DECCW) has specific Director General Requirements pertaining to the assessment and management of Acid Sulphate Soils on this site. This report addresses these requirements.

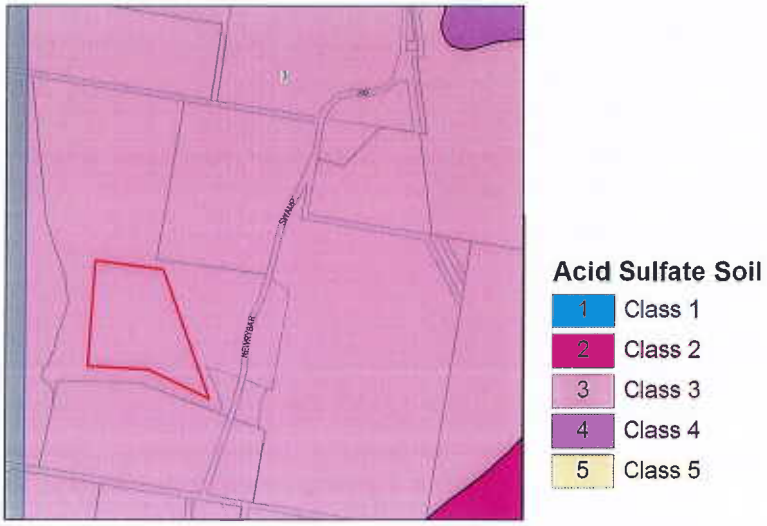


Figure 2 ASS Map (*Source BSC LEP 2011*)

3.4 Scope

The scope of work for this Acid Sulphate Soil Assessment included:

- Drilling of 13 boreholes to 8 m and 5 boreholes to 15m depth;
- Obtaining soil samples from the boreholes at 0.5 m intervals;
- Analysis of all samples for field pH (pH_F) and field peroxide pH (pH_{fox}) to provide initial indication of PASS/AASS;
- Laboratory analysis of 92 samples to determine Total Actual Acidity (TAA) and % Chromium Reducible Sulphur ($\%S_{CR}$);
- Summary of ASS assessment results with calculated liming rates; and
- Development of an acid sulphate soils management plan (ASSMP)

4 Proposed Excavation Works

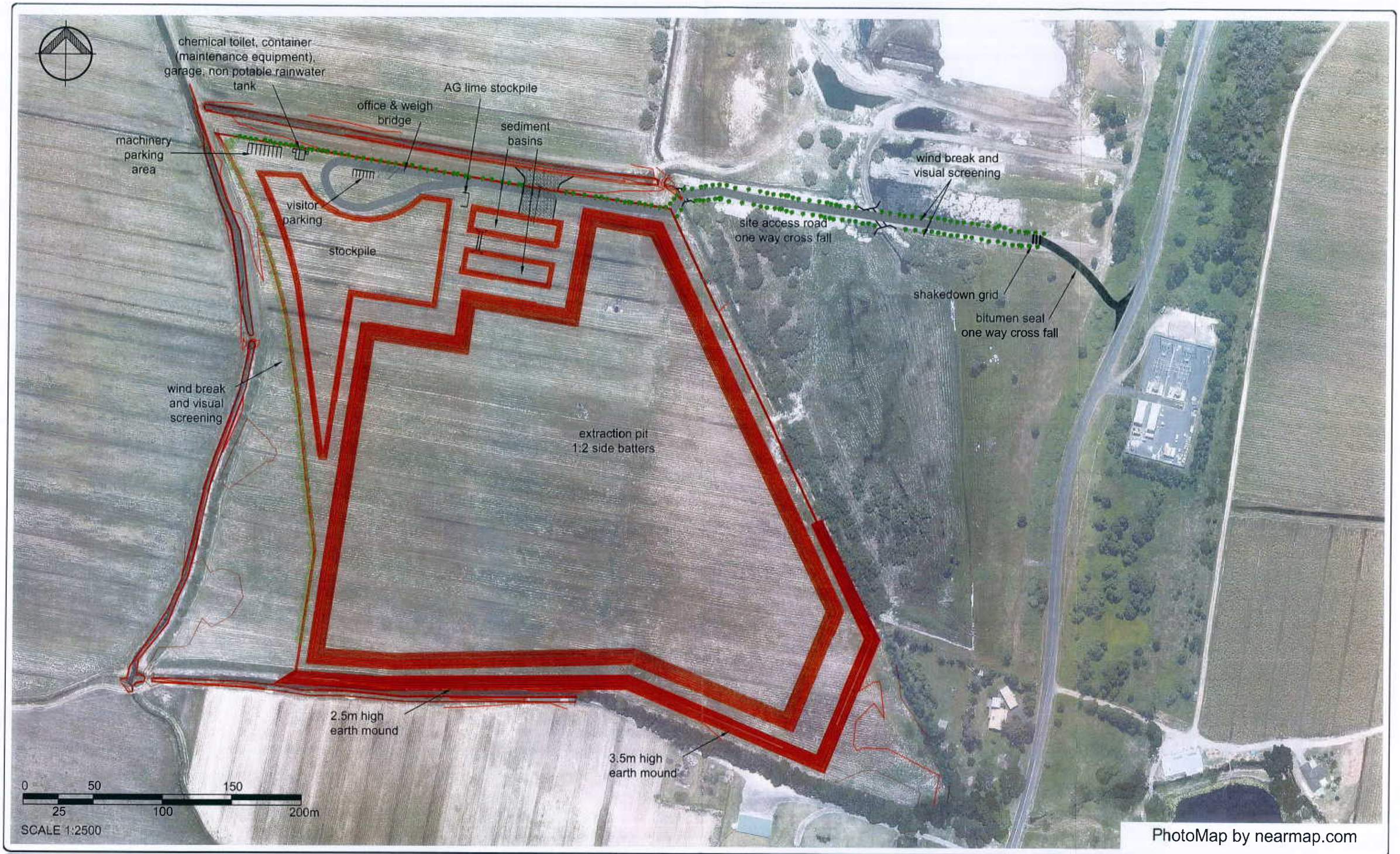
The proposed works involves sand extraction to a maximum depth of ~6 mbgl with a maximum annual extraction rate of 80 000 m^3pa. Sand extraction operations will primarily be conducted during the drier parts of the year and will include stripping topsoil (for use in minor site filling and earthen acoustic and visual mounds), extraction, treatment and stockpiling of soil and then loading into haulage trucks for dispatch to market. The proposed pit will have a footprint of approximately 15 ha as shown on **Figure 3.**

5 Field Work and Testing

An initial round of field work was carried out by Craig Pullman Investigations and Ardill Payne from 18th March to 20th March 2008. This involved the excavation of five boreholes (BH1 – BH5) to a maximum depth of 15.5 mbgl. Samples for acid sulphate testing were taken from each soil horizon and were submitted to the NATA Accredited Environmental Analysis Laboratory (EAL) at Southern Cross University (Lismore campus) and were analysed using both the SPOCAS method and the Chromium Reducible Sulphur technique.

ASSMAC require a sampling density of 2 holes per hectare for works exceeding 4 hectares. Consequently, an additional 13 boreholes were excavated over the 6th May to 10th May, 2011 by Australian Soils & Concrete Testing and Ardill Payne.

The boreholes were drilled 8 mbgl as the maximum extraction depth is anticipated to be 6 mbgl. Samples for acid sulphate testing were recovered at 0.5 m intervals to 8.0 m depth at each borehole location. Soil samples were placed in sealed plastic bags and placed under cold storage conditions to minimise oxidation. Field pH and field peroxide pH tests were carried out on all samples. Selected samples were submitted to the EAL for analysis with the 'chromium suite', i.e. Titratable Actual Acidity (TAA), Reduced Inorganic Sulphur (%S_{CR}) and liming rate calculations.



Project:
Lot 32 DP 1151612
Newrybar Swamp Road
Lennox Head

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Client:
Ballina Sands

Title:
Proposed Extraction Plan
Final Stage

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Design	JF	Scale at A3	1:2500
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6 Site Conditions

6.1 Surface

The subject site is situated on a low remnant dunal sand ridge which falls gently to the west. Natural elevations range from 3 – 5 m AHD. The site is cleared and grassed. Land use in adjacent areas include sand extraction operations, low intensity agricultural uses, sugar cane farming and sparsely scattered rural dwellings.

6.2 Sub-surface

The Tweed Heads 1:250 000 geological map issued by the NSW Geological Survey shows that the site is underlain by Quaternary Alluvial sediments of varying composition of sands, clays and gravels. Morand (1994) maps the area as a "ty – Tyagarah" landscape (Figure 4). The dominant soil materials in this soil landscape, when inland of inner barriers, consist of black loamy sands overlying bleached sand, then brown organic pan (coffee rock). Boundaries between materials are wavy and the depth to coffee rock varies. Black organic peat may occur as a surface layer in depressions and near swampy areas or as discrete layers within sands. Acid peats may also be found at varying depth.

Site geotechnical investigations are described qualitatively below. Borehole logs and a geological visual aid are attached in Attachment 1. Borehole locations are indicated in Figure 5.

Generally, the site is overlain by loose, silty sand. Some boreholes also contained clayey sand in their top layers, although no spatial pattern can be inferred from the borehole logs with respects to clay. The loose, finer layer was generally confined to the topsoil, but tended to extend to greater depths (up to 1.5 mbgl) on the western side of the site.

At depth, the entire site was underlain by clean, fine-grain sands with little or no fines. The soil can be generally described as non-plastic with no dry strength. The sand became increasingly dense down the soil profile. Indurated sand was observed at the base of boreholes BH1, BH5, BH2.6, BH2.7, BH2.10 and BH2.13. Striated indurated sand was observed at the base of BH2.2, BH2.3, BH2.8. Indurated material (both 'blocks' and 'striations') was encountered at shallower depths in BH1, BH2, BH2.12 and BH2.13.

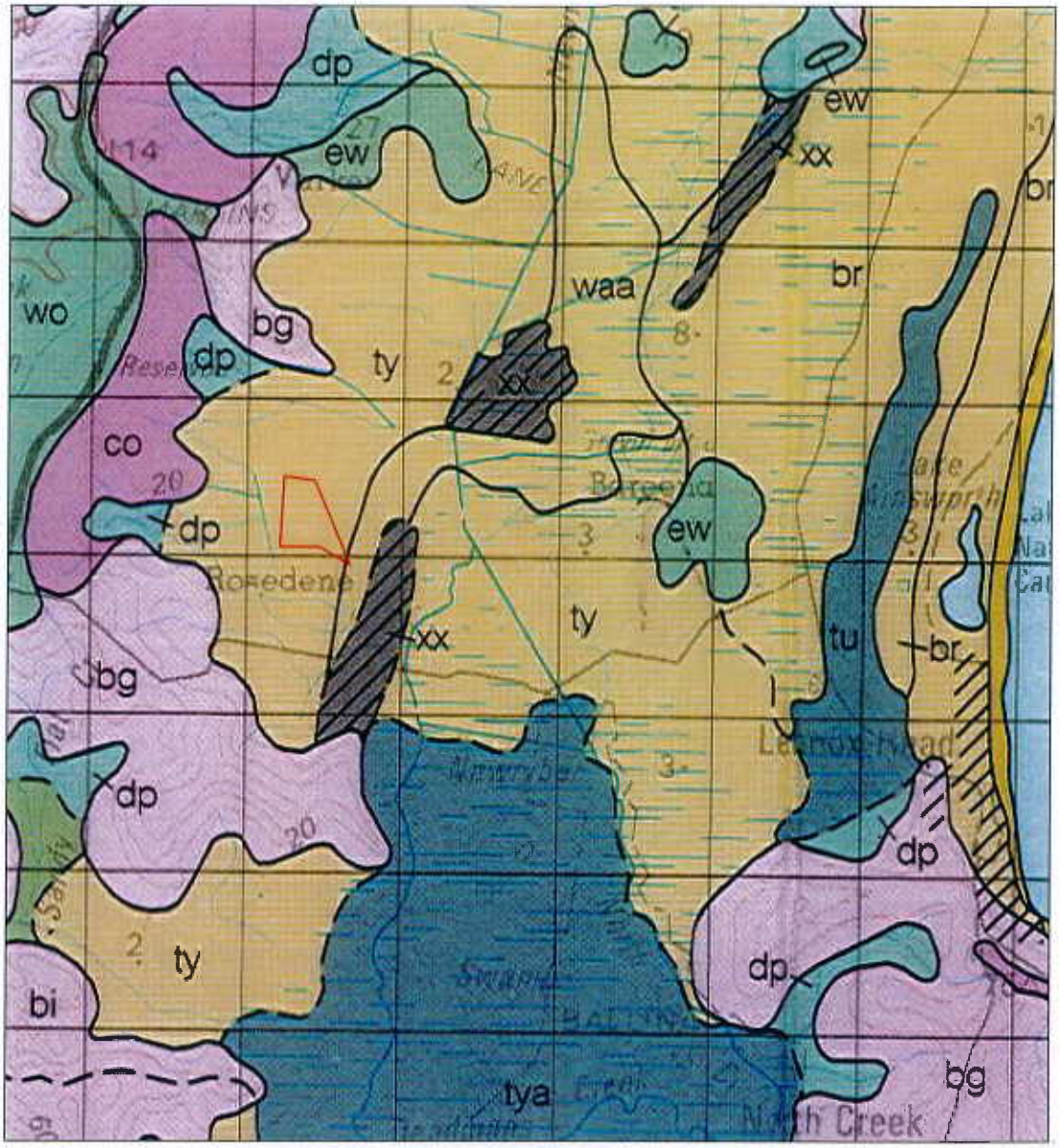


Figure 4 - Soil Map (Morand, 1994)

The depth and location of indurated material is of interest, in an ASS context, as there is a reasonably strong association between the dark, indurated material and oxidisable sulphur concentrations (PASS). This is discussed further in Secion 6.1. The location and distribution of Acid Sulphate Soils is discussed in Section 7.

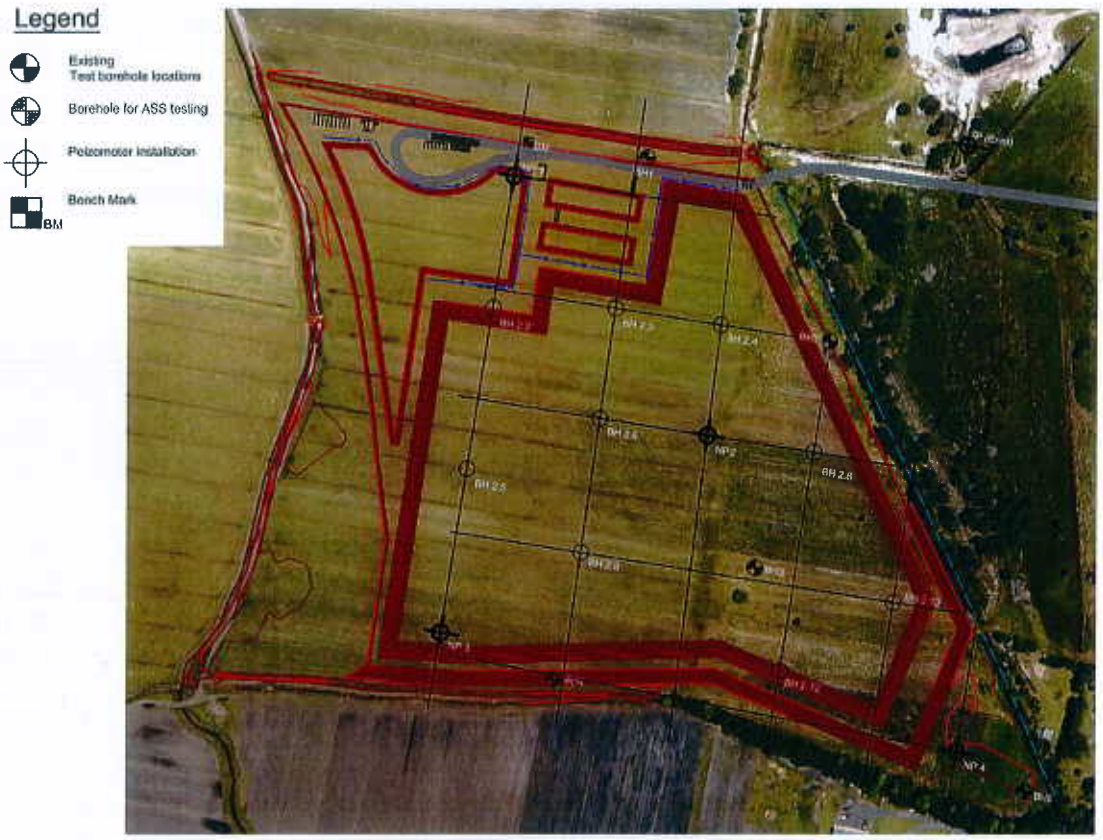


Figure 5 Borehole Locations

7.1 2011 Investigation

The ASSMAC action criteria for AASS and PASS soils are as follows:

Table 1 - Acid Sulphate Soil Action Criteria

Soil Category (Texture)	Action Criteria (>1000 tonnes to be disturbed)	
	Oxidisable Sulphur (% S_{cr}) (Strong indicator of PASS/AASS)	Titratable Actual Acidity (TAA) (mol H^+/tonne) (Indicator of AASS)
Coarse	0.03	18
Medium	0.03	18
Fine	0.03	18

Laboratory testing is required to determine $\%S_{CR}$ and TAA values. However, the cost of laboratory testing for this sample size (214) is substantial, thus, only selected samples were sent to the lab for testing. Samples were strategically selected based on the results of field pH and peroxide tests. These are simple, qualitative techniques used to gauge the likely presence and severity of AASS and PASS. Field test results are included in Attachment 2. Field and lab results were used together to generate a complete picture of the distribution of ASS on the site. Lab results, alongside field test results, are included in Attachment 2. Laboratory certificates are included in Attachment 3.

7.1.1 PASS

A PASS classification tool (Table 2) for interpreting field test results was developed based on *Appendix 1: Field pH and the Peroxide Test* of the Acid Sulphate Soils Manual (ASSMAC, 1998). This tool was not only developed for this assessment, but also allows ongoing, effective management during operation.

Table 2 - **Likelihood and severity of PASS based on field testing**

	$pH_{FOX}<2$	$2 \leq pH_{FOX}<3$	$3 \leq pH_{FOX}<4$	$pH_{FOX} \geq 4$
pH drop>5	HIGH	HIGH	MODERATE	MODERATE
5≥pH drop>3	HIGH	MODERATE	MODERATE	LOW
3≥pH drop>1	MODERATE	MODERATE	LOW	LOW
pH drop<1	MODERATE	LOW	LOW	LOW

NB: pH drop = pH_F - pH_{FOX}

The tool was validated by comparing it against lab results for oxidisable sulphur concentration. Table 3 demonstrates that samples in the high and moderate risk category had concentrations of oxidisable sulphur

warranting management. Samples in the low risk category are not included in Table 3 unless they had $\%S_{CR}>0.03$ – these are anomalies. Apart from these anomalies, the remaining set of low risk samples (19 samples) submitted to the lab contained $\%S_{CR}<0.03$, i.e. soils that do not require PASS management.

Table 3 - **Validation of PASS classification tool**

Location	Depth (mbgl)	pH_{FOX}	pH Drop	Risk/Severity Category	$\%S_{CR}$
BH 2.3	3.5-4	0.99	3.84	5	0.14
BH 2.3	4-4.5	0.99	4.02	5	0.16
BH 2.3	4.5-5	1.23	3.75	5	0.15
BH 2.3	5-5.5	0.31	4.81	5	0.16
BH 2.3	5.5-6	1.45	3.61	5	0.16
BH 2.3	6-6.5	1.51	4.27	5	0.22
BH 2.3	6.5-7	1.5	3.11	5	0.27
BH 2.1	7-7.5	1.52	3.88	5	0.14
BH 2.6	3.5-4	1.7	3.36	5	0.17
BH 2.7	5.5-6	1.29	3.49	5	0.14
BH 2.9	4-4.5	1.19	3.82	5	0.13
BH 2.11	4.5-5	0.7	4.25	5	0.28
BH 2.11	4-4.5	0.88	4.15	5	0.21
BH 2.4	6-6.5	1.5	3.53	5	0.09
BH 2.3	3-3.5	1.85	2.95	4	0.12
BH 2.3	7-7.5	2.19	2.44	3	0.19
BH 2.3	7.5-8	2.62	2.14	3	0.12
BH 2.10	4	2.68	2.3	3	0.1
BH 2.10	4.5	2.62	2.3	3	0.1
BH 2.10	5	2.89	1.96	3	0.09
BH 2.10	5.5	2.88	1.8	3	0.08
BH 2.10	6	2.87	1.97	3	0.41
BH 2.10	7	2.77	2.06	3	0.14
BH 2.10	7.5	2.11	2.6	3	0.16
BH 2.7	3.5-4	2.69	2.31	3	0.08
BH 2.13	3.5-4	2.98	1.87	3	0.1
BH 2.13	4-4.5	2.48	2.36	3	0.13
BH 2.5	6.5-7	2.63	2.56	3	0.35
BH 2.8	3-3.5	3.32	1.25	2	0.26
BH 2.8	6.5-7	3.05	1.32	2	0.13
BH 2.12	3-3.5	3.43	1.35	2	0.08
BH 2.10	6.5	3.57	1.5	2	0.06
BH 2.12	4.5-5	4.85	0.17	0	0.08

One hundred of the 214 samples qualified for the high to moderate PASS risk category. These were generally found at depth – in some

areas, they were encountered at and below 2 mbgl and in other areas, they were first encountered at 4 mbgl. Oxidisable sulphur concentrations ranged from 0.08 to 0.41 $\%S_{CR}$. The character of these soils and their distribution are discussed further in Section 6.

As discussed in Section 5.2, both 'blocks' and striations of dark, indurated sand were encountered across the site, typically at depth although there were some instances where the induration was encountered just below surface (BH 2.12 and 2.13 on the eastern side of the site). During field peroxide testing, the dark, indurated sands typically underwent vigorous, heat generating reactions and had very high pH_{FOX}. ASSMAC advises that the peroxide field test is 'least useful' on coffee rock. This is because of the high organic content and various oxides associated with coffee rock. Mindful of this, a large number of samples from indurated horizons were submitted for laboratory analysis. Lab results indicated that the indurated material, in fact, had high oxidisable sulphur concentrations (Table 4). All lab tested samples from indurated horizons had $\%S_{CR}$>0.03 and the highest $\%S_{CR}$ detected were from indurated sands. This indicates that the field tests were effective in identifying oxidisable sulphur in the indurated sands, and indurated layers will require management.

Table 4 - **$\%S_{CR}$ for samples submitted from indurated sand horizons**

Location	Depth (mbgl)	%Scr
BH 2.3	7-7.5	**0.19**
BH 2.3	7.5-8	**0.12**
BH 2.5	6.5-7	**0.35**
BH 2.10	6-6.5	**0.41**
BH 2.10	6.5-7	**0.06**
BH 2.10	7-7.5	**0.14**
BH 2.10	7.5-7	**0.16**
BH 2.12	3-3.5	**0.08**
BH 2.12	4.5-5	**0.08**

7.1.2 AASS

A similar technique was trialled for AASS, using pH_F as a classification tool for AASS. However, field pH was not a strong predictor for TAA. Field pH tests indicated site soils were acidic and generally less acidic at depth as indicated in Table 5 below.

Table 5 - **Trends in Field pH (pH_F) down soil profile**

Depth (mbgl)	Mean pH_F
Topsoil – 1	4.32
1 – 3	4.82
3 – 8	4.95

TAA exceeding ASSMAC action criteria were detected in 35 of the 52 samples submitted. These high TAA samples were found at each 0.5 m interval down the soil profile and little can be inferred from field and laboratory tests with respect to the spatial distribution of AASS.

The management of Acid Sulphate Soils on this site will focus on PASS, i.e. managing PASS to minimise the potential for future acid generation.

7.2 2008 Investigation

As fewer boreholes were excavated in the 2008 investigation, the cost of laboratory analysis was not as prohibitive and so samples from each soil profile were submitted for analysis. These results are presented in Attachment 5. They are generally consistent with the 2011 findings. Site soils were acidic and oxidisable sulphur concentrations exceeding ASSMAC action criteria ($\%S_{CR}$>0.03) were generally found below 3 mbgl. The maximum oxidisable sulphur concentration found in this investigation was 0.287 $\%S_{CR}$.

8 Site Characterisation – Acid Sulphate Soils

Acid Sulphate Soils are present across the entire site at varying depths and at varying severity. Two different presentations of the spatial distribution of ASS on site are included. Figure 6 is an array which shows the depths to low, moderate and high risk PASS soils in detail; Figure 7 is a time lapse series, which indicates at what depths PASS will be encountered across the site. APP proposes that Figure 7 be used as a management tool during operation.

Figure 7 indicates that the first two metres of soil fall into the low risk category. These soils are acidic, but have low potential for further acid generation. Further down the soil profile, the distribution of both moderate and high risk PASS increases, with the western portion of the site worse effected than the eastern portion. At depth (7 – 8 mbgl), the high risk PASS recedes away from the centre of the site, but is still present along the western boundary and in the eastern corner.

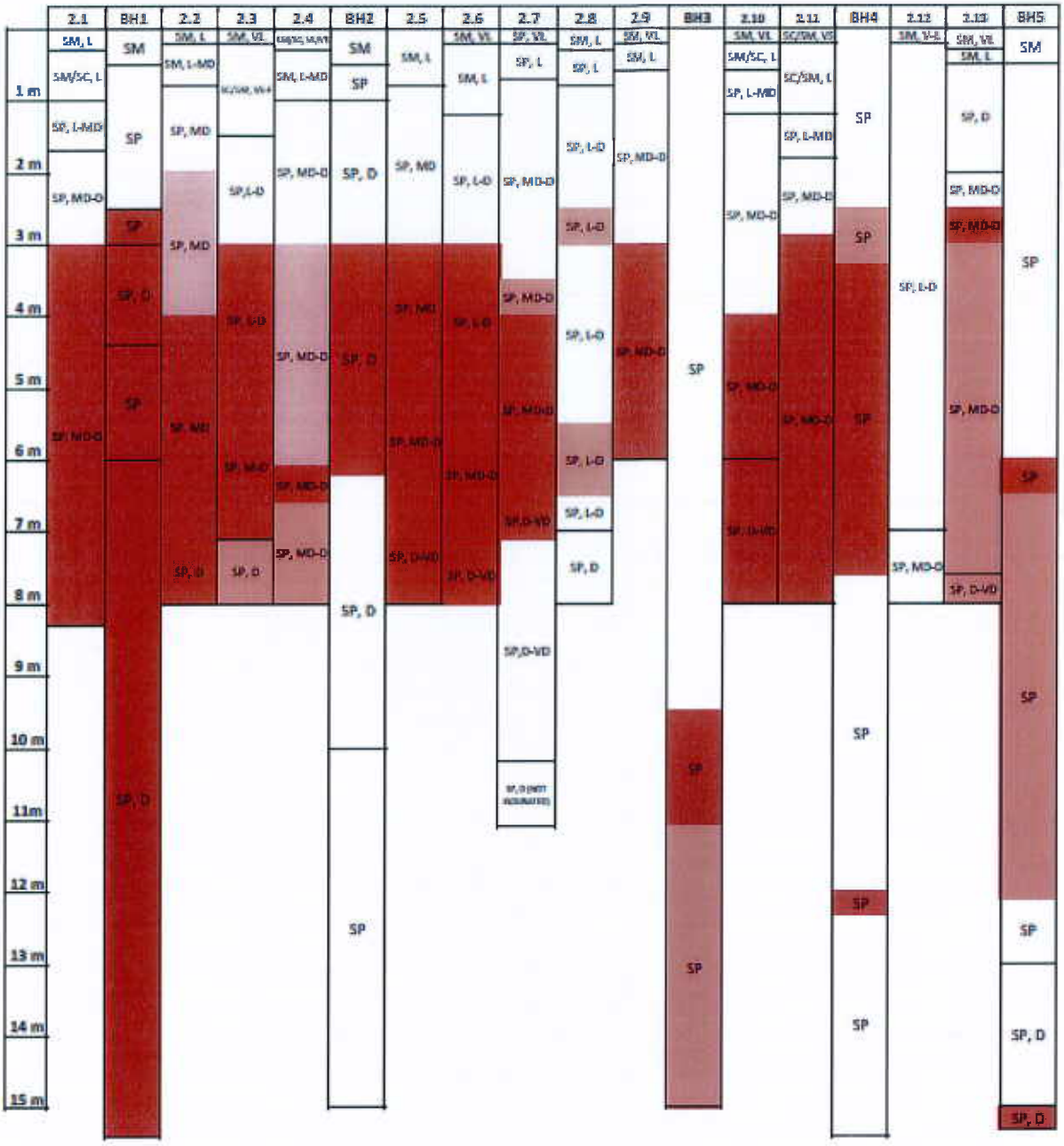


Figure 6 PASS Array

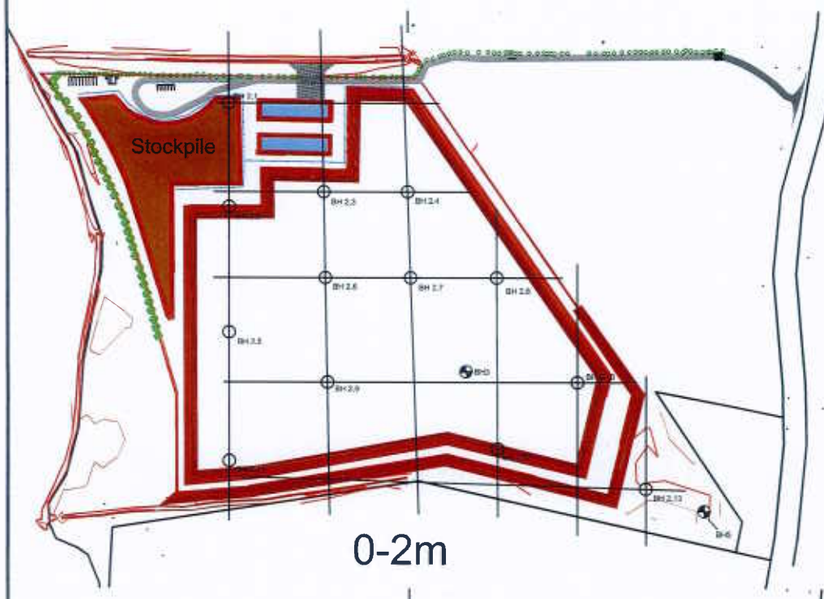
Existing Test borehole locations

Borehole for ASS testing

High risk/severity PASS ~ 13Kg/tonne

Moderate risk/severity PASS ~ 9Kg/tonne

low risk/severity PASS ~ 4Kg/tonne



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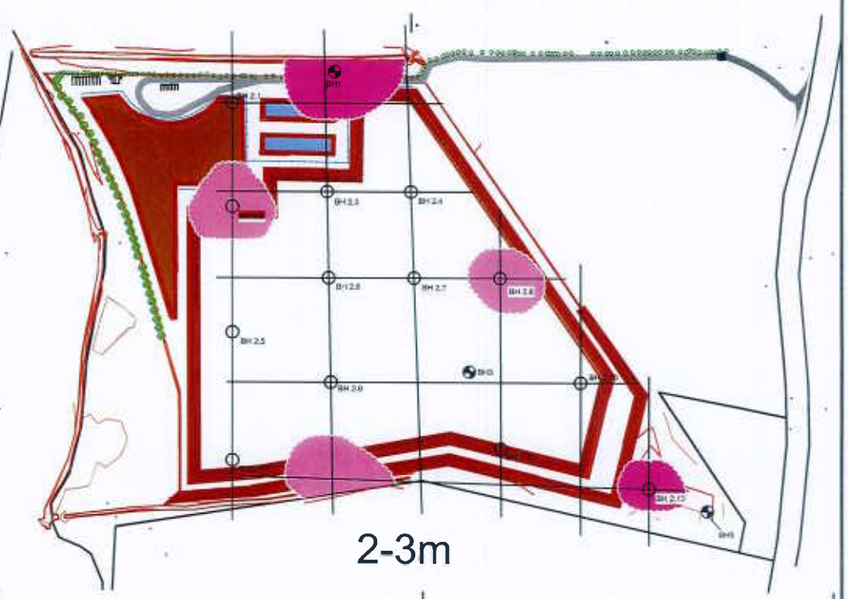

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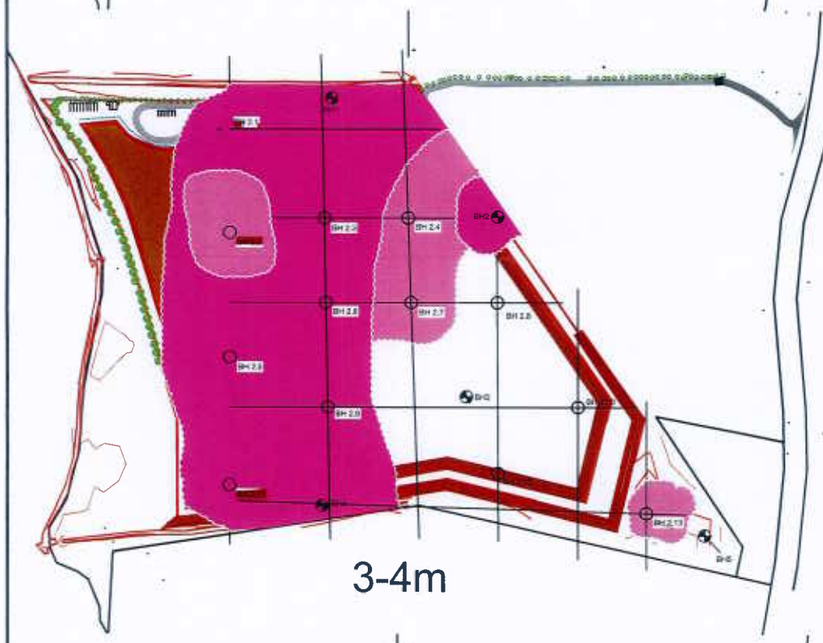

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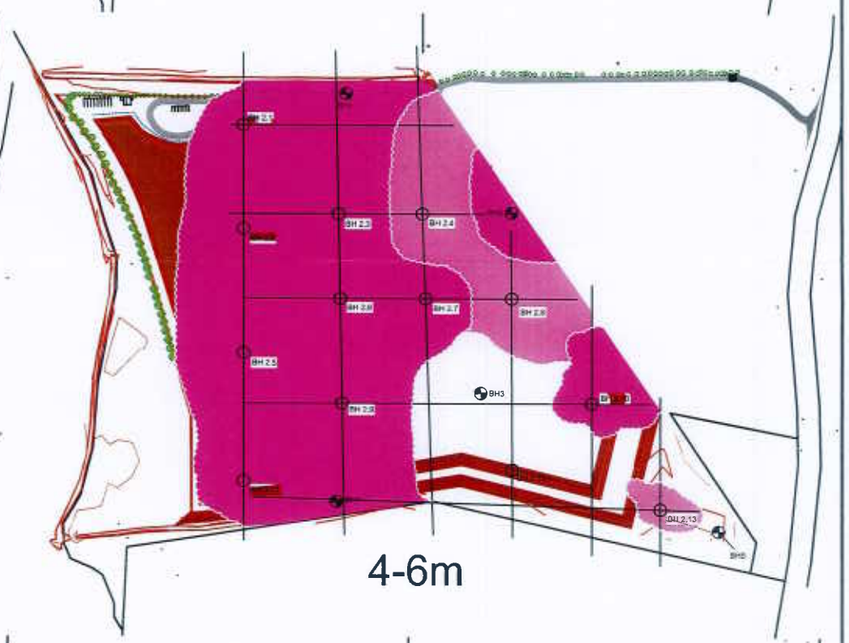

4-6m

6-7m

7-8m

Project:
Lot 32 DP 1151612
Newrybar Swamp Rd
Lennox Head

Client:
Ballina Sands

Title:
PASS Risk/Severity Map for ASS Management During Operations

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Drawn	RMcG	Datum	N/A
Checked		Date	29/08/12
Filename	6542w-PASS MAP 29-8-2012		
Job No.	6542	Dwg. No.	Issue

9 Acid Sulphate Soil Management

The most common Acid Sulphate Soils mitigation method relies on providing sufficient neutralising agent to neutralise acid as it is produced over time due to the gradual oxidation of acid sulphate soils (ASSMAC, 1998). This method will be used here.

9.1 Lime Rates

APP has categorised the site into three categories:

- Low risk/severity PASS;
- Moderate risk/severity PASS; and
- High risk/severity PASS.

Each of these categories is associated with a liming rate. The liming rates were derived by compiling all laboratory calculated liming rates for each category, removing outliers[1], and then taking the 90th percentile (Table 6).

Table 6 - Lime calculations for different PASS categories

Maximum Lime (kg $CaCO_3$/tonne DW)	Entire Range Maximum	90th Percentile Maximum	75th Percentile Maximum	Mean	Median	Standard Deviation
High	15	**13**	11	9.69	8.75	2.52
Moderate	12	**9**	8	7.42	7.48	2.08
Low	5	**4**	4	2.84	3.23	1.37

The depth and extent of these soil categories is depicted in Figure 4 (Section 6.2).

Good quality, fine agricultural lime, with a neutralising value of 100, will be used. Lime will be applied using the 'common method' described in the Acid Sulphate Soil Manual, i.e. spreading out excavated soils in 0.3 m layers over a thin bed of lime, air drying and mechanically breaking up clods. When soil is sufficiently dry, appropriate lime quantity will be applied and thoroughly mixed. Material will be removed to a nearby stockpile area and tested prior to removal from site (Section 8.1.1).

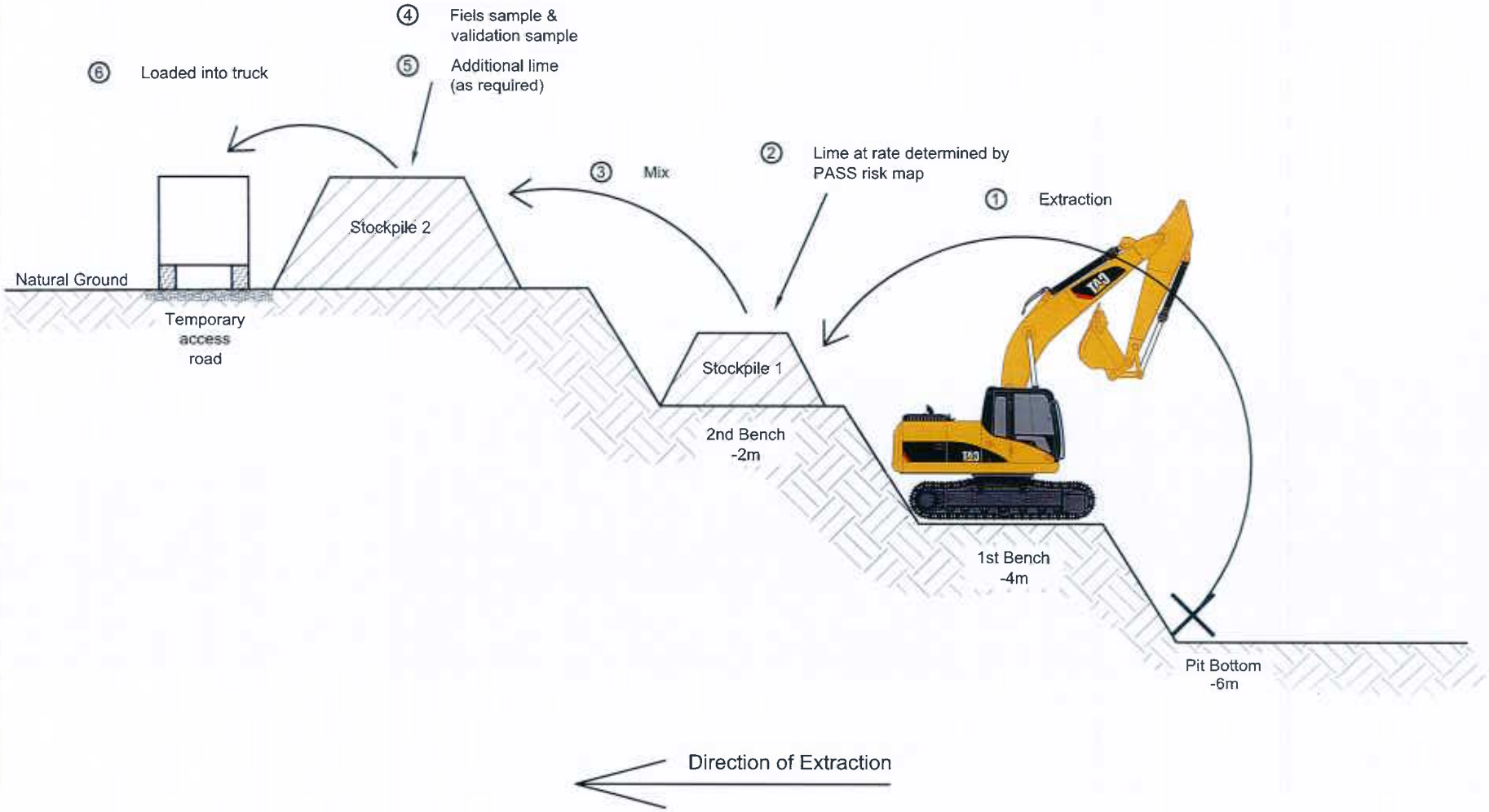
The whole site including pit, stockpile and treatment areas will be bunded, with stormwater collection and treatment systems (described in Section 8.2).

[1] There were very few outliers (see Table 3). Often, outliers were associated with the dark, indurated sand soil type.

A schematic diagram depicting the neutralisation process is included in Figure 8.

Table 7 – Staged Liming and Validation Sampling Procedure

Stage	Description
1	Excavate virgin material from pit.
2	Stockpile on bench. (Add lime at required rate for PASS severity depth / area as indicated on Figure 7).
3	Thoroughly mix lime as stockpile lifted to next bench.
4	Validation sampling at required frequency.
5	Additional lime (as required).
6	Load on trucks for transport.



PROJECT:

Environmental Management Plan

Watsons Sand Quarry,
Newrybar Swamp Road
Lennox Head

TITLE:

ASS Management Plan

CLIENT:

Ballina Sands

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Scale at A4 NTS	Datum AHD
Design JF	Date 10-5-12
Drawn RMcG	File 6542 ASS MANAGEMENT PLAN
Dwg No.	Job No. 6542

9.2 Monitoring

9.2.1 Validation Testing

The *Acid Sulphate Soils Manual* states that if material is to be moved to another site, then it must be fully treated with lime using at least a safety factor of 1.5 and tested to show success. Testing will involve sending samples to the EAL for analysis with the Chromium Suite (AS-PACK-01) and Acid Neutralising Capacity (AS-SING-03). Testing will be carried out with the following frequency:

- 0 -2 m below surface: One (1) sample per 2500 m^2 at one metre vertical intervals; and
- Below 2 m: One (1) sample per 1000 m^3

The sample should be made representative of the stockpile by compositing. In order to minimise stockpile time, all Chain of Custody (COC) documents should be labelled urgent to ensure quick turn-around times. A COC template is included in Attachment 4.

Soil will be considered effectively treated, and suitable for removal off site, when it complies with the following:

- $\%S_{CR}$<0.03 AND/OR sufficient buffering capacity in the soil to prevent the generation of acid
- pH>5.5 in 1:5 water suspension.

In the event that neutralisation has not been achieved by the first round of liming, excavated material is to be re-limed at a rate of 4kg $CaCO_3$/Tonne DW (or more if validation sampling indicates) and thoroughly mixed.

9.2.1 Field Testing

Field testing can be used to indicate the soil pH prior to and post liming treatment.

Field testing for pH_f >5.5 in a 1:5 soil water suspension should be returned from all treated soils prior to leaving site. All field testing results should be entered into the site log book.

Table 8:Monitoring Program

Tested Component	Test Frequency	Assessing for	Soil and Water Quality Parameters	Test Method
Extracted sand material	Upon extraction, - Soils to a depth of 2 m: 1 test per 2500m^3 - Soils below 2 m: 1 tests per 1000 m^3	Presence of ASS	Will inform liming rate	Field test (See Section 7.1.1)
Validation Sampling	- Soils to a depth of 2 m: 1 test per 2500m^3 - Soils below 2 m: 1 tests per 1000 m^3	Acid neutralisation	Soil leaving site must not have a Chromium Reducible Sulphur percentage>0.03%; and actual acidity>18 mole H^+/T and a pH greater than 5.5 in a 1:5 water suspension	NATA Accredited Laboratory Analysis
Groundwater	Monthly	Acid generation as a result of extraction of acid sulphate material	Groundwater pH to be monitored and compared with baseline data	Field – handheld pH meter
Water in sediment retention basin	Prior to release of water	Presence of acidic water and the need for treatment if required prior to discharge	pH 6.5-8.5 TSS 50 mg/L (50 NTU)	NATA Accredited Laboratory Analysis / Multiparameter Water Quality Analyser

9.3 Lime Storage

A dedicated lime storage stockpile shall be kept on site. Agricultural lime is typically transported by road in bulk and tipped into the designated stockpile. This stockpile shall be covered when not in use. The location of the lime stockpile is shown in Figure 3.

As a minimum, 1 tonne of lime should be kept on site at all times.

Hydrated lime needs to be kept dry. A shipping container on site has historically been used to store hydrated lime supplies for pH adjustment of the sediment basin.

9.4 Stormwater Controls

As the whole site is bunded, all stormwater from the site will discharge through the sediment basin prior to leaving site. This basin will assist and allow sedimentation as well as pH control (via a liming spillway) to effectively neutralise any acid generation and control sediment runoff.

9.4.1 Stormwater Monitoring

All stormwater discharges will be monitored and TSS and pH levels recorded upon release in accordance with the EPA license conditions. Details are given in Table 8.

9.5 Groundwater Controls

Four piezometers were installed on the proposed site in 2011 and are currently being monitored to obtain baseline data. The location of these sites is shown in Figure 5.

9.5.1 Groundwater Monitoring

These sites will be monitored during operation of the extraction. Any change in groundwater pH will be monitored and recorded monthly. Details of groundwater monitoring are given in Table 8.

9.6 Stockpiling of Materials

If it is necessary to stockpile soils (such as in the case of prolonged wet weather), provision should be made to safely store the material. Stockpile design should include the following features:

- Be within the bunded site area as shown on Figure 3;
- Be connected to the stormwater collection and treatment systems;
- All stockpiled material to be immediately limed and treated;
- Where possible wind breaks shall be planted around the stockpile area to minimise wind disturbance.

- A water truck shall be utilised to moisten stockpiles to reduce dust generation during windy climatic conditions.
- Minimise surface area by keeping stockpiles below 2m in height; and
- The base of the stockpile area should be limed at the rate of 0.5kg/m^2 to ensure any leachate generated is effectively neutralised.

Otherwise, during normal operation (dry weather), material shall be limed, mixed and validated on benches adjacent to the excavation prior to being loaded for transport.

9.7 Training and Supervision

All staff involved in excavation and dewatering shall undertake mandatory training to ensure they are aware of their responsibilities with respects to ASS management. The training session will be undertaken prior to the commencement of earthworks on site.

9.8 Responsible Parties

The Operations Manager shall be the responsible party undertaking all monitoring, testing and maintenance requirements detailed in this plan.

Ballina Sands Pty Ltd

Newrybar Swamp Road

Lennox Head NSW 2478

Mine Operations Manager: Mr Jack Krupski

Ph – 0488 001 002

9.9 Contingency Plan

This contingency plan is prepared as a precautionary measure in the unlikely event the ASS management strategy does not identify and effectively treat excavated sulfidic soils.

9.9.1 Remediation Equipment

Remedial equipment will require the on site storage of additional lime, above the anticipated requirements for normal operations, in the event an unanticipated source and/or potential discharge of acid. Suitable equipment to apply the lime as a slurry to the sediment retention/water treatment basin shall be available on site to ensure the slurry is suitably mixed.

In addition, field pH monitoring equipment is to be permanently kept on site for ongoing pH assessment of the pit and discharge waters.

9.9.2 Restorative Action

If unacceptable generation of acid drainage occurs, extraction in the affected area will be discontinued until the acid discharge is suitably controlled. The need to cease extraction in the affected area will be determined by the Production Manager in association with their Environmental Consultant. Further consultation with the Office of Environment and Heritage will be carried out if deemed necessary. The Production Manager shall monitor pit and discharge pH levels on a daily basis during restoration action activity.

The cause of the unacceptable acid generation will be assessed in terms of:

- *Ineffective implementation of the ASS management strategy.* If this occurs the management plan will be audited and modified to ensure it can be effectively implemented and soil/water monitoring will be increased to ensure that compliance with required criteria is achieved.
- *Ineffective management strategies.* If the management strategy is ineffective the management plan will be reviewed, including the outcome of remedial actions taken and the management plan will be modified by the Environmental Consultant who may undertake further consultation with the Office of Environment and Heritage.

9.10 Auditing Program

An annual environmental audit of the ASS monitoring and management system is required and shall be undertaken by a suitably qualified independent person or persons experienced in the field of acid sulphate soil management. Details of the auditing program are included in the AP Plan of Management.

10 Conclusion

Ardill Payne (AP) has been commissioned by Ballina Sands Pty Ltd to carry out an Acid Sulphate Soil (ASS) Assessment and prepare a Management Plan for the sand extraction operation proposed for Lot 32 DP 1151612, Newrybar Swamp Road, Lennox Head.

The ASS assessment has found both Potential Acid Sulphate Soils (PASS) and Actual Acid Sulphate Soils (AASS) at levels warranting management. Leachate and stormwater associated with these soils will also require management. The approach to management has been described here.

This assessment and management plan has been prepared in accordance with the Acid Sulphate Soils Manual (ASSMAC, 1998).

11 General Notes

General

Geotechnical and environmental reports present the results of investigations carried out for a specific project and usually for a specific phase of the project (e.g. preliminary design). The report is based on specific criteria, such as the nature of the project, underground utilities or scope of service limitations imposed by the Client. The report may not be relevant for other phases of the project (e.g. construction), after some time, or where project details and clients change.

Soil and Rock Description

Soil and rock descriptions are based on AS1726-1993 using visual and tactile assessment except at discrete locations where field and/or laboratory tests have been carried out.

Groundwater

The water levels indicated are taken at the time of measurement and depending on material permeability may not reflect the actual groundwater level at those specified locations. Also groundwater levels can vary with time due to seasonal or tidal fluctuation, construction activities and other external factors.

Interpretation of Results

The discussion and recommendations in the accompanying report are based on extrapolation/interpolation from data obtained at discrete locations and other external sources and guidelines. The actual interface between the materials may be far more gradual or abrupt than indicated. Also actual conditions in areas not sampled may differ from those predicted.

The report is based on significant background details that only the authors can be aware off, and therefore implementation of the recommendations by others may lead to misinterpretation and complications. Therefore this company should be consulted to explain the reports implications to other involved parties.

Reporting relies on interpretation of often limited factual information based on judgement and opinion which has a level of uncertainty and ambiguity attached to it, and is far less exact than other design disciplines. This should be considered by users of the report when assessing the implications of the recommendations.

Change in Conditions

Subsurface conditions can change with time and can vary between test locations. Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations can also affect subsurface conditions.

12 Scope of Engagement

This report has been prepared by Ardill Payne (AP) at the request of Ballina Sands Pty Ltd for the purpose of assessing Acid Sulphate Soils and providing management advice, and is not to be used for any other purpose or by any other person or corporation.

This report has been prepared from the information provided to us and from other information obtained as a result of enquiries made by us. APP accepts no responsibility for any loss or damage suffered howsoever arising to any person or corporation who may use or rely on this document for a purpose other than that described above.

APP declares that it does not have, nor expects to have, a beneficial interest in the subject project.

To avoid this advice being used inappropriately it is recommended that you consult with AP before conveying the information to another who may not fully understand the objectives of the report. This report is meant only for the subject site/project and should not be applied to any other.

13 References

Acid Sulphate Soils Management Advisory Committee (ASSMAC). August 1998. *Acid Sulphate Soil Manual.*

Morand, D.T. 1994. *Soil Landscapes of the Lismore-Ballina 1:100 000 Sheet Map*. Soil Conservation Service of NSW, Sydney.

14 Attachments

Attachment 1	Engineering Bore logs and Geotech Visual Aid
Attachment 2	Field Test and Laboratory Results (2011)
Attachment 3	Laboratory Certificates (2011)
Attachment 4	Template Chain of Custody for Validation Testing

ATTACHMENT 1

Attachment 1
Engineering Borelogs

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BOREHOLE LOG

Job No:	6542
Date:	18/03/2008
No:	**BH1**
Sheet:	1 of 3
Logged by:	P. Moodie
Ckecked:	
Level:	Existing

Client	Mr R Watson
Project	New Extractive Industry, Newrbar Swamp Rd, Lennox Head
Equipment	Truck mounted drill rig
Location	See Site Plan

Test Method	Water	Samples and Tests	Depth	ASS	PASS	DESCRIPTION (Material, Plasticity, Particle Size, Colour, Secondary Components, Other)	MOISTURE	COMMENTS
						Silty SAND - black grey.	D	Sample at 0.5 mbgl
			1.0			SAND - grey to brown.	M	Sample at 1.0 mbgl
						SAND - brown.	W	Sample at 1.5 mbgl Sample at 2.5 - 2.95 mbgl
			2.0					
			3.0			Indurated SAND - brown/green	W	
			4.0					Sample at 4.0 - 4.45 mbgl
			5.0			Sand - pale brown	W	

CLASSIFICATION SYMBOLS

TEST METHOD	Size	PLASTICITY	MOISTURE	CONSISTENCY/DENSITY	
X Existing excavation	F Fine	LP Low Plastity	D Dry	VS Very soft	VL Very loose
A Auger	M Medium	MP Medium Plasticity	M Moist	S Soft	L Loose
BH Backhoe Bucket	C Coarse	HP Highly Plastic	W Wet	Fi Firm	MD Medium
				St Stiff	D Dense
				V St Very stiff	VD Very dense
				H Hard	Fb Friable

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Logged by:	P. Moodie
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Ckecked:	
Location	See Site Plan
Level:	Existing

Test Method	Water	Samples and Tests	Depth	ASS	PASS	DESCRIPTION (Material, Plasticity, Particle Size, Colour, Secondary Components, Other)	MOISTURE	COMMENTS
						Sand - pale brown (continued)	W	Sample at 6.0 - 6.5 mbgl
			6.0			Indurated SAND - brown	W	
			7.0					
			8.0			Coffee rock - brown, very hard.	W	Sample at 8.0 - 8.2 mbgl
			9.0			Indurated SAND - brown	W	
			10.0					

CLASSIFICATION SYMBOLS

TEST METHOD	Size	PLASTICITY	MOISTURE	CONSISTENCY/DENSITY	
X Existing excavation	F Fine	LP Low Plastity	D Dry	VS Very soft	VL Very loose
A Auger	M Medium	MP Medium Plasticity	M Moist	S Soft	L Loose
BH Backhoe Bucket	C Coarse	HP Highly Plastic	W Wet	Fi Firm	MD Medium
				St Stiff	D Dense
				V St Very stiff	VD Very dense
				H Hard	Fb Friable

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Level:	Existing

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Project	New Extractive Industry, Newrbar Swamp Rd, Lennox Head
Equipment	Truck mounted drill rig
Location	See Site Plan

Test Method	Water	Samples and Tests	Depth	ASS	PASS	DESCRIPTION (Material, Plasticity, Particle Size, Colour, Secondary Components, Other)	MOISTURE	COMMENTS
			11.0			Indurated SAND - brown (continued)	W	Sample at 11.0 - 11.15 mbgl
			12.0			Indurated SAND - pale brown	W	
			13.0					
			14.0					
			15.0			Indurated SAND - blue to grey		Sample at 15.0 - 15.45 mbgl
						End of borehole at 15.45 mbgl.		

CLASSIFICATION SYMBOLS

TEST METHOD	Size	PLASTICITY	MOISTURE	CONSISTENCY/DENSITY	
X Existing excavation	F Fine	LP Low Plastity	D Dry	VS Very soft	VL Very loose
A Auger	M Medium	MP Medium Plasticity	M Moist	S Soft	L Loose
BH Backhoe Bucket	C Coarse	HP Highly Plastic	W Wet	Fi Firm	MD Medium
				St Stiff	D Dense
				V St Very stiff	VD Very dense
				H Hard	Fb Friable

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Job No:	6542
Date:	18-19/03/2008
No:	**BH2**
Sheet:	1 of 3
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Level:	Existing

Client	Mr R Watson
Project	New Extractive Industry, Newrbar Swamp Rd, Lennox Head
Equipment	Truck mounted drill rig
Location	See Site Plan

Test Method	Water	Samples and Tests	Depth	ASS	PASS	DESCRIPTION (Material, Plasticity, Particle Size, Colour, Secondary Components, Other)	MOISTURE	COMMENTS
						Silty SAND - brown.	D	Sample at 0.5 mbgl
			1.0			SAND - grey to brown.	D	Sample at 1.0 mbgl
								Sample at 1.5 mbgl. Water at 1.3 mbgl
			2.0					
			3.0			Indurated SAND - brown.	W	Sample at 3.0 - 3.3 mbgl
			4.0					
			5.0					

CLASSIFICATION SYMBOLS

TEST METHOD	Size	PLASTICITY	MOISTURE	CONSISTENCY/DENSITY	
X Existing excavation	F Fine	LP Low Plastity	D Dry	VS Very soft	VL Very loose
A Auger	M Medium	MP Medium Plasticity	M Moist	S Soft	L Loose
BH Backhoe Bucket	C Coarse	HP Highly Plastic	W Wet	Fi Firm	MD Medium
				St Stiff	D Dense
				V St Very stiff	VD Very dense
				H Hard	Fb Friable

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Client	Mr R Watson
Project	New Extractive Industry, Newrbar Swamp Rd, Lennox Head
Equipment	Truck mounted drill rig
Location	See Site Plan

Test Method	Water	Samples and Tests	Depth	ASS	PASS	DESCRIPTION (Material, Plasticity, Particle Size, Colour, Secondary Components, Other)	MOISTURE	COMMENTS
			6.0			Indurated SAND - brown (continued).	W	Sample at 6.0 - 6.2 mbgl
			7.0				W	
			8.0			Indurated SAND - brown, very hard	W	Sample at 8.0 - 8.2 mbgl
			9.0				W	
			10.0					

CLASSIFICATION SYMBOLS

TEST METHOD	Size	PLASTICITY	MOISTURE	CONSISTENCY/DENSITY	
X Existing excavation	F Fine	LP Low Plastity	D Dry	VS Very soft	VL Very loose
A Auger	M Medium	MP Medium Plasticity	M Moist	S Soft	L Loose
BH Backhoe Bucket	C Coarse	HP Highly Plastic	W Wet	Fi Firm	MD Medium
				St Stiff	D Dense
				V St Very stiff	VD Very dense
				H Hard	Fb Friable

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Level:	Existing

Client	Mr R Watson
Project	New Extractive Industry, Newrbar Swamp Rd, Lennox Head
Equipment	Truck mounted drill rig
Location	See Site Plan

Test Method	Water	Samples and Tests	Depth	ASS	PASS	DESCRIPTION (Material, Plasticity, Particle Size, Colour, Secondary Components, Other)	MOISTURE	COMMENTS
			11.0					
			12.0			SAND - brown to grey	W	
			13.0					
			14.0					
			15.0					
						End of borehole at 15.0 mbgl.		

CLASSIFICATION SYMBOLS

TEST METHOD	Size	PLASTICITY	MOISTURE	CONSISTENCY/DENSITY	
X Existing excavation	F Fine	LP Low Plastity	D Dry	VS Very soft	VL Very loose
A Auger	M Medium	MP Medium Plasticity	M Moist	S Soft	L Loose
BH Backhoe Bucket	C Coarse	HP Highly Plastic	W Wet	Fi Firm	MD Medium
				St Stiff	D Dense
				V St Very stiff	VD Very dense
				H Hard	Fb Friable

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Date:	19/03/2008
No:	**BH3**
Sheet:	1 of 3
Logged by:	P. Moodie
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Level:	Existing

Client	Mr R Watson
Project	New Extractive Industry, Newrbar Swamp Rd, Lennox Head
Equipment	Truck mounted drill rig
Location	See Site Plan

Test Method	Water	Samples and Tests	Depth	ASS	PASS	DESCRIPTION (Material, Plasticity, Particle Size, Colour, Secondary Components, Other)	MOISTURE	COMMENTS
						SAND - grey.	D	Sample at 0.2 mbgl
			1.0			SAND - dark brown to black.	D	Sample at 0.6 mbgl Water at 1.0 mbgl
			2.0			SAND - brown	W	Sample at 1.2 mbgl
			3.0			SAND - red to brown	W	Sample at 4.0 - 4.45 mbgl
			4.0					
			5.0				W	

CLASSIFICATION SYMBOLS

TEST METHOD	Size	PLASTICITY	MOISTURE	CONSISTENCY/DENSITY	
X Existing excavation	F Fine	LP Low Plastity	D Dry	VS Very soft	VL Very loose
A Auger	M Medium	MP Medium Plasticity	M Moist	S Soft	L Loose
BH Backhoe Bucket	C Coarse	HP Highly Plastic	W Wet	Fi Firm	MD Medium
				St Stiff	D Dense
				V St Very stiff	VD Very dense
				H Hard	Fb Friable

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No:	**BH3**
Sheet:	2 of 3
Logged by:	P. Moodie
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Level:	Existing

Client	Mr R Watson
Project	New Extractive Industry, Newrbar Swamp Rd, Lennox Head
Equipment	Truck mounted drill rig
Location	See Site Plan

Test Method	Water	Samples and Tests	Depth	ASS	PASS	DESCRIPTION (Material, Plasticity, Particle Size, Colour, Secondary Components, Other)	MOISTURE	COMMENTS
			6.0			SAND - red to brown (continued)	W	Sample at 5.0 - 5.4 mbgl
			7.0			SAND - dark brown	W	
			8.0			SAND - red to brown	W	
			9.0			SAND - brown	W	
			10.0					Sample at 9.5 - 9.59 mbgl

CLASSIFICATION SYMBOLS

TEST METHOD	Size	PLASTICITY	MOISTURE	CONSISTENCY/DENSITY	
X Existing excavation	F Fine	LP Low Plastity	D Dry	VS Very soft	VL Very loose
A Auger	M Medium	MP Medium Plasticity	M Moist	S Soft	L Loose
BH Backhoe Bucket	C Coarse	HP Highly Plastic	W Wet	Fi Firm	MD Medium
				St Stiff	D Dense
				V St Very stiff	VD Very dense
				H Hard	Fb Friable

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Job No:	6542
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No:	**BH3**
Sheet:	3 of 3
Logged by:	P. Moodie
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Level:	Existing

Client	Mr R Watson
Project	New Extractive Industry, Newrbar Swamp Rd, Lennox Head
Equipment	Truck mounted drill rig
Location	See Site Plan

Test Method	Water	Samples and Tests	Depth	ASS	PASS	DESCRIPTION (Material, Plasticity, Particle Size, Colour, Secondary Components, Other)	MOISTURE	COMMENTS
			11.0			SAND - brown (continued)	W	Sample at 11.0 - 11.12 mbgl
			12.0					
			13.0			SAND - pale brown	W	
			14.0			SAND - white	W	
			15.0			SAND - blue to grey	W	Sample at 15.0 - 15.45 mbgl
						End of borehole at 15.45 mbgl.		

CLASSIFICATION SYMBOLS

TEST METHOD	Size	PLASTICITY	MOISTURE	CONSISTENCY/DENSITY	
X Existing excavation	F Fine	LP Low Plastity	D Dry	VS Very soft	VL Very loose
A Auger	M Medium	MP Medium Plasticity	M Moist	S Soft	L Loose
BH Backhoe Bucket	C Coarse	HP Highly Plastic	W Wet	Fi Firm	MD Medium
				St Stiff	D Dense
				V St Very stiff	VD Very dense
				H Hard	Fb Friable

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Job No:	6542
Date:	19/03/2008
No:	**BH4**
Sheet:	1 of 3
Logged by:	P. Moodie
Ckecked:	
Level:	Existing

Client	Mr R Watson
Project	New Extractive Industry, Newrbar Swamp Rd, Lennox Head
Equipment	Truck mounted drill rig
Location	See Site Plan

Test Method	Water	Samples and Tests	Depth	ASS	PASS	DESCRIPTION (Material, Plasticity, Particle Size, Colour, Secondary Components, Other)	MOISTURE	COMMENTS
						SAND - dark brown.	D	
						SAND - paler brown.	D	Sample at 0.5 mbgl
			1.0			SAND - red to brown.		Sample at 0.8 mbgl
						SAND - red to brown.		Sample at 1.2 mbgl Water at 1.3 mbgl
			2.0				W	Sample at 1.9 mbgl
			3.0			SAND - dark brown		Sample at 3.0 - 3.25 mbgl
			4.0			SAND - pale brown	W	
			5.0				W	

CLASSIFICATION SYMBOLS

TEST METHOD	Size	PLASTICITY	MOISTURE	CONSISTENCY/DENSITY	
X Existing excavation	F Fine	LP Low Plastity	D Dry	VS Very soft	VL Very loose
A Auger	M Medium	MP Medium Plasticity	M Moist	S Soft	L Loose
BH Backhoe Bucket	C Coarse	HP Highly Plastic	W Wet	Fi Firm	MD Medium
				St Stiff	D Dense
				V St Very stiff	VD Very dense
				H Hard	Fb Friable

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Client	Mr R Watson
Project	New Extractive Industry, Newrbar Swamp Rd, Lennox Head
Equipment	Truck mounted drill rig
Location	See Site Plan

Test Method	Water	Samples and Tests	Depth	ASS	PASS	DESCRIPTION (Material, Plasticity, Particle Size, Colour, Secondary Components, Other)	MOISTURE	COMMENTS
			6.0			SAND - pale brown (continued)	W	Sample at 6.0 - 6.4 mbgl
			7.0					
			8.0			SAND - white	W	
			9.0			SAND - dark brown	W	Sample at 9.0 - 9.17 mbgl
			10.0					

CLASSIFICATION SYMBOLS

TEST METHOD	Size	PLASTICITY	MOISTURE	CONSISTENCY/DENSITY	
X Existing excavation	F Fine	LP Low Plastity	D Dry	VS Very soft	VL Very loose
A Auger	M Medium	MP Medium Plasticity	M Moist	S Soft	L Loose
BH Backhoe Bucket	C Coarse	HP Highly Plastic	W Wet	Fi Firm	MD Medium
				St Stiff	D Dense
				V St Very stiff	VD Very dense
				H Hard	Fb Friable

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Logged by:	P. Moodie
Ckecked:	
Level:	Existing

Client	Mr R Watson
Project	New Extractive Industry, Newrbar Swamp Rd, Lennox Head
Equipment	Truck mounted drill rig
Location	See Site Plan

Test Method	Water	Samples and Tests	Depth	ASS	PASS	DESCRIPTION (Material, Plasticity, Particle Size, Colour, Secondary Components, Other)	MOISTURE	COMMENTS
			11.0			SAND - dark brown (continued)	W	
			12.0					Sample at 12.0 - 12.3 mbgl
			13.0				W	
			14.0			SAND - white to grey	W	
			15.0			SAND - blue to grey	W	Sample at 15.0 - 15.45 mbgl
						End of borehole at 15.45 mbgl.		

CLASSIFICATION SYMBOLS

TEST METHOD	Size	PLASTICITY	MOISTURE	CONSISTENCY/DENSITY	
X Existing excavation	F Fine	LP Low Plastity	D Dry	VS Very soft	VL Very loose
A Auger	M Medium	MP Medium Plasticity	M Moist	S Soft	L Loose
BH Backhoe Bucket	C Coarse	HP Highly Plastic	W Wet	Fi Firm	MD Medium
				St Stiff	D Dense
				V St Very stiff	VD Very dense
				H Hard	Fb Friable

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BOREHOLE LOG

Job No:	6542
Date:	20/03/2008
No:	**BH5**
Sheet:	1 of 3
Logged by:	P. Moodie
Ckecked:	
Level:	Existing

Client	Mr R Watson
Project	New Extractive Industry, Newrbar Swamp Rd, Lennox Head
Equipment	Truck mounted drill rig
Location	See Site Plan

Test Method	Water	Samples and Tests	Depth	ASS	PASS	DESCRIPTION (Material, Plasticity, Particle Size, Colour, Secondary Components, Other)	MOISTURE	COMMENTS
						Silty SAND - grey brown.	D	
			1.0			SAND - dark grey to brown.	M	Sample at 0.5 mbgl
								Sample at 1.0 mbgl
			2.0			SAND - dark brown.	W	Water 1.95 - 2.8 mbgl
								Sample at 2.0 mbgl
			3.0					Sample at 2.8 - 2.95 mbgl
			4.0			SAND - red brown	W	
			5.0					

CLASSIFICATION SYMBOLS

TEST METHOD	Size	PLASTICITY	MOISTURE	CONSISTENCY/DENSITY	
X Existing excavation	F Fine	LP Low Plastity	D Dry	VS Very soft	VL Very loose
A Auger	M Medium	MP Medium Plasticity	M Moist	S Soft	L Loose
BH Backhoe Bucket	C Coarse	HP Highly Plastic	W Wet	Fi Firm	MD Medium
				St Stiff	D Dense
				V St Very stiff	VD Very dense
				H Hard	Fb Friable

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BOREHOLE LOG

Job No:	6542
Date:	20/03/2008
No:	**BH5**
Client	Mr R Watson
Sheet:	2 of 3
Project	New Extractive Industry, Newrbar Swamp Rd, Lennox Head
Logged by:	P. Moodie
Equipment	Truck mounted drill rig
Ckecked:	
Location	See Site Plan
Level:	Existing

Test Method	Water	Samples and Tests	Depth	ASS	PASS	DESCRIPTION (Material, Plasticity, Particle Size, Colour, Secondary Components, Other)	MOISTURE	COMMENTS
			6.0			SAND - red brown (continued)	W	Sample at 6.0 - 6.5 mbgl
			7.0					
			8.0			SAND - blue white	W	
			9.0					Sample at 9.0 - 9.3 mbgl
			10.0			SAND - red brown	W	

CLASSIFICATION SYMBOLS

TEST METHOD	Size	PLASTICITY	MOISTURE	CONSISTENCY/DENSITY	
X Existing excavation	F Fine	LP Low Plastity	D Dry	VS Very soft	VL Very loose
A Auger	M Medium	MP Medium Plasticity	M Moist	S Soft	L Loose
BH Backhoe Bucket	C Coarse	HP Highly Plastic	W Wet	Fi Firm	MD Medium
				St Stiff	D Dense
				V St Very stiff	VD Very dense
				H Hard	Fb Friable

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BOREHOLE LOG

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Job No:	6542
Date:	20/03/2008
No:	**BH5**
Sheet:	3 of 3
Logged by:	P. Moodie
Ckecked:	
Level:	Existing

Client	Mr R Watson
Project	New Extractive Industry, Newrbar Swamp Rd, Lennox Head
Equipment	Truck mounted drill rig
Location	See Site Plan

Test Method	Water	Samples and Tests	Depth	ASS	PASS	DESCRIPTION (Material, Plasticity, Particle Size, Colour, Secondary Components, Other)	MOISTURE	COMMENTS
			11.0			SAND - red brown (continued)	W	
			12.0					Sample at 12.0 - 12.1 mbgl
			13.0			Indurated SAND - brown	W	
			14.0					
			15.0					Sample at 15.0 - 15.3 mbgl
						SAND - blue to grey. End of borehole at 15.3 mbgl.		

CLASSIFICATION SYMBOLS

TEST METHOD	Size	PLASTICITY	MOISTURE	CONSISTENCY/DENSITY	
X Existing excavation	F Fine	LP Low Plastity	D Dry	VS Very soft	VL Very loose
A Auger	M Medium	MP Medium Plasticity	M Moist	S Soft	L Loose
BH Backhoe Bucket	C Coarse	HP Highly Plastic	W Wet	Fi Firm	MD Medium
				St Stiff	D Dense
				V St Very stiff	VD Very dense
				H Hard	Fb Friable

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Particle Size Distribution Report

Client: Ardill Payne & Partners	**Project No:** 044-513	**Project:** Lot 32 Newrybar Swamp Rd, Lennox Hd
Test Methods: AS1289.3.6.1	**Report no:** 044-513-001	**Date Sampled:** 9/5/11

Lab No: 13708

Sieve Size (mm)	Passing (%)	Lower Limit (%)	Upper Limit (%)
100.0			
75.0			
53.0			
37.5			
26.5			
19.0			
13.20			
9.50			
6.70			
4.75			
2.36			
1.180	100		
0.600	99		
0.425	95		
0.300	64		
0.150	3		
0.075	2		
0.0135			
A Ratio			
B Ratio			
C Ratio			

Date Tested: 11/5/11

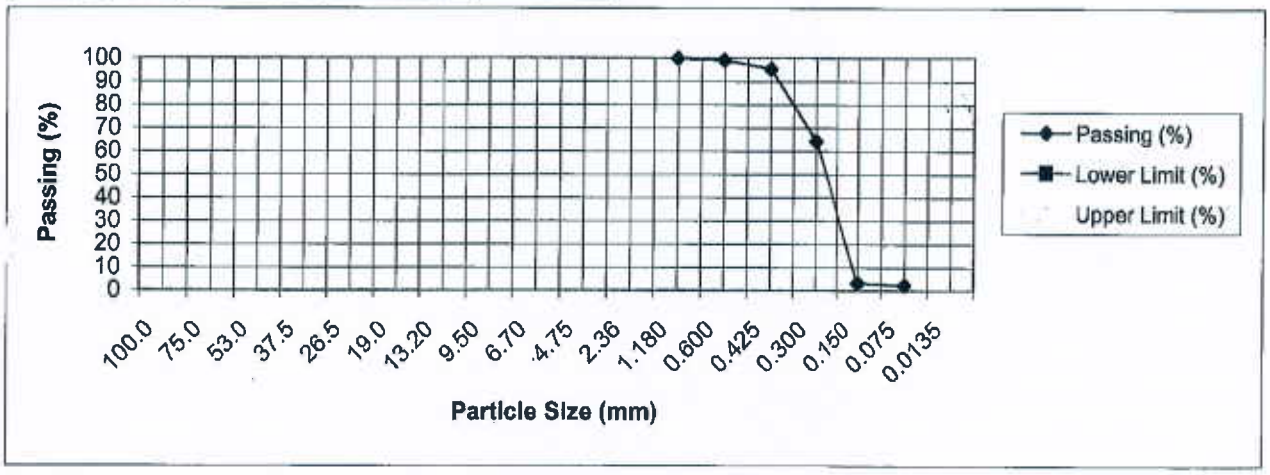
Sampled By: ASCT P/L

Sample Location: Piezometer 2

Sampling Method: AS1289.1.2.1.6.5.3

Sample Preparation: Oven Dried AS1289.1.1

Sample Description: Sand: Brown



NATA ACCREDITED FOR TECHNICAL COMPETENCE

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Signed: Brian Dick Date: 13/5/11

Brian Dick
(Approved Signatory)

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BOREHOLE LOG – PIEZOMETER

Client: Ardill Payne & Partners	**Project No**: 044-513	**Project**: Proposed Sand Pit, Lot 32 Newrybar Swamp Road, Lennox Head.		
Lab No: 13708		**Piezo No**: 1	**Page**:	**Of**:

Piezo Information

Diameter (mm): 50	**Sump (m)**: 0.95	**Slotted (m)**: 3.0	**Depth in ground (m)**: 8.3	**Stick-up (m)**: 0.4

Bore Information

Piezometer Inclination: 90°	**Piezometer Direction**: Vertical	**Date Installed**: 9/5/11
Surface Elevation: Existing Surface Level	**Drilling Method**: Explora 85 Drill Rig	**Drill Type**: 100mm Auger
Piezometer Location: P1 (see plan attached)		

Bore Log

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SILTY SAND TOPSOIL: black, low plastic, low dry strength, fine sand, some organic matter and clay, loose, wet.	- 0.0		SM	L	None
SILTY SAND: dark grey, low plastic, low dry strength, fine sand, trace of clay, loose, wet.	- 0.3		SM/SC	L	
ter Table @ 1.0m					
SAND: brown, non-plastic, no dry strength, fine sand, loose to medium dense, wet.	- 1.0		SP	L-MD	
SAND: pale grey to white, non-plastic, no dry strength, fine to medium sand, medium dense to dense, wet.	- 1.7		SP	MD-D	
SAND: pale brown-grey to brown, non-plastic, no dry strength, fine sand, medium dense to dense, wet	- 2.7		SP	MD-D	
SAND: grey, non-plastic, no dry strength, fine sand, medium dense to dense, wet.	- 6.5		SP	MD-D	
Stopped – No Change.	- 8.3				

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BOREHOLE LOG – PIEZOMETER

Client: Ardill Payne & Partners	**Project No**: 044-513	**Project**: Proposed Sand Pit, Lot 32 Newrybar Swamp Road, Lennox Head.	
Lab No: 13708		**Piezo No**: 2	**Page**: **Of**:

Piezo Information

Diameter (mm): 50	**Sump (m)**: 0.7	**Slotted (m)**: 3.0	**Depth in ground (m)**: 11.1	**Stick-up (m)**: 0.4

Bore Information

Piezometer Inclination: 90°	**Piezometer Direction**: Vertical	**Date Installed**: 9/5/11
Surface Elevation: Existing Surface Level	**Drilling Method**: Explora 85 Drill Rig	**Drill Type**: 100mm Auger
Piezometer Location: P2 (see plan attached)		

Bore Log

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SAND TOPSOIL: dark grey, non-plastic, no dry strength, fine to medium sand, some organic matter, very loose, very moist.	- 0.0		SP	VL	None
SAND: grey, non-plastic, no dry strength, fine to medium sand, loose, very moist.	- 0.2		SP	L	
SAND: dark brown to brown, non-plastic, no dry strength, fine sand, medium dense to dense, wet.	- 0.7		SP	MD-D	
Water Table @ 0.8m	- *0.8*				
SAND: grey brown, non-plastic, no dry strength, fine to medium sand, medium dense to dense, wet.	- 5.0		SP	MD-D	
SAND: dark brown, indurated, non-plastic, no dry strength, fine sand, trace of silt, dense to very dense, wet	- 6.6		SP	D-VD	
SAND: brown, non-plastic, no dry strength, fine sand, dense, wet.	- 10.2		SP	D	
Stopped – No Change.	- 11.1				

Testing performed at ASCT P/L Ballina Laboratory, NATA Accreditation No. 3229.

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BOREHOLE LOG – PIEZOMETER

Client: Ardill Payne & Partners	**Project No:** 044-513	**Project:** Proposed Sand Pit, Lot 32 Newrybar Swamp Road, Lennox Head.		
Lab No: 13712		**Piezo No:** 3	**Page:**	**Of:**

Piezo Information

Diameter (mm): 50	**Sump (m):** 0.5	**Slotted (m):** 3.0	**Depth in ground (m):** 9.1	**Stick-up (m):** 0.4

Bore Information

Piezometer Inclination: 90°	**Piezometer Direction:** Vertical	**Date Installed:** 10/5/11
Surface Elevation: Existing Surface Level	**Drilling Method:** Explora 85 Drill Rig	**Drill Type:** 100mm Auger
Piezometer Location: P3 (see plan attached)		

Bore Log

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
CLAYEY SILTY SAND TOPSOIL: black, low plastic, low dry strength, fine sand, some organic matter, very soft, moist.	- 0.0		SC	VS	None
CLAYEY SILTY SAND: dark grey, low plastic, low dry strength, fine sand, soft, moist to wet.	- 0.4		SC	S	
Water Table @ 0.9m	- 0.9				
SAND: grey, non-plastic, low dry strength, fine sand, trace of silt and clay, loose to medium dense, wet.	- 1.4		SP	L-MD	
SAND: brown, non-plastic, no dry strength, fine sand, loose to medium dense, wet.	- 1.8		SP	L-MD	
SAND: pale grey to white, non-plastic, no dry strength, fine sand, medium dense, wet.	- 2.3		SP	MD	
SAND: brown, non-plastic, no dry strength, fine sand, medium dense to dense, wet.			SP	MD-D	
SAND: dark brown, partly indurated, non-plastic, no dry strength, fine sand, dense to very dense, wet.	- 9.7		SP	D-VD	
Stopped – No Change.	- 10.5				

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BOREHOLE LOG – PIEZOMETER

Client: Ardill Payne & Partners	**Project No**: 044-513	**Project**: Proposed Sand Pit, Lot 32 Newrybar Swamp Road, Lennox Head.	
Lab No: 13712		**Piezo No**: 4	**Page**: / **Of**:

Piezo Information

Diameter (mm): 50	**Sump (m)**: 0.5	**Slotted (m)**: 3.0	**Depth in ground (m)**: 10.6	**Stick-up (m)**: 0.4

Bore Information

Piezometer Inclination: 90°	**Piezometer Direction**: Vertical	**Date Installed**: 10/5/11
Surface Elevation: Existing Surface Level	**Drilling Method**: Explora 85 Drill Rig	**Drill Type**: 100mm Auger
Piezometer Location: P4 (see plan attached)		

Bore Log

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SILTY SAND TOPSOIL: black, non-plastic, no dry strength, fine sand, some organic matter, loose, moist.	- 0.0		SM	L	None
SAND: grey, non-plastic, no dry strength, fine sand, loose, moist to very moist.	- 0.2		SP	L	
SAND: brown, non-plastic, no dry strength, fine sand, medium dense to dense, wet. ***Water Table @ 1.2m***	- 1.2		SP	MD-D	
SAND: dark brown, indurated, non-plastic, no dry strength, fine sand, dense to very dense, wet.	- 7.8		SP	D-VD	
SAND: dark brown, partly indurated (some indurated bands), non-plastic, no dry strength, fine sand, dense to very dense, wet.	- 8.3		SP	D-VD	
Stopped – No Change.	- 10.6				

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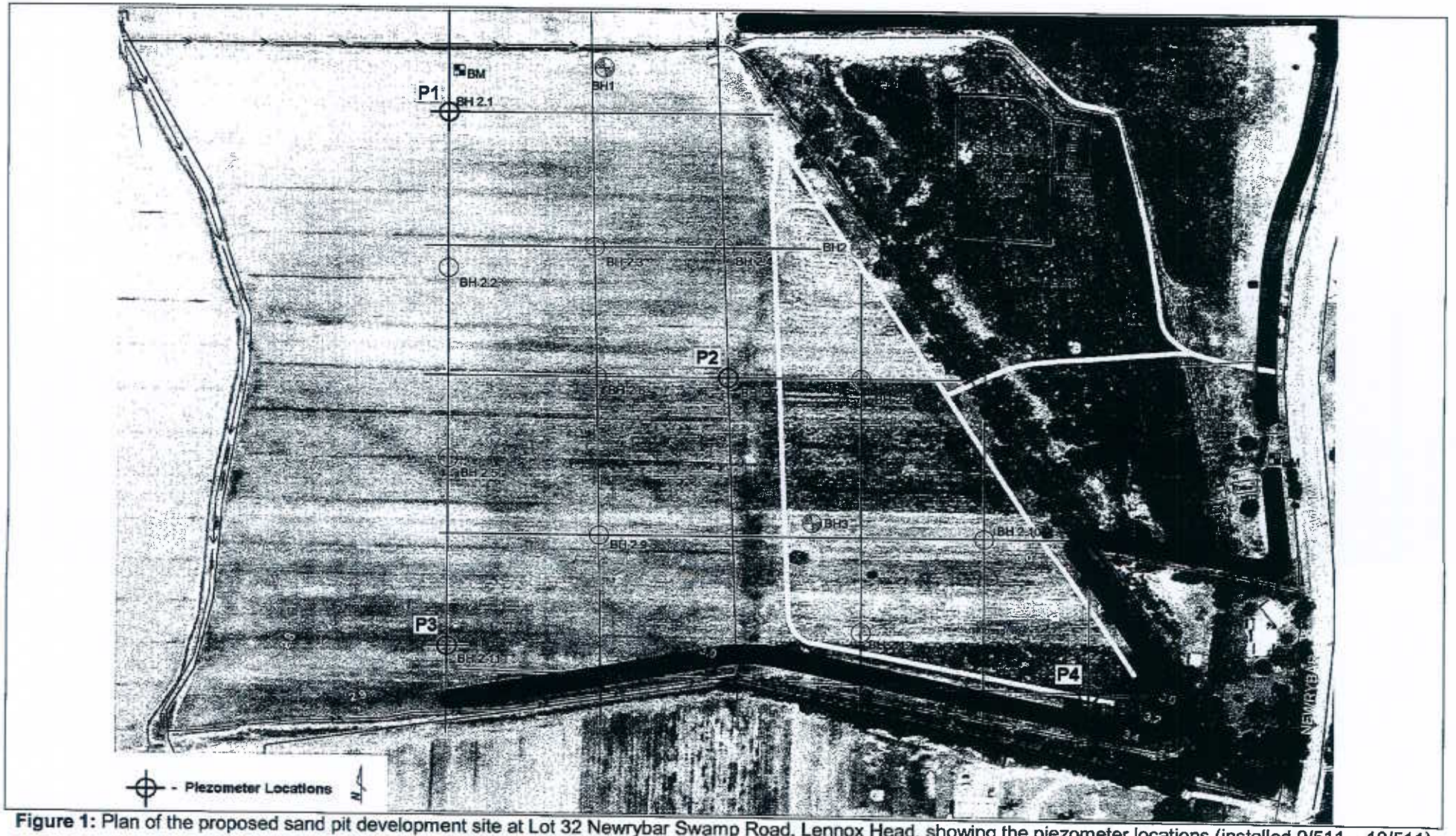

Figure 1: Plan of the proposed sand pit development site at Lot 32 Newrybar Swamp Road, Lennox Head, showing the piezometer locations (installed 9/511 – 10/511).

Testing performed at ASCT P/L Ballina Laboratory, NATA Accreditation No. 3229.

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BOREHOLE LOG

Client: Ardill Payne & Partners	**Project No**: 044-513	**Project**: Proposed Sand Pit, Lot 32 Newrybar Swamp Road, Lennox Head.		
Lab No: 13708		**Borehole No**: 2.1	**Page**:	**Of**:

Borehole Inclination: 90°	**Borehole Direction**: Vertical	**Date Drilled**: 9/5/11
Surface Elevation: Existing Surface Level	**Drilling Method**: Explora 85 Drill Rig	**Drill Type**: 100mm Auger
Borehole Location: 2.1 (see plan attached)		

TEST DATA

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SILTY SAND TOPSOIL: black, low plastic, low dry strength, fine sand, some organic matter and clay, loose, wet.	- 0.0		SM	L	ASS Topsoil
SILTY SAND: dark grey, low plastic, low dry strength, fine sand, trace of clay, loose, wet.	- 0.3		SM/SC	L	ASS 0.0-0.5m
Water Table @ 1.0m					ASS 0.5-1.0m
SAND: brown, non-plastic, no dry strength, fine sand, loose to medium dense, wet.	- 1.0		SP	L-MD	ASS 1.0-1.5m
SAND: pale grey to white, non-plastic, no dry strength, fine to medium sand, medium dense to dense, wet.	- 1.7		SP	MD-D	ASS 1.5-2.0m
					ASS 2.0-2.5m
SAND: pale brown-grey to brown, non-plastic, no dry strength, fine sand, medium dense to dense, wet	- 2.7		SP	MD-D	ASS 2.5-3.0m
					ASS 3.0-3.5m
					ASS 3.5-4.0m
					ASS 4.0-4.5m
					ASS 4.5-5.0m
					ASS 5.0-5.5m
					ASS 5.5-6.0m
SAND: grey, non-plastic, no dry strength, fine sand, medium dense to dense, wet.	- 6.5		SP	MD-D	ASS 6.0-6.5m
					ASS 6.5-7.0m
					ASS 7.0-7.5m
Stopped – No Change.	- 8.3				ASS 7.5-8.0m

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BOREHOLE LOG

Client: Ardill Payne & Partners	**Project No:** 044-513	**Project:** Proposed Sand Plt, Lot 32 Newrybar Swamp Road, Lennox Head.		
Lab No: 13712		**Borehole No:** 2.2	**Page:**	**Of:**

Borehole Inclination: 90°	**Borehole Direction:** Vertical	**Date Drilled:** 10/5/11
Surface Elevation: Existing Surface Level	**Drilling Method:** Explora 85 Drill Rig	**Drill Type:** 100mm Auger
Borehole Location: 2.2 (see plan attached)		

TEST DATA

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SILTY SAND TOPSOIL: dark grey, non-plastic, low dry strength, fine sand, some organic matter, trace of clay, loose, very moist.	- 0.0		SM	L	ASS Topsoil
SILTY SAND: dark brown, non-plastic, low dry strength, fine sand, trace of clay, loose to medium dense, moist to wet.	- 0.2		SM	L-MD	ASS 0.0-0.5m
ND: pale brown grey, non-plastic, no dry strength, fine sand, medium dense, wet.	- 0.8		SP	MD	ASS 0.5-1.0m
Water Table @ 1.0m	***- 1.0***				ASS 1.0-1.5m
					ASS 1.5-2.0m
					ASS 2.0-2.5m
					ASS 2.5-3.0m
					ASS 3.0-3.5m
					ASS 3.5-4.0m
					ASS 4.0-4.5m
					ASS 4.5-5.0m
					ASS 5.0-5.5m
					ASS 5.5-6.0m
					ASS 6.0-6.5m
SAND: dark brown, partly indurated, non-plastic, no dry strength, fine sand, dense, wet.	- 7.1		SP	D	ASS 6.5-7.0m
					ASS 7.0-7.5m
Stopped – No Change.	- 8.0				ASS 7.5-8.0m

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BOREHOLE LOG

Client: Ardill Payne & Partners	**Project No**: 044-513	**Project**: Proposed Sand Pit, Lot 32 Newrybar Swamp Road, Lennox Head.		
Lab No: 13712		**Borehole No**: 2.3	**Page**:	**Of**:

Borehole Inclination: 90°	**Borehole Direction**: Vertical	**Date Drilled**: 10/5/11
Surface Elevation: Existing Surface Level	**Drilling Method**: Explora 85 Drill Rig	**Drill Type**: 100mm Auger
Borehole Location: 2.3 (see plan attached)		

TEST DATA

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SILTY SAND TOPSOIL: black, non-plastic, low dry strength, fine sand, some organic matter, trace of clay, very loose, wet.	- 0.0		SM	VL	ASS Topsoil
CLAYEY SILTY SAND: dark brown grey, low plastic, low dry strength, fine sand, very soft to firm, wet.	- 0.25		SC/SM	VS-F	ASS 0.0-0.5m
					ASS 0.5-1.0m
ater Table @ 1.0m	- *1.0*				
					ASS 1.0-1.5m
SAND: brown, non-plastic, no dry strength, fine sand, loose to dense, wet.	- 1.5		SP	L-D	ASS 1.5-2.0m
					ASS 2.0-2.5m
					ASS 2.5-3.0m
					ASS 3.0-3.5m
					ASS 3.5-4.0m
					ASS 4.0-4.5m
SAND: grey, non-plastic, no dry strength, fine sand, medium dense to dense, wet.	- 5.1		SP	MD-D	ASS 4.5-5.0m
					ASS 5.0-5.5m
					ASS 5.5-6.0m
SAND: dark brown, partly indurated, non-plastic, no dry strength, fine sand, dense, wet	- 7.1		SP	D	ASS 6.0-6.5m
					ASS 6.5-7.0m
					ASS 7.0-7.5m
Stopped – No Change.	- 8.0				ASS 7.5-8.0m

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BOREHOLE LOG

Client: Ardill Payne & Partners	**Project No**: 044-513	**Project**: Proposed Sand Pit, Lot 32 Newrybar Swamp Road, Lennox Head.		
Lab No: 13708		**Borehole No**: 2.4	**Page**:	**Of**:

Borehole Inclination: 90°	**Borehole Direction**: Vertical	**Date Drilled**: 9/5/11
Surface Elevation: Existing Surface Level	**Drilling Method**: Explora 85 Drill Rig	**Drill Type**: 100mm Auger
Borehole Location: 2.4 (see plan attached)		

TEST DATA

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SILTY SAND TOPSOIL: black, low plastic, low dry strength, fine sand, some organic matter and clay, very loose/very soft, wet.	- 0.0		SM/SC	VL/VS	ASS Topsoil
	- 0.3				ASS 0.0-0.5m
SILTY SAND: dark brown, low plastic, low dry strength, fine sand, trace of clay, loose to medium dense, wet.			SM	L-MD	
Water Table @ 0.9m	- ***0.9***				ASS 0.5-1.0m
SAND: brown to dark brown, non-plastic, no dry strength, fine sand, medium dense to dense, wet.	- 1.0		SP	MD-D	
					ASS 1.0-1.5m
					ASS 1.5-2.0m
					ASS 2.0-2.5m
					ASS 2.5-3.0m
					ASS 3.0-3.5m
					ASS 3.5-4.0m
					ASS 4.0-4.5m
					ASS 4.5-5.0m
					ASS 5.0-5.5m
					ASS 5.5-6.0m
					ASS 6.0-6.5m
					ASS 6.5-7.0m
					ASS 7.0-7.5m
Stopped – No Change.	- 8.0				ASS 7.5-8.0m

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BOREHOLE LOG

Client: Ardill Payne & Partners	**Project No:** 044-513	**Project:** Proposed Sand Pit, Lot 32 Newrybar Swamp Road, Lennox Head.		
Lab No: 13712		**Borehole No:** 2.5	**Page:**	**Of:**

Borehole Inclination: 90°	**Borehole Direction:** Vertical	**Date Drilled:** 10/5/11
Surface Elevation: Existing Surface Level	**Drilling Method:** Explora 85 Drill Rig	**Drill Type:** 100mm Auger
Borehole Location: 2.5 (see plan attached)		

TEST DATA

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SILTY SAND TOPSOIL: dark grey, non-plastic, low dry strength, fine sand, some organic matter, trace of clay, loose, moist.	- 0.0		SM	L	ASS Topsoil
SILTY SAND: dark brown, non-plastic, low dry strength, fine sand, trace of clay, loose, moist to very moist.	- 0.3		SM	L	ASS 0.0-0.5m
	- 0.8				ASS 0.5-1.0m
SAND: brown to pale brown, non-plastic, no dry strength, fine sand, medium dense, wet.			SP	MD	
Water Table @ 1.0m	***- 1.0***				ASS 1.0-1.5m
					ASS 1.5-2.0m
					ASS 2.0-2.5m
					ASS 2.5-3.0m
					ASS 3.0-3.5m
					ASS 3.5-4.0m
					ASS 4.0-4.5m
SAND: grey, non-plastic, no dry strength, fine sand, medium dense to dense, wet.	- 4.8		SP	MD-D	ASS 4.5-5.0m
					ASS 5.0-5.5m
					ASS 5.5-6.0m
					ASS 6.0-6.5m
SAND: dark brown, indurated, non-plastic, no dry strength, fine sand, dense to very dense, wet.	- 6.7		SP	D-VD	ASS 6.5-7.0m
					ASS 7.0-7.5m
Stopped – No Change.	- 8.0				ASS 7.5-8.0m

Testing performed at ASCT P/L Ballina Laboratory, NATA Accreditation No. 3229.

AUSTRALIAN SOIL AND CONCRETE TESTING P/L A.B.N. 49 050 539 930

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BOREHOLE LOG

Client: Ardill Payne & Partners	**Project No**: 044-513	**Project**: Proposed Sand Pit, Lot 32 Newrybar Swamp Road, Lennox Head.		
Lab No: 13712		**Borehole No**: 2.6	**Page**:	**Of**:

Borehole Inclination: 90°	**Borehole Direction**: Vertical	**Date Drilled**: 10/5/11
Surface Elevation: Existing Surface Level	**Drilling Method**: Explora 85 Drill Rig	**Drill Type**: 100mm Auger
Borehole Location: 2.6 (see plan attached)		

TEST DATA

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SILTY SAND TOPSOIL: black, low plastic, low dry strength, fine sand, some organic matter, trace of clay, very loose, wet.	- 0.0		SM	VL	ASS Topsoil
SILTY SAND: dark grey brown, non-plastic, low dry strength, fine sand, trace of clay, loose, wet.	- 0.25		SM	L	ASS 0.0-0.5m
Water Table @ 0.8m	- *0.8*				ASS 0.5-1.0m
SAND: brown, non-plastic, no dry strength, fine sand, loose to dense, wet.	- 1.2		SP	L-D	ASS 1.0-1.5m
					ASS 1.5-2.0m
					ASS 2.0-2.5m
					ASS 2.5-3.0m
					ASS 3.0-3.5m
					ASS 3.5-4.0m
					ASS 4.0-4.5m
					ASS 4.5-5.0m
SAND: grey, non-plastic, no dry strength, fine sand, medium dense to dense, wet.	- 5.2		SP	MD-D	ASS 5.0-5.5m
					ASS 5.5-6.0m
					ASS 6.0-6.5m
					ASS 6.5-7.0m
SAND: dark brown, indurated, non-plastic, no dry strength, fine sand, dense to very dense, wet	- 7.2		SP	D-VD	ASS 7.0-7.5m
Stopped – No Change.	- 8.0				ASS 7.5-8.0m

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BOREHOLE LOG

Client: Ardill Payne & Partners	**Project No**: 044-513	**Project**: Proposed Sand Pit, Lot 32 Newrybar Swamp Road, Lennox Head.		
Lab No: 13708		**Borehole No**: 2.7	**Page**:	**Of**:

Borehole Inclination: 90°	**Borehole Direction**: Vertical	**Date Drilled**: 9/5/11
Surface Elevation: Existing Surface Level	**Drilling Method**: Explora 85 Drill Rig	**Drill Type**: 100mm Auger
Borehole Location: 2.7 (see plan attached)		

TEST DATA

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SAND TOPSOIL: dark grey, non-plastic, no dry strength, fine to medium sand, some organic matter, very loose, very moist.	- 0.0		SP	VL	ASS Topsoil
SAND: grey, non-plastic, no dry strength, fine to medium sand, loose, very moist.	- 0.2		SP	L	ASS 0.0-0.5m ASS 0.5-1.0m
SAND: dark brown to brown, non-plastic, no dry strength, fine sand, medium dense to dense, wet. ***Water Table @ 0.8m***	- 0.7 - ***0.8***		SP	MD-D	ASS 1.0-1.5m ASS 1.5-2.0m ASS 2.0-2.5m ASS 2.5-3.0m ASS 3.0-3.5m ASS 3.5-4.0m
SAND: grey brown, non-plastic, no dry strength, fine to medium sand, medium dense to dense, wet.	- 5.0		SP	MD-D	ASS 4.0-4.5m ASS 4.5-5.0m ASS 5.0-5.5m
SAND: dark brown, indurated, non-plastic, no dry strength, fine sand, trace of silt, dense to very dense, wet	- 6.6		SP	D-VD	ASS 5.5-6.0m ASS 6.0-6.5m ASS 6.5-7.0m ASS 7.0-7.5m ASS 7.5-8.0m
SAND: brown, non-plastic, no dry strength, fine sand, dense, wet.	- 10.2		SP	D	
Stopped – No Change.	- 11.1				

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BOREHOLE LOG

Client: Ardill Payne & Partners	**Project No:** 044-513	**Project:** Proposed Sand Plt, Lot 32 Newrybar Swamp Road, Lennox Head.		
Lab No: 13712		**Borehole No:** 2.8	**Page:**	**Of:**

Borehole Inclination: 90°	**Borehole Direction:** Vertical	**Date Drilled:** 10/5/11
Surface Elevation: Existing Surface Level	**Drilling Method:** Explora 85 Drill Rig	**Drill Type:** 100mm Auger
Borehole Location: 2.8 (see plan attached)		

TEST DATA

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SILTY SAND TOPSOIL: black, non-plastic, low dry strength, fine sand, some organic matter, trace of clay, loose, very moist.	- 0.0		SM	L	ASS Topsoil
SAND: dark grey, non-plastic, no dry strength, fine sand, loose, very moist to wet.	- 0.3		SP	L	ASS 0.0-0.5m
Water Table @ 0.7m	- ***0.7***				ASS 0.5-1.0m
SAND: brown to dark brown, non-plastic, no dry strength, fine sand, loose to dense, wet.	- 0.8		SP	L-D	ASS 1.0-1.5m
					ASS 1.5-2.0m
					ASS 2.0-2.5m
					ASS 2.5-3.0m
					ASS 3.0-3.5m
					ASS 3.5-4.0m
					ASS 4.0-4.5m
					ASS 4.5-5.0m
					ASS 5.0-5.5m
					ASS 5.5-6.0m
					ASS 6.0-6.5m
SAND: dark brown, partly indurated, non-plastic, no dry strength, fine sand, dense, wet.	- 7.0		SP	D	ASS 6.5-7.0m
					ASS 7.0-7.5m
Stopped – No Change.	- 8.0				ASS 7.5-8.0m

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BOREHOLE LOG

Client: Ardill Payne & Partners	**Project No**: 044-513	**Project**: Proposed Sand Pit, Lot 32 Newrybar Swamp Road, Lennox Head.		
Lab No: 13700		**Borehole No**: 2.9	**Page**:	**Of**:

Borehole Inclination: 90°	**Borehole Direction**: Vertical	**Date Drilled**: 6/5/11
Surface Elevation: Existing Surface Level	**Drilling Method**: Explora 85 Drill Rig	**Drill Type**: 100mm Auger
Borehole Location: 2.9 (see plan attached)		

TEST DATA

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SILTY SAND TOPSOIL: dark grey, non-plastic, low dry strength, fine sand, some organic matter, trace of clay, very loose, wet.	- 0.0		SM	VL	ASS Topsoil
SILTY SAND: brown, non-plastic, low dry strength, fine sand, trace of clay, loose, very moist.	- 0.25		SM	L	ASS 0.0-0.5m
SAND: brown, non-plastic, no dry strength, fine sand, medium dense - dense, wet.	- 0.6		SP	MD-D	ASS 0.5-1.0m
Water Table @ 0.8m	- *0.8*				ASS 1.0-1.5m
					ASS 1.5-2.0m
					ASS 2.0-2.5m
					ASS 2.5-3.0m
					ASS 3.0-3.5m
					ASS 3.5-4.0m
					ASS 4.0-4.5m
					ASS 4.5-5.0m
					ASS 5.0-5.5m
					ASS 5.5-6.0m
Stopped – No Change.	- 6.0				

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BOREHOLE LOG

Client: Ardill Payne & Partners	**Project No**: 044-513	**Project**: Proposed Sand Pit, Lot 32 Newrybar Swamp Road, Lennox Head.		
Lab No: 13700		**Borehole No**: 2.13	**Page**:	**Of**:

Borehole Inclination: 90°	**Borehole Direction**: Vertical	**Date Drilled**: 6/5/11
Surface Elevation: Existing Surface Level	**Drilling Method**: Explora 85 Drill Rig	**Drill Type**: 100mm Auger
Borehole Location: 2.13 (see plan attached)		

TEST DATA

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SILTY SAND TOPSOIL: dark grey, non-plastic, low dry strength, fine sand, some organic matter, very loose, wet.	- 0.0		SM	VL	ASS Topsoil
SILTY SAND: dark grey, non-plastic, low dry strength, fine sand, some organic matter, loose, very moist to wet.	- 0.3		SM	L	ASS 0.0-0.5m
SAND: dark brown, partly indurated, non-plastic, no dry strength, fine sand, dense, moist to wet.	- 0.5		SP	D	ASS 0.5-1.0m
Water Table @ 0.9m	- ***0.9***				ASS 1.0-1.5m
SAND: dark brown to brown, non-plastic, no dry strength, fine sand, medium dense to dense, wet.	- 2.0		SP	MD-D	ASS 1.5-2.0m
					ASS 2.0-2.5m
					ASS 2.5-3.0m
					ASS 3.0-3.5m
					ASS 3.5-4.0m
					ASS 4.0-4.5m
					ASS 4.5-5.0m
					ASS 5.0-5.5m
					ASS 5.5-6.0m
					ASS 6.0-6.5m
					ASS 6.5-7.0m
SAND: dark brown, indurated, non-plastic, no dry strength, fine sand, dense to very dense, moist.	- 7.6		SP	D-VD	ASS 7.0-7.5m
Stopped – No Change.	- 8.0				ASS 7.5-8.0m

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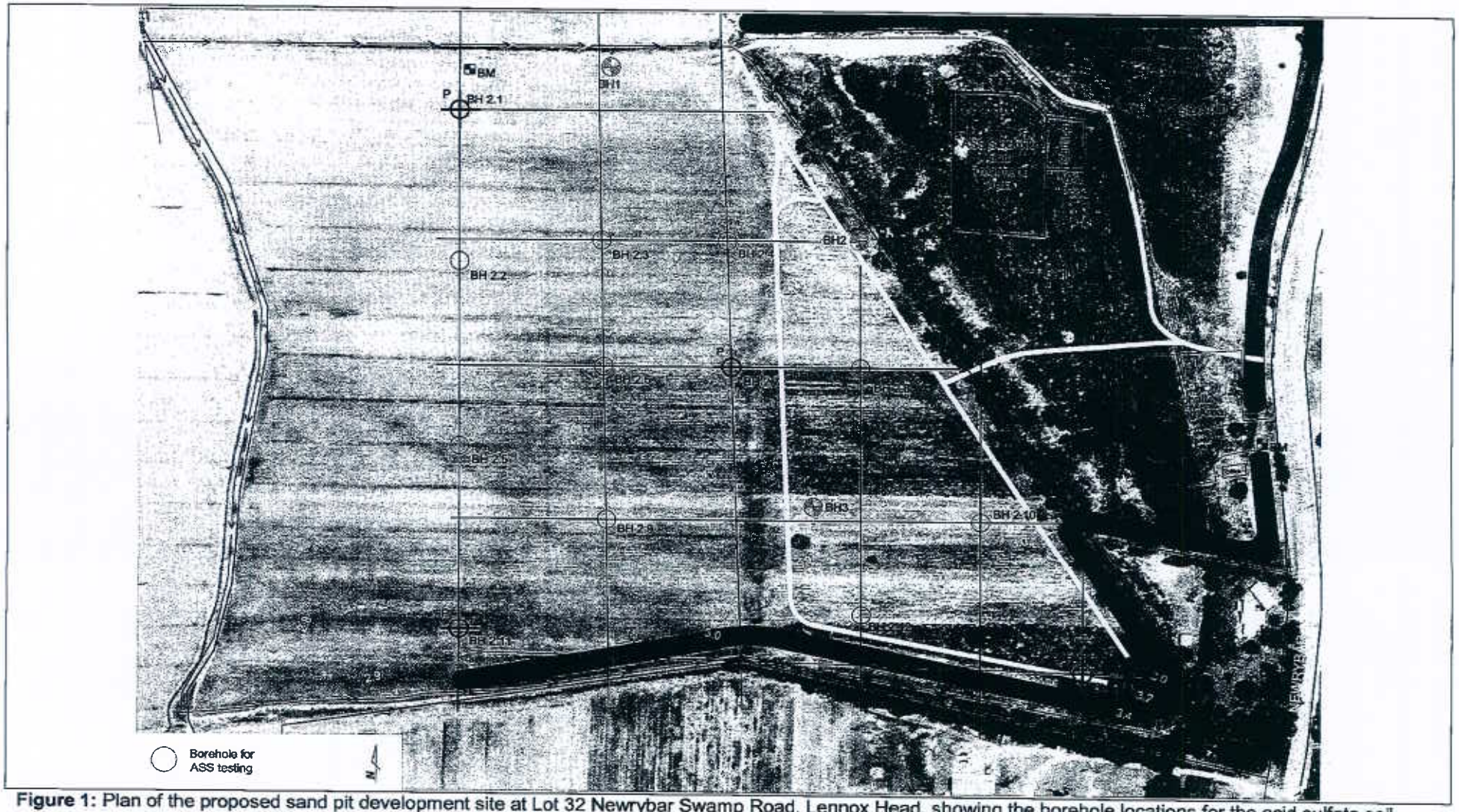

Figure 1: Plan of the proposed sand pit development site at Lot 32 Newrybar Swamp Road, Lennox Head, showing the borehole locations for the acid sulfate soil investigation.

Testing performed at ASCT P/L Ballina Laboratory, NATA Accreditation No. 3229.

ATTACHMENT 2

Attachment 2
Field Test and Laboratory
Results (2011) & (2008)

Sample location	Sample Depth (mbgl)	pH_F	pH_{Fox}	pH_{Drop}
BH 2.1	TOPSOIL	4.81	4.49	**0.32**
BH 2.1	0-0.5	4.83	4.45	**0.38**
BH 2.1	0.5-1	5	4.69	**0.31**
BH 2.1	1-1.5	5.2	4.78	**0.42**
BH 2.1	1.5-2	5.5	5.22	**0.28**
BH 2.1	2-2.5	5.25	4.18	**1.07**
BH 2.1	2.5-3	5.09	3.1	**1.99**
BH 2.1	3-3.5	5.26	1.18	**4.08**
BH 2.1	3.5-4	4.9	1.06	**3.84**
BH 2.1	4-4.5	4.85	1.04	**3.81**
BH 2.1	4.5-5	5.13	1.15	**3.98**
BH 2.1	5-5.5	5.04	1.35	**3.69**
BH 2.1	5.5-6	5.04	1.22	**3.82**
BH 2.1	6-6.5	5.04	1.24	**3.8**
BH 2.1	6.5-7	4.96	1.22	**3.74**
BH 2.1	7-7.5	5.4	1.52	**3.88**
BH 2.1	7.5-8	5.27	1.18	**4.09**

Sample location	Sample Depth (mbgl)	pH_F	pH_{Fox}	pH_{Drop}
BH 2.2	TOPSOIL	4.42	4.31	**0.11**
BH 2.2	0-0.5	4.57	4.44	**0.13**
BH 2.2	0.5-1	4.86	4.51	**0.35**
BH 2.2	1-1.5	5.04	4.59	**0.45**
BH 2.2	1.5-2	4.88	4.69	**0.19**
BH 2.2	2-2.5	4.9	2.63	**2.27**
BH 2.2	2.5-3	4.38	1.95	**2.43**
BH 2.2	3-3.5	4.55	2.63	**1.92**
BH 2.2	3.5-4	4.46	1.5	**2.96**
BH 2.2	4-4.5	4.7	1.4	**3.3**
BH 2.2	4.5-5	5.08	1.55	**3.53**
BH 2.2	5-5.5	5.18	1.54	**3.64**
BH 2.2	5.5-6	4.8	1.51	**3.29**
BH 2.2	6-6.5	5.54	1.67	**3.87**
BH 2.2	6.5-7	4.67	1.65	**3.02**
BH 2.2	7-7.5	5.23	3.08	**2.15**
BH 2.2	7.5-8	5.21	1.66	**3.55**

Sample location	Sample Depth (mbgl)	pH_F	pH_{Fox}	pH_{Drop}
BH 2.3	TOPSOIL	4.36	3.75	**0.61**
BH 2.3	0-0.5	4.07	4.21	**-0.14**
BH 2.3	0.5-1	4.82	4.57	**0.25**
BH 2.3	1-1.5	4.44	4.63	**-0.19**
BH 2.3	1.5-2	4.69	4.34	**0.35**
BH 2.3	2-2.5	5.22	3.86	**1.36**
BH 2.3	2.5-3	4.96	3.69	**1.27**
BH 2.3	3-3.5	4.8	1.85	**2.95**
BH 2.3	3.5-4	4.83	0.99	**3.84**
BH 2.3	4-4.5	5.01	0.99	**4.02**
BH 2.3	4.5-5	4.98	1.23	**3.75**
BH 2.3	5-5.5	5.12	0.31	**4.81**
BH 2.3	5.5-6	5.06	1.45	**3.61**
BH 2.3	6-6.5	5.78	1.51	**4.27**
BH 2.3	6.5-7	4.61	1.5	**3.11**
BH 2.3	7-7.5	4.63	2.19	**2.44**
BH 2.3	7.5-8	4.76	2.62	**2.14**

Sample location	Sample Depth (mbgl)	pH_F	pH_{Fox}	pH_{Drop}
BH 2.4	TOPSOIL	5.16	4.01	**1.15**
BH 2.4	0-0.5	3.96	3.73	**0.23**
BH 2.4	0.5-1	4.32	3.98	**0.34**
BH 2.4	1-1.5	4.92	4.31	**0.61**
BH 2.4	1.5-2	5.03	4.1	**0.93**
BH 2.4	2-2.5	4.97	3.92	**1.05**
BH 2.4	2.5-3	4.92	3.91	**1.01**
BH 2.4	3-3.5	4.98	2.7	**2.28**
BH 2.4	3.5-4	5.06	3.26	**1.8**
BH 2.4	4-4.5	5.09	2.77	**2.32**
BH 2.4	4.5-5	5.06	3.08	**1.98**
BH 2.4	5-5.5			
BH 2.4	5.5-6	4.95	3.41	**1.54**
BH 2.4	6-6.5	5.03	1.5	**3.53**
BH 2.4	6.5-7	5.02	2.9	**2.12**
BH 2.4	7-7.5	5.23	2.91	**2.32**
BH 2.4	7.5-8	5.07	2.92	**2.15**

Sample location	Sample Depth (mbgl)	pH_F	pH_{Fox}	pH_{Drop}
BH 2.5	TOPSOIL	4.08	2.97	**1.11**
BH 2.5	0-0.5	4.42	4	**0.42**
BH 2.5	0.5-1	4.63	4.49	**0.14**
BH 2.5	1-1.5	4.65	4.55	**0.1**
BH 2.5	1.5-2	4.61	4.52	**0.09**
BH 2.5	2-2.5	4.82	4.14	**0.68**
BH 2.5	2.5-3	4.95	3.53	**1.42**
BH 2.5	3-3.5	4.57	1.95	**2.62**
BH 2.5	3.5-4	4.86	1.62	**3.24**
BH 2.5	4-4.5	4.68	1.79	**2.89**
BH 2.5	4.5-5	5.19	1.45	**3.74**
BH 2.5	5-5.5	5.31	1.6	**3.71**
BH 2.5	5.5-6	4.6	1.44	**3.16**
BH 2.5	6-6.5	4.98	1.4	**3.58**
BH 2.5	6.5-7	5.19	2.63	**2.56**
BH 2.5	7-7.5	5.42	3.04	**2.38**
BH 2.5	7.5-8	5.82	2.81	**3.01**

Sample location	Sample Depth (mbgl)	pH_F	pH_{Fox}	pH_{Drop}
BH 2.6	TOPSOIL	3.75	2.63	**1.12**
BH 2.6	0-0.5	4.22	3.86	**0.36**
BH 2.6	0.5-1	4.77	4.28	**0.49**
BH 2.6	1-1.5	4.64	4.27	**0.37**
BH 2.6	1.5-2	4.82	4.13	**0.69**
BH 2.6	2-2.5	5.31	4.06	**1.25**
BH 2.6	2.5-3	5.17	3.54	**1.63**
BH 2.6	3-3.5	5.11	1.62	**3.49**
BH 2.6	3.5-4	5.06	1.7	**3.36**
BH 2.6	4-4.5	4.7	1.8	**2.9**
BH 2.6	4.5-5	5.01	1.87	**3.14**
BH 2.6	5-5.5	5.05	1.7	**3.35**
BH 2.6	5.5-6	5.53	1.92	**3.61**
BH 2.6	6-6.5	5.16	1.7	**3.46**
BH 2.6	6.5-7	4.8	1.68	**3.12**
BH 2.6	7-7.5	5.59	2.18	**3.41**
BH 2.6	7.5-8	5.35	2.05	**3.3**

Sample location	Sample Depth (mbgl)	pH_F	pH_{Fox}	pH_{Drop}
BH 2.7	TOPSOIL	3.45	4.09	**-0.64**
BH 2.7	0-0.5	3.81	3.79	**0.02**
BH 2.7	0.5-1	3.55	3.2	**0.35**
BH 2.7	1-1.5	4.3	3.84	**0.46**
BH 2.7	1.5-2	4.74	4.33	**0.41**
BH 2.7	2-2.5	5.16	4.44	**0.72**
BH 2.7	2.5-3	5.14	4.62	**0.52**
BH 2.7	3-3.5	5.05	3.41	**1.64**
BH 2.7	3.5-4	5	2.69	**2.31**
BH 2.7	4-4.5	4.76	1.68	**3.08**
BH 2.7	4.5-5	4.95	1.63	**3.32**
BH 2.7	5-5.5	5.12	1.33	**3.79**
BH 2.7	5.5-6	4.78	1.29	**3.49**
BH 2.7	6-6.5	5.2	1.4	**3.8**
BH 2.7	6.5-7	4.78	1.55	**3.23**
BH 2.7	7-7.5	5.88	3.22	**2.66**
BH 2.7	7.5-8	5.69	3.74	**1.95**

Sample location	Sample Depth (mbgl)	pH_F	pH_{Fox}	pH_{Drop}
BH 2.8	TOPSOIL	3.75	3.06	**0.69**
BH 2.8	0-0.5	4.02	3.92	**0.1**
BH 2.8	0.5-1	4.67	4.45	**0.22**
BH 2.8	1-1.5	4.48	3.98	**0.5**
BH 2.8	1.5-2	4.61	3.99	**0.62**
BH 2.8	2-2.5	4.37	4.07	**0.3**
BH 2.8	2.5-3	4.22	1.28	**2.94**
BH 2.8	3-3.5	4.57	3.32	**1.25**
BH 2.8	3.5-4	4.52	3.12	**1.4**
BH 2.8	4-4.5	5.29	3.05	**2.24**
BH 2.8	4.5-5	4.59	3.05	**1.54**
BH 2.8	5-5.5	4.52	3.26	**1.26**
BH 2.8	5.5-6	5.08	2.78	**2.3**
BH 2.8	6-6.5	4.7	2.48	**2.22**
BH 2.8	6.5-7	4.37	3.05	**1.32**
BH 2.8	7-7.5	5.29	3.14	**2.15**
BH 2.8	7.5-8	5.5	3.48	**2.02**

Sample location	Sample Depth (mbgl)	pH_F	pH_{Fox}	pH_{Drop}
BH 2.9	TOPSOIL	3.72	3.27	**0.45**
BH 2.9	0-0.5	4.7	3.92	**0.78**
BH 2.9	0.5-1	4.33	4.25	**0.08**
BH 2.9	1-1.5	4.7	4.44	**0.26**
BH 2.9	2-2.5	4.78	4.83	**-0.05**
BH 2.9	2.5-3	4.96	4.54	**0.42**
BH 2.9	3-3.5	4.95	1.42	**3.53**
BH 2.9	3.5-4	4.91	2.12	**2.79**
BH 2.9	4-4.5	5.01	1.19	**3.82**
BH 2.9	4.5-5	4.84	1.35	**3.49**
BH 2.9	5-5.5	4.96	1.36	**3.6**
BH 2.9	5.5-6	4.87	1.42	**3.45**

Sample location	Sample Depth (mbgl)	pH_F	pH_{Fox}	pH_{Drop}
BH 2.10	0	3.21	3.54	**-0.33**
BH 2.10	0.5	3.61	3.53	**0.08**
BH 2.10	1	4.39	4.17	**0.22**
BH 2.10	1.5	4.61	4.56	**0.05**
BH 2.10	2	4.63	4.56	**0.07**
BH 2.10	2.5	4.74	4.49	**0.25**
BH 2.10	3	4.75	4.61	**0.14**
BH 2.10	3.5	4.94	3.33	**1.61**
BH 2.10	4	4.98	2.68	**2.3**
BH 2.10	4.5	4.92	2.62	**2.3**
BH 2.10	5	4.85	2.89	**1.96**
BH 2.10	5.5	4.68	2.88	**1.8**
BH 2.10	6	4.84	2.87	**1.97**
BH 2.10	6.5	5.07	3.57	**1.5**
BH 2.10	7	4.83	2.77	**2.06**
BH 2.10	7.5	4.71	2.11	**2.6**

Sample location	Sample Depth (mbgl)	pH_F	pH_{Fox}	pH_{Drop}
BH 2.11	0-0.5	4.82	4.4	**0.42**
BH 2.11	0.5-1	4.98	4.64	**0.34**
BH 2.11	1-1.5	4.02	4.69	**-0.67**
BH 2.11	1.5-2	4.88	4.46	**0.42**
BH 2.11	2-2.5	4.99	4.17	**0.82**
BH 2.11	2.5-3	4.86	4.05	**0.81**
BH 2.11	3-3.5	4.71	1.42	**3.29**
BH 2.11	3.5-4	4.9	1.76	**3.14**
BH 2.11	4-4.5	5.03	0.88	**4.15**
BH 2.11	4.5-5	4.95	0.7	**4.25**
BH 2.11	5-5.5	5.01	0.83	**4.18**
BH 2.11	5.5-6	4.81	0.79	**4.02**
BH 2.11	6-6.5	4.99	1.22	**3.77**
BH 2.11	6.5-7	4.84	1.31	**3.53**
BH 2.11	7-7.5	5.01	1.32	**3.69**
BH 2.11	7.5-8	5.21	0.73	**4.48**

Sample location	Sample Depth (mbgl)	pH_F	pH_{Fox}	pH_{Drop}
BH 2.12	TOPSOIL	4.08	3.83	**0.25**
BH 2.12	0-0.5	4.23	3.94	**0.29**
BH 2.12	0.5-1	4.47	4.16	**0.31**
BH 2.12	1-1.5	4.7	4.39	**0.31**
BH 2.12	1.5-2	4.32	4.07	**0.25**
BH 2.12	2-2.5	4.88	4	**0.88**
BH 2.12	2.5-3	4.85	4.26	**0.59**
BH 2.12	3-3.5	4.78	3.43	**1.35**
BH 2.12	3.5-4	4.64	3.83	**0.81**
BH 2.12	4-4.5	4.96	4.26	**0.7**
BH 2.12	4.5-5	5.02	4.85	**0.17**
BH 2.12	5-5.5	4.9	4.04	**0.86**
BH 2.12	5.5-6	No Sample	N/A	
BH 2.12	6-6.5		N/A	
BH 2.12	6.5-7		N/A	
BH 2.12	7-7.5	5.02	3	**2.02**
BH 2.12	7.5-8	5.37	3.76	**1.61**

Sample location	Sample Depth (mbgl)	pH_F	pH_{Fox}	pH_{Drop}
BH 2.13	TOPSOIL	3.56	3.29	**0.27**
BH 2.13	0-0.5	3.51	3.38	**0.13**
BH 2.13	0.5-1	4.4	4.1	**0.3**
BH 2.13	1-1.5	4.68	4.13	**0.55**
BH 2.13	1.5-2	4.91	4.03	**0.88**
BH 2.13	2-2.5	4.59	3.57	**1.02**
BH 2.13	2.5-3	4.87	1.81	**3.06**
BH 2.13	3-3.5	4.86	2.66	**2.2**
BH 2.13	3.5-4	4.85	2.98	**1.87**
BH 2.13	4-4.5	4.84	2.48	**2.36**
BH 2.13	4.5-5	4.82	2.7	**2.12**
BH 2.13	5-5.5	4.83	2.9	**1.93**
BH 2.13	5.5-6	4.82	2.94	**1.88**
BH 2.13	6-6.5	4.46	2.09	**2.37**
BH 2.13	6.5-7	4.6	3.02	**1.58**
BH 2.13	7-7.5	5.33	3.18	**2.15**
BH 2.13	7.5-8	5.51	3.33	**2.18**

ATTACHMENT 3

Attachment3
Laboratory Certificates
(2011) & (2008)

Report Date/Time: 18 May 2011 9:28:38AM

Sample Receipt Notification (SRN)

Project:	EAL/B4070
Customer:	**Ardill Payne & Partners**
Contact:	Madeleine Payne
Client Job ID:	6542 Watson's Sandpit
No. of Samples:	52 samples
Date Received:	18/05/2011 9:25:36AM
Comments:	Standard Request
Biller:	**Ardill Payne & Partners** - Madeleine Payne - 02 6686 3280

Environmental Analysis Laboratory

Environmental Analysis Laboratory
PO Box 157
Lismore NSW 2480
ABN: 41 995 651 524
Tel: (02) 6620 3678 Fax (02) 6620 3957
Email: eal@scu.edu.au

Test Request

Sample Text ID	Client Sample ID	Chromium Suite (AS-PACK-01)
EAL/B4070/001	BH 2.1 7-7.5	1
EAL/B4070/002	BH 2.2 1-1.5	1
EAL/B4070/003	BH 2.2 1.5-2	1
EAL/B4070/004	BH 2.3 0-0.5	1
EAL/B4070/005	BH 2.3 0.5-1	1
EAL/B4070/006	BH 2.3 1-1.5	1
EAL/B4070/007	BH 2.3 1.5-2	1
EAL/B4070/008	BH 2.3 2-2.5	1
EAL/B4070/009	BH 2.3 2.5-3	1
EAL/B4070/010	BH 2.3 3-3.5	1
EAL/B4070/011	BH 2.3 3.5-4	1
EAL/B4070/012	BH 2.3 4-4.5	1
EAL/B4070/013	BH 2.3 4.5-5	1

Sample Receipt Notification (SRN) for EAL/B4070

Environmental Analysis Laboratory

		Chromium Suite	AS-PACK-01
EAL/B4070/014	BH 2.3 5-5.5	1	
EAL/B4070/015	BH 2.3 5.5-6	1	
EAL/B4070/016	BH 2.3 6-6.5	1	
EAL/B4070/017	BH 2.3 6.5-7	1	
EAL/B4070/018	BH 2.3 7-7.5	1	
EAL/B4070/019	BH 2.3 7.5-8	1	
EAL/B4070/020	BH 2.3 TOP	1	
EAL/B4070/021	BH 2.4 2-2.5	1	
EAL/B4070/022	BH 2.4 6-6.5	1	
EAL/B4070/023	BH 2.5 6.5-7	1	
EAL/B4070/024	BH 2.6 3.5-4	1	
EAL/B4070/025	BH 2.7 5.5-6	1	
EAL/B4070/026	BH 2.7 3.5-4	1	
EAL/B4070/027	BH 2.8 3-3.5	1	
EAL/B4070/028	BH 2.8 6.5-7	1	
EAL/B4070/029	BH 2.9 4-4.5	1	
EAL/B4070/030	BH 2.9 2.5-3	1	
EAL/B4070/031	BH 2.10 0-0.5	1	

Sample Receipt Notification (SRN) for EAL/B4070

Environmental Analysis Laboratory

		Chromium Suite	AS-PACK-01
EAL/B4070/032	BH 2.10 0.5-1	1	
EAL/B4070/033	BH 2.10 1-1.5	1	
EAL/B4070/034	BH 2.10 1.5-2	1	
EAL/B4070/035	BH 2.10 2-2.5	1	
EAL/B4070/036	BH 2.10 2.5-3	1	
EAL/B4070/037	BH 2.10 3-3.5	1	
EAL/B4070/038	BH 2.10 3.5-4	1	
EAL/B4070/039	BH 2.10 4-4.5	1	
EAL/B4070/040	BH 2.10 4.5-5	1	
EAL/B4070/041	BH 2.10 5-5.5	1	
EAL/B4070/042	BH 2.10 5.5-6	1	
EAL/B4070/043	BH 2.10 6-6.5	1	
EAL/B4070/044	BH 2.10 6.5-7	1	
EAL/B4070/045	BH 2.10 7-7.5	1	
EAL/B4070/046	BH 2.10 7.5-8	1	
EAL/B4070/047	BH 2.11 4-4.5	1	
EAL/B4070/048	BH 2.11 4.5-5	1	
EAL/B4070/049	BH 2.12 3-3.5	1	

Sample Receipt Notification (SRN) for EAL/B4070

Environmental Analysis Laboratory

		Chromium Suite	AS-PACK-01
EAL/B4070/050	BH 2.12 4.5-5	1	
EAL/B4070/051	BH 2.13 3.5-4	1	
EAL/B4070/052	BH 2.13 4-4.5	1	
Total		**52**	

Report Date/Time: 27 July 2011 10:47:10AM

Sample Receipt Notification (SRN)

Project:	EAL/B5137
Customer:	**Ardill Payne & Partners**
Contact:	Madeleine Payne
Client Job ID:	Client: Watson 25x Soil Samples
No. of Samples:	25 samples
Date Received:	27/07/2011
Comments:	Standard Request
Biller:	**Ardill Payne & Partners** - Madeleine Payne - 02 6686 3280

Environmental Analysis Laboratory

Environmental Analysis Laboratory
PO Box 157
Lismore NSW 2480
ABN: 41 995 651 524
Tel: (02) 6620 3678 Fax (02) 6620 3957
Email: eal@scu.edu.au

Test Request

Sample Text ID	Client Sample ID	Chromium Suite (AS-PACK-01)	ANC (AS-SING-03)
B5137/001	P1 - 0.5	1	-
B5137/002	P1 - 1	1	-
B5137/003	P1 - 1.5	1	-
B5137/004	P1 - 2	1	-
B5137/005	P1 - 2.5	1	-
B5137/006	P - 3	1	-
B5137/007	P1 - 3.5	1	-
B5137/008	P1 - 4	1	-
B5137/009	P1 - 4.5	1	-
B5137/010	P1 - 5	1	-
B5137/011	P1 - 5.5	1	-
B5137/012	P1 - 6	1	-
B5137/013	P2 - 1.5	1	-
B5137/014	P2 - 4.5	1	-
B5137/015	P2 - 5.5	1	-
B5137/016	P3 - 1	1	-

Sample Receipt Notification (SRN) for EAL/B5137

Environmental Analysis Laboratory

		AS-PACK-01	AS-SING-03
		Chromium Suite	ANC
B5137/017	P3 - 2	1	-
B5137/018	P3 - 5	1	-
B5137/019	P3 - 6	1	-
B5137/020	P4 - 1.5	1	-
B5137/021	P4 - 3	1	-
B5137/022	P4 - 4	1	-
B5137/023	P4 - 5	1	-
B5137/024	P4 - 6	1	-
B5137/025	Stockpile	1	1
Total		**25**	**1**

CHAIN OF CUSTODY

B4070

Environmental Analysis Laboratory	Client Details	EAL Quote No:	Project Ref: 6542 Watson's Sandpit
Despatch Samples To:	Company Name: Ardill Payne & Partners		
EAL - Southern Cross University P O Box 157 / Military Road LISMORE NSW 2480	Contact Person: Maddy Payne		Phone: 66863280
	Mobile:		Fax:
Phone: 02 6620 3678 Fax: 02 6620 3957 Mobile: 0419 984 088 Email: eal@scu.edu.au	Email Address: madeleinep@ardillpayne.com.au		
	Postal Address:		

Payment Method: (please tick ☐) (circle type of c/card)	☐ Credit Card	☐ Cheque	☐ Invoice (prior approval required)	☐ Purchase Order
	Bankcard / Mastercard / Visa	No: _____/_____/_____/_____		Exp. Date:
	Name on Card:		Signature:	
Billing Address: (if different from above)				

Relinquished By: M. Payne	Date: 17/5/11	Time: 9.30 am	Signed: Madeleine Payne
Sample Preservation: None / Warm / Cool / On Ice / Frozen / Acidified / Filtered / Other: _____			
Received By:	Date:	Time:	Signed:
Sample Condition on receipt:			

Sample No.	Sample ID	Sample Depth	Sampling Date	Your Client	Crop ID	Container (size and type)	Sample Type (e.g. water, leaf, soil)	Sample Analysis Request: Price List Code (e.g. SW-PACK-06) AS-PACK-01
1	BH 2.1 7-7.5	7-7.5	9/05/2011			PLASTIC BAG	SOIL	X
2	BH 2.1 1-1.5	1-1.5	9/05/2011			PLASTIC BAG	SOIL	X
3	BH 2.2 1.5-2	1.5-2	10/05/2011			PLASTIC BAG	SOIL	X
4	BH 2.3 0-0.5	0-0.5	10/05/2011			PLASTIC BAG	SOIL	X
5	BH 2.3 0.5-1	0.5-1	10/05/2011			PLASTIC BAG	SOIL	X
6	BH 2.3 1-1.5	1-1.5	10/05/2011			PLASTIC BAG	SOIL	X
7	BH 2.3 1.5-2	1.5-2	10/05/2011			PLASTIC BAG	SOIL	X
8	BH 2.3 2-2.5	2-2.5	10/05/2011			PLASTIC BAG	SOIL	X

CHAIN OF CUSTODY

Relinquished By: M. Payne	Date: 17/5/11	Time: 9.30 am	Signed: Madeleine Payne
Sample Preservation: None / Warm / Cool / On Ice / Frozen / Acidified / Filtered / Other: _____			
Received By:	Date:	Time:	Signed:
Sample Condition on receipt:			

Sample No.	Sample ID	Sample Depth	Sampling Date	Your Client	Crop ID	Container (size and type)	Sample Type (e.g. water, leaf, soil)	Sample Analysis Request: Price List Code (e.g. SW-PACK-06) AS-PACK-01
9	BH 2.3 2.5-3	2.5-3	10/05/2011			PLASTIC BAG	SOIL	X
10	BH 2.3 3-3.5	3-3.5	10/05/2011			PLASTIC BAG	SOIL	X
11	BH 2.3 3.5-4	3.5-4	10/05/2011			PLASTIC BAG	SOIL	X
12	BH 2.3 4-4.5	4-4.5	10/05/2011			PLASTIC BAG	SOIL	X
13	BH 2.3 4.5-5	4.5-5	10/05/2011			PLASTIC BAG	SOIL	X
14	BH 2.3 5-5.5	5-5.5	10/05/2011			PLASTIC BAG	SOIL	X
15	BH 2.3 5.5-6	5.5-6	10/05/2011			PLASTIC BAG	SOIL	X
16	BH 2.3 6-6.5	6-6.5	10/05/2011			PLASTIC BAG	SOIL	X
17	BH 2.3 6.5-7	6.5-7	10/05/2011			PLASTIC BAG	SOIL	X
18	BH 2.3 7-7.5	7-7.5	10/05/2011			PLASTIC BAG	SOIL	X
19	BH 2.3 7.5-8	7.5-8	10/05/2011			PLASTIC BAG	SOIL	X
20	BH 2.3 TOP	TOP	10/05/2011			PLASTIC BAG	SOIL	X
21	BH 2.4 2-2.5	2-2.5	9/05/2011			PLASTIC BAG	SOIL	X
22	BH 2.4 6-6.5	6-6.5	9/05/2011			PLASTIC BAG	SOIL	X
23	BH 2.5 6.5-7	6.5-7	10/05/2011			PLASTIC BAG	SOIL	X
24	BH 2.6 3.5-4	3.5-4	10/05/2011			PLASTIC BAG	SOIL	X
25	BH 2.7 5.5-6	5.5-6	9/05/2011			PLASTIC BAG	SOIL	X
26	BH 2.7 3.5-4	3.5-4	9/05/2011			PLASTIC BAG	SOIL	X
27	BH 2.8 3-3.5	3-3.5	10/05/2011			PLASTIC BAG	SOIL	X
28	BH 2.8 6.5-7	6.5-7	10/05/2011			PLASTIC BAG	SOIL	X
29	BH 2.9 4-4.5	4-4.5	6/05/2011			PLASTIC BAG	SOIL	X
30	BH 2.9 2.5-3	2.5-3	6/05/2011			PLASTIC BAG	SOIL	X
31	BH 2.10 0	0-0.5	6/05/2011			PLASTIC BAG	SOIL	X

CHAIN OF CUSTODY

Relinquished By: M. Payne	Date: 17/5/11	Time: 9.30 am	Signed: Madeleine Payne
Sample Preservation: None / Warm / Cool / On Ice / Frozen / Acidified / Filtered / Other: _____			
Received By:	Date:	Time:	Signed:
Sample Condition on receipt:			

Sample No.	Sample ID	Sample Depth	Sampling Date	Your Client	Crop ID	Container (size and type)	Sample Type (e.g. water, leaf, soil)	Sample Analysis Request — Price List Code (e.g. SW-PACK-06): AS-PACK-01
32	BH 2.10 0.5	0.5-1	6/05/2011			PLASTIC BAG	SOIL	X
33	BH 2.10 1	1-1.5	6/05/2011			PLASTIC BAG	SOIL	X
34	BH 2.10 1.5	1.5-2	6/05/2011			PLASTIC BAG	SOIL	X
35	BH 2.10 2	2-2.5	6/05/2011			PLASTIC BAG	SOIL	X
36	BH 2.10 2.5	2.5-3	6/05/2011			PLASTIC BAG	SOIL	X
37	BH 2.10 3	3-3.5	6/05/2011			PLASTIC BAG	SOIL	X
38	BH 2.10 3.5	3.5-4	6/05/2011			PLASTIC BAG	SOIL	X
39	BH 2.10 4	4-4.5	6/05/2011			PLASTIC BAG	SOIL	X
40	BH 2.10 4.5	4.5-5	6/05/2011			PLASTIC BAG	SOIL	X
41	BH 2.10 5	5-5.5	6/05/2011			PLASTIC BAG	SOIL	X
42	BH 2.10 5.5	5.5-6	6/05/2011			PLASTIC BAG	SOIL	X
43	BH 2.10 6	6-6.5	6/05/2011			PLASTIC BAG	SOIL	X
44	BH 2.10 6.5	6.5-7	6/05/2011			PLASTIC BAG	SOIL	X
45	BH 2.10 7	7-7.5	6/05/2011			PLASTIC BAG	SOIL	X
46	BH 2.10 7.5	7.5-8	6/05/2011			PLASTIC BAG	SOIL	X
47	BH 2.11 4-4.5 ✓	4-4.5	6/05/2011			PLASTIC BAG	SOIL	X
48	BH 2.11 4.5-5 ✓	4.5-5	6/05/2011			PLASTIC BAG	SOIL	X
49	BH 2.12 3-3.5 ✓	3-3.5	6/05/2011			PLASTIC BAG	SOIL	X
50	BH 2.12 4.5-5 ✓	4.5-5	6/05/2011			PLASTIC BAG	SOIL	X
51	BH 2.13 3.5-4 ✓	3.5-4	6/05/2011			PLASTIC BAG	SOIL	X
52	BH 2.13 4-4.5 ✓	4-4.5	6/05/2011			PLASTIC BAG	SOIL	X

CHAIN OF CUSTODY

B5137

Environmental Analysis Laboratory	Client Details	EAL Quote No:	Project Ref: 6542w – Watson's Sandpit
Despatch Samples To:	Company Name: Ardill Payne & Partners		
EAL - Southern Cross University P O Box 157 / Military Road LISMORE NSW 2480	Contact Person: Maddy Payne		Phone: 6686 3280
	Mobile:		Fax:
Phone: 02 6620 3678 Fax: 02 6620 3957 Mobile: 0419 984 088 Email: eal@scu.edu.au	Email Address: madeleinep@ardillpayne.com.au		
	Postal Address:		

Payment Method: (please tick ☐) (circle type of c/card)	☐ Credit Card	☐ Cheque	☐ **Invoice (prior approval required)**	☐ Purchase Order
	Bankcard / Mastercard / Visa	No: _____/_____/_____/_____		Exp. Date:
	Name on Card:		Signature:	
Billing Address: (if different from above)				

Relinquished By: M. Payne	Date: 26/7/11	Time: 9am	Signed: Madeleine Payne
Sample Preservation: None / Warm / Cool / On Ice / Frozen / Acidified / Filtered / Other: _____			
Received By: EAL C. Starr	Date: 26.7	Time: 4:00	Signed:
Sample Condition on receipt:			

Sample No.	Sample ID	Sample Depth	Sampling Date	Your Client	Crop ID	Container (size and type)	Sample Type (e.g. water, leaf, soil)	Sample Analysis Request – Price List Code (e.g. SW-PACK-06): AS-PACK-01	AS-SING-03								
1	P1 - 0.5	0.5	13/7/11	Watson		Plastic bag	Soil	x									
2	P1 - 1	1	13/7/11	Watson		Plastic bag	Soil	x									
3	P1 - 1.5	1.5	13/7/11	Watson		Plastic bag	Soil	x									
4	P1 - 2	2	13/7/11	Watson		Plastic bag	Soil	x									
5	P1 - 2.5	2.5	13/7/11	Watson		Plastic bag	Soil	x									
6	P1 - 3	3	13/7/11	Watson		Plastic bag	Soil	x									
7	P1 - 3.5	3.5	13/7/11	Watson		Plastic bag	Soil	x									
8	P1 - 4	4	13/7/11	Watson		Plastic bag	Soil	x									

CHAIN OF CUSTODY

Relinquished By: M. Payne	Date: 26/7/11	Time:9am	Signed: Madelen Payne
Sample Preservation: None / Warm / Cool / On Ice / Frozen / Acidified / Filtered / Other: _____			
Received By:	Date:	Time:	Signed:
Sample Condition on receipt:			

Sample No.	Sample ID	Sample Depth	Sampling Date	Your Client	Crop ID	Container (size and type)	Sample Type (e.g. water, leaf, soil)	Sample Analysis Request: Price List Code (e.g. SW-PACK-06) AS-PACK-01	AS-SING-03
9	P1 - 4.5	4.5	13/7/11	Watson		Plastic bag	Soil	x	
10	P1 - 5	5	13/7/11	Watson		Plastic bag	Soil	x	
11	P1 - 5.5	5.5	13/7/11	Watson		Plastic bag	Soil	x	
12	P1 - 6	6	13/7/11	Watson		Plastic bag	Soil	x	
13	P2 - 1.5	1.5	13/7/11	Watson		Plastic bag	Soil	x	
14	P2 - 4.5	4.5	13/7/11	Watson		Plastic bag	Soil	x	
15	P2 - 5.5	5.5	13/7/11	Watson		Plastic bag	Soil	x	
16	P3 - 1	1	13/7/11	Watson		Plastic bag	Soil	x	
17	P3 - 2	2	13/7/11	Watson		Plastic bag	Soil	x	
18	P3 - 5	5	13/7/11	Watson		Plastic bag	Soil	x	
19	P3 - 6	6	13/7/11	Watson		Plastic bag	Soil	x	
20	P4 - 1.5	1.5	13/7/11	Watson		Plastic bag	Soil	x	
21	P4 - 3	3	13/7/11	Watson		Plastic bag	Soil	x	
22	P4 - 4	4	13/7/11	Watson		Plastic bag	Soil	x	
23	P4 - 5	5	13/7/11	Watson		Plastic bag	Soil	x	
24	P4 - 6	6	13/7/11	Watson		Plastic bag	Soil	x	
25	Stockpile	N/A	13/7/11	Watson		Plastic bag	Soil	x	x

ATTACHMENT 4

Attachment 4
Template Chain of Custody
for Validation Testing

CHAIN OF CUSTODY

Environmental Analysis Laboratory	**Client Details**	EAL Quote No:	Project Ref:6542w
Despatch Samples To:	Company Name: Ardill Payne & Partners		
EAL - Southern Cross University P O Box 157 / Military Road LISMORE NSW 2480	Contact Person: James Foster		Phone: 6686 3280
	Mobile:		Fax:
Phone: 02 6620 3678 Fax: 02 6620 3957 Mobile: 0419 984 088 Email: eal@scu.edu.au	Email Address: jamesf@ardillpayne.com.au		
	Postal Address:		

Payment Method: (please tick ☐) (circle type of c/card)	☐ Credit Card	☐ Cheque	☐ **Invoice (prior approval required)**	☐ Purchase Order
	Bankcard / Mastercard / Visa	No: _ _ _ _ _ _/_ _ _ _ _ _/_ _ _ _ _ _/_ _ _ _ _ _		Exp. Date:
	Name on Card:		Signature:	
Billing Address: (if different from above)				

Relinquished By:	Date:	Time:	Signed:
Sample Preservation: None / Warm / Cool / On Ice / Frozen / Acidified / Filtered / Other: _____			
Received By:	Date:	Time:	Signed:
Sample Condition on receipt:			

Sample Analysis Request									
Price List Code (e.g. SW-PACK-06)									

Sample No.	**Sample ID**	**Sample Depth**	**Sampling Date**	**Your Client**	**Crop ID**	**Container** (size and type)	**Sample Type** (e.g. water, leaf, soil)