GEOTECHNICAL ASSESSMENT

OYSTER LEASE DREDGING, LEASE # 80 – 178,
WALLIS LAKE

PREPARED FOR:

TREVOR DENT

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GEOLYSE

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Report Title:	***Geotechnical Assessment***
Project:	**Oyster Lease Dredging, Lease # 80 – 178, Wallis Lake**
Client:	***Mr Trevor Dent***
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Geolyse Pty Ltd and the authors responsible for the preparation and compilation of this report declare that we do not have, nor expect to have a beneficial interest in the study area of this project and will not benefit from any of the recommendations outlined in this report.

The preparation of this report has been in accordance with the project brief provided by the client and has relied upon the information, data and results provided or collected from the sources and under the conditions outlined in the report.

All data contained within this report are prepared for the exclusive use of Mr. Trevor Dent to accompany this report for the land described herein and are not to be used for any other purpose or by any other person or entity. No reliance should be placed on the information contained in this report for any purposes apart from those stated therein.

Geolyse Pty Ltd accepts no responsibility for any loss, damage suffered or inconveniences arising from, any person or entity using the plans or information in this study for purposes other than those stated above.

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Introduction

1.1 BACKGROUND

Geolyse Pty Ltd was commissioned by Mr. Trevor Dent (the client) to undertake a Geotechnical Assessment of material proposed to be dredged from an oyster lease in Wallis Lake, Forster. The aim of the geotechnical assessment is to:

- Determine the nature and origin of the material to be dredged;
- Determine through particle size analysis, the proportion of sand and fines in the material;
- Determine the resource potential of the material;
- Determine whether the material is Acid Sulfate Soil or Potential Acid Sulfate Soil; and
- Determine liming rates required for acid neutralisation.

The report describes geotechnical investigations undertaken on Oyster Lease # 80 – 178 in Wallis Lake, NSW (**Figure 1.1**). The investigation is required to provide geotechnical and acid sulfate assessment to accompany an Environmental Assessment under Part 3A of the *Environmental Planning and Assessment Act 1979* for dredging of the oyster lease and stockpiling and sale of the dredged material.

Additional data utilised for the project consisted of the following:

- Detailed hydro-survey of the lease and surrounding areas (McGlashan & Crisp, 2006); and
- General bed sediment distribution mapping (Webb McKeown, 1999).

Methodology

2.1 FIELD AND LABORATORY INVESTIGATIONS

Fieldwork was conducted on 15 March 2006 and comprised the following:

- 12 x 3 m long 50 mm PVC tubes were pushed into the bed from an oyster punt to a depth ranging between 1.5 to 2 m below the bed surface;
- Cores were recovered manually and their position recorded;
- Cores were stored for stored for two weeks to enable sufficient dewatering prior to splitting and logging;
- All cores showed minimal disturbance and good preservation of sedimentary structures (*eg*. shell layers, lamination of organic material, bedding structures); and
- All cores were logged and samples taken from cores for particle size and acid sulfate analyses.

Due to the homogenous nature of the bed sediment, 10 samples for particle size analysis were sent to RCA Australia Pty Ltd's NATA accredited laboratory and analysed in accordance with AS 1289.3.6.1, while eight samples were assessed for acid sulfate (ASS) potential. Samples for ASS analysis were frozen and sent to Southern Cross University's NATA accredited laboratory and analysed in accordance with methods detailed in Ahern *et al*., (2004).

Locations of cores are shown in **Figure 1.2**.

Core logs are provided in **Appendix A**. Results of particle size analysis are provided in **Appendix B**, while results from the ASS assessment are detailed in **Appendix C**.

Results

3.1 GEOLOGICAL CONTEXT

Wallis Lake is a barrier estuary (Roy, 1984) with a permanently open (trained) entrance. The oyster lease site is located in the lower end of Wallis Lake, toward the upper limits of the flood tide delta (Webb McKeown. 1999) where the Wallamba River enters the main body of the estuary. The lower end of Wallis Lake is characterised by a series of sub-aerial deposits of Quaternary (Holocene) marine sand, with intertidal areas overlain or inter-bedded with thin deposits of fluvially-derived fines deposited during flood events.

The flood tide delta comprises sand from the adjacent coastal dune systems that has been reworked by tidal and fluvial flows. In general, this material comprises well sorted, well rounded, greyish sands with organic coatings, with some mixing with fluvially-derived fines (Webb McKeown, 1999).

3.1.1 SITE GEOMORPHOLOGY

The area of the estuary around the oyster lease has been heavily modified over the years, with extensive dredging (100,000 m^3) having been undertaken to create the Jonnel Channel (north of the oyster lease) and adjacent residential land in Taree St and Jonnel Park (Webb McKeown, 1999). Additional dredging has also been undertaken around the lease area for oyster leases, to divert flows and further define and channelise fluvial and tidal flows.

The site of the oyster lease has been modified extensively from its pre-European condition. Large areas of the bed of the site (in particular in the south western extents) were raised through the placement of felled cabbage tree palms and placement of overburden, in order to raise the bed to a height sufficient for oyster cultivation. Other parts of the lease have been dredged to various extents over the ensuing years.

3.1.2 SURFACE AND SUBSURFACE CONDITIONS

12 core samples were taken across the site to characterise the surface and subsurface sediments. Surface sediments comprised primarily fine sand, with varying degrees of minor silt content (estimated as 5 – 10 %).

The subsurface conditions encountered during the geotechnical assessment are detailed in the core (**Appendix A**). In general, stratigraphy across the site was uniform, with subtle variations in silt content/interbedding and organic laminations in core profiles. In general, the profile comprised:

- Yellow/brown sand, minor silt content, well sorted, well rounded, few shell fragments to a depth of 0.4 m;
- Light grey fine sand, occasional silty lenses, rounded, well sorted. Minor shell fragments, some organics staining to a depth of 2.0 m.

In some cores, there was a distinct inter-fingering of the two layers at depth, indicating episodic deposition of marine sands and fluvial fines.

One core contained a lense of fine mud with numerous shells and shell fragments, representing a relict intertidal deposit.

Cores were sampled for testing of particle size distribution and acid sulfate potential.

3.1.3 PARTICLE SIZE DISTRIBUTION

10 samples from the cores were subjected to particle size analysis at a NATA accredited laboratory in accordance with AS 1289.3.6.1. Results of the analysis are provided in **Appendix B**. In general, the material to be dredged from the oyster lease is characterised as fine to coarse-grained sand, with some very minor traces of silt and fine gravel, with gravel being composed of shell and shell fragments. In summary, particle size analysis indicates the following:

- Silt/clay fraction ranged between 3.2 – 7.2 % (mean 5.25 %)
- Sand fraction (fine to coarse sands) ranged between 89.8 – 96.4 % (mean 93.94 %);
- Fine to medium gravel fraction ranged between 0.1 – 2.9 % (mean 0.81 %).
- Dry weight bulk density (based on ASS samples – **Appendix C**) varied between 1.3 – 1.6 t m^{-3}.

3.1.4 SAND AND PRODUCT QUALITY

It is understood that it is not proposed to undertake any processing of the sand, apart from removal of fines in settling ponds. Potential uses for the sand resource are listed below:

- Bedding Sand;
- Top Dressing;
- Landscaping;
- Golf Course Construction; and
- Various other construction and land development works.

3.1.5 RESOURCE QUANTITY

Laboratory analyses of samples taken from cores extracted from the oyster lease area indicate that the material to be extracted is suitable for use as an extractive quarry resource.

The maximum depth of dredging below the bed is estimated to be approximately 2 m, equivalent to the depth of adjacent dredged channels and oyster lease areas. Average depth of dredging over the site is estimated to be 1.5 – 2.0 m. Based on a dredge footprint of 8 ha, this equates to a volume of dredged material between 120,000 – 160,000 m^3. Based on sampling test results, the average sand-

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fraction is 94 %. Therefore it is estimated that 112,800 – 150,400 m^3 of sand-fraction will be recovered from the dredge operation.

During the processing of dredge slurry in the settling ponds, however, based on previous experience it is estimated that at least 50 % of the fines (average 2.625 % of volume) will be incorporated into the sands as they drop out of suspension. Therefore, it is estimated that 115,950 – 154,600 m^3 of material could be recovered as 'sand' and stockpiled. The remaining fines would be extracted from the settling ponds following cessation of the operation. The fines material would have a variety of uses, primarily for landscaping and horticultural applications as a soil conditioner mix or for topdressing.

3.2 ACID SULFATE SOILS

Acid sulfate testing was undertaken on samples from eight cores taken from the dredge site. Results of the screening tests are provided in **Appendix C,** with a summary provided in **Table 3.1**.

Table 3.1 – Summary Results of Acid Sulfate Soil Analysis

Core	Depth* of sample (m)	Reduced Inorganic Sulfur (% chromium reducible S) (% Scr)	Net Acidity – Chromium Suite mole H^+/tonne (based on %Scr)
1	1.0 – 1.1	0.067	-158
2	1.1 – 1.2	0.038	-349
3	1.1 – 1.2	0.025	-151
5	1.0 – 1.1	0.131	-91
6	0.8 – 1.0	0.162	-132
7	0.75 – 0.95	0.025	-184
9	1.0	0.082	-169
10	1.0	0.306	-209

* = Depth below bed surface

The results indicate that the material is not Actual Acid Sulfate Soil, though is classified as Potential Acid Sulfate Soil, based on % Chromium reducible Sulfur.

The material was determined, however, to have insitu neutralising capacity due to the negative net acidity and shell ($CaCO_3$) content. As such, the addition of lime for neutralisation was not recommended by the laboratory. Notwithstanding, lime will be kept on site for the management of return waters if required. Management of potential acid sulfate soils during the dredging process will therefore be based on ensuring that pH of return waters meets appropriate criteria set in the conditions prior to discharge to the Wallamba River.

Discussion

4.1 SUMMARY

Particle size analysis indicates that the material to be dredged from the oyster lease area is comprised primarily of fine to medium sands (mean 94 %) of marine origin with a minor fluvially-derived and organics fines content (mean 5 %). Dry bulk density of samples varied between 1.3 – 1.6 t m^{-3}. The sedimentology is consistent with the upper reaches of a flood tide delta depositional environment, in particular, in an area of low flow.

Laboratory analysis indicate that the material can be characterised as Potential Acid Sulfate Soil, though actual acidity is extremely low and can be neutralised insitu by the shell content in the material. While no liming rates were recommended, it is suggested that hydrated lime be stored on site as a precaution, should return waters require neutralisation prior to discharge. Management of Acid Sulfate Soils would therefore be limited to monitoring of pH of return waters to ensure that pH is within recommended guideline limits set in the conditions of consent.

Based on estimates of extraction volumes, it is anticipated that up to 154,600 m^3 of sand resource could be recovered from the operation. This material would be suitable for a variety of construction purposes.

References

Ahern, C.R., McElnea, A.E. and Sullivan, L.A. (2004). *Acid Sulfate Soils Laboratory Methods Guidelines*. QLD DNRME.

McGlashan & Crisp Pty Ltd (2006). *Hydro-survey of Oyster Lease # 80 – 178 and surrounding areas*. Unpublished survey data prepared for Geolyse Pty Ltd.

Webb McKeown and Associates Pty Ltd (1999) *Wallis Lake Estuary Processes Study.* Unpublished report prepared for Great Lakes Council. 129 pp + App.

Appendix D1

CORE LOGS
OYSTER LEASE # 80 – 178

Appendix D2

PARTICLE SIZE ANALYSIS
RCA AUSTRALIA PTY LTD

Appendix D3

ACID SULFATE SOILS ANALYSIS
SOUTHERN CROSS UNIVERSITY