

7 January 2008

SEQ Water  
Information Centre Brisbane Valley Highway  
PO Box 367  
FERNVALE QLD 4306

**Attention: Mr Barton Maher**

Dear Barton

**RE: Site Inspection Report and Proposal for Further Work  
Outlet Works Cutting Stability, Lake Wivenhoe**

## **1 INTRODUCTION**

According to your verbal request, Coffey Geotechnics has visited the above site to inspect the existing cutting adjacent to the Outlet Works at Lake Wivenhoe. The purpose of the inspection was to assess the general condition of the cutting and to recommend further investigation work required to provide detailed remediation options for the wall. We understand you have concerns over ravelling of the existing cutting face and also the potential instability of isolated sandstone blocks. Both issues present a safety hazard for personnel working near the toe of the cutting and also a damage risk to nearby infrastructure.

## **2 SITE INSPECTION**

The site was visited on 12 December 2007 by Geotechnical Engineer Nick Alexander from our Newstead office. Prior to the inspection a short briefing was provided by Barton Maher of SEQ Water who outlined concerns in regard to the safety of the cutting.

The cutting is located east of the main outlet works for Lake Wivenhoe and near the downstream toe of the dam. It is understood that the cutting has been exposed for about 30 years. During the inspection general observations of the cutting including geometry, geology and face condition were recorded along with the type and proximity of surrounding structures. Photographs taken during the visit are attached.

The cutting consists of 4 faces which are essentially vertical. Two main faces are oriented east – west (main north face) and north – south (main east face) and are about 18.5 m and 16.5 m in length respectively with maximum height of about 11 m. Two smaller faces located at the western end are oriented approximately northwest - southeast and north - south, being about 5 m in length each with a maximum height of about 9.5 m.

Work shop buildings are located at the western end of the cutting and an electrical substation is located at the eastern end of the cutting. The substation is surrounded by chain wire mesh fencing. A steel service pipe runs along the main northern face about 1 m off the ground and 3 steel service pipes run up the main eastern face. A sketch of the general layout is shown on Figure 1.

The cutting has been excavated mainly in moderately and slightly weathered sandstone with the higher degrees of weathering located near the crest. Behind the crest the surface is grassed and there appears to be a thin cover of residual soil, estimated at less than 0.5 m thick, overlying the sandstone. The exposed sandstone in the cutting has developed an uneven relief due to weathering/erosion and raveling of cobble size fragments has begun to occur. Some fragments about 0.25 m across were noted at the toe of the cutting. The sandstone beds typically dip at about 2° to 5° but are locally steeper (up to 10°) in some areas.

Two bands of highly weathered to extremely siltstone present in the northern and eastern faces lie concordant with the sandstone beds varying between about 0.3 m and 0.8 m thick. The weathered siltstone bands have eroded more rapidly than the sandstone and have begun to undercut the overlying face by typically 0.2 m to 0.3 m but on the main eastern face the undercutting extends up to about 0.5 m deep.

There appears to be a vertical joint set striking approximately north – south. Two of these joints daylight near the north eastern corner of the cutting. There appears to be no obvious ground water seepage through these joints or in other areas on the face.

A number of irregular shaped sandstone blocks and/or slabs about 0.5 to 1.5 m in height were identified at the western end of the main north face. Larger blocks up to about 2.5 m in height were identified at the western end of the cutting. It is unclear at this stage if the blocks have been formed by systematic joint sets or random fractures within the rock mass. The blocks could possibly be released with further erosion and water ingress along the face.

## 2.1 Stability Issues and Preliminary Considerations for Remediation

Potential stability issues that were identified during the initial site inspection that are considered to pose a safety risk to personal and damage risk to infrastructure and potential remediation measures are detailed in Table 1. It should be noted that this is a preliminary assessment only and further work should be undertaken to confidently establish all potential risks.

**Table 1: Stability Issues and Preliminary Considerations for Remediation**

No.	Identified Stability Issues	Preliminary Remediation Options
1	Ravelling of the sandstone face resulting in large cobble and small boulder size fragments being released from the wall. (General across all faces)	<ul style="list-style-type: none"> <li>Establishment of fence barrier at toe of cutting at say 1.5 m to 2 m from face,</li> <li>Scaling / smoothing of the cutting face with an excavator to remove ravelling potential. Access around substation difficult and would probably require it to be isolated.</li> <li>Installation of chain wire mesh draped over and anchored into face,</li> <li>Shotcreting of surface,</li> <li>Or combination of above.</li> </ul>

2	Erosion of the siltstone beds causing undercutting and instability of overlying sandstone beds. (Main northern and eastern faces)	<ul style="list-style-type: none"> <li>• Shotcreting with reinforcement dowel bars or mesh. Drainage requirements such as weep holes or strip drains to be considered to control hydrostatic pressures behind the shotcrete.</li> </ul>
3	Minor blocks / slabs of sandstone 0.5 m to 1.5 m height. (Western end / main north face)	<ul style="list-style-type: none"> <li>• Removal of blocks with an excavator.</li> <li>• Retention with chain wire mesh draped over and anchored into face, however may not provide enough restraint for larger blocks.</li> </ul>
4	Major blocks / slabs / wedges of sandstone 2 m to 2.5 m height extending some distance into face. (Western end of cutting)	<ul style="list-style-type: none"> <li>• Removal with an excavator. Need to consider affect on stability of surrounding rock mass and effect on nearby infrastructure.</li> <li>• Stabilise with rock bolts however need to consider potential for dislodgement during installation.</li> </ul>

### 3 PROPOSAL FOR FURTHER WORK

#### 3.1 Field Work

It is proposed Coffey revisit the site to undertake detailed mapping of the cutting including geometry, rock types, bedding, rock mass defects, and the size or specific sandstone blocks. The additional work may identify issues not raised from the brief site inspection, and help determine appropriate remediation options for the cutting.

An extension ladder (used to a maximum height of 7.5 m to comply with Health and Safety Legislation) will be used to help access the cutting at height. This will be important in mapping zones where some of the larger blocks at the western end of the cutting exist. Note that access to the main eastern face will be restricted due to overhead wires associated with the electrical substation.

The inspection would be undertaken by an experienced geotechnical engineer or geologist who would be accompanied by a technician to assist in the safe use of the ladder. Alternatively SEQ Water could provide a person to assist the Coffey engineer or geologist.

#### 3.2 Engineering Analysis and Reporting

On completion of the field work we would prepare a formal report presenting the factual findings of the inspection, together with comments on:

- Longitudinal sections and cross section sketches would be provide as well as annotated photos,
- Stereonet analysis to assess kinematic stability,
- Identification of stability issues,
- Qualitative risk hazard assessment for personnel and infrastructure,
- Detailed discussion on remediation options for remediation of the cutting,
- Design details for preferred remediation options determined in consultation with SEQ Water.

### **3.3 Fees and Costs and Basis of Engagement**

The work would be carried out under our standard Terms of Agreement for Professional Service, Issue 1, Revision 2 July 2006, a copy of which is attached.

We have estimated our fees to be as shown in Attachment A. This estimate is based on 1 day of field work which we consider to be feasible for the proposed inspection assuming there are no delays due to access, inclement weather or mechanical breakdowns. Our final invoice will be based on the actual work carried out in the field, and the unit rates presented in our estimate. We will contact you if circumstances are such that it is necessary to exceed the estimate. All third party costs will attract a handling fee of 15%. Post-report consultations or meetings including travel to and from site that you may subsequently require would be charged at applicable hourly rates.

We anticipate being able to commence field work within 2 weeks of receipt of your written instructions to proceed. The final report would be available within a further 4 weeks after the completion of the field work, however preliminary information on the findings of the field work could be provided earlier if requested.

This proposal will remain valid for a period of 30 days following which time we reserve the right to amend the cost and program estimates contained herein. If you have any questions regarding this matter please contact Nick Alexander or the undersigned.

For and on behalf of Coffey Geotechnics Pty Ltd



**Coffey Geotechnics**

f.

Philip Styles

Associate Engineering Geologist

Attachment A: Site Sketch

Attachment B: Photographs

Attachment C: Estimate of Costs and Fees

Attachment D: Authorisation to Proceed

client: SEA WATER

office: NEWCASTLE, AUSTRALIA

principal:

date: 12/12/07

project: OUTLET WORKS CUTTING

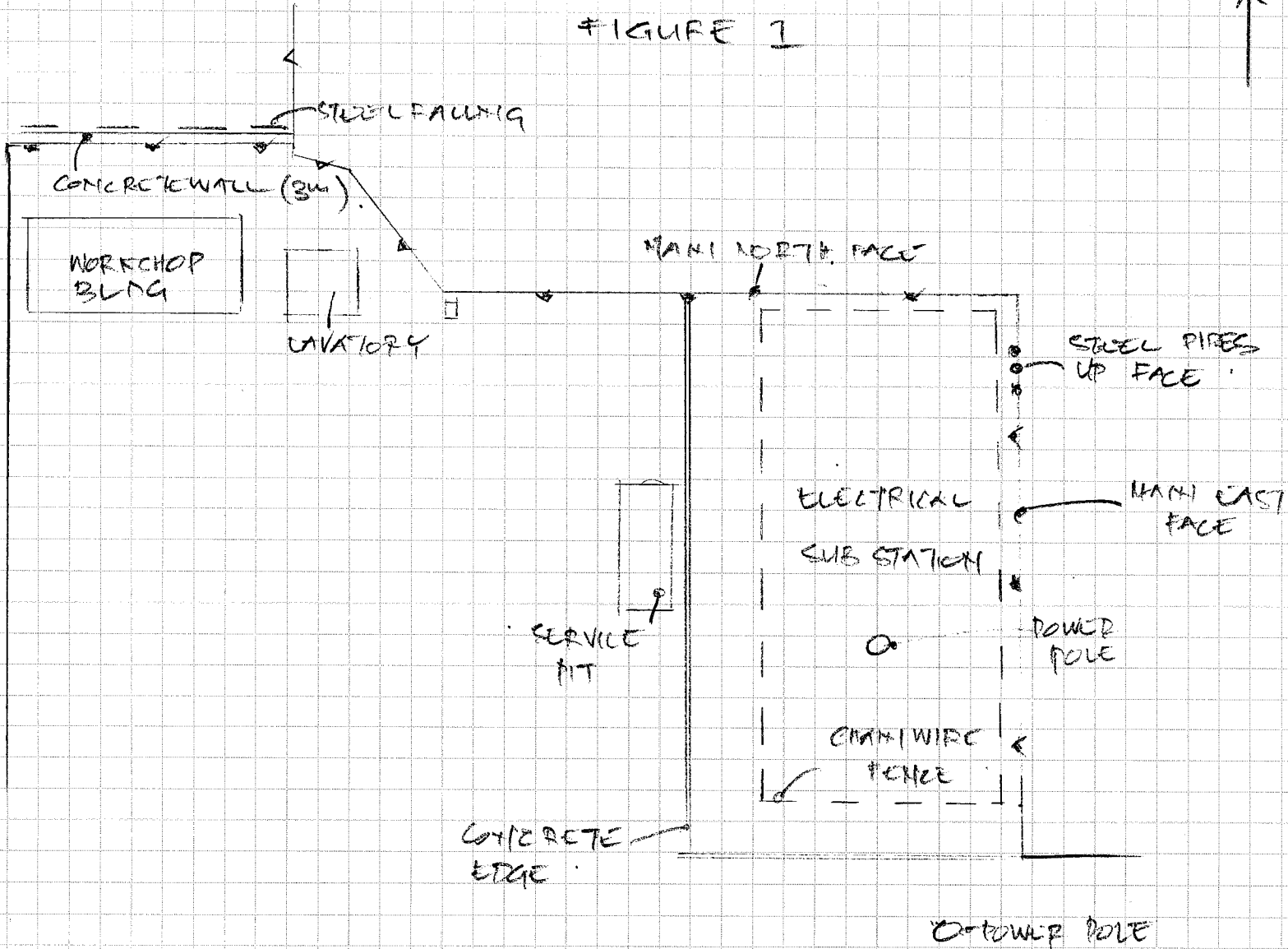
by: N.A.

location: LATE WINE MERE

checked:



SITE SKETCH (NOT TO SCALE)  
FIGURE 1

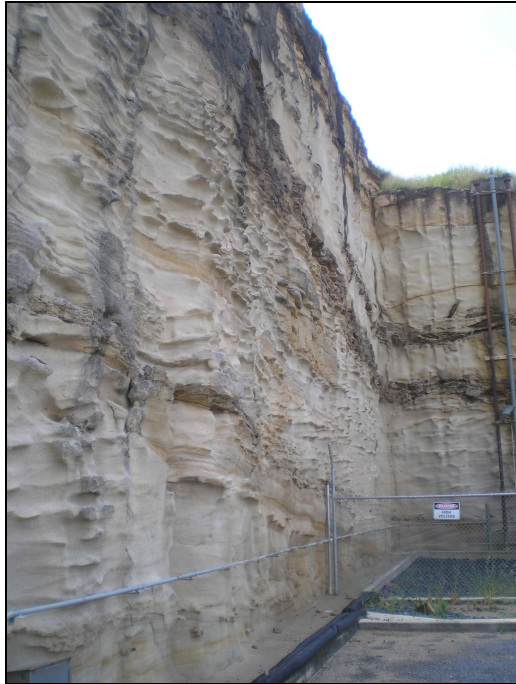


## ATTACHMENT B

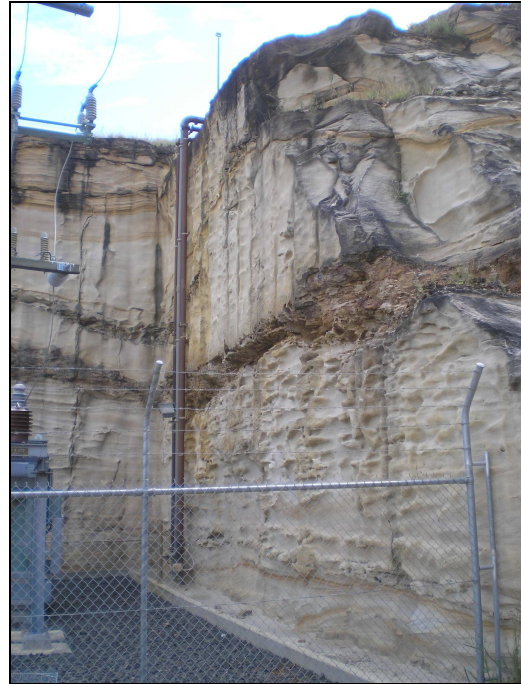


**Photo 1: View of cutting looking towards north. Electrical substation located to right and workshop buildings located to left. Highly weathered siltstone beds arrowed.**

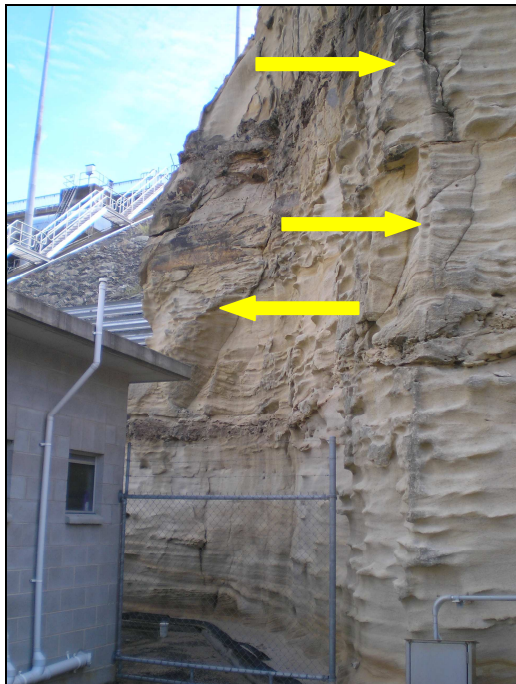




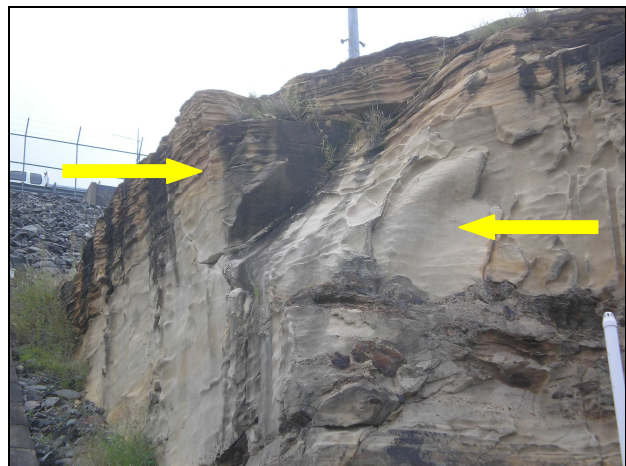
**Photo 2: View of main north face towards east. Uneven surface relief visible; surface ravelling occurring.**



**Photo 3: View of main east face towards north. Undercutting of siltstone beds evident.**



**Photo 4: View of small faces towards western end of cutting. Irregular, potentially unstable blocks / slabs arrowed.**



**Photo 5: View of top of western end of cutting. Potentially unstable block arrowed.**

## ATTACHMENT C

### Proposal for Geotechnical Inspection and Advice Outlet Works Cutting Remediation Estimate of Fees And Costs

1.	<b>Planning / Project Management</b>		
	Senior / Project Geotechnical Engineer	\$155 / hr	
	<b>Estimate</b>		<b>\$620.00</b>
2.	<b>Field Work</b>		
	Experienced Engineer / Geologist	\$155 / hr	
	Technician	\$80 / hr	
	Car Hire + Fuel	\$100 / day	
	Extension Ladder Hire	\$70 / day	
	<b>Estimate</b>		<b>\$2,000.00</b>
3.	<b>Reports, analysis, engineering</b>		
	Project Geotechnical Engineer	\$155/hr	
	Principal Geotechnical Engineer	\$235/hr	
	Admin / Secretary	\$90/hr	
	<b>Estimate</b>		<b>\$3,000.00</b>
	<b>Sub Total</b>		<b>\$5,620.00</b>
	<b>GST (10%)</b>		<b>\$562.00</b>
	<b>Total Estimate</b>		<b>\$6,182.00</b>



Please fax or post to:

Coffey Geotechnics Pty Ltd

PO Box 2301

FORTITUDE VALLEY BC QLD 4006

Attention:

Fax No. 07 3852 2805

**RE AUTHORISATION TO PROCEED**

**Site Inspection Report and Proposal for Further Work**

**Outlet Works Cutting Stability, Lake Wivenhoe**

It is hereby agreed that I/we accept the scope of work, programme, cost, terms and conditions as described in the Coffey Geotechnics Pty Ltd. proposal Ref: GEOTNEWS20208AA-A, dated 7 January 2008 and Coffey Geotechnics Pty Ltd is authorised to proceed.

*Please note that the organisation that authorises the work is responsible for payment. Payment is to be made within 14 days regardless of any contracts that maybe held with third parties. Commissioning of work by third party organisations that are not responsible for the payment will not be accepted.*

Name: \_\_\_\_\_ Position: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Company to Invoice: \_\_\_\_\_

ACN: \_\_\_\_\_ ABN: \_\_\_\_\_

Accounts Mailing Address: \_\_\_\_\_

\_\_\_\_\_  
Postcode: \_\_\_\_\_

Accounts Phone: \_\_\_\_\_ Accounts Fax: \_\_\_\_\_

PLEASE SIGN THIS ACCEPTANCE AND FORWARD TO COFFEY GEOTECHNICS BY MAIL OR FACSIMILE.  
UPON RECEIPT OF THIS ACCEPTANCE, COFFEY GEOSCIENCES WILL COMMENCE WORK ON THE  
PROJECT