

28 June 2007

Manildra Group
PO Box 123
Nowra NSW 2541

Attention: Greg Murphy

Dear Sir,

**RE: ADDITIONAL GEOTECHNICAL ADVICE
RIVER BANK STABILISATION OPTIONS
PROPOSED NEW FLOUR MILL AND SILOS
SHOALHAVEN STARCHES
160 BOLONG ROAD, BOMADERRY**

1 INTRODUCTION

At the request of Manildra Group, Coffey Geotechnics Pty Ltd (Coffey) has considered alternative river bank stabilisation options for the section of river bank adjacent to the proposed flour mill and silos at the Shoalhaven Starches Plant in Bomaderry. This follows a recent report by Coffey on a geotechnical assessment of river bank stability, Report Ref. GEOTUNAN02584-AA-AE, dated 23 April, 2007. A letter from the Department of Water and Energy to the Department of Planning (Ref. ERM2007/04604, dated 13/6/07) in relation to the above development, requested that alternative bank stabilisation options to the rock revetment proposed in the Coffey report be presented. If the rock revetment wall is the preferred option, then the re-establishment of appropriate natural vegetation will need to be incorporated with the revetment works.

This should be read in conjunction with the previous report by Coffey GEOTUNAN02584-AA-AE dated 23/4/07.

2 CURRENT ROCK REVETMENT OPTION

The current rock revetment option is intended to provide protection from erosion and to reduce the risk of river bank failure adjacent to the proposed new structure. A rock revetment wall was used to support a section of the river bank that failed in February, 2007. This rock revetment work is immediately downstream of the section of river bank adjacent to the proposed development. The advantages of continuing this wall about 80m upstream to the existing jetty are as follows:-

- This type of rock revetment has been used successfully by a local contractor along other parts of the river
- The rock revetment used recently (March, 2007) to stabilise a failed section of the river bank has been successful in preventing further movement in this area
- The rock revetment is a natural product that covers a geosynthetic lining placed between the rocks and the river bank
- The rock revetment will provide resistance to scouring from river flows as well as protection from impact of floating debris (e.g. logs) and from vessels that may damage other linings
- The rock revetment will continue along a similar alignment and geometry to the recently constructed rock revetment. This will minimise the risk of erosion due to eddy currents at changes in revetment alignment.
- The rock materials used in the revetment wall are available locally and can be constructed by a contractor with significant local experience, particularly at the Shoalhaven Starches Plant.
- The rock revetment proposed will allow some existing trees on the bank to remain in place and the major of trees along the top of the bank to remain. Natural vegetation can also be planted at selected locations within the wall to replace existing coral or she-oaks that are removed during the works.

3 OTHER EROSION PROTECTION / STABILISATION OPTIONS CONSIDERED

Other river bank stabilisation / erosion protection options considered include:-

- Gabion wall with Reno mattress over base and upper bank lining
- Reno mattress placed over trimmed or prepared bank, and extending into the river below low tide mark
- High density polyethylene mesh
- Mass concrete block wall placed on a Reno mattress base or geogrid / geotextile and rock fill base

Advantages and Disadvantages of the Above Options

The advantages and disadvantages of the above alternative options and the rock revetment option are presented in the following table.

<u>Stabilisation Option</u>	<u>Advantages</u>	<u>Disadvantages</u>
1. Rock Revetment (with geotextile lining)	<ul style="list-style-type: none">▪ Matches geometry of recent revetment works▪ Can be adjusted to match bank conditions without significant trimming of bank▪ Materials readily available▪ Natural product covering geotextile lining▪ Durable, resistant to erosion and impact damage▪ Can be constructed around trees that need to be preserved▪ Will allow other vegetation to be established▪ Flexible design given presence of deep soft soils below the site	<ul style="list-style-type: none">▪ Selecting suitable flat rocks for placement▪ Handling of rocks requires use of large excavator
2. Gabion wall / Reno Mattress	<ul style="list-style-type: none">▪ Proven method of erosion protection / bank support▪ Can be constructed with limited heavy machinery access	<ul style="list-style-type: none">▪ Requires trimming re-shaping of bank to allow placement of Reno mattress and uniform shape of wall▪ Does not allow for leaving any existing trees in place▪ Does not allow for revegetation within wall area▪ Damage to wire cages would result in significant deterioration of wall▪ Slower construction process than rock revetment, requiring more labour

<u>Stabilisation Option</u>	<u>Advantages</u>	<u>Disadvantages</u>
3. Reno Mattress only	<ul style="list-style-type: none"> ▪ Proven method of erosion protection ▪ Can be constructed with limited heavy machinery access 	<ul style="list-style-type: none"> ▪ As for Galion wall ▪ Batter suited to flatter grades
4. HDPE Mesh	<ul style="list-style-type: none"> ▪ Allows revegetation of grass and small plants ▪ Would provide reasonable erosion protection but limited bank support 	<ul style="list-style-type: none"> ▪ Requires significant trimming of bank to form a uniform batter ▪ Assumes material can be readily pinned or anchored to underlying soils. In this case soils may be disturbed by site preparation earthworks ▪ Difficult to re-establish trees without cutting holes out of mesh ▪ Does not provide support along toe of embankment as provided by rock revetment or Gabion wall.
5. Mass Concrete Block wall / constructed on geogrid or Reno Mattress base	<ul style="list-style-type: none"> ▪ Durable wall. Can resist erosion and impact ▪ Can be readily placed once site earthworks is complete 	<ul style="list-style-type: none"> ▪ Not flexible compared to rock revetment or gabion wall, given deep soft soils underlying and potential for differential settlement ▪ Does not allow flexibility to leave any trees on bank in place or space for new vegetation ▪ Requires significant trimming of bank to achieve required geometry for placement of blocks ▪ Availability of sufficient blocks may be limited ▪ Poor appearance from river side

Preferred Option

Based on the site conditions observed and our knowledge of the subsurface conditions in Shoalhaven Starches Plant area from many previous investigations, the preferred option for river bank stabilisation / erosion protection at the location is the rock revetment wall placed over a geotextile filter fabric. Geogrid in combination with geotextile fabric is proposed under the base layer of rocks which should extend at least 1m beyond the low tide mark or about 3m beyond the base of the bank to reduce the risk of undercutting of the toe of the wall.

The rock revetment should extend to within 0.5m of the top of the river bank. The geotextile fabric placed behind the rock revetment should be placed over the prepared bank, keyed into the crest of the bank and extending to the outer edge of the rock revetment. The geotextile fabric should have a high textile strength and permeability (e.g. Bidim A64). The fabric should be rolled out down the embankment and should be overlapped and joined where not continuous from top of bank to the outer edge of the revetment. Along the base of the wall a geogrid should be placed over the fabric with a layer of coarse grade crushed rock (75mm to 10mm) approximately 200mm thick placed over the geogrid to provide interlocking of particles with the grid before placing the large revetment rocks over the crushed rock. Rocks used in the revetment wall should generally range from about 1m to 1.5m (maximum dimension) with flat faces for stacking over the batter slope, and rocks ranging from about 300mm to 500mm placed over the flatter slope in the tidal zone.

4 ACID SULFATE SOILS

Coffey were requested to comment on the likely presence (and treatment, if encountered) of Acid Sulfate Soils (ASS) in relation to the proposed river bank revetment works and piling works for structures. Our advice in relation to ASS is presented in a separate letter attached to this report.

5 SURVEY INFORMATION

Survey sections for the section of river bank in question have been prepared by Allen Price Surveyors. The revetment wall will typically follow the sections shown on the drawings with additional rocks placed as required to achieve an overall batter of between 1H:1V and 1.5H:1V.

The attached document, titled 'Important Information about your Coffey Report' should be read in conjunction with this report.

Should you have any questions in relation to the discussion and recommendations provided above please contact the undersigned.

For and on behalf of

COFFEY GEOTECHNICS PTY LTD

A handwritten signature in black ink, appearing to read 'Jon Thompson', followed by a horizontal line.

JON THOMPSON CPEng

Principal Geotechnical Engineer

Attachments

Important Information about your Coffey Report

Coffey letter, Reference GEOTUNAN02584-AA-AF, titled "Management of Potential Acid Sulfate Soils"

Important information about your **Coffey** Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by

earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Important information about your **Coffey Report**

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

Data should not be separated from the report*

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way.

Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment.

Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Rely on Coffey for additional assistance

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

* For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical Information in Construction Contracts" published by the Institution of Engineers Australia, National Headquarters, Canberra, 1987.

28 June 2007

Manildra Group
PO Box 123
Nowra NSW 2541

Attention: Brian Hanley

Dear Sir,

**RE: MANAGEMENT OF POTENTIAL ACID SULFATE SOILS
RIVER BANK EROSION PROTECTION WORK
PROPOSED NEW SILOS AND FLOUR MILL BUILDING
MANILDRA PLANT, BOLONG ROAD, BOMADERRY**

At your request, Coffey Geotechnics Pty Ltd (Coffey) is pleased to provide this letter with additional information on the management of potential Acid Sulfate Soils (ASS) for the above project.

We understand that the Department of Planning has requested information on measures for management of ASS, should they be encountered in relation to the proposed river bank erosion protection works for the project.

Coffey recently carried out a preliminary assessment of the potential for ASS to be encountered at the site of the proposed project which was reported in a Preliminary Contamination Assessment report (Ref: GEOTUNAN02584AA-AD, dated 20 April 2007). The ASS risk map for the area indicated that ASS, if present, are considered to be sporadic in occurrence greater than 3m below the ground surface. In summary, based on the results of the testing carried out the report concluded that ASS was unlikely to be present in the upper 2m of the soil profile.

It is understood that the river bank erosion protection works involve extending the rock revetment along the river bank and that excavation works will be generally limited to some trimming of the river bank face.

Intrusive sampling into the river bank was not possible at the time due to access constraints. In relation to the proposed river bank erosion protection works, we would recommend the following preliminary management measures:

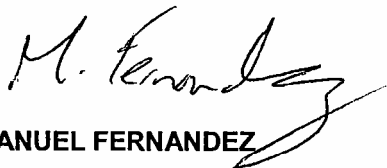
- Disturbance of soils below a depth of about 2m should be avoided where possible;
- If natural soils below about 2m depth require disturbance, observations should be made of these soils by an experienced environmental consultant for evidence that they may be ASS. As a guide, natural soils which differ in appearance to soils found in the upper 2m, such as soils that have a softer consistency, are sandier or darker in colour, could suggest the potential presence of ASS.

If different natural soils are encountered or have similar characteristics as those described above, these soils should be stockpiled separately and an experienced environmental consultant notified to collect samples to assess if they are ASS and require management;

- If ASS are identified and require management, this is likely to comprise the following:
 - Initially checking procedures to see if the disturbance of ASS can be avoided;
 - Burial of the ASS below a permanent water table (this may not be practicable in this instance);
 - Neutralisation of the soils with a neutralising agent such as fine powdered agricultural lime using appropriate controls. Following neutralisation and validation, soils may be re-used on site if appropriate or disposed offsite to a landfill licensed to accept the soils.

We trust this information is suitable for your present needs. Should you have any questions in relation to the above please do not hesitate to contact the undersigned.

For and on behalf of Coffey Geotechnics Pty Ltd



MANUEL FERNANDEZ

Senior Environmental Engineer